The burden of respiratory syncytial virus in adults in the UK

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¹University of Cambridge
This report presents an investigation of the burden in the United Kingdom of respiratory syncytial virus (RSV) in adults, including the burden of RSV in those aged 65 and over and adults who are in high-risk groups. RSV is a common virus affecting a large number of adults each year, to varying degrees. The burden of RSV comprises the ill health of the adult with RSV themselves, impacts on the health and social care systems relating to the costs of providing care, and impacts on the wider economy in relation to economic productivity.

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Summary

This study describes and quantifies the burden of respiratory syncytial virus (RSV) in the United Kingdom (UK) in adults (18+) to the health and social care systems and the economy. RSV is a virus that causes acute lower respiratory tract infections such as pneumonia and bronchiolitis, and is prevalent in children under 5, but also in adults during winter months.

We have taken a broad, societal perspective that includes the health impact on people with RSV (reduced quality of life in all cases and death in some cases), the costs to the NHS of caring for them, and the costs to the economy of time taken off work.

The evidence presented here is from a literature review, consultations with key stakeholders and our modelling based on published data. The literature review and consultations informed our economic model, which comprised direct costs (NHS resource use) and indirect costs (productivity losses to the UK economy).

Based on the literature, we estimate that each year in the UK there are approximately 3.6 million cases of RSV in adults. In many cases the individual affected manages their own care. However, RSV in adults leads to around 600,000 GP visits, 460,000 NHS 111 calls and 24,000 hospitalisations in the UK each year.

Although many cases of RSV are relatively mild in their impact, in some cases the consequences are severe and even fatal. We estimate that there are 11,800 deaths annually in the UK as a result of RSV in adults.

The annual cost to the NHS of looking after adult patients with RSV is estimated to be around £140m (in 2023 price terms). On top of this is an annual cost to the UK’s economy of an estimated £179m due to time off work. Thus, the total economic cost is estimated to be around £319m annually. This is equivalent to a mean cost per adult with RSV of £87.51 per case.

These costs are, however, disproportionately distributed across different age groups. Whilst those aged 18–64 make up 74% of RSV cases annually in adults, and the 65+ population represent 26% of RSV cases, the spread of the health and cost burden by age is rather different. The large majority, 91%, of adult deaths from RSV are in the 65+ population. Much of the burden of RSV associated with NHS costs is attributable to patients aged 65+, whereas much of the indirect cost (productivity loss) falls on those aged 18–49.

We estimate that each year RSV in adults costs the UK around £319 million.
Those aged 65+ drive two thirds (£93m) of the total £140m in NHS costs. This is due to people in older ages being more likely to seek and require more complex care (e.g. hospitalisation) than younger adults. Per case of RSV, the mean cost to the NHS in those aged 18–49 is £10.52, but this increases to £141.04 per case in those aged 75+.

The estimated £179m annual loss of GDP due to time off work because of RSV is by definition a burden that arises in the working-age population. It is important to note that whilst those in older age groups may contribute to the economy in other ways (e.g. as unpaid carers, or doing voluntary work), which was mentioned by stakeholders during interviews conducted as part of this study, we were not able to model this dimension of the burden of RSV due to the scarcity of data.

In addition to differing costs by age, people of any age who have pre-existing respiratory and/or cardiovascular conditions, or who are immunodeficient, are at increased risk of contracting RSV and are also likely to suffer increased burden through the exacerbation of their existing conditions.

