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1 **Title page**

2 **Title:** Respiratory syncytial virus-associated hospitalisation in adults with
3 comorbidities in two European countries: a modelling study

4 **Running title:** RSV in adults with comorbidities

5 **Summary:** Adults with COPD, asthma, ischemic heart disease, stroke, diabetes and
6 chronic kidney disease were at higher risk of RSV hospitalisation than the overall
7 population aged 45 years and older in two European countries.

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38 **Abstract**

39 **Background**

40 Individuals with comorbidities are at increased risk of severe RSV infection. We
41 estimated RSV-associated respiratory tract infection (RTI) hospitalisation among
42 adults aged 45 years and older with comorbidities in Denmark and Scotland.

43 **Methods**

44 By analysing national hospital and virological data, we estimated the annual average
45 number and rate of RSV-associated hospitalisations by seven selected comorbidities
46 and ages during 2010-2018. We estimated rate ratios (RRs) of RSV-associated
47 hospitalisation and 95% uncertainty ranges in comorbid adults versus the overall
48 populations.

49 **Results**

50 In Danish adults (≥ 45 years), annual RSV-RTI hospitalisation rates ranged from 3.1
51 per 1000 adults with asthma to 19.4 per 1000 adults with chronic kidney disease
52 (CKD). In Scotland, the annual rate ranged from 2.4 per 1000 adults with chronic liver
53 disease (CLD) to 9.0 per 1000 adults with chronic obstructive pulmonary disease
54 (COPD). In both countries, we found 2-4-fold increased risk of RSV hospitalisation in
55 adults with COPD, ischemic heart disease (IHD), stroke and diabetes, 1.5-3-fold
56 increased risk in adults with asthma, and 3-7-fold for those with CKD. RSV
57 hospitalisation rates among adults aged 45-64 years with COPD, asthma, IHD or CKD
58 were higher compared with the overall population.

59 **Conclusion**

60 The findings of this study provide important evidence for identifying risk groups and
61 assisting health authorities in RSV vaccination policymaking.

62 **Keywords.** Respiratory syncytial virus, adults, comorbidity, hospitalisation.

63

64 **Background**

65 Respiratory syncytial virus (RSV) is a major cause of respiratory tract infections (RTI),
66 and leads to about 245,000 and 158,000 hospitalisations annually in young children
67 and adults aged 18 years and older respectively in EU countries, with a
68 disproportionate burden occurring in infants and adults aged 65 years and older [1,
69 2]. Besides older age, comorbidities are a key risk factor for RSV hospitalisation in the
70 adult population. Previous epidemiological studies show that comorbidities like
71 chronic respiratory diseases, chronic heart diseases and diabetes, are prevalent
72 among adult patients hospitalised with RSV-associated respiratory tract infection[3-
73 6]. Moreover, chronic kidney diseases and cardiovascular diseases are found to be
74 linked with the risk of RSV severe illnesses and mortality[7-9]. A systematic review
75 estimated a high incidence of RSV-associated ARI, and a high risk of mortality from
76 hospitalised RSV among adults with comorbidities (e.g., cystic fibrosis, congestive
77 heart failure, chronic obstructive pulmonary disease, or immunosuppression) [10].
78 However, estimates of RSV-associated ARI hospitalisation rates among comorbid
79 adults are sparse in terms of geographical diversity [10, 11] and of the type of
80 comorbidities being investigated [11], and none is available yet in the European
81 region. Two RSV vaccines, RSVPreF3-AS01E and RSVpreF, have been approved for
82 use in older adults by the European Medicines Agency (EMA) [12, 13]. In view of the
83 rapid progress in the development and evaluation of RSV vaccines and prophylaxis
84 products, estimates of RSV hospitalisation rates in comorbid adults could provide
85 timely evidence for recommendations on RSV immunisation among the adult
86 population on the horizon.

87 Using routinely collected data from national hospital registries and virological
88 surveillance, we aimed to estimate the number, rates and risk of RTI hospitalisations
89 associated with RSV in pre COVID-19 era among Danish and Scottish adults aged 45
90 years and older that had at least one of seven comorbidities (specified below in case
91 definitions), selected based on influenza vaccination recommendations and data
92 availability, using a regression modelling approach [14]. Regression models are
93 widely used to estimate RSV disease burden, especially among adults, while
94 accounting for under-ascertainment of RSV diseases due to the lack of systematic
95 RSV testing [15] and poor sensitivity of RSV-specific ICD-10 codes in routine clinical
96 care practice [16, 17], and imperfect sensitivity of viral diagnostic tests [18], and the
97 potentially poor detection of RSV in late-stage disease samples.

