Algorithms for Identifying Immunocompromised Adults in Administrative Claims Data – a Targeted Literature Review

Nikita Stempniewicz[1], Andrea Steffens[2], Helen Trenz[2], Simi Khan[3], Rajiv Ahlawat[3], Sara Poston[1], David Singer[1]
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SUPPLEMENTARY INFORMATION

Limitations:

There are several limitations related to this targeted literature review.

1. This is not a systematic literature review that aimed to include all eligible studies. This targeted literature review prioritized studies for review that were newer, conducted in the US, and included a relevant study population defined or stratified by immunocompromised status. Studies with details describing the algorithm used for determining immunocompromised status were also prioritized.
2. Only one study included validation of the algorithm used for determining immunocompromised status.[1]
3. Third, a few studies included data sources based on electronic health records or disease registries, and corresponding algorithms may need to be adjusted for use with administrative claims data.

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AUTHORS information and disclosures

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Prioritized studies for data extraction

REFERENCE	GENERAL			STUDY DESIGN		STUDY RESULTS	IMMUNOCOMPROMISED (IC) ALGORITHM						
Short Reference	Disease Area	Target Population	Country/ Region	Study Period	Data Source(s)	Sample Size	Summary of Algorithm	Claims / Clinical	DX*/ RX**	Algorithm Use (inclusion, exclusion, outcome, other)	Levels/Degrees of IC Status	Time-varying Immunocompromisd Status	Algorithm Reference
Adams, et al. (2022)	COVID-19	Adult patients hospitalized during Omicron predominance	US	12/26/2021 to 4/30/2022	IVY Network (a 21-hospital collaborative in the US; EHR, patient interview, vaccine registries)	3,181	Conditions considered in this analysis to be immunocompromising: inflammatory bowel disease (IBD) including Crohn's disease or ulcerative colitis, prior kidney transplant, prior stem cell or bone marrow transplant, active solid organ cancer without metastases; active cancer defined as treatment for the cancer or newly diagnosed cancer in the past 6 months, active solid organ cancer with metastases; active cancer defined as treatment for the cancer or newly diagnosed cancer in the past 6 months, active hematologic cancer (such as leukemia/lymphoma/myeloma) or active cancer defined as treatment for the cancer or newly diagnosed cancer in the past 6 months, human immunodeficiency virus (HIV) infection without acquired immunodeficiency syndrome (AIDS), AIDS, congenital immunodeficiency disorder, prior splenectomy, prior solid organ transplant (SOT), immunosuppression medication, systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), psoriasis, scleroderma.	Clinical	DX*	Stratification	N	N	NA
Chen, et al. (2014)	Herpes zoster (HZ)	Adults aged 18+ years	US	1/1/2005 to 12/31/2009	Administrative claims databases (commercial, Medicare, Medicaid)	51,022,838	Identified patients with the following nine potentially cognitive–motor interference (CMI)-altering conditions: cancer (excluding skin cancer), HIV infection, bone marrow or stem cell transplantation (BMSCT), SOT, SLE, RA, IBD, psoriasis, and multiple sclerosis (MS). These conditions were identified by ICD-9-CM diagnosis codes and procedures of the medical claims. For cancer, we required at least two medical claims on two separate dates to ascertain a diagnosis. A patient could have multiple conditions and could also contribute to multiple disease populations. Chemotherapy treatments among patients with cancer and the administration of immunosuppressants for the selected conditions, except for HIV-infected individuals, were recorded from pharmacy claims and procedure codes in medical claims during the study period.	Claims	DX* and RX**	Stratification Results are stratified by the specific immunocomprosing condition and by whether the patient also had immunosuppressive therapy	N	N	NA
