Prevalence and factors associated with cumulative anticholinergic burden among older long-stay nursing home residents with overactive bladder

Journal name:

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| ICD-9 code | ICD-9 description                      |
|-----------|---------------------------------------|
| 596.5     | Other functional disorders of bladder |
| 596.51    | Hypertonicity of the bladder           |
| 788.3     | Urinary incontinence unspecified      |
| 788.31    | Urge incontinence                     |
| 788.33    | Mixed incontinence                    |
| 788.41    | Urinary frequency                     |
| 788.43    | Nocturia                              |
| 788.63    | Urgency of urination                  |
| 788.91    | Functional urinary incontinence       |
| R32       | Unspecified urinary incontinence      |
| N39.41    | Urge incontinence                     |
| N39.46    | Mixed incontinence                    |
| R35.0     | Frequency of micturition               |
| R35.1     | Nocturia                              |
| R39.15    | Urgency of urination                  |
| R39.81    | Functional urinary incontinence       |
| N32.81    | Overactive bladder                    |
| N39.498   | Other specified urinary incontinence   |

Abbreviations: ICD = International Classification of Diseases
Supplementary Table 2. OAB-specific medications to identify individuals managed for OAB

| Brand name (generic name) | NDC / CPT code(s) |
|---------------------------|-------------------|
| Enablex (darifenacin)     | 00078-0419-15, 00078-0419-34, 00078-0420-15, 00078-0420-34 |
| Toviaz (fesoterodine)     | 00069-0242-30, 00069-0242-68, 00069-0242-41, 00069-0244-30, 00069-0244-68, 00069-0244-41 |
| Oxytrol (oxybutynin)      | 52544-0920-08     |
| Gelnique (oxybutynin)     | 52544-0041-54     |
| Gelnique (oxybutynin chloride) | 52544-0084-30   |
| Ditropan (IR) (oxybutynin chloride) | 17314-9200-01, 17314-9201-04 |
| Ditropan (XL) (oxybutynin chloride) | 50458-0805-01, 50458-0810-01, 50458-0815-01 |
| VESIcare (solifenacin)    | 51248-0150-01, 51248-0150-03, 51248-0150-52, 51248-0151-01, 51248-0151-03, 51248-0151-52 |
| Detrol (IR) (tolterodine) | 00009-4541-02, 00009-4541-03, 00009-4541-01, 00009-4544-02, 00009-4544-03, 00009-4544-01 |
| Detrol (LA) (tolterodine) | 00009-5190-03, 00009-5190-04, 00009-5191-03, 00009-5191-04 |
| Sanctura                  | 00023-3513-60     |
| Sanctura XR (trospium chloride) | 00023-9350-30   |
| Myrbetriq (mirabegron)   | 00469-2601-30, 00469-2601-71, 00469-2601-90, 00469-2602-30, 00469-2602-71, 00469-2602-90 |
| Botox (onabotulinumtoxinA) | CPT code: 52287 (injection into the bladder) |

Abbreviations: CPT = Current Procedural Terminology; IR = immediate release; LA = long acting; NDC = National Drug Code; OAB = overactive bladder; XL = extended release; XR = extended release
Supplementary Table 3. Additional baseline characteristics of elderly nursing home residents with OAB, categorized by levels of cumulative anticholinergic burden

