

Characteristics Associated with the Presence of One or More Risk Factors for Severe Respiratory Syncytial Virus Disease among Adults in the United States

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Background

- RSV causes **substantial disease burden** in **older adults** and in **adults with certain underlying medical conditions**.¹
- In 2023, **RSV vaccines** were **approved by the US FDA** for the **prevention of LRTD** caused by RSV in adults **≥60 YoA**.¹ Additionally, the indication for **adjuvanted RSVPreF3 vaccine** was **expanded by the FDA** in June 2024 to include adults **50-59 YoA** who are at increased risk of RSV LRTD.²
- To understand disparities in risk factors for severe RSV disease, this study examined **characteristics associated with having diagnosed and undiagnosed risk factors for severe RSV disease** among US adults.

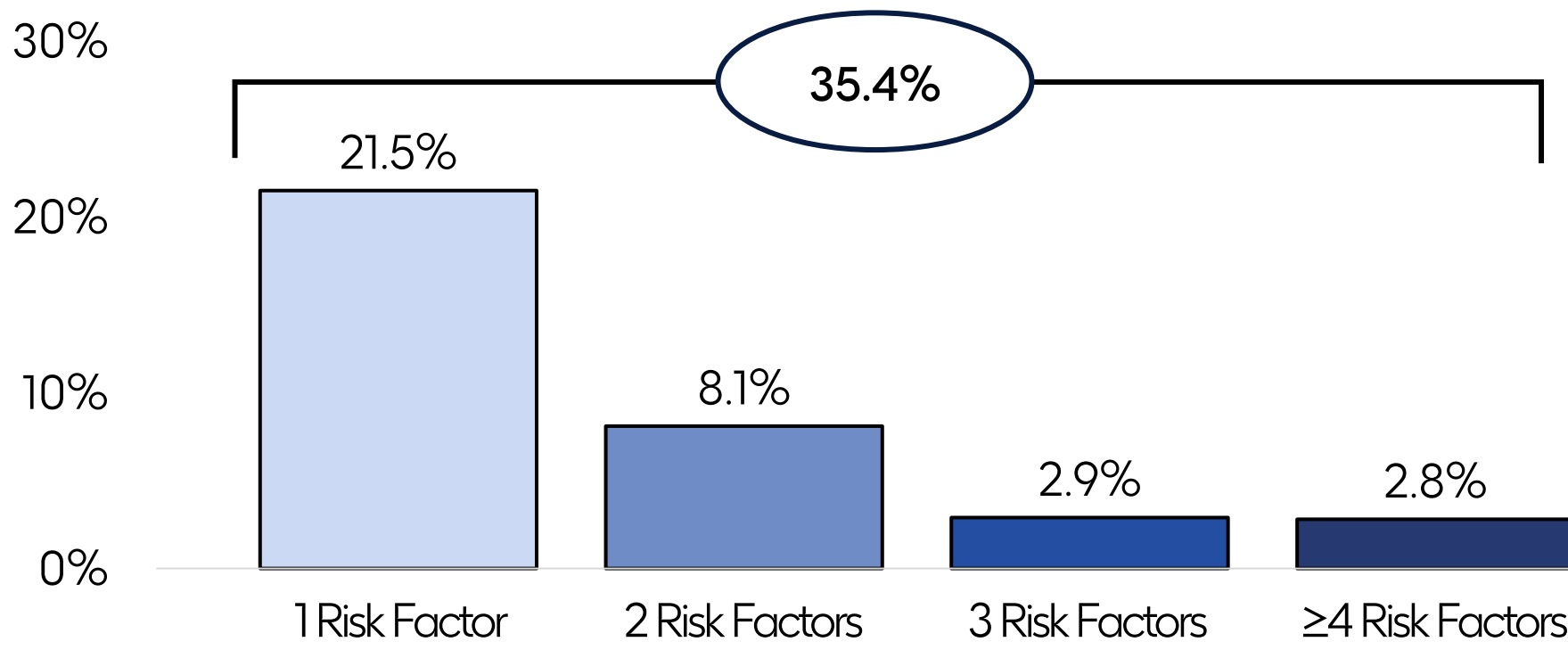
Study design

- Design:** Retrospective, cross-sectional analysis of pooled NHANES data from January 2011-March 2020
- Population:** Respondents ≥20 YoA from 4 survey cycles (2011-2012, 2013-2014, 2015-2016, 2017-March 2020), with results weighted to reflect the entire US non-institutionalized adult population³
- Outcomes:** Included 10 risk factors for severe RSV disease: COPD, asthma, CHF, coronary heart disease, stroke, angina pectoris, MI, diabetes, renal disease, liver disease^{4*}
- **Diagnosed risk factors:** Self-reported in interview component of NHANES
 - **Undiagnosed risk factors:** Examination/laboratory tests indicative of condition in absence of corresponding self-reported diagnosis in interview component of NHANES (limited to diabetes and renal disease)
- Analysis:** Multivariable logistic regression models used to estimate the association between respondent characteristics and presence of ≥1 risk factor for severe RSV disease
- * See Supplementary File for relevant NHANES interview question details.
‡ See Supplementary File for details on variable selection in models.

