**Table S1.** Characteristics of five sleep databases included in the current study.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Sleep database** | **PSG recording software usea/ Scoring criteria / N included** | **Hypopnea criteria** |
|  | **London Health Sciences Centre Sleep Apnea Assessment Unit PSG database (London, Ontario)**All consecutive individuals who underwent Level 1 in-hospital diagnostic polysomnography (PSG) at the London Health Sciences Centre between 2007 and 2015 | Software: Natus SD3200 with Mdrive Scoring: the American Academy of Sleep Medicine (AASM) criteria 20071 and 20122N=12,672 (4,086 by 2012 criteria) | 2007 criteria: ≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥4%2012 criteria: ≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥3% OR an associated arousal |
|  | **Sunnybrook Health Sciences Centre Sleep database (Toronto, Ontario)**All consecutive individuals who underwent Level 1 in-hospital PSG at the Sunnybrook Health Sciences Centre between 2010 and 2015  | Software: Compumedics NeuroscanScoring: the AASM criteria 20071N=3,006 | ≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥4% |
|  | **St. Michael’s Hospital Sleep Laboratory database (Toronto, Ontario)**All consecutive individuals who underwent Level 1 in-hospital PSG at theSt. Michael’s Hospital between 1994 [mostly since 1996] and 2010 | Software: Sandman 7.3 (and older versions) Scoring: the AASM Task Force 1999 (Chicago Criteria)3N**=**9,530 | ≥50% decrease in flow OR a clear reduction in flow that does not reach ≥50% AND is associated with either an oxygen desaturation of ≥3% or an arousal |
|  | **The Ottawa Hospital (TOH) Sleep database** **(Ottawa, Ontario)**All consecutive individuals who underwent Level 1 in-hospital PSG at the TOH between 2015 and 2017 | Software:Sandman 10.1Scoring: the AASM criteria 20122N=4,816 | ≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥3% OR an associated arousal |
|  | **TOH Surgical Sleep database (Ottawa, Ontario)**All consecutive individuals who underwent Level 1 in-hospital PSG at the TOH before surgery between 2003 and 2011 | Software:Sandman 9.2Scoring: the AASM criteria 20071N=4,051 | ≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥4% |

aEach patient in the cohort underwent full in-laboratory polysomnography recording that was scored by a sleep technologist and reviewed by a sleep physician.

**Table S2. Categorization of cancers by cancer subtypes from the Ontario Cancer Registrya (https://seer.cancer.gov/siterecode/icdo3\_dwhoheme/index.html)**