| Characteristics                              | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|----------------------------------------------|---------------------|-------------------------|-------------------------------|-------------------------------|
| Elderly Long-stay NH patients with OAB having prescription records during 101-180 days of follow-up (N=123,308)* |                     |                         |                               |                               |
| **Baseline Need Factors**                    |                     |                         |                               |                               |
| N = 15,801 (12.8%)                           | N=22,215 (18.0%)    | N=51,668 (41.9%)        | N=33,624 (27.3%)               |                               |
| Elixhauser comorbidities                     |                     |                         |                               |                               |
| Hypertension                                 | 14,517 (91.87)      | 21,326 (96.00)          | 50,345 (97.44)                 | 32,820 (97.61)                |
| Fluid and electrolyte disorders              | 11,045 (69.90)      | 16,571 (74.59)          | 39,753 (76.94)                 | 26,168 (77.83)                |
| Depression                                   | 9,941 (62.91)       | 15,635 (70.35)          | 38,446 (74.41)                 | 26,639 (79.23)                |
| Cardiac arrhythmias                          | 8,758 (55.43)       | 14,131 (63.61)          | 35,049 (67.84)                 | 24,508 (72.89)                |
| Peripheral vascular disorders                | 10,983 (69.51)      | 16,145 (72.68)          | 38,163 (73.86)                 | 24,862 (73.94)                |
| Congestive heart failure                     | 5,962 (37.73)       | 10,830 (48.75)          | 31,592 (61.14)                 | 22,813 (67.85)                |
| Chronic pulmonary disease                    | 6,987 (44.22)       | 11,389 (51.27)          | 30,185 (58.42)                 | 21,419 (63.70)                |
| Other neurological disorders                 | 8,528 (53.97)       | 12,725 (57.28)          | 29,178 (56.47)                 | 19,148 (56.95)                |
| Diabetes                                     | 7,328 (46.38)       | 11,163 (50.25)          | 29,256 (56.62)                 | 20,586 (61.22)                |
| Renal failure                                | 5,719 (36.19)       | 9,378 (42.21)           | 24,641 (47.69)                 | 16,392 (48.75)                |
| Hypothyroidism                               | 6,979 (44.17)       | 10,463 (47.10)          | 25,715 (49.77)                 | 17,612 (52.38)                |
| Psychoses                                    | 6,703 (42.42)       | 11,714 (52.73)          | 27,748 (53.70)                 | 18,632 (55.41)                |
| Weight Loss                                  | 6,701 (42.41)       | 9,702 (43.67)           | 20,277 (39.24)                 | 12,487 (37.14)                |
| Valvular disease                             | 4,188 (26.50)       | 7,309 (32.90)           | 19,562 (37.86)                 | 13,463 (40.04)                |
| Deficiency anemias                           | 5,032 (31.85)       | 7,847 (35.32)           | 18,689 (36.17)                 | 12,452 (37.03)                |
| Obesity                                      | 1,801 (11.40)       | 3,274 (14.74)           | 12,016 (23.26)                 | 9,914 (29.48)                 |
| Coagulopathy                                 | 2,221 (14.06)       | 3,825 (17.22)           | 9,419 (18.23)                  | 6,553 (19.49)                 |
| Pulmonary circulation disorders              | 1,597 (10.11)       | 3,180 (14.31)           | 9,626 (18.63)                  | 7,188 (21.38)                 |
| Solid tumor without metastasis               | 2,686 (17.00)       | 3,915 (17.62)           | 9,054 (17.52)                  | 5,842 (17.37)                 |
| Paralysis                                    | 2,270 (14.37)       | 3,186 (14.34)           | 7,463 (14.44)                  | 4,907 (14.59)                 |
### Elderly Long-stay NH patients with OAB having prescription records during 101-180 days of follow-up (N=123,308)*

| Characteristics              | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|------------------------------|---------------------|-------------------------|---------------------------------|---------------------------------|
| Rheumatoid arthritis         | 1,702 (10.77)       | 2,806 (12.63)           | 7,408 (14.34)                   | 5,639 (16.77)                   |
| Liver disease                | 1,441 (9.11)        | 2,351 (10.58)           | 5,821 (11.27)                   | 4,316 (12.84)                   |
| Blood loss anemias           | 1,215 (7.69)        | 2,070 (9.32)            | 5,058 (9.79)                    | 3,240 (9.64)                    |
| Peptic ulcer                 | 761 (4.82)          | 1,277 (5.75)            | 3,176 (6.15)                    | 2,161 (6.43)                    |
| Drug abuse                   | 650 (4.11)          | 1,088 (4.90)            | 2,418 (4.68)                    | 1,638 (4.87)                    |
| Alcohol abuse                | 508 (3.21)          | 1,067 (4.80)            | 3,020 (5.85)                    | 2,697 (8.02)                    |
| Metastatic cancer            | 567 (3.59)          | 845 (3.80)              | 1,953 (3.78)                    | 1,238 (3.68)                    |
| Lymphoma                     | 274 (1.73)          | 414 (1.86)              | 930 (1.80)                      | 616 (1.83)                      |
| AIDS/HIV†                    | 54 (0.34)           | 63 (0.28)               | 139 (0.27)                      | 96 (0.29)                       |