Results

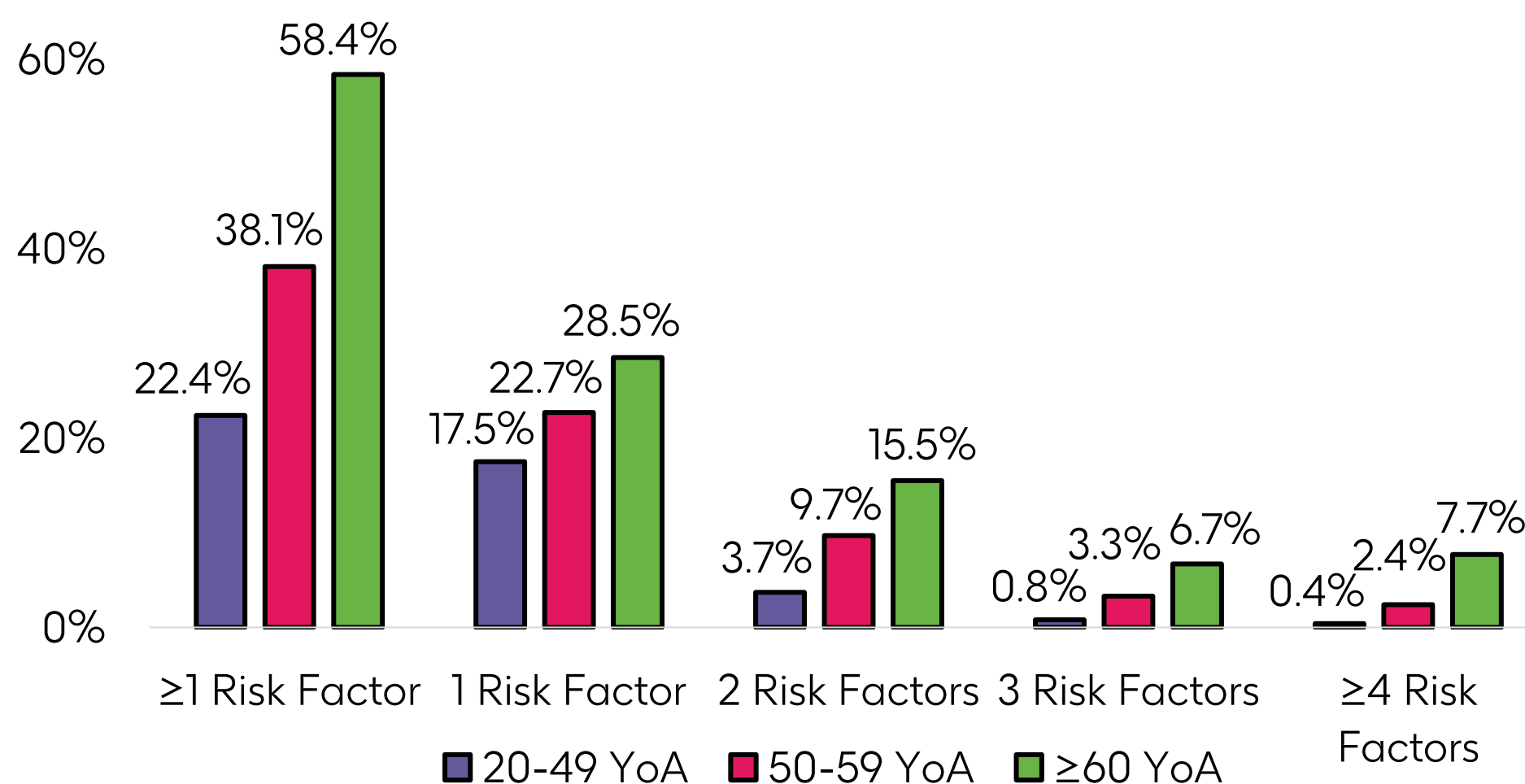
Prevalence of risk factors for severe RSV disease in adults ≥20 YoA

35.4% of adults ≥20 YoA (n=82,413,506/233,102,301) had **≥1 risk factor** (diagnosed or undiagnosed) for severe RSV disease (after extrapolation to the non-institutionalized US population).



Prevalence of risk factors for severe RSV disease, by age group

Prevalence of risk factors (diagnosed or undiagnosed) for severe RSV disease **increased with age**.



Note: Estimated populations with ≥1 risk factor (diagnosed or undiagnosed) for severe RSV disease include 28,086,485 adults 20-49 YoA (22.4% of N=125,255,765), 16,298,939 adults 50-59 YoA (38.1% of N=42,750,712), and 38,028,082 adults ≥60 YoA (58.4% of N=65,095,825). See Supplementary File for results including HIV and limited to diagnosed risk factors.

Conclusions



Among US adults ≥20 YoA, several **social determinants of health** are **associated** with the **presence of ≥1 diagnosed and undiagnosed risk factor** for severe RSV disease.



Understanding characteristics associated with risk factors for severe RSV disease can **help to improve access to RSV vaccination** among these **higher risk groups**.

Characteristics associated with the presence of ≥1 risk factor for severe RSV disease

For both **diagnosed and undiagnosed** risk factors, **increasing age**, **lower income**, **being a current smoker**, and **having obesity** were associated with significantly **higher odds** of having ≥1 risk factor.

Adults with **government insurance** had significantly **higher odds** of having ≥1 **diagnosed** risk factor (than those with private insurance).
Adults with **no routine place for healthcare** had significantly **lower odds** of having ≥1 **diagnosed** risk factor (than those whose routine place for healthcare was doctors' offices).

Adults from **racial and ethnic minority groups** had significantly **higher odds** than non-Hispanic White adults of having ≥1 **undiagnosed** risk factor.
Adults whose routine place for healthcare was the **emergency room** had significantly **lower odds** of having ≥1 **undiagnosed** risk factor (than those whose routine place for healthcare was doctors' offices).