|  |  |  |
| --- | --- | --- |
|  | **ICD-O-3 Site**  | **ICD-O-3 Histology (Type)** |
|  | **From the National Cancer Institute website** |
| **Anatomic sub-type (most common)** |
| Prostate  | C619 | excluding 9050-9055, 9140, 9590-9992 |
| Breast  | C500-C509 |
| Lung  | C340-C349 |
| Colorectal  | Colon excluding Rectum: C180-C189, C260Rectum and Rectosigmoid Junction: C199, C209 |
| Kidney | Kidney and Renal Pelvis: C649, C659 |
| Bladder | Urinary Bladder: C670-C679 |
| Melanoma of the skin | C440-C449  | 8720-8790 |
| **Etiological type** |
| Potentially smoking-related4, 5\* | Oral Cavity and Pharynx (excluding tonsil and salivary gland): C000-C009, C019-C029, C030-C039, C040-C049, C050-C059, C060-C069, C100-C109, C110-C119, C129, C130-C139, C140, C142, C148Pancreas: C250-C259Nose, Nasal Cavity and Middle Ear: C300-C301, C310-C319Larynx: C320-C329Lung and Bronchus: C340-C349Pleura: C384Urinary Bladder: C670-C679Kidney and Renal Pelvis: C649, C659Other Urinary Organs: C680-C689 | excluding 9050-9055, 9140, 9590-9992 |
| Potentially alcohol-related6 | Tongue: C019-C029Floor of Mouth: C040-C049Gum and Other Mouth: C030-C039, C050-C059, C060-C069Oropharynx: C100-C109Hypopharynx: C129, C130-C139Other Oral Cavity and Pharynx: C140, C142, C148Esophagus: C150-C159Liver: C220Intrahepatic Bile Duct: C221Larynx: C320-C329 | excluding 9050-9055, 9140, 9590-9992 |
| Potentially virus/immune-related6 | Liver: C220Intrahepatic Bile Duct: C221Skin, non-melanoma: C440-C449 (excluding histology: 8720-8790 for melanoma)Cervix Uteri: C530-C539Hodgkin Lymphoma: Hodgkin – Nodal: C024, C098-C099, C111, C142, C379, C422, C770-C779 (histology: 9650-9667)Hodgkin – Extranodal: All other sites (histology: 9650-9667)Non-Hodgkin Lymphoma:NHL – Nodal: C024, C098, C099, C111, C142, C379, C422, C770-C779 (histology: 9590-9597, 9670-9671, 9673, 9675, 9678-9680, 9684, 9687-9691, 9695, 9698-9702, 9705, 9708-9709, 9712, 9714-9719, 9724-9729, 9735, 9737-9738, 9811-9818, 9823, 9827, 9837)NHL – Extranodal: All sites except C024, C098-C099, C111, C142, C379, C422, C770-C779 (histology: 9590-9597, 9670-9671, 9673, 9675, 9678-9680, 9684, 9687, 9688, 9689-9691, 9695, 9698-9702, 9705, 9708-9709, 9712, 9714-9719, 9724-9729, 9735, 9737, 9738) OR All sites except C024, C098-C099, C111, C142, C379, C420-C422, C424, C770-C779 (histology: 9811-9818, 9823, 9827, 9837)Leukemia: Lymphocytic Leukemia: C420, C421, C424Myeloid and Monocytic Leukemia: (histology: 9840, 9861, 9865-9867, 9869, 9871-9874, 9895-9897, 9898, 9910-9911, 9920, 9891, 9863, 9875-9876, 9945-9946, 9860, 9930)Other Acute Leukemia: histology: 9801, 9805-9809, 9931Aleukemic, subleukemic and NOS: C420, C421, C424 (histology: 9733, 9742, 9800, 9831, 9870, 9948, 9963-9964, 9827)Myeloma histology: 9731-9732, 9734 | excluding 9050-9055, 9140, 9590-9992 |
| Potentially hormone-related6 | Breast: C500-C509 Corpus Uteri: C540-C549 Ovary: C569Other Female Genital Organs: C570-C579Prostate: C619 | excluding 9050-9055, 9140, 9590-9992 |
| **Detectable by screening** |
| Prostate, Breast, Colorectal, Cervical  | Prostate: C619Breast: C500-C509Cervix Uteri: C530-C539Colon excluding Rectum: C180-C189, C260Rectum and Rectosigmoid Junction: C199, C209  | excluding 9050-9055, 9140, 9590-9992 |

aInformation on cancer status and type was derived from the Ontario Cancer Registry (OCR), a computerized database of information on all Ontarians since 1964 who have been newly diagnosed with cancer or died of cancer. It uses U.S. Surveillance, Epidemiology and End Results Site Recode definitions as International Classification of Diseases for Oncology (ICD-O)-3 codes (https://seer.cancer.gov/siterecode/) and is based on multiple combined sources of data to provide good quality incidence data7-10.

**Table S3**. **Definitions of variables considered in the statistical models derived from the health administrative data**

|  |  |
| --- | --- |
| **Variables** | **Definition** |
| **Demographics** |
| Age at baselinea, years | Defined from both clinical and health administrative data |
| Sex, Men | Defined from both clinical and health administrative data |
| Neighbourhood income status | Ontario neighbourhoods are classified into one of the five approximately equal-sized income quintiles, ranked from poorest (Q1) to wealthiest (Q5) and these have been shown to be related to population health status and health care utilization11. Each patient was assigned to the income quintile based on the patient’s postal code at the time of baseline and Statistics Canada’s Postal Code Conversion File12, 13. |
| Living in rural area at baseline | Defined using patient’s postal code14. |
| Being an immigrant | Immigration Status was defined from the IRCC (Immigration, Refugees and Citizenship Canada) Permanent Residents database (https://open.canada.ca/data/en/dataset/) |
| **Presence of Prior Comorbidities (as defined from health administrative data)** |
| Alcohol use disorder | (1) Hospitalizations (from CIHI/DAD):* ICD-9 codes: 303; 3050
* ICD-10 codes: E244; E512; F10; G312; G621; G721; I426; K292; K70; K860; T510; X45; X65; Y15; Y573; Z502; Z714; Z721