This study adds to research on the burden of RSV in adults in the UK by quantifying productivity losses to the economy as well as the direct costs to the NHS.
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<tr>
<td>A&amp;E</td>
<td>Accident and Emergency</td>
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<td>AURTI</td>
<td>Acute Upper Respiratory Tract Infections</td>
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<td>B&amp;B</td>
<td>Bronchitis/Bronchiolitis</td>
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<td>CAP</td>
<td>Community Acquired Pneumonia</td>
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<td>CI</td>
<td>Confidence Interval</td>
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<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
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<td>CPRD</td>
<td>Clinical Practice Research Datalink</td>
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<td>GBP</td>
<td>Great British Pounds</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<td>HES</td>
<td>Hospital Episode Statistics</td>
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<td>HRG</td>
<td>Healthcare Resource Group</td>
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<td>HRQoL</td>
<td>Health Related Quality of Life</td>
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<td>ICD</td>
<td>International Classification of Diseases</td>
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<td>ICU</td>
<td>Intensive Care Unit</td>
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<td>IPD</td>
<td>Invasive Pneumococcal Disease</td>
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<td>IQR</td>
<td>Interquartile Range</td>
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<td>MeSH</td>
<td>Medical Subject Heading</td>
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<td>MI</td>
<td>Myocardial Infarction</td>
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<td>NHS</td>
<td>National Health Service</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>NICE</td>
<td>National Institute for Health and Care Excellence</td>
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<td>ONS</td>
<td>Office for National Statistics</td>
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<td>OOP</td>
<td>Out-of-pocket</td>
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<tr>
<td>PHE</td>
<td>Public Health England</td>
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<tr>
<td>P&amp;I</td>
<td>Pneumonia and Influenza</td>
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<tr>
<td>PSA</td>
<td>Probabilistic Sensitivity Analysis</td>
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<tr>
<td>QALY</td>
<td>Quality Adjusted Life Year</td>
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<td>RDMS</td>
<td>Respiratory DataMart Surveillance</td>
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<td>REA</td>
<td>Rapid Evidence Assessment</td>
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<td>RSV</td>
<td>Respiratory Syncytial Virus</td>
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<td>UK</td>
<td>United Kingdom</td>
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<td>US</td>
<td>United States</td>
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1 Study context and aims

This study describes and quantifies the burden of respiratory syncytial virus (RSV) in the United Kingdom (UK) in adults, particularly those aged 65 and over and those in high-risk groups. We estimate the burden on individuals’ health, the costs incurred by the healthcare system and the impact on the economy. The evidence presented derives from a literature review, interviews with key stakeholders, published data and our economic model of direct costs (NHS resource use) and indirect costs (productivity losses to the UK economy).

RSV is a virus that causes acute lower respiratory tract infections such as pneumonia and bronchiolitis (Centers for Disease Control and Prevention 2023). It is known to be a frequent cause of respiratory tract infections in children under the age of five, particularly infants (Nam & Ison 2019). A previous report estimated that in the UK, RSV in children aged up to five has an annual burden in terms of healthcare costs and lost productivity (among the children’s parents/carers) of approximately £80m (in 2020/21 price terms) (Fusco et al. 2022).

RSV infections, however, also occur frequently during adulthood. Symptoms usually involve a cough, sore throat, a runny or blocked nose, fever and fatigue (Paes et al. 2011). This means that the clinical presentation of RSV infection is not easily distinguishable from most viral respiratory-based pathogens (Falsey et al. 2003; Falsey & Walsh 2005; Wald et al. 1995), and can vary from a cold-like infection to significant respiratory failure (Falsey 1998; Falsey & Walsh 2005). As a result, knowing whether someone has RSV requires diagnosis through laboratory confirmation. This makes it difficult to identify the true incidence of RSV in adults, as laboratory diagnosis rarely occurs due to symptoms often being resolved on their own and before the individual has sought care (Falsey & Walsh 2005). In adults, RSV infection is often treatable using over-the-counter medications to help alleviate symptoms. For some adults, however, especially those who are elderly or in high-risk groups (e.g. who have respiratory or cardiovascular conditions, or who are immunocompromised), RSV can lead to more serious outcomes: these cases are associated with higher rates of morbidity and mortality (Falsey et al. 2005; Falsey et al. 2014; Nicholson et al. 1997; Stein et al. 2017; Tin Tin Htar et al. 2020).