Covariates	Diagnosed ^a (N=188,812,110)		Undiagnosed ^b (N=184,243,151)		Diagnosed or Undiagnosed (N=188,812,110)	
	OR	95% CI	OR	95% CI	OR	95% CI
Age group at screening (ref: 20-49 years)						
50-59 years	2.07	1.82-2.34	1.95	1.65-2.31	2.06	1.83-2.31
60-64 years	2.92	2.42-3.53	2.65	2.19-3.19	3.03	2.58-3.56
≥65 years	2.71	2.18-3.37	6.02	4.98-7.29	4.19	3.49-5.04
Gender (ref: Female) Male	1.04	0.95-1.14	0.88	0.77-1.00	0.90	0.83-0.99
Race and ethnicity (ref: Non-Hispanic White)						
Hispanic ^c	0.87	0.78-0.97	1.21	1.07-1.37	0.94	0.85-1.04
Non-Hispanic Black	0.96	0.87-1.05	1.55	1.36-1.76	1.12	1.01-1.23
Non-Hispanic Asian	0.92	0.82-1.04	1.42	1.19-1.70	1.11	1.00-1.24
Poverty income ratio ^d (ref: ≥5)						
4-<5	1.16	0.96-1.42	1.05	0.83-1.32	1.15	0.97-1.37
3-<4	1.30	1.05-1.61	1.13	0.91-1.42	1.26	1.03-1.54
2-<3	1.52	1.28-1.81	1.43	1.20-1.71	1.59	1.35-1.88
1-<2	1.73	1.50-1.99	1.65	1.37-1.98	1.78	1.54-2.04
0-<1	1.99	1.70-2.33	1.88	1.52-2.33	2.10	1.82-2.42
Health insurance status ^e (ref: Private medical insurance)						
Medicare	1.98	1.63-2.40	1.14	0.93-1.38	1.68	1.42-1.99
Medicaid	1.69	1.45-1.98	1.03	0.85-1.25	1.49	1.28-1.72
Dual-eligible	3.59	2.75-4.69	1.21	0.92-1.61	2.96	2.21-3.96
Other government health plan	1.23	1.02-1.47	1.10	0.90-1.34	1.23	1.04-1.45
Other insurance	0.98	0.49-1.97	0.89	0.48-1.64	0.96	0.53-1.71
Uninsured/unknown	0.99	0.85-1.15	1.10	0.94-1.29	1.03	0.91-1.17
Most frequented place for healthcare ^f (ref: Clinic or doctor's office)						
Hospital emergency room	1.21	0.95-1.54	0.69	0.49-0.97	1.09	0.87-1.36
Hospital outpatient department	1.20	0.75-1.90	0.80	0.48-1.32	1.09	0.65-1.82
Other	0.85	0.57-1.29	1.18	0.63-2.23	1.00	0.67-1.48
Unknown place	1.21	1.09-1.35	0.95	0.81-1.10	1.14	1.02-1.28
None	0.50	0.44-0.57	0.86	0.73-1.02	0.62	0.55-0.70
Smoking status ^g (ref: Non-smoker) Current smoker	1.45	1.27-1.65	1.15	1.01-1.31	1.37	1.20-1.56
Body mass index (ref: Healthy weight [18.5-<25.0 kg/m ²])						
Underweight (<18.5 kg/m ²)	1.41	0.89-2.22	1.39	0.96-2.00	1.35	0.92-1.97
Overweight (25.0-<30.0 kg/m ²)	1.22	1.09-1.38	1.09	0.94-1.26	1.20	1.07-1.34
Obese (≥30 kg/m ²)	2.11	1.87-2.38	1.72	1.50-1.98	2.11	1.88-2.38

Note: See Supplementary File for the footnotes of the forest plot. Undiagnosed risk factors are limited to diabetes and renal disease.

Abbreviations

CHF: congestive heart failure; CI: confidence interval; COPD: chronic obstructive pulmonary disease; FDA: Food and Drug Administration; HIV: human immunodeficiency virus; LRTD: lower respiratory tract disease; MI: myocardial infarction; N: number of adults; NHANES: National Health and Nutrition Examination Survey; OR: odds ratio; RSV: respiratory syncytial virus; US: United States; YoA: years of age.

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Acknowledgements

Editorial and publication coordination support provided by Business & Decision Life Sciences Medical Communication Service Center c/o GSK. Study support provided by Hai Nguyen and Jolene Darnon of Evidera.

Disclosures

Funding: GSK (GSK study identifier: VEO-000686).
Conflicts of interest: EKH and DS are employees of, and hold financial equities in, GSK. ABo, CSM and ABe are employed by Evidera PPD, which received funding from GSK to conduct this study and other studies. Evidera PPD also received consulting fees from other pharmaceutical, biotech, and medical device companies, outside the submitted work. The authors declare no other financial and non-financial relationships and activities.