#### Baseline Medication Use

| Medication                  | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|-----------------------------|---------------------|-------------------------|---------------------------------|---------------------------------|
| Antidepressants             | 8,856 (56.05)       | 15,313 (68.93)          | 38,604 (74.72)                  | 27,072 (80.51)                  |
| Diuretics                   | 5,190 (32.85)       | 10,781 (48.53)          | 34,354 (66.49)                  | 24,280 (72.21)                  |
| Beta-blockers               | 4,200 (26.58)       | 11,498 (51.76)          | 31,998 (61.93)                  | 22,116 (65.77)                  |
| Calcium channel blockers    | 5,342 (33.81)       | 8,605 (38.74)           | 22,540 (43.62)                  | 15,565 (46.29)                  |
| Anticonvulsants             | 4,437 (28.08)       | 8,005 (36.03)           | 22,331 (43.22)                  | 16,830 (50.05)                  |
| ACE inhibitors              | 5,357 (33.90)       | 8,589 (38.66)           | 22,252 (43.07)                  | 14,774 (43.94)                  |
| Antipsychotics              | 3,096 (19.59)       | 8,588 (38.66)           | 20,591 (39.85)                  | 14,739 (43.83)                  |
| Antiparkinson agents        | 1,918 (12.14)       | 2,929 (13.18)           | 7,929 (15.35)                   | 6,709 (19.95)                   |
| Alpha-blockers              | 471 (2.98)          | 782 (3.52)              | 2,103 (4.07)                    | 1,349 (4.01)                    |

#### OAB Medication Use

| Medication                        | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|-----------------------------------|---------------------|-------------------------|---------------------------------|---------------------------------|
| Antimuscarinic only               | 5 (0.3)             | 504 (2.45)              | 8,722 (18.43)                   | 11,564 (38.24)                  |
| Mirabegron only                   | 74 (0.5)            | 111 (0.54)              | 211 (0.45)                      | 99 (0.33)                       |
| Mirabegron + antimuscarinic       | 67 (0.46)           | 120 (0.58)              | 644 (1.36)                      | 775 (2.56)                      |
| No mirabegron or antimuscarinic   | 14,515 (99.00)      | 19,859 (96.43)          | 37,756 (79.77)                  | 17,805 (58.87)                  |

#### Other Medication Use

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*NH: Nursing Home, OAB: Overactive Bladder, N: Number
Elderly Long-stay NH patients with OAB having prescription records during 101-180 days of follow-up (N=123,308)*