98 **Methods**

99 *Study design and data sources*

100 The study design and data sources have been described previously [19]. Briefly, we
101 conducted a retrospective analysis using national hospital registries and virological
102 surveillance data in Denmark (2010 to 2018) and Scotland (2010 to 2016). A season
103 was from week 40 of one year to week 39 of the following year.

104 *Case definitions*

105 As done previously [19, 20], we defined RTI hospitalisations based on ICD-10
106 diagnosis codes (Supplementary Table 1). RTI admission was defined as an admission
107 with any mention of RTI in the diagnosis codes. We included seven comorbidities,
108 i.e., chronic obstructive pulmonary disease (COPD), asthma, ischemic heart disease
109 (IHD), stroke, diabetes, chronic kidney diseases (CKD) and chronic liver disease (CLD)

110 according to Scotland recommendations on high-risk conditions for influenza
111 vaccination and data availability[21]. The comorbidities were identified using ICD-10
112 diagnosis codes according to previous disease burden study (ICD-10 codes are given
113 in Supplementary Table 2) [22]. We searched all the diagnostic fields to identify
114 individuals that were hospitalised due to and with the diseases, and were recorded
115 on any occasions during healthcare utilisation within 5 years before the RTI hospital
116 episode or at the episode.

117 Scottish Burden of Disease group estimates of the prevalence of the seven chronic
118 medical conditions in 2014 was used to derive hospitalisation rates in Scotland [22].
119 The prevalence of IHD, stroke, diabetes and CKD in Danish adults in 2015, and the
120 prevalence of COPD and asthma in 2014, obtained from Danish disease burden
121 reports and registers [23, 24] were used to derive hospitalisation rates in Denmark.
122 Due to small case counts, Danish adults with CLD were excluded from the study.

123 ***Statistical analyses***

124 ***Model overview***

125 Data were accessed and analysed separately by partners in Denmark and Scotland,
126 based on the same analytical approach. A multiple linear regression model was used
127 to estimate the number of RTI hospitalisations associated with RSV, as “RSV-
128 associated RTI”, in adults aged 45y+ with chronic medical conditions similar to
129 previous analyses [19, 25, 26]. Overall, the model included a natural cubic spline
130 function for weeks during the study period to model the long-term trend and
131 seasonal pattern of RTI hospitalisations, and the number of RSV positive tests; the
132 number of influenza positive tests were also included to account for the confounding
133 effect of co-circulating influenza. In Scotland, we considered an interaction term of

134 influenza-positive tests and season (2010-11 season; other seasons) as there were a
135 greater number of influenza-positive tests in the 2010-11 season compared to other
136 seasons, which may reflect changes in testing practices over the study period. We
137 modelled separately for each of the chronic medical conditions in the two countries;
138 for each condition, we further conducted subgroup analyses by age groups (45-54y,
139 55-64y, 65-74y, 75-84y, and 85y+) where appropriate. For each comorbidity and age
140 group, we tested for the optimal lag/lead combination on RSV and influenza among a
141 lag/lead of 0-3 weeks. The goodness of fit was assessed based on adjusted R-squared
142 and the Akaike information criterion (AIC). Details of the model structure are given in
143 Supplementary File 1.

144 We estimated the annual number of RSV-associated RTI hospital admissions based
145 on model coefficients for RSV, and the number of RSV-positive tests. The 95%
146 confidence intervals (CIs) were estimated using a 52-week-block bootstrap with 1
147 000 replicates. We estimated rate ratios (RRs) of RSV-associated RTI hospitalisation
148 between the comorbid population and the overall population (with or without the
149 comorbidity) of the same age band. The 95% uncertainty ranges (URs) of RR were
150 estimated based on 1000 samples generated from a log-normal distribution of
151 estimates of hospitalisation rates, with the 2.5th percentile of the samples as the
152 lower bound and the 97.5th percentile of the samples as the upper bound as
153 previously done [27].