Di Fusco, et al. (2021)	COVID-19	COVID 19 vaccinated enrollees with BNT162b2	US	12/10/2020 to 7/8/2021	De-identified patient-level payor-agnostic claims data aggregated by HealthVerity	4,375,051	At least 1 hospitalization or at least 2 outpatient visits on separate dates with an ICD-10 code on a healthcare claim indicating an IC condition (ICC) or usage of specific immunosuppressive (IS) medications during a 12-month baseline period. The IC case definition identified 9 groups based on clinical diagnoses and 2 other groups based on usage of IS medications only, for a total of 11 groups with an ICC (Figure 1). Individuals with >1 ICC were also assessed, for a total of 12 mutually exclusive groups for inclusion in this study. The list of ICD-10 codes used to identify IC cases by diseases and list of IS medications are shown in Supplementary Tables 1 and 2, respectively. The disease ICC groups included (1) symptomatic HIV/AIDS; (2) solid malignancy; (3) bone marrow transplant; (4) organ transplant (excluding bone marrow transplant); (5) rheumatologic or other inflammatory condition; (6) a primary immunodeficiency; (7) other immune conditions; (8) chronic kidney disease (CKD) or end stage renal disease (ESRD); and (9) hematologic malignancy.	Claims	DX* and RX**	Stratification	N	N	Greenberg, et al. (2016)
El Hechi, et al. (2020)	Colectomy	All patients 18 years or older undergoing an emergency colectomy	US	2012 to 2016	Colectomy-Targeted ACS-NSQIP database	17,707	Immunosuppression was defined using the ACS-NSQIP database variable definition for 'Steroid/Immunosuppressant Use for a Chronic Condition.' To meet this NSQIP criteria, patients must have required the regular administration of oral or parenteral corticosteroid or immunosuppressant medications for a chronic medical condition, within the 30 days prior to the principal operative procedure. Patients that only required a one-time pulse, limited short course, or a taper of less than 10 days of duration would not qualify for this variable. Chronic medical conditions include but are not limited to: chronic obstructive pulmonary disease (COPD), asthma, RA, and IBD. Examples of steroid medications include prednisone and decadron, and examples of immunosuppressants include azathioprine, cyclosporine, and methotrexate.	Clinical	DX* and RX**	Stratification	N	N	Immunosuppression was defined using the ACS-NSQIP database variable definition for 'Steroid/Immunosuppressant Use for a Chronic Condition.'
Embi, et al. (2021)	COVID-19	Hospitalized persons aged 18+ years with COVID-19–like illness	US (9 states, 187 hospitals)	1/17/2021 to 9/5/2021	VISION Network (a collaboration between the Centers for Disease Control and prevention [CDC] and seven US health care systems and research centers with integrated medical, laboratory, and vaccination records)	69,116 non-IC 20,101 IC	Diagnoses across five categories of ICCs were derived from lists used in previous studies of large hospital based or administrative databases and included the following conditions: 1) solid malignancies, 2) hematologic malignancies, 3) rheumatologic or inflammatory disorders, 4) other intrinsic immune conditions or immunodeficiencies, and 5) organ or stem cell transplants (see bibliographic review). IC status was presumed based on the presence of at least one discharge diagnosis, using ICD-9 and ICD-10 diagnosis codes for solid malignancy (ICD-10 codes: C00–C80, C7A, C7B, D3A, Z51.0, and Z51.1), hematologic malignancy (ICD-10 codes: C81–C86, C88, C90–C96, D46, D61.0, D70.0, D61.2, D61.9, and D71), rheumatologic or inflammatory disorder (ICD-10 codes: D86, E85 [except E85.0], G35, J67.9, L40.54, L40.59, L93.0, L93.2, L94, M05–M08, M30, M31.3, M31.5, M32–M34, M35.3, M35.8, M35.9, M46, and T78.40), other intrinsic immune condition or immunodeficiency (ICD-10 codes: D27.9, D61.09, D72.89, D80, D81 [except D81.3], D82–D84, D89 [except D89.2], K70.3, K70.4, K72, K74.3–K74.6 [except K74.60 and K74.69], N04, and R18), or organ or stem cell transplant (ICD-10 codes: T86 [except T86.82–T86.84, T86.89, and T86.9], D47.Z1, Z48.2, Z94, and Z98.85). Immunosuppressive medication use data were not available for these analyses.	Clinical	DX*	Stratification	N	N	Derived from lists used in previous studies of large hospital based or administrative databases: Hughes, et al. (2021) Patel, et al. (2020) Greenberg, et al. (2016)
Gatwood, et al. (2022)	Influenza	Adults aged 18+ years	US	2013 to 2016	MarketScan administrative claims databases	6,694,571	To determine IC status, diagnosis codes for hematologic malignancy, solid tumor malignancy, HIV/AIDS, chronic renal failure, nephrotic syndrome, mycobacteria, actinomycotic infection, opportunistic mycoses, toxoplasmosis, disorders involving the immune mechanism, aplastic anemia, neutropenia, neutrophils, genetic anomaly of leukocytes, other selected conditions, or organ transplant during the baseline period were used.	Claims	DX*	Covariates	N	N	NA