Audio file



PDF

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Supplement

Table S1. NHANES survey questions: Interview component

Diagnosed risk factors		
Pulmonary conditions		
Chronic obstructive pulmonary disease	MCQ160, MCQ170 ^b	Has a doctor or other health professional ever told {you/SP} that {you/s/he} had COPD? (2013-2014 and 2015-2016 only) {Do you/Does SP} still have chronic bronchitis? (2011-2012, 2013-2014, and 2015-2016 only) Has a doctor or other health professional ever told {you/SP} that {you/s/he} had emphysema? (2011-2012, 2013-2014, and 2015-2016 only) {Have you/Has SP} ever been told by a doctor or other health professional that {you/he/she} had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis? (2017-2020 only)
Asthma ^a	MCQ035	{Do you/Does SP} still have asthma?
Cardiovascular conditions		
Congestive heart failure	MCQ160b	Has a doctor or other health professional ever told {you/SP} that {you/s/he} had congestive heart failure?
Coronary heart disease	MCQ160c	Has a doctor or other health professional ever told {you/SP} that {you/s/he} had coronary heart disease?
Stroke	MCQ160f	Has a doctor or other health professional ever told {you/SP} that {you/s/he} had a stroke?
Angina pectoris	MCQ160d	Has a doctor or other health professional ever told {you/SP} that {you/s/he} had angina, also called angina pectoris?
Myocardial infarction	MCQ160e	Has a doctor or other health professional ever told {you/SP} that {you/s/he} . . .had a heart attack (also called myocardial infarction)?
Endocrine and metabolic conditions		
Diabetes	DIQ010	{Other than during pregnancy, {have you/has SP}/{Have you/Has SP}} ever been told by a doctor or health professional that {you have/{he/she/SP} has} diabetes or sugar diabetes?
Renal disease	KIQ022	{Have you/Has SP} ever been told by a doctor or other health professional that {you/s/he} had weak or failing kidneys? Do not include kidney stones, bladder infections, or incontinence.
Liver disease ^a	MCQ170l	{Do you/Does SP} still have any kind of liver condition?

^a Limited to respondents who answered 'yes' to currently having the risk factor.

^b Includes respondents who answered 'yes' to any of the following questionnaire items: MCQ160o "Has a doctor or other health professional ever told {you/SP} that {you/s/he} had COPD?" (2013-2014 and 2015-2016 only), MCQ170k "{Do you/Does SP} still have chronic bronchitis?" (2011-2012, 2013-2014, and 2015-2016 only), MCQ160g "Has a doctor or other health professional ever told {you/SP} that {you/s/he} had emphysema?" (2011-2012, 2013-2014, and 2015-2016 only), or MCQ160p "{Have you/Has SP} ever been told by a doctor or other health professional that {you/he/she} had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis?" (2017-2020 only).

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Supplement

Table S2. Characteristics of the weighted study population, NHANES January 2011 - March 2020

	Interview (N=233,118,491)	Laboratory/examination (N=221,518,089)
Age group at screening		
20-49 years	125,255,765 (53.7%)	119,055,292 (53.7%)
50-59 years	42,750,712 (18.3%)	40,905,912 (18.5%)
60-64 years	19,204,620 (8.2%)	18,493,471 (8.3%)
≥65 years	45,907,395 (19.7%)	43,063,414 (19.4%)
Gender		
Female	121,075,826 (51.9%)	115,439,910 (52.1%)
Male	112,042,665 (48.1%)	106,078,179 (47.9%)
Race and ethnicity		
Non-Hispanic White	150,001,228 (64.3%)	142,469,542 (64.3%)
Hispanic ^a	35,427,374 (15.2%)	33,684,703 (15.2%)
Non-Hispanic Black	26,693,818 (11.5%)	25,546,758 (11.5%)
Non-Hispanic Asian	13,178,978 (5.7%)	12,368,168 (5.6%)
Other (including multi-racial)	7,817,093 (3.4%)	7,448,918 (3.4%)
Poverty income ratio ^b		
≥5	56,705,042 (24.3%)	54,201,269 (24.5%)
4-<5	21,649,397 (9.3%)	20,710,560 (9.3%)
3-<4	26,718,652 (11.5%)	25,809,591 (11.7%)
2-<3	32,092,050 (13.8%)	30,737,444 (13.9%)
1-<2	43,133,903 (18.5%)	41,363,461 (18.7%)
0-<1	31,377,565 (13.5%)	29,977,917 (13.5%)
Missing	21,441,882 (9.2%)	18,717,848 (8.4%)
Health insurance status ^c		
Private medical insurance	114,073,772 (48.9%)	108,786,442 (49.1%)
Medicare	42,122,054 (18.1%)	39,616,885 (17.9%)
Medicaid	16,219,932 (7.0%)	15,314,354 (6.9%)
Dual-eligible	5,012,867 (2.2%)	4,769,155 (2.2%)
Other government health plan	17,509,818 (7.5%)	16,870,162 (7.6%)
Other insurance	1,259,757 (0.5%)	1,174,325 (0.5%)
Uninsured/unknown	36,920,292 (15.8%)	34,986,768 (15.8%)