| Characteristics                        | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|----------------------------------------|---------------------|-------------------------|---------------------------------|---------------------------------|
| Glucocorticoids                        | 1,952 (12.35)       | 3,980 (17.92)           | 12,580 (24.35)                  | 10,258 (30.51)                  |
| Natural opium alkaloids                | 1,659 (10.50)       | 3,212 (14.46)           | 9,376 (18.15)                   | 8,275 (24.61)                   |
| Benzodiazepine derivatives             | 2,429 (15.37)       | 5,062 (22.79)           | 14,455 (27.98)                  | 11,713 (34.84)                  |
| Other hypnotics†                       | 87 (0.55)           | 158 (0.71)              | 434 (0.84)                      | 315 (0.94)                      |
| Antihistamines – aminoalkyl ethers†    | 21 (0.13)           | 61 (0.27)               | 166 (0.32)                      | 148 (0.44)                      |
| Antihistamines – phenothiazine derivatives | 506 (3.20)       | 1,099 (4.95)            | 3,887 (7.52)                    | 3,704 (11.02)                   |
| Other antihistamines – for systemic use† | 72 (0.46)          | 118 (0.53)              | 341 (0.66)                      | 320 (0.95)                      |
| Baseline ACB score (mean ± SD)         |                     |                         | 0.95 ± 1.63                     |                                 |
| **ACB level 0**                        |                     |                         |                                 |                                 |
| n=75,841                               | 12,007 (75.99)      | 14,358 (64.63)          | 30,692 (59.40)                  | 18,424 (54.79)                  |
|                                        | (15.9%)             | (19.0%)                 | (40.7%)                         | (24.4%)                         |
| **ACB level 1 or 2 or 3**              |                     |                         |                                 |                                 |
| n=47,827                               | 3,794 (24.01)       | 7,857 (35.37)           | 20,976 (40.60)                  | 15,200 (45.21)                  |
|                                        | (7.9%)              | (16.4%)                 | (43.9%)                         | (31.8%)                         |
| **ACB level 2 or 3**                   |                     |                         |                                 |                                 |
| n=19,414                               | 1,423 (9.01)        | 2,829 (12.73)           | 8,409 (16.28)                   | 6,753 (20.08)                   |
|                                        | (7.3%)              | (14.6%)                 | (43.3%)                         | (34.8%)                         |
| **Body Mass Index**                    |                     |                         |                                 |                                 |
| Underweight n=34,862                    | 5,582 (44.16)       | 7,478 (42.75)           | 13,817 (33.66)                  | 7,985 (30.00)                   |
|                                        | (16.0%)             | (21.5%)                 | (39.6%)                         | (22.9%)                         |
| Normal weight n=6,138                   | 1,220 (9.65)        | 1,427 (8.16)            | 2,202 (5.36)                    | 1,289 (4.84)                    |
|                                        | (19.9%)             | (23.2%)                 | (35.9%)                         | (21.0%)                         |
| Overweight n=28,181                     | 3,540 (28.00)       | 4,966 (28.39)           | 12,330 (30.04)                  | 7,345 (27.59)                   |
|                                        | (12.6%)             | (17.6%)                 | (43.8%)                         | (26.1%)                         |
| Obese n=28,621                         | 2,299 (18.19)       | 3,622 (20.71)           | 12,701 (30.94)                  | 9,999 (37.56)                   |
|                                        | (8%)                | (12.7%)                 | (44.4%)                         | (34.9%)                         |
| **Urinary Continence**                 |                     |                         |                                 |                                 |
| Always continent n=15,308               | 1,820 (14.08)       | 2,472 (13.80)           | 6,372 (15.25)                   | 4,644 (17.15)                   |
|                                        | (11.9%)             | (16.1%)                 | (41.6%)                         | (30.3%)                         |
| Occasionally incontinent n=16,945      | 1,866 (14.44)       | 2,706 (15.11)           | 7,134 (17.08)                   | 5,239 (19.34)                   |
|                                        | (11.0%)             | (16.0%)                 | (42.1%)                         | (30.9%)                         |
| Frequently incontinent n=33,505         | 4,209 (32.57)       | 6,006 (33.54)           | 14,260 (34.13)                  | 9,030 (33.34)                   |
|                                        | (12.6%)             | (17.9%)                 | (42.6%)                         | (27.0%)                         |
## Elderly Long-stay NH patients with OAB having prescription records during 101-180 days of follow-up (N=123,308)*

### Characteristics

| Characteristics              | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|------------------------------|---------------------|-------------------------|--------------------------------|-------------------------------|
| Always incontinent           | 4,258 (32.95)       | 5,663 (31.62)           | 11,471 (27.46)                  | 6,296 (23.24)                 |
| n=27,688                     | (13.4%)             | (20.5%)                 | (41.4%)                         | (22.7%)                       |
| Not rated                    | 769 (5.95)          | 1,060 (5.92)            | 2,539 (6.08)                    | 1,877 (6.93)                  |
| n=6,245                      | (12.3%)             | (17.0%)                 | (40.7%)                         | (30.1%)                       |

### Bladder continence Management*

#### Indwelling catheter

|                       | Yes | n=6,704 | No | n=93,087 |
|-----------------------|-----|---------|----|----------|
|                        | 821 (6.35) | 1,110 (6.19) | 2,753 (6.58) | 2,020 (7.45) |
|                        | (12.2%)    | (16.6%)    | (41.1%)    | (30.1%)    |

#### External catheter

|                       | Yes | n=115 | No | n=99,640 |
|-----------------------|-----|-------|----|----------|
|                        | 17 (0.13) | 29 (0.16) | 69 (0.16) | 38 (0.14) |
|                        | (14.8%)    | (25.2%)    | (60.0%)    | (33.0%)    |