A recent systematic review found that estimates of the annual RSV incidence rate in the UK vary between 6.6 and 15.1% in adults generally and between 0.7 and 16% in adults in high-risk groups (Wilkinson et al. 2023). Furthermore, 93% of RSV-attributed deaths in adults occurred in people aged 65 and older between 1995 and 2009 (Wilkinson et al. 2023). The authors of the review suggest that the large ranges of incidence rates may be due to variability between annual RSV
seasons, including the impact of the COVID-19 pandemic, differences in timeline and time periods (e.g. annual; seasonal; varying years), RSV testing/verification methods (i.e. reported symptoms of influenza-like illness versus lab-confirmed RSV), and potential differences in health-seeking behaviours in patients (Wilkinson et al. 2023). RAND Europe and the University of Cambridge recently published a report on the overall burden of RSV in under-5s in the UK, which included the burdens on the patient, their families and carers, the healthcare system and the wider economy (Fusco et al. 2022). There are a limited number of studies that investigate elements of the burden of RSV in adults in the UK, many of which are presented in a recent systematic review and gap analysis conducted by Wilkinson et al. (2023). No study has attempted to estimate the total burden of RSV in adults from a societal perspective. The systematic review by Wilkinson et al. highlighted that the current understanding of the burden of RSV in adults in the UK is mostly related to understanding incidence rates, mortality and direct resource use in healthcare (e.g. GP appointments, hospital admissions, drug use and telehealth services), and suggested a lack of economic burden outcomes, particularly related to indirect costs (Wilkinson et al. 2023). Whilst studies have been conducted to understand the broader economic burden of RSV in adults (Carrico et al. 2023; Grace et al. 2023; Mesa-Frias et al. 2022; Prasad et al. 2020), these have not been in a UK context.

Therefore, our study aimed to:

- Bring together insights from the academic literature, stakeholder consultations and economic modelling to help understand the burden of RSV in the UK on adults, particularly those who are aged 65 and over and those in any other high-risk groups identified.
- Consider diverse areas of burden, including the patients, the health and social care systems, and the wider economy.

1.1. Reader’s guide

Chapter 2 of this report briefly describes the methods used to conduct the study. Greater detail about the methods used in each part of the study can be found in Annexes A–C, which also present full details of the results of each component method used. Chapter 3 provides a synthesis of the results from all research activities undertaken and presents the findings under key message headings. Finally, Chapter 4 provides a discussion of and conclusion to the study.
2 Methods

This study comprised three main elements: a Rapid Evidence Assessment of the literature, consultations with key stakeholders and economic modelling. This chapter outlines the methods used, with full details provided in Annexes A–C. The literature review and consultations provided information on health impacts (mortality and health-related quality of life). Healthcare costs and productivity losses in the economy (due to time away from work) were modelled based on data in the published literature. Where data relevant to the UK was lacking, for example on out-of-pocket costs incurred by adults through RSV self-treating or travelling to healthcare appointments, we have used assumptions based on experience in other high-income countries.

2.1. Rapid Evidence Assessment

We conducted a literature review using the Rapid Evidence Assessment (REA) methodology that applies a systematic search strategy similar to a conventional systematic review. This method includes a transparent prioritisation scheme to ensure the depth and breadth of relevant research literature is captured (see Varker et al. (2015) for more information on the REA approach). The REA process included: (1) development of a search strategy; (2) development of inclusion/exclusion criteria and screening articles’ titles and abstracts against the criteria; (3) prioritisation of articles for extraction; (4) data extraction and analysis; and (5) quality of evidence assessment.

The REA included papers on RSV in adults (aged 18+), focused on the UK context. We reviewed the full texts of 34 papers, of which only four were included in the final review and had data extracted from them. A number of papers that met the inclusion criteria were in the Wilkinson et al. (2023) systematic review. The data in those papers that we required as inputs for our model of the cost burden of RSV in adults in the UK had been extracted and presented by Wilkinson et al. The Wilkinson et al. review was therefore an important source for some model parameter values. See Annex A for more detail about the REA methodology and findings. See Annex C for a full explanation of the sources of all data used in our costing model.

2.2. Stakeholder consultations

To complement the literature review and discuss some gaps in the published evidence, we conducted semi-structured interviews (consultations) with key academic, clinical and patient organisation representatives. Thirty-four potential interviewees were identified based on desk research scoping, snowballing from the REA, and RAND Europe and the Cambridge Centre for Health Services Research (CCHSR) networks. In order to obtain
a range of relevant perspectives efficiently we excluded 11 stakeholders that would have led to duplicated institutional representation. We contacted the remaining 23 stakeholders. Six stakeholders agreed to be interviewed, five of whom were clinical experts and one of whom was a patient organisation representative. The clinical experts comprised a respiratory consultant, a consultant with experience in the 85+ population, a paediatrician currently conducting research on RSV using data on adults, a general practitioner, and a respiratory symptom management specialist. The patient organisation representative was a programme lead for a charity focusing on respiratory conditions. The interviews covered topics related to the impact of RSV on: patients (e.g. health and quality of life in the long and short term); families and/or carers; health and social care systems; wider society; and the economy. We conducted a thematic analysis of each individual interview and then a cross analysis spanning all interviews. See Annex B for more detail about the stakeholder consultations and interview topic guide.