(2) Outpatient visits for alcohol dependence syndrome: OHIP codes: 303 |
| Congestive Heart Failure | From the Ontario Congestive Heart Failure (CHF) Dataset15 (ICES-derived Cohorts) |
| Diabetes | From the Ontario Diabetes Dataset16 (ICES-derived Cohorts) |
| COPD | From the Chronic Obstructive Pulmonary Disease Dataset17 (ICES-derived Cohorts) |
| Hypertension | From Ontario Hypertension Database18 (ICES-derived Cohorts) |
| Obesity | Hospitalizations (from CIHI/DAD):* ICD-10 codes: E66.x
* ICD-9 codes: 278.0
 |
| Depression  | (1) Hospitalization for depression (from CIHI/DAD and Ontario Mental Health Reporting System)* ICD-9 codes: 296.2; 296.3; 296.5; 300.4; 309.x; 311
* ICD-10 codes: F20.4; F31.3-F31.5; F32.x; F33.x; F34.1; F41.2; F43.2
* DSM-IV codes: 29620 – 29626; 29630 – 29636; 29650 – 29656; 30040; 30900; 30928; 31100

(2) Outpatient visits for depression/anxiety OHIP codes: 311; 300 |
| Charlson Comorbidity Index | Charlson et al. developed a weighted index of comorbidities for predicting mortality, originally derived in hospitalized general medical patients and initially validated in female oncology patients19. This index was subsequently adapted by Deyo et al. for use with the ICD-9 diagnosis and procedure codes that are frequently used in electronic health care administrative databases and is ubiquitous in health services research20. |
| **Variables reflecting the quality of care and prior health care exposure from health administrative data**  |
| Blood glucose testing (within 3 years before the diagnostic sleep study) | The OHIP lab data for any of the fee codes L111, L112, L104, L103, L253 |
| Chest X-ray (within 3 years before the diagnostic sleep study) | Any of the OHIP fee codes X090, X901, X902 |
| The number of the primary care office visit (within 1-year before the diagnostic sleep study) | The OHIP records for the desired period, where (feesuff = ‘A’ and spec = ‘00’) and location in (‘H’, ‘O’, ‘L’)  |
| **OSA-Related Treatment in Follow-up: PAP, or bariatric, MMA or UPPP surgeries** |
| Acceptance of positive airway pressure (PAP) treatment as based on PAP claims from ADP database21 | Individuals who received government-funded: * “Continuous Positive Airway Pressure” OR
* “Bi-level Positive Airway Pressure” OR
* “Auto-titrating Positive Airway Pressure”22.

The date of the PAP funding approval was used as the date for a PAP treatment initiation.In Ontario, 75% of the cost of a basic continuous (CPAP), auto-titration (APAP), or bilevel (without a back-up breathing rate) device is covered through the ADP which can only be prescribed by specialist sleep physicians following a diagnostic sleep study. Bilevel devices with a backup rate are fully funded by the government. |
| Bariatric surgery  | (1) In-patient Bariatric Procedures23: ICD-10 codes: E66 AND CCI codes: 1NF78 (2) Outpatient bariatric procedures23: OHIP feecodes: S120; S114; S189(3) Before 2002: ICD-9 codes24 Procedures: 1) 44.31, 44.38, and 44.39, 2) 43.82, 3) 44.95, and 4) 43.7, 43.89, 44.68, 44.69, 45.50, 45.51, 45.90, and 45.91. To confirm the procedures as weight-loss surgery, only patients with obesity diagnosis (ICD-9 codes: 278.0, 278.00, 278.01, 278.03, 278.8, V77.8, and V85.30-V85.45) or with diagnosis-related group (DRG) code of 288 (indicating the primary reason for the hospital admission is weight-loss surgery) were included. Patients identified with abdominal neoplasm diagnosis (ICD-9 codes: 150.0–159.9) at hospital admission were excluded. |
| MMA/UPPP | Using CCI codes (1) 2002-present: INCODE1-20 (CCI codes see below): INATSTAT1-20, exclude status attribute='A'. * MMA: 1EE79
* UPPP: 1FQ78LA

(2) From July 1991 to 2001: PRCODE1-10 (CCI codes see below); PRSUFF1-10, exclude procedures with suffixes of '0', '8' or '9'* UPPP: 3961, 3962, 3963, 3969
* MMA: 8851, 8871, 8876
 |
|  |  |
| To adjust for possible lag time between the diagnosis of OSA and diagnosis of cancer | Incident cancers diagnosed within one year (lag period) from the date of the diagnostic sleep study were censored and only cancers first diagnosed after that lag period were analyzed. |

athe date of the diagnostic sleep study

**List of datasets used**: The Registered Persons Database (RPDB), Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD) and the Same Day Surgery (CIHI-SDS), Ontario Health Insurance Plan Physician Services Claims database (OHIP), NACRS - National Ambulatory Care Reporting System, HYPERTENSION, Ontario Congestive Heart Failure database (CHF), Ontario Chronic Obstructive Pulmonary Disease database, Assistive Devices Program dataset (ADP).