#### Ostomy

|                       | Yes | n=1,785 | No | n=98,006 |
|-----------------------|-----|---------|----|----------|
|                        | 204 (1.58) | 287 (1.60) | 759 (1.81) | 535 (1.97) |
|                        | (11.4%)    | (16.1%)    | (42.5%)    | (30.0%)    |

#### Intermittent catheterization

|                       | Yes | n=347 | No | n=99,445 |
|-----------------------|-----|-------|----|----------|
|                        | 43 (0.33) | 60 (0.33) | 142 (0.34) | 102 (0.38) |
|                        | (12.4%)    | (17.3%)    | (40.9%)    | (29.4%)    |

#### None of the above

|                       | Yes | n=91,326 | No | n=8,463  |
|-----------------------|-----|----------|----|----------|
|                        | 11,905 (92.09) | 16,518 (92.16) | 38,311 (91.61) | 24,592 (90.68) |
|                        | (13.0%)    | (18.1%)    | (41.9%)    | (26.9%)    |

### Urinary Toileting Program*

|                       | Yes | n=9,775 | No | n=99,445 |
|-----------------------|-----|---------|----|----------|
|                        | 1,224 (59.82) | 1,728 (61.87) | 4,159 (63.49) | 2,664 (64.25) |
|                        | (12.5%)    | (17.7%)    | (42.5%)    | (27.3%)    |
Elderly Long-stay NH patients with OAB having prescription records during 101-180 days of follow-up (N=123,308*)