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REFERENCE	GENERAL			STUDY DESIGN		STUDY RESULTS	IMMUNOCOMPROMISED (IC) ALGORITHM						
Short Reference	Disease Area	Target Population	Country/ Region	Study Period	Data Source(s)	Sample Size	Summary of Algorithm	Claims / Clinical	DX*/ RX**	Algorithm Use (inclusion, exclusion, outcome, other)	Levels/Degrees of IC Status	Time-varying Immunocompromised Status	Algorithm Reference
Greenberg, et al. (2016)	Sepsis	Adults aged 18+ years with severe sepsis	US	1/1/2010 to 12/31/2012	Univerity HealthSystem Consortium (UHC) database (117 medical centers and 300 affiliated hospitals; includes demographic data, medication data, discharge diagnoses)	421	Three types of conditions were considered definitely immunosuppressive: HIV/AIDS, hematological malignancies, or other intrinsic immune conditions. Patients with three other types of conditions were considered immunosuppressed only if they received an immunosuppressive medication during the studied hospitalization: solid malignancies, organ transplantations, and rheumatologic/inflammatory conditions. All patients with a possibly IS condition were considered IC if they received chemotherapy or immunemodulating agents. Additionally, patients with rheumatologic/inflammatory conditions were considered IC if they received systemic steroids.	Claims	DX* and RX**	Inclusion	N	N	NA
Hughes, et al. (2021)	Influenza, Acute respiratory illness	Adults aged 18+ years, with admission for an acute respiratory illness or worsening of a chronic respiratory illness with a new or worsening cough	US (Pennsylvania, Michigan, Tennessee, Texas)	2017 to 2018	HAIVEN network (enrollment interview, electronic medical records [EMR])	3,524	Eight groups of ICCs were defined: organ transplantation, stem cell transplantation, underlying immunodeficiency (inborn errors of immunity), connective tissue disorder, receipt of chemotherapy or radiation therapy, hematologic conditions, chronic steroid use, and HIV. The basis for the groups was a previously described algorithm for identifying patients with active immunosuppression using ICD and current procedural terminology (CPT) codes in a large database of patients with severe sepsis (Greenberg, et al. [2016]). We slightly modified this algorithm in 2 aspects. For solid malignancies, we only included patients actively treated with chemotherapy or radiation to improve specificity of immunosuppression. We also included patients on chronic use of steroids (identified by ICD-10-CM codes). We identified patients with ICCs based on ICD-10-CM codes listed (Supplementary Table S2), except for the receipt of chemotherapy or radiation therapy, which were determined from ICD-10-CM codes, or receipt of one of the biologic chemotherapeutic agents listed, or a positive answer to the enrollment question about the receipt of chemotherapy or radiation therapy.	Clinical	DX* and RX**	Stratification	N	N	Greenberg, et al. (2016)
Izurieta, et al. (2021)	Herpes zoster	Medicare Part D community-dwelling beneficiaries aged >65 years	US	11/1/2017 to 10/20/2019	Medicare claims and enrollment databases	15,589,546	A modified version of Greenberg, et al. with nine mutually exclusive (i.e., implemented one at a time) categories: HIV/AIDS, Hematological Malignancy and Related Conditions, Immune Deficiencies (treatment-dependent), Immune Deficiencies, (treatment-independent), Solid Malignancy, Transplant and Related Conditions, Rheumatological/Inflammatory, Dialysis, Intermediate Conditions.	Claims	DX* and RX**	Covariates	N	Time-varying use of immunocompromising drugs	Greenberg, et al. (2016)