	Interview (N=233,118,491)	Laboratory/examination (N=221,518,089)
Most frequented place for healthcare ^d		
Clinic or doctor's office	117,827,491 (50.5%)	113,752,345 (51.4%)
Hospital emergency room	3,920,245 (1.7%)	3,786,983 (1.7%)
Hospital outpatient department	1,807,773 (0.8%)	1,754,049 (0.8%)
Other	2,874,767 (1.2%)	2,710,466 (1.2%)
Unknown place	69,423,205 (29.8%)	64,325,957 (29.0%)
None	37,265,010 (16.0%)	35,188,289 (15.9%)
Smoking status ^e		
Non-smoker	163,329,661 (70.1%)	160,555,854 (72.5%)
Current smoker	56,834,532 (24.4%)	54,618,118 (24.7%)
Missing	12,954,298 (5.6%)	6,344,117 (2.9%)
Body mass index		
Healthy weight (18.5-<25.0 kg/m ²)	58,734,200 (25.2%)	58,734,200 (26.5%)
Underweight (<18.5 kg/m ²)	3,215,168 (1.4%)	3,215,168 (1.5%)
Overweight (25.0-<30.0 kg/m ²)	70,894,601 (30.4%)	70,894,601 (32.0%)
Obese (≥30 kg/m ²)	86,139,940 (37.0%)	86,139,940 (38.9%)
Missing	14,134,583 (6.1%)	2,534,181 (1.1%)
Risk factors for severe RSV disease ^f		
COPD ^g	14,069,235 (6.0%)	NA
Asthma ^h	20,489,285 (8.8%)	NA
Congestive heart failure	6,071,509 (2.6%)	NA
Coronary heart disease	8,560,342 (3.7%)	NA
Stroke	7,374,503 (3.2%)	NA
Angina pectoris	5,115,446 (2.2%)	NA
Myocardial infarction	8,038,711 (3.5%)	NA
Diabetes ⁱ	24,709,817 (10.6%)	7,000,918 (3.7%)
Renal disease ^j	7,045,747 (3.0%)	25,783,773 (12.5%)
Liver disease ^h	5,142,428 (2.2%)	NA

^a Hispanic group defined in NHANES as Mexican American or other Hispanic.

^b Calculated by NHANES by dividing family (or individual) income by the HHS poverty guidelines specific to the survey year. A ratio <1 represents family income below poverty level.

^c "Private medical insurance": reported having private medical insurance AND not having Medicare, Medi-gap, Medicaid, SCHIP, Military health plan, Indian Health Service, State-sponsored health plan, or other government insurance. "Medicare": reported having Medicare AND not having Medicaid. "Medicaid": reported having Medicaid AND not having Medicare or Medi-gap. "Dual-eligible": reported having Medicare AND Medicaid. "Other government health plan": reported having Military health plan, SCHIP, Indian Health Service, State-sponsored health plan, or other government insurance AND are not classified elsewhere. "Other insurance": reported having some form(s) of insurance AND are not classified elsewhere. "Uninsured/unknown": reported having no insurance or don't know/refused.

^d "Clinic or doctor's office": reported having a most frequent place of healthcare AND the type most often visited as a clinic or health center OR doctor's office or HMO. "Hospital emergency room": reported having a most frequent place of healthcare AND the type most often visited as an emergency room. "Hospital outpatient department": reported having a most frequent place of healthcare AND the type most often visited as an outpatient department. "Other": reported having a most frequent place of healthcare AND the type most often visited as other place or doesn't go to one place most often. "Unknown place": reported having a most frequent place of healthcare AND the type most often visited as refused/don't know/missing (includes respondents in 2017-March 2020 survey cycle who reported having a most frequent place of healthcare because no question was included on the type most often visited). "None": reported having no routine place to go for healthcare.

^e Current smoker is defined as having a 'yes' response to "do you now smoke cigarettes?" and/or Cotinine laboratory results as >10 ng/mL.

^f Percentages do not equal n/N because of variability in the number of respondents with refused, don't know, or missing responses. Examination/laboratory tests to determine presence of condition were only available for diabetes and renal disease.

^g Includes respondents who answered 'yes' to any of the following: "Has a doctor or other health professional ever told {you/SP} that {you/s/he} had COPD?" (2013-2014 and 2015-2016 only), "{Do you/Does SP} still have chronic bronchitis?" (2011-2012, 2013-2014, and 2015-2016 only), "Has a doctor or other health professional ever told {you/SP} that {you/s/he} had emphysema?" (2011-2012, 2013-2014, and 2015-2016 only), or "{Have you/Has SP} ever been told by a doctor or other health professional that {you/he/she} had COPD, emphysema, or chronic bronchitis?" (2017-2020 only).

^h Limited to respondents who answered 'yes' to currently having the risk factor.

ⁱ Undiagnosed diabetes defined as plasma fasting glucose >126 mg/dL (≥7.0 mmol/L), HbA1C >6.5%, or a 2-hour oral glucose tolerance test result ≥200 mg/dL. The 2-hour oral glucose tolerance test is not available in 2017-2020.

^j Undiagnosed renal disease defined as eGFR <60 mg/dL (CKD-EPI formula) or urine albumin creatinine ratio ≥30 mg/g.

Abbreviations
CKD-EPI: chronic kidney disease epidemiology collaboration; **COPD**: chronic obstructive pulmonary disease; **eGFR**: estimated glomerular filtration rate; **HbA1C**: hemoglobin A1C; **HHS**: Department of Health and Human Services; **HMO**: health maintenance organization; **N**: number of adults; **NA**: not assessed; **NHANES**: National Health and Nutrition Examination Survey; **RSV**: respiratory syncytial virus; **SCHIP**: State Children's Health Insurance Program; **SP**: sample person.