154 ***Sensitivity analyses***

155 We conducted the following sensitivity analyses among adults aged 45y+ to assess
156 the robustness of RSV burden estimates: (1) assuming zero lags for RSV and influenza
157 predictors; (2) removing the influenza predictor from the models of which the

158 coefficient was negative; (3) using the Poisson regression model; (4) time series data
159 of rhinovirus positive tests were added to the models to account for its potential
160 confounding effect for Scottish population, based on existing empirical evidence that
161 rhinovirus is identified in a proportion of RTI hospitalisations among adults,
162 especially adults with co-morbidities [28, 29].

163 ***Ethical statement***

164 Data access approvals were obtained in both countries and analyses were conducted
165 separately in each country in a secured environment.

166 **Results**

167 ***Average annual number and proportion of RSV-associated RTI hospitalisation in*** 168 ***comorbid adults aged 45y+***

169 We estimated that, in Danish adults aged 45y+ with comorbidities, the average
170 annual number of RSV-associated RTI hospitalisations ranged from 165 (95% CI: 160
171 – 218) in adults with CKD to 1876 (1613 – 2178) in adults with COPD (Supplementary
172 Table 3). RSV-associated RTI accounted for between 5.8% (4.5 – 7.3) in all RTI
173 hospitalisations among adults with stroke and 16.8% (14.2 – 19.4) among adults with
174 asthma (Supplementary Table 4).

175 In Scottish adults aged 45y+ with comorbidities, the average annual number of RSV-
176 associated RTI hospitalisations ranged from 64 (95% CI: 25 – 93) in adults with CLD to
177 914 (95% CI: 564 – 1122) in adults with IHD. The proportion of RSV-RTI
178 hospitalisations ranged from 3.6% (1.4 – 5.0) in all RTI hospitalisations among adults
179 with CLD to 7.4% (4.5 – 8.4) among adults with stroke (Supplementary Table 4).

180 Estimates from the regression models generally fitted the observed data well

181 (Supplementary Figure 1 and 2). In comparison, average annual estimates of
182 influenza-associated RTI hospitalisation ranged from 77 (32– 80) among adults with
183 CLD to 888 (371 – 1073) among adults with IHD (Supplementary Table 3).

184 ***Average annual rate and rate ratio of RSV-associated RTI hospitalisation***

185 RSV-RTI hospitalisation rates in the comorbid adults aged 45y+ varied between
186 Denmark and Scotland (Table 1). In Denmark, we found the highest risk in adults
187 with CKD, with a rate of 9.4 (95% CI: 18.9 - 25.7) RSV-RTI hospitalisations per 1 000
188 individuals per year, and an RR of 7.2 (95% UR: 5.2 - 10.3) compared with Danish
189 overall population aged 45y+. For the other comorbidities, we estimated,
190 approximately, a four-fold higher rate in Danish adults with COPD and IHD versus the
191 overall population, a two-fold higher rate in those with diabetes and stroke, and a
192 1.5-fold higher rate in those with asthma. In Scotland, the highest risk was in adults
193 with COPD, with a rate of 7.1 (4.6 – 8.8) RSV-RTI hospitalisations per 1 000
194 individuals per year, and an RR of 5.9 (95% UR 4.1 – 8.7) versus the overall
195 population aged 45y+. For the remaining comorbidities, we estimated a four-fold
196 higher rate in adults with IHD compared with the overall population, a three-fold
197 higher rate in those with asthma, stroke and CKD, and a two-fold higher rate in those
198 with CLD and diabetes (Table 1). In comparison, rates of influenza-associated RTI
199 hospitalisation ranged from 4.4 (1.8 – 4.6) per 1000 adults with CLD per year to 7.6
200 (3.7 – 8.1) for those with asthma (Supplementary Table 3).

201 An exploratory analysis shows that in Denmark, the estimated yearly RSV-RTI
202 hospitalisation rates in comorbid adults aged 45y showed an increasing trend
203 between the 2013/14 and 2017/18 seasons (Supplementary Figure 3). In the
204 contrast, the rates remained similar in Scotland from the 2010/11 to 2015/16

205 seasons (Supplementary Figure 4).

206 ***RSV-RTI hospitalisation rates in comorbid adults by age group***

207 In the two nations, hospitalisation rates rose quite steeply from the 60s to 80s age
208 groups, and were the highest in those aged 85y+ across most of comorbidity groups
209 (Table 2). In particular, adults with COPD and asthma had more than six-fold higher
210 hospitalisation rates at 75y+ compared with their younger counterparts in the two
211 nations. The age-related patterns were less profound for the other comorbidities.