2.3. Economic model

The literature review, reinforced by the information obtained in the consultation interviews, provided the data and assumptions for our model of the direct costs (NHS resource use) and indirect costs (productivity losses to the UK economy) arising per year as a result of RSV in adults (aged 18+) in the UK. Estimates for resource use and associated costs were calculated using 2023 as the reference year. Among the relevant papers we identified in the literature, the systematic literature review by Wilkinson et al. (2023) was especially helpful. Two of the papers reviewed by Wilkinson et al. contain much of the data needed to form the central framework for our model (Fleming et al. 2015; Green et al. 2013). These two studies both used a regression modelling approach, based upon data from large, nationally representative datasets, and in the case of Fleming et al. (2015) across multiple years. Incidence rates and rates of NHS resource use were identified and combined with UK population data from the Office for National Statistics (Office for National Statistics 2021) and with unit costs of resources taken from a range of sources including the Personal Social Services Research Unit cost book (Personal Social Services Research Unit 2020). Several additional sources provided further data to enable estimation of the productivity costs. We were not able to find estimates of out-of-pocket costs borne by patients with RSV (e.g. purchases of over-the-counter medicines and costs of travelling to healthcare appointments). Nor did we find estimates of costs borne by carers or families of the patient. The full details of all data used and their sources, and the assumptions made when modelling the total UK impact, are presented in Annex C. The direct and indirect cost categories modelled are listed in Table 1.

The model has been developed with the best available data to derive estimates of the burden of RSV from a societal perspective. Data were drawn from literature identified in the REA, and where more than one source was available a decision on the most appropriate for incorporation in the model was made based upon an overall assessment of date of publication (most recent) and study characteristics (relevance to the UK setting, study population, exposure and outcome measures, sample size, study setting). Other more general model inputs (e.g. NHS unit costs, productivity costs) were obtained from national UK publications or peer-reviewed publications.
Table 1. Modelled cost categories for RSV infections in adults (18+) in the UK

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<thead>
<tr>
<th>Direct costs</th>
<th>Indirect costs</th>
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<tr>
<td>GP consultations</td>
<td>Lost productivity due to non-fatal RSV illness</td>
</tr>
<tr>
<td>NHS 111 calls</td>
<td>Lost productivity due to receipt of healthcare for RSV</td>
</tr>
<tr>
<td>Hospitalisations (inpatient stays, ICU stays)</td>
<td>Lost productivity due to RSV mortality</td>
</tr>
<tr>
<td>Outpatient visits</td>
<td></td>
</tr>
<tr>
<td>Prescribed medications (e.g. for antibiotics)</td>
<td></td>
</tr>
<tr>
<td>Out-of-pocket (OOP) costs incurred by patients and families*</td>
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* Included in sensitivity analysis only

It was necessary, however, to make a number of assumptions for the base case analysis in the absence of directly relevant data, or where the clinical picture was not sufficiently strong to justify inclusion in the base case analysis. For example, it is likely that self-treatment for RSV infection would include the purchase of over-the-counter medications such as paracetamol. In the absence of UK-based studies on out-of-pocket (OOP) costs for RSV infection, it was decided not to include these in the base case analysis. An estimate of OOP costs from a non-UK study was included in a sensitivity analysis to evaluate the potential impact on the total RSV burden. Whilst studies estimating the rate of RSV-attributable myocardial infarction (MI) and stroke were identified, the causality regarding the association between RSV infection and vascular events remained uncertain. The costs associated with these outcomes were not therefore included in the base case analysis, but were included in the sensitivity analysis to evaluate the impact on the total RSV burden. Where other assumptions have been drawn (e.g. no productivity losses beyond a retirement age of 65 years), these were as far as possible conservative.