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Figure S1. Prevalence of risk factors for severe RSV disease (overall, including HIV) in adults ≥20 YoA

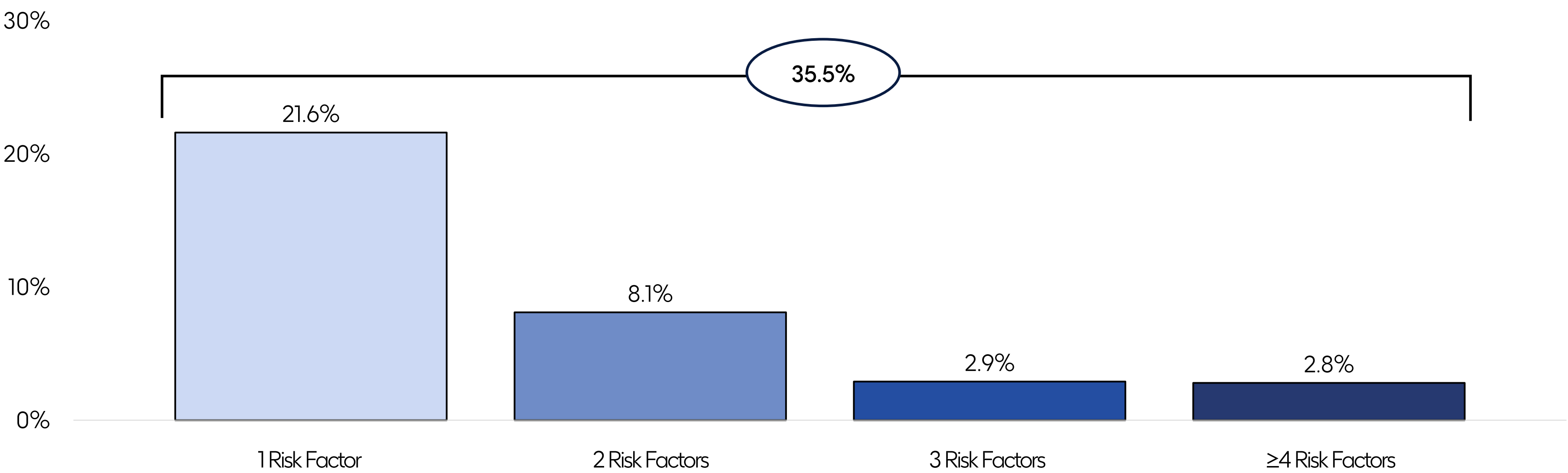
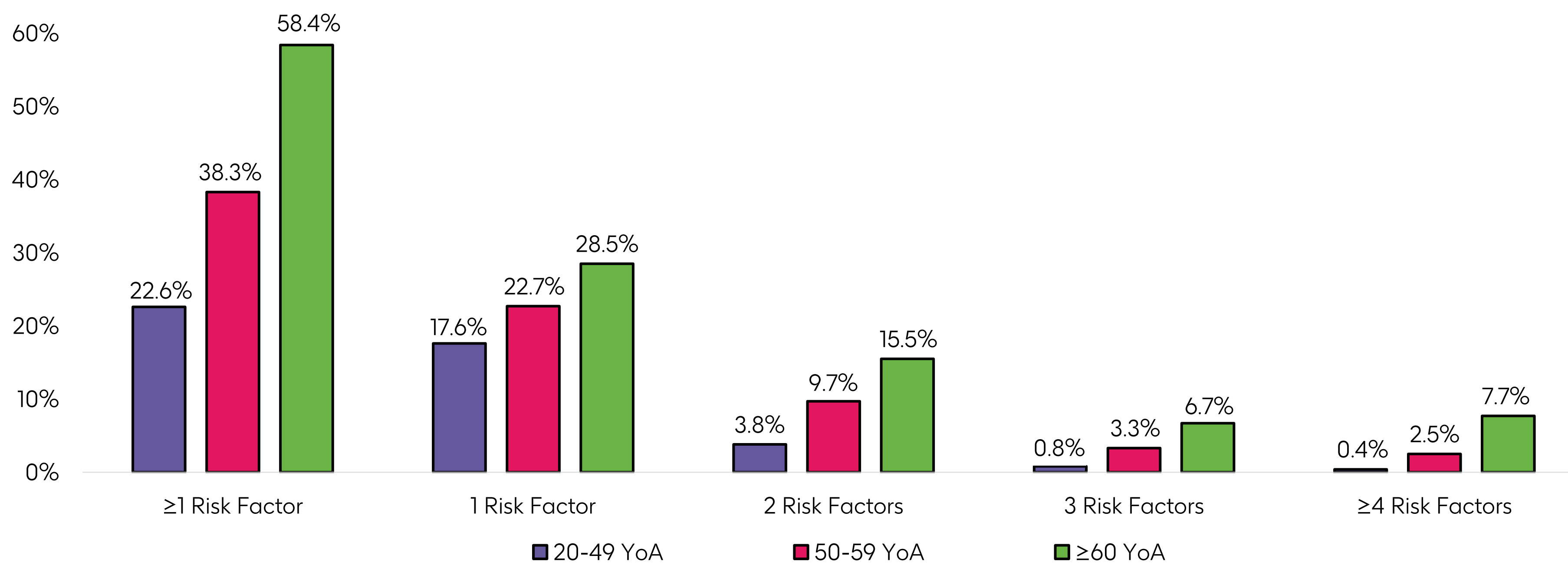


Figure S2. Prevalence of risk factors for severe RSV disease (overall, including HIV), by age group



Note: Estimated populations with ≥1 risk factor for severe RSV disease (overall, including HIV) include 28,304,897 adults 20-49 YoA (22.6% of N=125,255,765), 16,382,937 adults 50-59 YoA (38.3% of N=42,750,712), and 38,028,082 adults ≥60 YoA (58.4% of N=65,095,825) [HIV antibody test only conducted among adults <60 YoA].