212 Across age groups, the comorbid adults had higher rates compared to the overall
213 population with an RR estimate above 1.0, except for several occasions (Figure 1 and
214 2, Supplementary Table 6). The RR estimates for comorbid adults versus the overall
215 population were generally higher in those aged 45-54y and/or 55-64y (Figure 1 and
216 2). In particular, Danish adults and Scottish adults aged 45-54 years with IHD had an
217 RR estimate of 7.8 (95% UR 6.0-10.3) and 6.0 (2.5,15.6); Scottish adults aged 55-64y
218 with COPD had an RR estimate of 6.7 (3.7-12.7). Exceptions to this pattern were
219 observed in adults with asthma (both countries) and stroke (Scotland only). In the
220 two countries, adults with asthma had a particularly high RR estimate at 75y+;
221 whereas Scottish adults with stroke had similar rates to the overall population at 45-
222 64y. Danish adults with diabetes had an RR of 4.8 (3.7,6.3) at 45-54y, but a RR below
223 1.0 at 55y+; Scottish adults aged 65-74y and younger had an RR estimate above 1.0.

224 ***Sensitivity analyses***

225 Estimates of RSV-RTI hospitalisation rates in the sensitivity analyses were broadly
226 comparable to the main analyses in two countries (Supplementary Table 7). Scottish
227 estimates of rates in the comorbid adults aged 45y+, based on Poisson regression
228 models and the models with addition of rhinovirus positive cases, changed by around

229 10% or less compared to those in the main models. Danish estimates for adults with
230 COPD, IHD and asthma using Poisson regression models were about 13% to 17%
231 lower than the main analyses; the estimates for the other comorbidities only
232 changed marginally (<10% changes). Models with zero lags in RSV and influenza
233 predictors showed lower accuracy compared with the main models, yielding
234 comparable estimates for RSV in the Scottish population, and lower estimates in the
235 Danish population.

236 **Discussion**

237 Using national hospital and virological databases, this study provides estimates of RSV-
238 associated RTI hospitalisation among adults aged 45 years and older with seven
239 comorbidities, and their RRs versus the overall population (with or without
240 comorbidities) in Scotland and Denmark. We found that in Danish adults aged 45y+,
241 RSV-RTI hospitalisation rates ranged from 3.1 per 1000 individuals with asthma to 19.4
242 per 1000 individuals with CKD per year; the rate ranged from 2.4 per 1000 individuals
243 per year with CLD, to 9.0 per 1000 individuals per year with COPD in Scotland. Adults
244 with the comorbidities showed a 1.5-fold to seven-fold higher rate compared to the
245 overall populations aged 45y+ across two countries. Adults with COPD, IHD and
246 diabetes consistently showed over four-, three- and two-fold higher rates in two
247 countries, while more between-country differences were found for asthma and CKD.
248 Across age groups, comorbid adults had higher rates compared to the overall
249 populations of same age except for several occasions. Adults aged 65y+ with the
250 comorbidities (except for Danish adults with diabetes) have a substantially high
251 burden of RSV hospitalisation, especially among those with COPD or asthma.

252 Our estimates of RSV-RTI hospitalisation rates in adults with COPD are comparable to
253 a US study that reported a rate of 13 per 1000 individuals per season in adults with
254 COPD or chronic heart failure aged 65y+, while greater than the results by a New
255 Zealand study [30]. In the New Zealand study, the RSV-RTI hospitalisation rate was
256 between 0.2 and 1.4 per 1,000 individuals among adults aged 50y+ with COPD, asthma,
257 congestive heart failure, coronary artery disease, cerebrovascular accident, diabetes,
258 or end-stage renal disease. The disparities in estimates of RSV-RTI hospitalisation rates
259 could be related to the use of different analytical approaches. In contrast to our study
260 using a regression modelling approach, the New Zealand study reported laboratory-
261 confirmed RSV hospital cases.