ADP – assistive device program; CCI – Canadian Classification of Health Interventions; CHF – chronic heart failure; COPD – chronic obstructive pulmonary disease; ICD – the International Statistical Classification of Diseases and Related Health Problems; MMA – maxillomandibular advancement surgery; UPPP – uvulopalatopharyngoplasty.

Reference:

1. Iber CA-I, S.; Chesson, A. and Quan, SF for the American Academy of Sleep Medicine. . The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specification, 1st ed.: . Westchester, Illinois: American Academy of Sleep Medicine. 2007.

2. Berry RB, Budhiraja R, Gottlieb DJ, et al. Rules for scoring respiratory events in sleep: update of the 2007 AASM Manual for the Scoring of Sleep and Associated Events. Deliberations of the Sleep Apnea Definitions Task Force of the American Academy of Sleep Medicine. J Clin Sleep Med. 2012;8: 597-619.

3. Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research. The Report of an American Academy of Sleep Medicine Task Force. Sleep. 1999;22: 667-689.

4. Smith GD, Shipley M, Leon DA. Height and mortality from cancer among men: prospective observational study. BMJ. 1998;317: 1351-1352.

5. Macleod J, Smith GD, Heslop P, Metcalfe C, Carroll D, Hart C. Are the effects of psychosocial exposures attributable to confounding? Evidence from a prospective observational study on psychological stress and mortality. J Epidemiol Community Health. 2001;55: 878-884.

6. Christensen AS, Clark A, Salo P, et al. Symptoms of sleep disordered breathing and risk of cancer: a prospective cohort study. Sleep. 2013;36: 1429-1435.

7. Robles SC, Marrett LD, Clarke EA, Risch HA. An application of capture-recapture methods to the estimation of completeness of cancer registration. J Clin Epidemiol. 1988;41: 495-501.

8. McLaughlin JR, Kreiger N, Marrett LD, Holowaty EJ. Cancer incidence registration and trends in Ontario. Eur J Cancer. 1991;27: 1520-1524.

9. Hall S, Schulze K, Groome P, Mackillop W, Holowaty E. Using cancer registry data for survival studies: the example of the Ontario Cancer Registry. J Clin Epidemiol. 2006;59: 67-76.

10. Brenner DR, Tammemagi MC, Bull SB, Pinnaduwaje D, Andrulis IL. Using cancer registry data: agreement in cause-of-death data between the Ontario Cancer Registry and a longitudinal study of breast cancer patients. Chronic Dis Can. 2009;30: 16-19.

11. Wilkins R, Tjepkema M, Mustard C, Choiniere R. The Canadian census mortality follow-up study, 1991 through 2001. Health Rep. 2008;19: 25-43.

12. Wilkins R. Use of postal codes and addresses in the analysis of health data. Health Rep. 1993;5: 157-177.

13. Southern DA, Faris PD, Knudtson ML, Ghali WA. Prognostic relevance of census-derived individual respondent incomes versus household incomes. Can J Public Health. 2006;97: 114-117.

14. Ontario Ministry of Health and Long-Term Care. Health Analyst’s Toolkit. Available from: <http://www.health.gov.on.ca/english/providers/pub/healthanalytics/health_toolkit/health_toolkit.pdf>.

15. Schultz SE, Rothwell DM, Chen Z, Tu K. Identifying cases of congestive heart failure from administrative data: a validation study using primary care patient records. Chronic Dis Inj Can. 2013;33: 160-166.

16. Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: determination of prevalence and incidence using a validated administrative data algorithm. Diabetes Care. 2002;25: 512-516.

17. Gershon AS, Wang C, Guan J, Vasilevska-Ristovska J, Cicutto L, To T. Identifying individuals with physcian diagnosed COPD in health administrative databases. COPD. 2009;6: 388-394.

18. Tu K, Campbell NR, Chen ZL, Cauch-Dudek KJ, McAlister FA. Accuracy of administrative databases in identifying patients with hypertension. Open Med. 2007;1: e18-26.

19. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987;40: 373-383.

20. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. J Clin Epidemiol. 1992;45: 613-619.

21. Policies and Procedures Manual for the Assistive Devices Program. Ministry of Health and Long-Term Care. January 2010: 1-121.

22. Assistive Devices Program. Continuous/Autotitrating/BiLevel Positive Pressure Systems. [accessed July 30, 2016, 2016].

23. Arkinson J, Ji H, Fallah S, Perez J, Chen XK, Leeb K. Bariatric surgery in Canada: a focus on day surgery procedures. Healthc Q. 2010;13: 15-18.

24. Zhang L, Scott J, Shi L, et al. Changes in utilization and peri-operative outcomes of bariatric surgery in large U.S. hospital database, 2011-2014. PLoS One. 2017;12: e0186306.