Figure S3. Prevalence of risk factors for severe RSV disease (diagnosed only, not including HIV) in adults ≥20 YoA

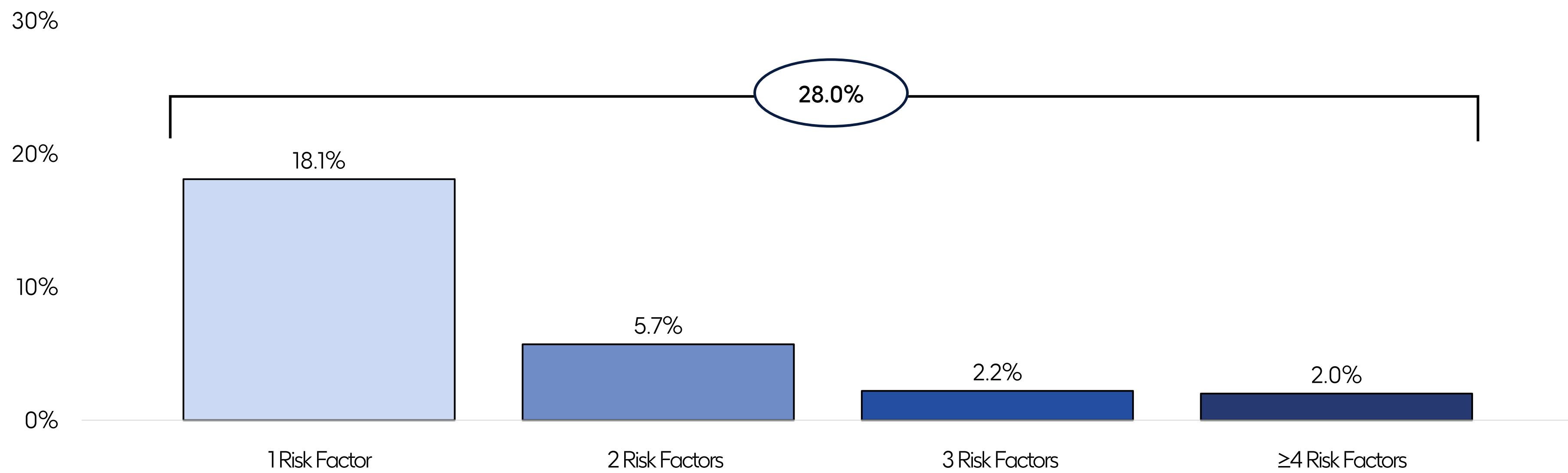
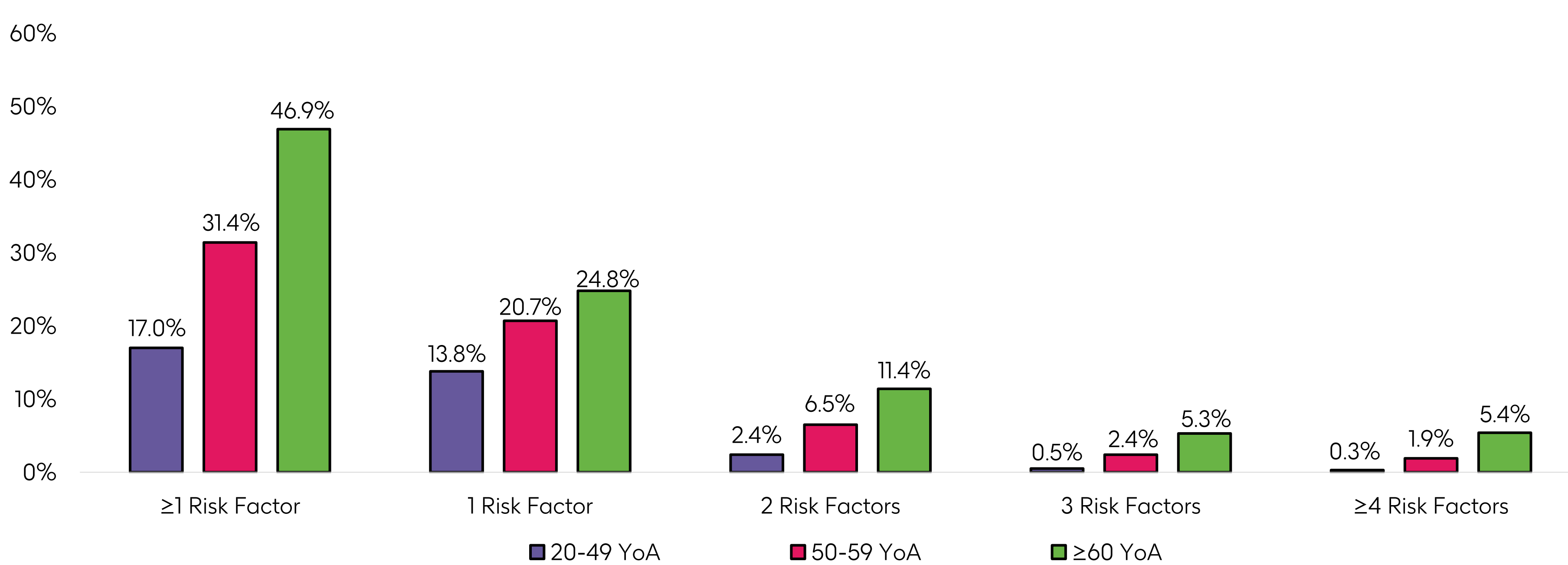


Figure S4. Prevalence of risk factors for severe RSV disease (diagnosed only, not including HIV), by age group



Note: Estimated populations with ≥1 risk factor for severe RSV disease (diagnosed only, not including HIV) include 21,335,182 adults 20-49 YoA (17.0% of N=125,255,765), 13,445,004 adults 50-59 YoA (31.4% of N=42,750,712), and 30,549,491 adults ≥60 YoA (46.9% of N=65,095,825).