262 The RR estimates reflect the risk of RSV-RTI hospitalisation associated with the
263 comorbidities, and are broadly comparable to previous population-based studies. A
264 modelling study in England showed that adults aged 65y+ with a range of
265 comorbidities were four-fold more likely be hospitalised for RSV-associated
266 respiratory diseases compared to those without comorbidities [31]. In New Zealand,
267 adults with seven comorbidities had between two-fold and 10-fold higher rates
268 compared to those without the comorbidities, and the RR varied across age groups
269 and comorbidities [11]. Similar to our results, the New Zealand study found a smaller
270 increase in the risk of RSV-RTI hospitalisation in adults with diabetes compared to
271 chronic respiratory and heart diseases, and the risk elevation was mainly observed in
272 young and middle-aged adults with diabetes and was less notable in older adults[11].
273 Our RR estimates should be viewed as a conservative estimation of the risk in the
274 comorbid adults in Denmark and Scotland, as we used the total population, with or
275 without comorbidities, as a control.

276 The age-specific estimates of RSV hospitalisation rates and RR provide evidence on
277 high-risk population groups that are relevant for RSV immunisation recommendations
278 and participant selection for vaccine evaluation in clinical trials and real-world studies.
279 Besides, using the overall adults aged 65-74y as a benchmark, estimates of RSV
280 hospitalisation rates among adults with certain comorbidities remained elevated at
281 45-54y (COPD, asthma and IHD) or 55-64y (COPD, asthma, IHD and CKD). The point
282 estimates in adults with CKD aged 45-54y were higher than the Scottish overall
283 population aged 65y+, though it was difficult to draw a conclusion due to the wide
284 confidence intervals of the estimates.

285 We found that RSV-associated RTI hospitalisation rates in Scottish adults aged 45y+
286 with the comorbidities were similar to influenza (Supplementary table 5). Findings of
287 the comparison could assist health authorities in RSV vaccination policy making, in
288 the presence of risk-based recommendations on influenza vaccination. Bruyndockx
289 et al report that, unlike influenza, risks of unresolved symptoms and illness
290 deterioration are associated with increasing age for RSV and patients aged over 75
291 years are at increased risks, and further highlight that prevalence and illness course
292 significantly worsens at higher ages for RSV whereas only illness course is affected
293 for influenza [32].

294 There are limitations and challenges in our study. One challenge in analyses of
295 comorbid adults relates to the difficulty in defining and identifying comorbidities[11,
296 26]. In this study, we identified comorbidities that were recorded on any occasions in
297 the national hospital-care registries within five years before an RSV hospital episode,
298 by assuming that pre-existing comorbidities were recorded in any diagnostic fields at
299 least once during recent healthcare utilisations prior to the RSV episode. It is possible

300 that some individuals, especially adults at younger ages, were not diagnosed because
301 they had been at early stage of disease progression, had mild symptoms or had
302 remained good health status for five years or longer time. Given these factors and
303 possible incomplete recording of comorbidities in the databases, our study provides
304 a conservative estimate of true RSV-associated RTI hospital burden in adults with the
305 comorbidities. Second, we assume that the virological data (RSV and influenza) in the
306 overall population is an indicator of viral activity in the comorbid adults. The
307 assumption is made based on observations that the time series data of hospitalised
308 RTI cases and the virological data had similar trends and times of peaks
309 (Supplementary Figure 1 and 2). Where exist, variations in RTI hospitalisation rates
310 and potential temporal sequential patterns in viral circulation between the
311 comorbidities and age groups have been accounted for, via the independent
312 modelling process [26]. Moreover, the model fits and results from sensitivity
313 analyses suggest that our estimates of RSV-RTI hospitalisation rates are generally
314 robust. The RSV testing level appears stable during the study period (Supplementary
315 Figure 1 and 2), yet variation in other patterns of testing (e.g., age structure) over
316 the years might affect our estimates. Third, we were unable to provide precise age-
317 specific estimates for Scottish adults with CLD or Danish adults with CKD, due to the
318 small RTI case counts in the groups. Finally, some of the individuals might have more
319 than one comorbidity, which could cause biases in the estimates. Future research
320 could compare the role of multiple comorbidities on risk of RSV infection. It is
321 important to recognise the profound effect of COVID-19 and the impact of
322 vaccination on RSV epidemiology and seasonality, which will likely confound any
323 modern attempts to define RSV burden especially in high-risk populations.