| Characteristics                          | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|------------------------------------------|---------------------|-------------------------|---------------------------------|---------------------------------|
| No                                       | 822 (40.18)         | 1,065 (38.13)           | 2,392 (36.51)                   | 1,482 (35.75)                   |
| n=5,761                                  | (14.3%)             | (18.5%)                 | (41.5%)                         | (25.7%)                         |
| Response to toileting program*           |                     |                         |                                 |                                 |
| No improvement                           | 332 (62.52)         | 466 (64.10)             | 1,045 (62.05)                   | 621 (59.20)                     |
| n=2,464                                  | (13.5%)             | (18.9%)                 | (42.4%)                         | (25.2%)                         |
| Decreased wetness                        | 154 (29.00)         | 219 (30.12)             | 518 (30.76)                     | 344 (32.79)                     |
| n=1,235                                  | (12.5%)             | (17.7%)                 | (41.9%)                         | (27.9%)                         |
| Completely dry (continent)               | 45 (8.47)           | 42 (5.78)               | 121 (7.19)                      | 84 (8.01)                       |
| n=292                                    | (15.4%)             | (14.4%)                 | (41.4%)                         | (28.8%)                         |
| Current toileting program or trial*      |                     |                         |                                 |                                 |
| Yes                                      | 1,902 (15.96)       | 2,612 (15.99)           | 6,162 (16.25)                   | 3,864 (15.92)                   |
| n=14,450                                 | (13.1%)             | (18.0%)                 | (42.4%)                         | (25.2%)                         |
| No                                       | 10,013 (84.04)      | 13,722 (84.01)          | 31,748 (83.75)                  | 20,400 (84.08)                  |
| n=75,883                                 | (13.2%)             | (18.1%)                 | (41.8%)                         | (26.9%)                         |
| Bowel continence*                        |                     |                         |                                 |                                 |
| Always continent                         | 4,017 (31.10)       | 5,556 (31.02)           | 14,784 (35.39)                  | 11,098 (40.98)                  |
| n=35,455                                 | (11.3%)             | (15.7%)                 | (41.7%)                         | (31.3%)                         |
| Occasionally incontinent                 | 1,547 (11.98)       | 2,163 (12.08)           | 5,366 (12.85)                   | 3,668 (13.54)                   |
| n=12,744                                 | (12.1%)             | (17.0%)                 | (42.1%)                         | (28.8%)                         |
| Frequently incontinent                   | 2,855 (22.10)       | 4,298 (24.00)           | 9,653 (23.11)                   | 5,649 (20.86)                   |
| n=22,455                                 | (12.7%)             | (19.1%)                 | (43.0%)                         | (25.2%)                         |
| Always incontinent                       | 4,292 (33.22)       | 5,614 (31.35)           | 11,220 (26.86)                  | 6,125 (22.61)                   |
| n=27,251                                 | (15.7%)             | (20.6%)                 | (41.2%)                         | (22.5%)                         |
| Not rated                                | 207 (1.60)          | 278 (1.55)              | 750 (1.80)                      | 54 (2.01)                       |
| n=1,289                                  | (16.1%)             | (21.6%)                 | (58.2%)                         | (4.2%)                          |
| MDS Cognitive Performance scale*         |                     |                         |                                 |                                 |
| Intact                                   | 11,710 (78.65)      | 16,736 (79.78)          | 42,027 (85.16)                  | 28,508 (87.91)                  |
| n=98,978                                 | (11.8%)             | (16.9%)                 | (42.5%)                         | (28.8%)                         |
| Mild                                     | 176 (1.18)          | 228 (1.09)              | 694 (1.41)                      | 441 (1.36)                      |
| n=1,539                                  | (11.4%)             | (14.8%)                 | (45.1%)                         | (28.7%)                         |
| Moderate                                 | 651 (4.37)          | 1,021 (4.87)            | 2,016 (4.08)                    | 1,279 (3.94)                    |
| n=4,967                                  | (13.1%)             | (20.6%)                 | (40.6%)                         | (25.7%)                         |
| Moderately severe                        | 383 (2.57)          | 545 (2.60)              | 897 (1.82)                      | 455 (1.40)                      |
| n=2,280                                  | (16.8%)             | (23.9%)                 | (39.3%)                         | (1.4%)                          |
| Characteristics                       | No burden (Score 0) | Low burden (Score 1-99) | Moderate burden (Score 100-499) | High burden (Score 500 or more) |
|---------------------------------------|---------------------|-------------------------|----------------------------------|-------------------------------|
| Elderly Long-stay NH patients with OAB having prescription records during 101-180 days of follow-up (N=123,308)* |
| Severe                                | 1,969 (13.22)       | 2,449 (11.67)           | 3,718 (7.53)                     | 1,747 (5.39)                 |
| n=9,883                               | (19.9%)             | (24.8%)                 | (37.6%)                         | (17.7%)                      |
| Severe                                |                     |                         |                                 |                               |
| Activities of daily living*           |                     |                         |                                 |                               |
| Independent                           | 2,418 (18.49)       | 3,409 (18.80)           | 8,957 (21.14)                    | 6,774 (24.66)                |
| n=21,558                              | (11.2%)             | (15.8%)                 | (41.5%)                         | (31.4%)                      |
| Limited/Extensive assistance          | 525 (4.01)          | 738 (4.07)              | 1,758 (4.15)                     | 1,276 (4.65)                 |
| n=4,297                               | (12.2%)             | (17.2%)                 | (40.9%)                         | (29.7%)                      |
| Dependent                             | 10,134 (77.49)      | 13,983 (77.13)          | 31,651 (74.71)                   | 19,415 (70.69)               |
| n=75,183                              | (13.5%)             | (18.6%)                 | (42.1%)                         | (25.8%)                      |
| Depressed mood indicator*             |                     |                         |                                 |                               |
| Yes                                   | 587 (4.76)          | 960 (5.68)              | 1,867 (4.76)                     | 1,075 (4.27)                 |
| n=4,489                               | (13.1%)             | (21.4%)                 | (41.6%)                         | (23.9%)                      |
| No                                    | 11,739 (95.24)      | 15,956 (94.32)          | 37,388 (95.24)                   | 24,096 (95.73)               |
| n=89,179                              | (13.2%)             | (17.9%)                 | (41.9%)                         | (27.0%)                      |

Abbreviations: ACB = anticholinergic burden; ACE = angiotensin-converting enzyme; AIDS/HIV = acquired immunodeficiency syndrome/human immunodeficiency virus; LSNH = long-stay nursing home; MDS = Minimum Data Set; OAB = overactive bladder

*Numbers within each category may not total 123,308 due to missing data