Abbreviations

HIV: human immunodeficiency virus; **N:** number of adults; **RSV:** respiratory syncytial virus, **YoA:** years of age.

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Study limitations

- **Responder bias:** Without medical record confirmation, accuracy of self-reported responses cannot be verified.
- **Diagnosed risk factors:** Not all risk factors for severe RSV disease are captured in the NHANES interview component (e.g., solid organ transplants, interstitial lung disease).
- **Undiagnosed risk factors:** Not all risk factors included in interview component have corresponding exam or lab tests (e.g., spirometry), limiting assessment of undiagnosed risk factors of interest.
- **Underestimation:** Prevalence estimates based on self-reported diagnoses of risk factors do not account for underdiagnosis, which disproportionately impacts certain groups (e.g., racial and ethnic minority and lower income adults).¹⁻⁵
- **Survey variables:** Some NHANES variables are not included in certain years (e.g., 2-hour oral glucose tolerance test), or wording of question changed over different cycles (e.g., COPD).
- **2017-March 2020 survey cycle*:** Degree to which information from 2017-March 2020 dataset approximates what would have been collected without COVID-19 disruption is unknown.

* Data collection for the 2019-2020 cycle was suspended in March 2020 due to safety concerns from the COVID-19 pandemic and was not rescheduled for the remaining sites in CY2020. Therefore, the partial 2019-March 2020 data were combined with data from the previous cycle (2017-2018) for survey content that was consistent across the two cycles to create nationally representative 2017-March 2020 pre-pandemic data files.

Footnotes for details on variable selection in models

Covariates for potential inclusion in model included age group at survey participation, gender, race and ethnicity, poverty income ratio, highest level of education attained, health insurance status, most frequented place for healthcare, employment status, smoking status, and body mass index. A correlation matrix was computed to determine if intercorrelation existed between potential covariates of interest; highest level of education attained and employment status were dropped from the final regression models due to intercorrelation between highest level of education attained and poverty income ratio, and between employment status and health insurance status. Retained covariates with a statistically significant univariable test of 10% ($p \leq 0.10$) in univariable analyses based on the corresponding Wald test statistics were considered for inclusion in the multivariable model, in addition to covariates considered clinically relevant (i.e., strong association with the outcome based on previous research findings in the literature).

Footnotes for characteristics associated with the presence of ≥ 1 risk factor for severe RSV disease

^a Self-reported diagnosis of the following conditions: congestive heart failure, coronary heart disease, stroke, angina pectoris, myocardial infarction, COPD, asthma, diabetes, liver disease, renal disease.

^b Limited to undiagnosed diabetes and undiagnosed renal disease. Undiagnosed diabetes defined as plasma fasting glucose >126 mg/dL (≥ 7.0 mmol/L), HbA1C $>6.5\%$, or a 2-hour oral glucose tolerance test result ≥ 200 mg/dL. The 2-hour oral glucose tolerance test is not available in 2017-2020. Undiagnosed renal disease defined as eGFR <60 mg/dL (CKD-EPI formula) or urine albumin creatinine ratio ≥ 30 mg/g.

^c Hispanic group defined in NHANES as Mexican American or other Hispanic.

^d Calculated by NHANES by dividing family (or individual) income by the HHS poverty guidelines specific to the survey year. A ratio <1 represents family income below poverty level.

^e “Private medical insurance”: reported having private medical insurance AND not having Medicare, Medi-gap, Medicaid, SCHIP, Military health plan, Indian Health Service, State-sponsored health plan, or other government insurance. “Medicare”: reported having Medicare AND not having Medicaid. “Medicaid”: reported having Medicaid AND not having Medicare or Medi-gap. “Dual-eligible”: reported having Medicare AND Medicaid. “Other government health plan”: reported having Military health plan, SCHIP, Indian Health Service, State-sponsored health plan, or other government insurance AND are not classified elsewhere. “Other insurance”: reported having some form(s) of insurance AND are not classified elsewhere. “Uninsured/unknown”: reported having no insurance or don’t know/refused.

^f “Clinic or doctor’s office”: reported having a most frequent place of healthcare AND the type most often visited as a clinic or health center OR doctor’s office or HMO. “Hospital emergency room”: reported having a most frequent place of healthcare AND the type most often visited as an emergency room. “Hospital outpatient department”: reported having a most frequent place of healthcare AND the type most often visited as an outpatient department. “Other”: reported having a most frequent place of healthcare AND the type most often visited as other place or doesn’t go to one place most often. “Unknown place”: reported having a most frequent place of healthcare AND the type most often visited as refused/don’t know/missing (includes respondents in 2017-March 2020 survey cycle who reported having a most frequent place of healthcare because no question was included on the type most often visited). “None”: reported having no routine place to go for healthcare.

^g Current smoker is defined as having a ‘yes’ response to “do you now smoke cigarettes?” and/or Cotinine laboratory results as >10 ng/mL.

Abbreviations

CKD-EPI: chronic kidney disease epidemiology collaboration; **COPD:** chronic obstructive pulmonary disease; **COVID-19:** coronavirus disease 2019; **CY:** calendar year; **eGFR:** estimated glomerular filtration rate; **HbA1C:** hemoglobin A1C; **HHS:** Department of Health and Human Services; **HMO:** health maintenance organization; **NHANES:** National Health and Nutrition Examination Survey; **RSV:** respiratory syncytial virus; **SCHIP:** State Children’s Health Insurance Program.

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