324 **Conclusion**

325 Using a standardised approach on national hospital and virological databases, we
326 provide age-specific estimates of RSV-RTI hospitalisation among adults with seven
327 comorbidities and aged 45y+ in two European countries. Our results show that adults
328 aged 65y+ with these comorbidities, and adults aged 45-64y with COPD, IHD, asthma,
329 or CKD remain a high priority population to consider for RSV immunisation when RSV
330 vaccines become available for use in adult population [12, 13].

Footnote Page

The PROMISE investigators are as follows:

Harry Campbell and Harish Nair (University of Edinburgh), Hanna Nohynek (THL, Finland), Anne Teirlinck (RIVM, The Netherlands), Michiel van Boven (RIVM, The Netherlands), Terho Heikkinen (University of Turku and Turku University Hospital, Finland), Louis Bont (University Medical Center Utrecht), Peter Openshaw (Imperial College, London), Phillippe Beutels (University of Antwerp), Andrew Pollard (University of Oxford), Veena Kumar (Novavax), Alexandro Orrico Sánchez (FISABIO, Spain), David Gideonse (RIVM, The Netherlands), Tin Tin Htar (Pfizer), Charlotte Vernhes (Sanofi Pasteur), Gael Dos Santos (GlaxoSmithKline), Rachel Cohen (GlaxoSmithKline), Jeroen Aerssens (Janssen), Rolf Kramer (Sanofi Pasteur), Ombeline Jollivet (Sanofi Pasteur), Nuria Manchin (TEAMIT).

Author Contributions

HC and HN conceptualised the study. XW and ROY analysed the Scottish data. CJ and AEC analysed the Danish data. JC prepared figures and tables. ROY and XW led the interpretation and wrote the draft with important inputs from HN, HC, TL, AUF, JP, TKF, CJ, AEC and JC. All the authors critically reviewed the manuscript.

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Potential conflict of interests

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Table 1. Hospitalisation rates of RSV-RTI per 1 000 individuals per year in adults aged 45 years and older with selected underlying medical conditions, and rate ratios (RR) compared with the overall population.*

	Denmark		Scotland	
	Hospitalisation rate (95% CI)	RR (95% UR)	Hospitalisation rate (95% CI)	RR (95% UR)
Overall population (with or without comorbidities)	2.0 (1.7,2.3)	Ref	1.2 (0.8,1.4)	Ref
COPD	9 (7.7,10.4)	4.5 (3.7,5.5)	7.1 (4.6,8.8)	5.9 (4.1,8.7)
Asthma	3.1 (2.6,3.6)	1.5 (1.3,1.9)	3.8 (2.6,4.8)	3.2 (2.2,4.7)
IHD	7.6 (6.4,8.8)	3.8 (3.1,4.7)	4.6 (2.8,5.6)	3.8 (2.7,5.6)
Stroke	3.7 (3.2,4.3)	1.8 (1.5,2.3)	3.5 (2.1,3.9)	2.9 (2.0,4.3)
Diabetes	4.7 (4.0,5.5)	2.3 (1.9,2.9)	2.4 (1.5,2.8)	2.0 (1.4,2.9)
Chronic kidney disease	19.4 (18.9,25.7)	9.7 (8.0,11.9)	3.3 (2.1,3.7)	2.7 (1.9,4.0)
Chronic liver disease	--	--	2.4 (0.9,3.5)	2.0 (1.4,2.9)

* COPD: chronic obstructive pulmonary disease. IHD: Ischemic heart disease. CKD: chronic kidney diseases, CLD: chronic liver disease, conditions were selected according to influenza vaccination recommendations and data availability.

Table 2. Hospitalisation rates of RSV-RTI per 1 000 individuals per year in adults aged 45 years and older with selected underlying medical conditions, by age groups.