Johnson, et al. (2015)	Herpes zoster	Immunocompetent patients aged	US	1/1/2011 to 12/31/2011	MarketScan administrative claims databases	113,861 (HZ) 27,616,373 (all)	A series of selected ICD-9-CM diagnoses, procedures and treatment criteria, informed by the CDC were used to determine the immunocompetent status of each patient. Patients were excluded if they had ICD-9-CM diagnosis or procedure codes for hematologic malignancy, solid tumor malignancy, HIV, chronic renal failure, nephrotic syndrome, and other select ICCs. Patients were also excluded if they had evidence of organ transplantation, procedures indicating injection or infusion of cancer chemotherapeutic substance, immunotherapy as antineoplastic agent, poisoning by antineoplastic and immunosuppressive drugs, or treatment with chemotherapy, radiation therapy, corticosteroids, tumor necrosis factor (TNF) inhibitors, protease inhibitors, reverse transcriptase inhibitors, azathioprine, cyclosporine, or tacrolimus.	Claims	DX* and RX**	Exclusion	N	N	Informed by the CDC, Advisory Committee on Immunization Practices (ACIP) recommendations: Centers for Disease Control and Prevention. Prevention of Herpes Zoster. Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR. 2008;57(Early Release):1–30.
Johnson, et al. (2016)	Herpes zoster	Immunocompetent adults with (cases) and without (controls) a diagnosis of HZ	US	1/1/2007 to 12/31/2011	MarketScan administrative claims databases	98,916	Immunocompetent status of patients was determined by a series of selected ICD-9-CM diagnoses, procedures, and treatment criteria. Specifically, these included malignancy, HIV, chronic renal disease, transplantation, diseases of white blood cells, aplastic anemia, other disease conditions indicating a compromised immune system, and treatment with selected chemotherapy/radiotherapy, corticosteroids, TNF inhibitors, protease inhibitors, and reverse transcriptase inhibitors, as well as azathioprine, cyclosporine, and tacrolimus.	Claims	DX* and RX**	Exclusion	N	N	Informed by the CDC: Department of Health and Human Service. Centers for Disease Control and Prevention. Shingles (Herpes Zoster). Atlanta, GA, 2014 http://www.cdc.gov/shingles/about/overview.html. Accessed April 10, 2013
Li, et al. (2016)	Herpes zoster	Adults aged 18-64 with HZ and select ICCs, and older adults aged 65+ with cancer	US	1/1/2005 to 12/31/2009	MarketScan administrative claims databases	Varied by population (cases): HIV: 1,927 SOT: 1,053 BMSCT: 281 Cancer: 13,137 Cancer (65+): 9,088	The diagnosis codes in the medical claims (Supplementary Appendix Table 1) during the 6-month preindex period were examined to identify the following 5 IC groups: HIV infection, SOT, BMSCT, and cancer (excluding skin cancer) in adults aged 18–64 years (ie, commercial insurance population); and cancer in adults aged ≥65 years (ie, Medicare population), where the other 3 conditions were not examined in this population due to the small sample size. Patients with cancer were required to have cancer diagnoses on multiple dates. A patient could have multiple conditions and contribute to multiple disease groups.	Claims	DX*	Inclusion	N	N	NA
Lu, et al. (2021)	Herpes zoster ophthalmicus	Adults aged 50+ years	US	1/1/2018 to 12/31/2019	Optum Labs Data Warehouse (claims, EHR)	4,842,579	IC status was determined with an ICD-9/10 code for HIV, AIDS, leukemia, or lymphoma, or an immunosuppressive medication prescription.	Claims	DX* and RX**	Exclusion	N	N	Tseng, et al. (2011)
Meyers, et al. (2017)	Herpes zoster, Postherpetic neuralgia	Immunocompetent patients aged 50 years or older with HZ	US	7/1/2008 to 6/30/2013	MarketScan administrative claims databases	142,519 patients with HZ; 357,907 matched controls	NA	Claims	DX* and RX**	Exclusion	N	N	NA