2.4. Strengths and limitations of the study

The method described in this chapter has the merits of drawing on the most up-to-date, peer-reviewed empirical evidence that has been published about the burden of RSV in adults in the UK, and of then complementing that by discussing the burden with clinical and patient group stakeholders. The timescale of the literature review covered publications up to 7 November 2023, and so has omitted any papers that may have been published since then. The scope of the stakeholder interviews covered all the key stakeholder groups, but the number of interviews was modest. The economic modelling has been as robustly based as possible. It uses parameter values from the recent empirical literature relevant to the UK context. However, as discussed earlier in this chapter and set out in detail in Annex C, a number of assumptions had to be made. The extent of published empirical evidence up to November 2023 enabled us to focus on the main elements of the burden of RSV in adults: the deaths that result from RSV infection; the use of healthcare resources and consequent
healthcare costs; and the losses of GDP resulting from time off work. We were not, however, able to produce robust estimates for some aspects of the burden of RSV in adults, namely: reductions in provision of unpaid care to family/friends; loss of voluntary work; and loss of utility from impact on leisure activities.
3 Key insights into the burden of RSV in adults in the UK

In this chapter we present the findings from a synthesis of the literature review, consultation with stakeholders and economic modelling based on information from the preceding two sources. We first describe the nature and scale of the total burden of RSV on the adult population in the UK. This burden includes: incidence of the illness itself and the consequent deaths and losses of quality of life; direct costs to the healthcare system in responding to the illness; and what we term indirect costs that are borne by the economy and society more generally. The second section of the chapter highlights how much of the burden, especially of the deaths and direct costs, is the result of the impact of RSV within the 65+ population. The third section contrasts this with the impact of RSV on the 18–64 age group, where the impact on the economy is greatest. The fourth and final section of the chapter discusses evidence of how the burden falls disproportionately on high-risk populations with certain comorbidities or compromised immune systems.

3.1. RSV is a significant problem for adults

As noted in the introduction to this report, discussion of the burden of RSV often highlights the impact it has on young children, especially in the first year of life. One study (Fusco et al. 2022), for example, found that RSV in children aged up to five is causing around half a million GP visits and 34,000 hospitalisations a year in the UK, contributing to an annual burden in terms of healthcare costs and lost productivity (among the children’s parents/carers) of approximately £80m (in 2020/21 price terms). The findings from our study of the burden on the adult population of the UK finds it to be even larger than the burden of RSV in children under five. In the remainder of this report all numbers refer to the burden of RSV in adults (18+) unless stated otherwise. Estimates are based on the UK population in 2019 and financial values are expressed in 2023 price terms.

3.1.1. RSV is common among adults and causes many deaths as well as reduced quality of life

Based upon estimates from an epidemiological study identified in the literature we reviewed, of RSV prevalence in the UK adult population (Green et al. 2013), we estimate that 3,642,220 RSV infections in adults (18+) arise in the UK each year, among a total adult population of 52,673,433. These cases lead to an estimated 596,108 GP consultations, leading in turn to an estimated 615,676 prescriptions for antibiotics. There are also an estimated 458,813 calls to the NHS 111 urgent healthcare advice service each year due to RSV. While approximately five-sixths of cases of RSV do not result in a
direct cost to the NHS – instead, the person with RSV manages the illness themselves or with the help of family and friends, a point that was echoed in the interviews we conducted – a large number of adult RSV cases, around 600,000, present to the NHS annually, with one GP interviewee perceiving RSV to be the largest single contributor to seeking a GP consultation during the winter season. Some stakeholders mentioned that due to increased testing, they are seeing an increase in RSV cases in 2023/24 compared with before the COVID-19 pandemic, and also a greater number of RSV cases compared with COVID-19 and influenza in 2023/24.