	Overall population (with or without comorbidities)	COPD	Asthma	IHD	Stroke	Diabetes	Chronic kidney disease [†]
Denmark							
45-54y	0.5 (0.4,0.6)	1.6 (1.3,1.8)	0.7 (0.6,0.8)	3.9 (3.3,4.6)	2.3 (1.9,2.6)	2.4 (2.0,2.8)	--
55-64y	1.2 (1.0,1.4)	4.0 (3.4,4.7)	3.5 (3.0,4.1)	4.4 (3.7,5.1)	2.2 (1.8,2.5)	1.2 (1.1,1.4)	--
65-74y	2.0 (1.7,2.3)	5.1 (4.3,5.9)	8.3 (7.0,9.7)	5.9 (5.0,6.9)	2.3 (1.9,2.6)	1.0 (0.8,1.1)	--
75-84y	4.9 (4.2,5.6)	10.5 (8.9,12.2)	27.6 (23.4,31.9)	12.9 (11.0,14.9)	6.4 (5.5,7.5)	1.9 (1.7,2.3)	--
85+y	7.9 (6.7,9.1)	17.6 (14.9,20.4)	49.5 (42.5,57.7)	14.4 (12.0,16.7)	9.4 (8.0,11.0)	2.3 (2.2,3.1)	--
Scotland							
45-54y	0.3 (0.1,0.4)	1.6 (0.5,2.4)	1.6 (0.8,2.2)	1.8 (0.4,2.8)	0.4 (-0.1,1.0)	1.0 (0.4,1.6)	1.9 (0.1,3.2)
55-64y	0.4 (0.2,0.5)	2.7 (1.8,3.5)	1.8 (1.0,2.3)	1.0 (0.4,1.6)	0.8 (-0.3,1.7)	0.9 (0.4,1.2)	1.5 (0.9,2.1)
65-74y	0.9 (0.6,1.2)	4.9 (3.0,6.6)	3.1 (1.4,5.1)	2.5 (1.5,4.3)	2.5 (1.3,3.7)	1.6 (1.0,2.3)	1.4 (0.9,1.7)
75-84y	3.0 (2.0, 3.6)	12.8 (8.3, 17.4)	10.0 (2.9, 9.6)	6.0 (3.8, 7.5)	4.7 (2.4, 5.7)	3.9 (2.0,4.7)	2.8 (1.7, 3.3)
85+y	8.2 (5.2,9.6)	39.2 (21.9,47.5)	47.9 (28,53.2)	13.7 (8.1,17.5)	7.2 (3.7,9.3)	9.9 (5.8,12.5)	12.3 (7.6,14.2)

[†] We were unable to provide age-specific estimates for Scottish adults with CLD or for Danish adults with CKD, due to the small RTI case counts in the groups.