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Short Reference	Disease Area	Target Population	Country/ Region	Study Period	Data Source(s)	Sample Size	Summary of Algorithm	Claims / Clinical	DX */ RX**	Algorithm Use (inclusion, exclusion, outcome, other)	Levels/Degrees of IC Status	Time-varying Immunocompromisd Status	Algorithm Reference
Meyers, et al. (2018)	Herpes zoster	Adults aged 50+ years identified as IC by disease or immunosuppressive treatment	US	7/2008 to 8/2013	MarketScan administrative claims databases	30,107 (HZ) 113,875 (non-HZ)	Patients were considered IC based on the presence of either: (1) a diagnosis for an immunocompromising conditions (ICC) in the 6 months before the HZ index date (a list of ICC and corresponding diagnosis codes is presented in Appendix Table A1. Note: some ICC [e.g., RA] also required receipt of an immunocompromising medication in the 6 months before the HZ index date, a list of these conditions is presented in Appendix Table A2), or (2) receipt of an immunocompromising medication at any point in the 6 months before the HZ index date (a list of immunocompromising medications is presented in Appendix Table A3). The date of the first observed diagnosis for an ICC (or the date of the first observed immunocompromising medication when no corresponding diagnosis was present) defined the immunocompromising index date. Sensitivity analyses conducted excluding the subgroup of patients who were identified as IC based on the presence of an immunocompromising medication only (ie. included only those patients who could be identified as IC based on the presence of a diagnosis code for an ICC).	Claims	DX* and RX**	Inclusion	N	N	NA
Patel, et al. (2020)	Acute respiratory illness	Immunosuppressed vs non-immunosuppressed	US	8/1/2012 to 7/31/2017	MarketScan administrative claims databases	47.2 million	Modified Greenberg: case definition of immunosuppressive conditions based on 6 groups of diseases and 3 classes of medications. We considered 3 groups of enrollees to be immunosuppressed: 1) persons with symptomatic HIV/AIDS (excluding asymptomatic HIV), hematologic malignancy, or other intrinsic immune conditions; 2) persons with solid malignancy, organ transplant, rheumatologic, or other inflammatory conditions that were deemed immunosuppressed if patients received chemotherapy or an immune modulator; or rheumatologic or other inflammatory conditions who received systemic (nontopical, noninhaled) steroids; 3) any enrollee not in the first 2 groups who received chemotherapy, an immune modulator, or systemic steroids for >14 days Enrollees were considered immunosuppressed during the enrollment year if they had >1 hospitalization or 2 separate outpatient visits listing a corresponding ICD code, or were prescribed 1 of the listed medications during each of the 12 months of the study period.	Claims	DX* and RX**	Stratification	N	N	Greenberg, et al. (2016)
Poutsiaka, et al. (2009)	Sepsis	Patients with severe sepsis syndrome	US	1/1993 to 4/1994	Academic Medical Center Consortium's (AMCC) prospective observational cohort study of sepsis	1,166	Preexisting immunosuppression was broadly defined as patients with HIV, hematological or solid cancer, solid organ or hematopoietic stem cell transplantation, neutropenia (total neutrophil count <500/mm3), or receiving immunosuppressive medications (corticosteroids within the prior week, myelosuppressive agents including chemotherapy, and/or immunosuppressive agents active against T lymphocytes within the prior month).	Clinical	DX* and RX**	Stratification	N	N	NA
Self, et al. (2021)	COVID-19	Hospitalized adults aged ≥18 years without immunocompromising conditions	US (18 states)	3/11/2021 to 8/15/2021	IVY Network (a 21-hospital collaborative in the US; EHR, patient interview, vaccine registries)	3,689	Immunocompromising conditions included having one or more of the following: active solid organ cancer (active cancer defined as treatment for the cancer or newly diagnosed cancer in the past 6 months), active hematologic cancer (such as leukemia, lymphoma, or myeloma), HIV infection without AIDS, AIDS, congenital immunodeficiency syndrome, prior splenectomy, prior SOT, immunosuppressive medication, SLE, RA, psoriasis, scleroderma, or IBD including Crohn's disease or ulcerative colitis.	Clinical	DX* and RX**	Exclusion	N	N	NA
Sun, et al. (2021) - CID	Herpes zoster	Non-IC, vaccine age-eligible individuals	US	1/1/2018 to 12/31/2019	Optum Labs Data Warehouse (claims, EHR)	4,769,819	IC status was defined as an ICD-9 or ICD-10 code for HIV, AIDS, leukemia, or lymphoma, or a prescription for immunosuppressive medications.	Claims	DX* and RX**	Exclusion	N	N	Tseng, et al. (2011)
Sun, et al. (2021) - Vaccine	Herpes zoster	Adults aged 50+ years	US (Hawaii)	1/1/2018 to 12/31/2019	Kaiser Permanente Hawaii (EHR)	78,356	IC status was defined as an ICD-10 code for HIV, AIDS, leukemia, lymphoma, or a prescription for immunosuppressive medications.	Clinical	DX* and RX**	Exclusion	N	N	Sun, et al. (2021) - CID
Tartof, et al. (2022)	COVID-19	Adults aged 18+ years	US (California)	12/14/2020 to 12/5/2021	Kaiser Permanente Southern California integrated health system (EHR, registries)	3,133,075	Participants with ICD-10 codes corresponding to hematologic malignancy, HIV/AIDS, or intrinsic immune compromising conditions associated with i) at least one inpatient diagnosis code or ii) two separate encounters in the outpatient, emergency department, virtual visit setting or combination of these settings (e.g., one emergency department diagnosis and one virtual visit); those on the solid organ or hematopoietic stem cell registries and those taking systemic immunosuppressive medications were identified as IC. Immunosuppressive medications included chemotherapy, immunomodulators, TNF alpha antagonists and steroids (≥600 mg prednisone equivalent). Patient immunocompromising status was defined as of December 14th, 2020. Outpatient dispensing criteria for immunosuppressive medications included having a days supply for an immunosuppressing medication that covered the index date. Rituximab infusion was considered a 90-days supply. Inpatient immunosuppressive dispensing criteria included inpatient use of any immunosuppressive medication within 90 days prior to the index date.	Clinical, registries	DX* and RX**	Stratification	N	N	Greenberg, et al. (2016)
Tolsma, et al. (2014)	Sepsis	Patients admitted to ICU for severe sepsis or septic shock	France	1/1997 to 8/2011	OutcomeRea multicenter prospective database	1,981	The IC patients were defined according to seven immunodeficiency profiles: AIDS, organ transplant, solid organ tumor without neutropenia, hematologic malignancy without neutropenia, all-cause neutropenia, inflammatory and/or immune disorder, and primary or congenital immunodeficiency. Of note, patients with neutropenia with solid tumor or with hematologic malignancy were classified in the neutropenia group.	Clinical	DX*	Stratification	N	N	NA
Tseng, et al. (2012)	Herpes zoster	Immunocompetent elderly individuals 60+ years old with a recent episode of HZ	US (California)	1/1/2007 to 12/31/2010	Kaiser Permanente Southern California integrated health system (EHR, registries)	Vaccinated: 1,036 Unvaccinated: 5,180	IC patients were those with HIV infection, leukemia, or lymphoma diagnoses or those having immunosuppressive agents prescribed during the period from at least 1 year before the index date until the end of follow-up.	Clinical	DX* and RX**	Exclusion	N	N	Tseng, et al. (2011)