RSV causes respiratory infections. Common symptoms include coughing, sore throat, runny or blocked nose, fever, and fatigue. Episodes usually last several days and may lead to reduced ability to undertake normal activities, including work, as well as to discomfort. In some cases, the consequences of RSV can be much more severe, leading to hospitalisation and even death. From our modelling (detailed in Annex C) we estimate that in the UK annually there are 24,006 hospital admissions due to RSV, of which 2,929 require an intensive care unit (ICU) stay, and 38,892 outpatient attendances. We estimate that in the UK 11,800 adult deaths per year are caused by RSV. This figure combines all RSV-attributable respiratory diseases as reported by Fleming et al. (2015). There is additional evidence that RSV infection can trigger some non-respiratory conditions, especially MI and stroke, which in turn result in deaths and costs (Blackburn et al. 2018). These are not included in our main estimates as the attribution is primarily to MI and stroke, but we include estimates and discussion of these costs in our sensitivity analysis in Annex C.

The health impact of RSV in the UK each year is large overall. It ranges from millions of adults suffering relatively minor ill health for several days and self-treating, to severe ill health requiring hospitalisation in around 4% of cases that present to the NHS and death in around 2% of cases that present to the NHS. The overall loss of quality-adjusted life years (QALYs) by adults in the UK being infected with RSV each year is estimated by our model to be 87,001, of which 81,078 are due to premature deaths and 5,923 to illness in non-fatal cases.

3.1.2. The cost to the NHS is large

Our modelling shows that the cost of RSV in adults to the NHS is large and overall annually contributes to:

- 596,108 GP visits
- 458,813 NHS 111 calls
- 24,006 hospitalisations (of which 2,929 require an ICU stay)
- 38,892 outpatient visits
- 615,676 antibiotic prescriptions.

The monetisation of these healthcare resources converts to an annual total cost to the NHS of RSV in adults aged 18 years and over in the UK of £139.8m, which represents a mean cost of £38.37 per RSV case. Of these costs, approximately 66% are incurred through secondary care (35% acute hospitalisation, 25% ICU admission, 6% outpatient appointments), with the remaining 34% located in primary care (16% GP episodes, 16% antibiotic prescriptions, 2% NHS 111 calls).

3.1.3. The cost to the economy is even larger

Our study aims to fill an evidence gap by estimating the loss to the economy (the reduction in GDP) that is caused by people with RSV missing work and being less productive at work because of their illness. We were able to estimate the total loss of UK GDP
per year (what we refer to as ‘indirect costs’) due to RSV in non-fatal cases in adults to be £179.0m (details of the calculation can be found in Annex C). This figure includes time off work due to being ill and time spent attending healthcare appointments. We were not able to estimate the possible reduction in productivity while still at work for some people suffering from RSV (in other words the productivity loss from ‘presenteeism’). Nor did we find data to enable us to estimate any time burden on carers or family members due to an adult being infected with RSV.

When this indirect cost is added to the direct cost to the NHS, the total cost burden of RSV in the UK in adults aged 18+ is £318.7m per year, representing a mean cost per case of £87.51.

We have already noted that the large majority, indeed millions, of cases of RSV among adults each year will be self-treated rather than NHS-treated. It is likely that some (perhaps most) instances of self-treatment will include the use of over-the-counter medications, such as paracetamol, purchased out of pocket. Furthermore, patients attending healthcare appointments are likely to incur OOP travel costs in addition to the time spent travelling. However, we have found no direct estimates in the literature of any out-of-pocket costs incurred by people with RSV. Our main cost estimate therefore excludes any such costs, but in our sensitivity analysis modelling we have estimated this cost based on two Dutch studies and one German study as cited in Zhang et al. (2020) (Ehiken et al. 2005; Miedema et al. 2001; Rath 2015) and used in our previous study (Fusco et al. 2022), which taken together imply that out-of-pocket costs average approximately 3.0% of direct healthcare costs. This would imply an additional cost of approximately £4.7m per year for OOP costs caused by RSV in adults.

Interviewees mentioned potential impacts of RSV on those with unpaid caring responsibilities (e.g. for elderly relatives or children) needing to find alternative care arrangements whilst they recovered from RSV. However, our literature search revealed no data on the cost of RSV sufferers not being able to continue with unpaid activities such as caring for others who are dependent on them or undertaking other voluntary work, or on the loss of wellbeing resulting from hindrance to leisure activities caused by RSV. Nor did we find any studies of the burden on the families and carers of adults with RSV in the UK. Consequently, we have not included any quantified estimate of this part of the burden of RSV. Hence our total cost figures understate the true scale of the burden of RSV.