Figure captions

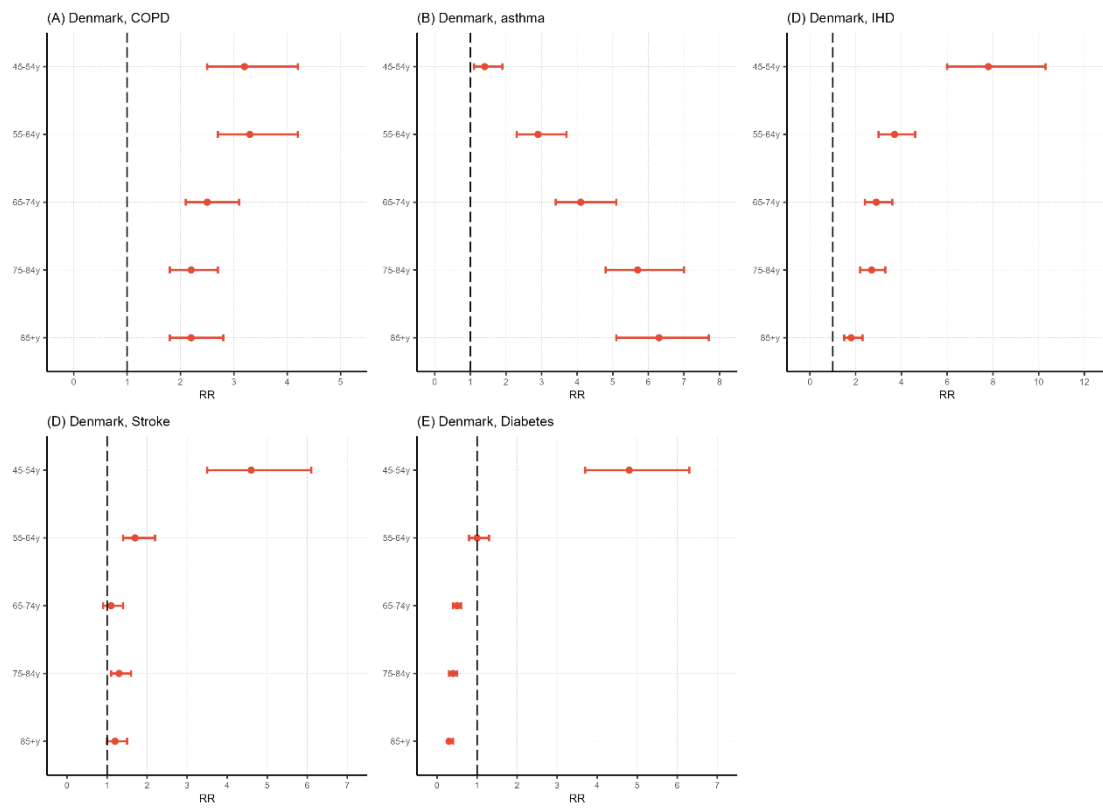


Figure 1. Age-specific rate ratios of RSV-associated RTI hospitalisation among the Danish adults versus Danish overall population.

Panels show estimates for COPD (A), asthma (B), IHD (C), stroke (D), and diabetes (E).

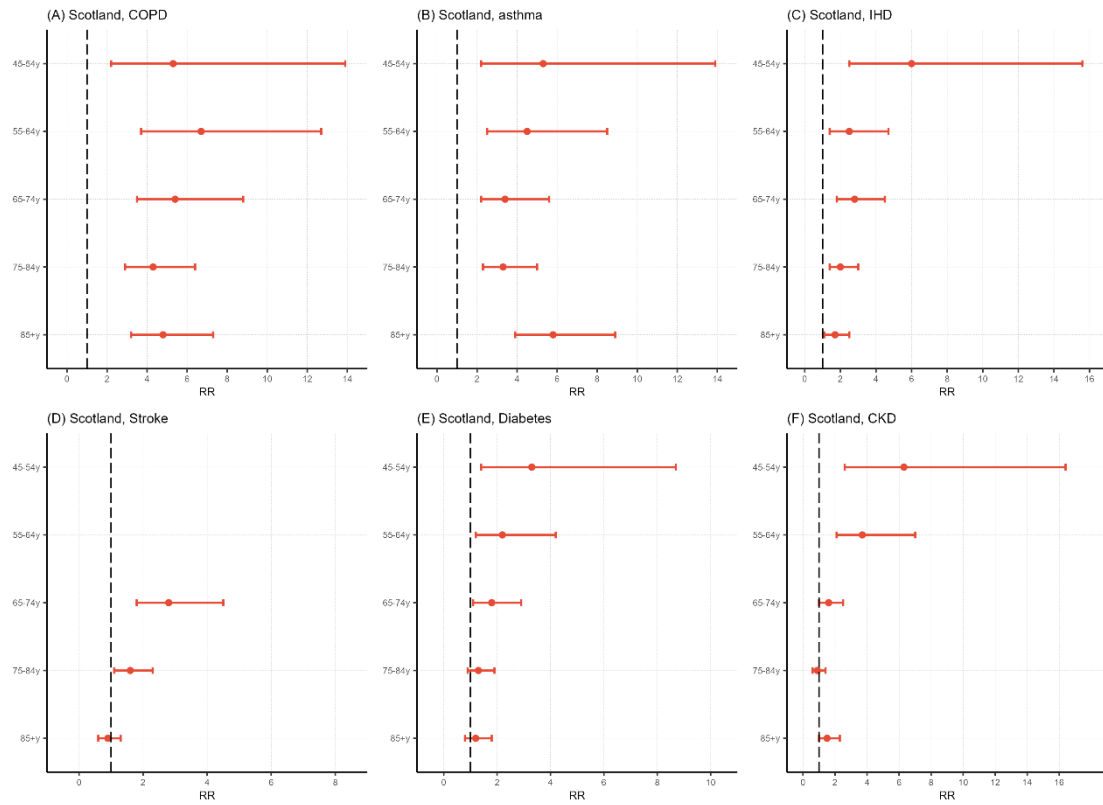


Figure 2. Age-specific rate ratios of RSV-associated RTI hospitalisation among the Scottish adults versus Scottish overall population.

Panels show estimates for COPD (A), asthma (B), IHD (C), stroke (D), diabetes (E), and chronic kidney diseases (F). RR was not calculated for the 45-54y and 55-64y with stroke, as the lower bound of their rate estimates was negative.