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Tseng, et al. (2020)	Herpez zoster	Immunocompetent and Zoster vaccine live-unvaccinatd adults aged ≥50 years	US	1/1/2011 12/31/2015	Kaiser Permanente Southern California integrated health system (EHR, registries)	1,360,248	Individuals with HIV, leukemia, or lymphoma diagnoses, or individuals who had immunosuppressing agents dispensed within the year prior to entering the cohort were excluded. The list of immunosuppressing agents was provided in previous publication (Tseng, et al. [2020]).	Clinical	DX* and RX**	Exclusion	N	N	Tseng, et al. (2011)
Vietri, et al. (2020)	Pneumonia	High-risk (IC) adults aged 19-64 years.	US	10/2012 to 10/2016	Optum claims and EHR databases	Claims: 267,022 EHR: 572,055	Reasons for inclusion in the high-risk population were categorized as congenital or acquired immunodeficiency, asplenia, or cerebrospinal fluid (CSF) leak; sickle-cell disease; HIV; renal failure or nephrotic syndrome; cancer or cancer treatment; SOT; iatrogenic immunosuppression; or a combination of any of these factors using respective ICD-9 and ICD-10 codes. There are several aspects of how the iatrogenic immunosuppression category was operationalized for the study that should be noted. First, iatrogenic immunosuppression is defined in the recommendation as, "Diseases requiring treatment with immunosuppressive drugs, including long-term corticosteroids and radiation therapy." The current study relied on use of National Drug Code (NDC) for written prescription or fill or Healthcare Common Procedure Coding System (HCPCS) codes for administration of immunosuppressive medication (e.g., methotrexate, adalimumab, rituximab, etc., as recorded in EHR or claims) in addition to the attributable provider specialties rather than diagnosis of a disease requiring such drugs or procedures. Furthermore, the long-term corticosteroid use mentioned in the recommendation was not incorporated into the category due to the complexity of operationalizing, so patients who would qualify as high-risk only because of long-term corticosteroid use were not included in the study. Finally, many therapies and procedures (identified via Current Procedural Terminology [CPT-4] codes) which would cause iatrogenic immunosuppression are oncological, and we chose to include such therapies which are specific to oncology or were prescribed by oncologists as "cancer or cancer treatment".	Claims and Clinical	DX* and RX**	Inclusion	N	N	NA