3.2. Much of the health burden and NHS cost burden of RSV is attributable to those aged 65+

We estimate that the percentage of the total number of RSV cases by age group are 47% in the 18–49 age group, 27% in the 50–64 age group, 14% in the 65–74 age group and 12% in the 75+ age group (see Figure 1) (Johannesen et al. 2022; Wilkinson et al. 2023). Despite forming a smaller proportion of RSV cases, older age groups are responsible for disproportionately large shares of the costs to the NHS, and it is among people in the oldest age groups that most deaths from RSV occur. We estimate that of the deaths attributable to RSV in the UK, 2% occur in the 18–49 age group, 7% in the 50–64 age group, 16% in the 65–74 age group and 75% in the 75+ age group. We estimate the QALYs lost in each age group, both as a result of lost health-related quality of life (HRQoL) and of deaths, to be 8,381 in the 18–49 age group, 12,726 in the 50–64 age group, 19,806 in the 65–74 age group and 46,087 in the 75+ age group.
Figure 1. Estimated annual incidence of RSV, UK adult population

![Graph showing estimated annual incidence of RSV, UK adult population.](image)

Figure 2. Direct costs, UK adult population

![Graph showing direct costs, UK adult population.](image)

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1 The figures given in this and Figures 2–5 are mean estimates. For details of variation around these point estimates, see Annex C. Note that total figures may not exactly equal the sum of their parts due to rounding.
Figure 3. Indirect costs, UK adult population

Figure 4. Total costs, UK adult population
Compared to younger adults with RSV, people aged 65+ are more likely to call NHS 111 (Morbey et al. 2017), more likely to consult their GP (Morbey et al. 2018) and are much more likely to be admitted to hospital – 79% of RSV hospitalisations of adults are of individuals in the 65+ age group (Fleming et al. 2015). Stakeholder consultations highlighted that frailty in older age can intensify the burden of RSV on the patient themselves as well as the health and social care systems required to support and treat them.

Figure 2 and Table 2 show the split of direct costs by age group resulting from the model. Expressing NHS costs per case of RSV in each age group shows how steeply the cost rises with age. The mean NHS costs per case of RSV are £10.52 in the 18–49 age group, £29.06 in the 50–64 age group, £63.04 in the 65–74 age group and £141.04 in the 75+ age group (see Figure 5). Thus, average NHS costs per case are more than 13 times greater for adults aged 75+ than they are for adults aged 18–49.

In our modelling, we have made the conservative assumption that people aged 65+ who suffer from RSV would not have been economically active. As some of the 65+ population remain in paid employment, not least because the state pension age is 67, this means we are underestimating the burden of RSV in terms of productivity losses. This approximation is driven by population data being presented in five-year age groups. The consequence is that we assume zero loss to measured GDP when RSV is among the 65+ population (see Figure 3). When indirect costs to the economy (that is, losses of GDP due to reduced productivity) are added to direct costs to the NHS, the total annual cost of RSV is £130.2m in the 18–49 age group (accounting for 41% of the total across all age groups), £95.3m in the 50–64 age group (30%), £32.1m in the 65–74 age group (10%) and £61.1m in the 75+ age group (19%) (see Figure 4). The mean total costs per case are £75.59, £97.55, £63.04 and £141.04, respectively (see Figure 5).
Table 2. Annual direct costs of RSV in adults by age group, base case\(^2\)