* Dx indicates algorithms using diagnoses to determine IC status.
** Rx indicates algorithms using medications to determine IC status.

ACIP: Advisory Committee on Immunization Practices; **ACS-NSQIP**: American College of Surgeons; National Surgical Quality Improvement Program; **AIDS**: acquired immunodeficiency syndrome; **AMCC**: Academic Medical Center Consortium; **BMSCT**: bone marrow or stem cell transplantation; **CDC**: Centers for Disease Control and prevention; **CKD**: chronic kidney disease; **CMI**: cognitive–motor interference; **COPD**: chronic obstructive pulmonary disease; **CPT**: current procedural terminology; **CSF**: cerebrospinal fluid; **EHR**: electronic health record; **EMR**: electronic medical records; **ESRD**: end stage renal disease; **HAIVEN network**: Hospitalized Adult Influenza Vaccine Effectiveness network; **HCPCS**: healthcare common procedure coding system; **HIV**: human immunodeficiency virus; **HZ**: herpes zoster; **IBD**: inflammatory bowel disease; **IC**: immunocompromised; **ICC**: immunocompromising conditions; **ICD-9(10)**: International Classification of Diseases, 9th (10th) revision; **ICD-9(10)-CM**: International Classification of Diseases, 9th (10th) revision, Clinical Modification; **ICU**: intensive care unit; **IS**: immunosuppressive; **IVY network**: The investigating respiratory viruses in the acutely Ill network; **MS**: multiple sclerosis; **N**: no; **NA**: non-available; **NDC**: national drug code; **RA**: rheumatoid arthritis; **SLE**: systemic lupus erythematosus; **SOT**: solid organ transplant; **TNF**: tumor necrosis factor; **UHC**: Univerity HealthSystem Consortium; **US**: United States

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Algorithms for Identifying Immunocompromised Adults in Administrative Claims Data – a Targeted Literature Review

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