<table>
<thead>
<tr>
<th></th>
<th>Total UK (18+)</th>
<th>18 to 49 years</th>
<th>50 to 64 years</th>
<th>65 to 74 years</th>
<th>75+ years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct costs – total</strong></td>
<td>£139,762,818</td>
<td>£18,113,949</td>
<td>£28,397,078</td>
<td>£32,123,363</td>
<td>£61,128,429</td>
</tr>
<tr>
<td><strong>Direct costs – per adult RSV case</strong></td>
<td>£38.37</td>
<td>£10.52</td>
<td>£29.06</td>
<td>£63.04</td>
<td>£141.04</td>
</tr>
<tr>
<td><strong>GP episodes: RSV-attributable</strong></td>
<td>£22,564,032</td>
<td>£7,041,083</td>
<td>£6,430,827</td>
<td>£4,409,357</td>
<td>£4,682,765</td>
</tr>
<tr>
<td><strong>Hospitalisations: RSV-attributable</strong></td>
<td>£84,448,708</td>
<td>£3,866,234</td>
<td>£13,531,614</td>
<td>£20,230,330</td>
<td>£46,820,531</td>
</tr>
<tr>
<td>Respiratory disease, acute</td>
<td>£48,996,556</td>
<td>£2,243,162</td>
<td>£7,850,949</td>
<td>£11,737,497</td>
<td>£27,164,948</td>
</tr>
<tr>
<td>Respiratory disease, ICU</td>
<td>£35,452,153</td>
<td>£1,623,072</td>
<td>£5,680,665</td>
<td>£8,492,833</td>
<td>£19,655,583</td>
</tr>
<tr>
<td><strong>Outpatient visits: RSV-attributable</strong></td>
<td>£7,715,491</td>
<td>£353,231</td>
<td>£1,236,289</td>
<td>£1,848,305</td>
<td>£4,277,666</td>
</tr>
<tr>
<td><strong>NHS 111 calls: RSV-attributable</strong></td>
<td>£2,141,400</td>
<td>£621,175</td>
<td>£289,877</td>
<td>£664,844</td>
<td>£565,504</td>
</tr>
<tr>
<td>NHS 111: Cold/flu</td>
<td>£150,827</td>
<td>£43,752</td>
<td>£20,417</td>
<td>£46,828</td>
<td>£39,931</td>
</tr>
<tr>
<td>NHS 111: Cough</td>
<td>£1,401,112</td>
<td>£406,433</td>
<td>£189,666</td>
<td>£435,006</td>
<td>£370,008</td>
</tr>
<tr>
<td>NHS 111: Difficulty breathing</td>
<td>£589,461</td>
<td>£170,990</td>
<td>£79,794</td>
<td>£183,011</td>
<td>£155,666</td>
</tr>
<tr>
<td>Antibiotic prescriptions: RSV-attributable</td>
<td>£22,893,186</td>
<td>£6,232,226</td>
<td>£6,908,470</td>
<td>£4,970,527</td>
<td>£4,781,963</td>
</tr>
</tbody>
</table>

\(^2\) Mean estimates. For details of variation around these point estimates, see Annex C. Note that total figures may not exactly equal the sum of their parts due to rounding.
3.3. Much of the burden in the 18–64 age group comes from lost productivity

As described earlier, the 18–64 age group experiences a large proportion (74%) of RSV cases in adults in the UK, but only 9% of adult deaths from RSV occur in this age group. Our estimates of the total QALYs lost in each age group are 8,381 in the 18–49 age group, 12,726 in the 50–64 age group, 19,806 in the 65–74 age group and 46,087 in the 75+ age group. Thus only 24% of the QALY loss from RSV for adults is in the 18–64 age group and 76% is in the 65+ age group. However, the 18–64 population experiences a large productivity loss from RSV.

The mean cost to the NHS of each RSV case is much lower in the 18–64 age group than in the 65+ age group. The net effect is that despite more numerous cases of RSV in the 18–64 age group, the 65+ age group accounts for two thirds (67%) of total NHS costs of RSV among adults.

While the 18–64 age group drives only one third of the total NHS costs of RSV, it is this age group where the indirect cost burden is felt. RSV leads to time off work for those who would otherwise be at work, and reduced productivity while at work for those who do not take time off. Further, stakeholders mentioned that individuals who care for people with RSV, whether formally in health and social care employment or as unpaid carers, may be at greater risk of contracting RSV themselves, which may further impact the productivity of people in these sectors and therefore the burden to wider society. Lost productivity was incorporated into our modelling through estimates for: time lost travelling to and attending GP and outpatient appointments; the duration of hospitalisations; and lost productivity due to being off work with an RSV infection. We lacked data to estimate the cost of presenteeism – i.e. reduced productivity while ill but still at work – caused by RSV. Annex C sets out the details of how these estimates have been derived. From our modelling we estimate that indirect costs of RSV total £179.0m per year, of which £112.1m occurs in the 18–49 age group and £66.9m in the 50–64 age group.

Hence, as stated earlier, when indirect costs to the economy are added to direct costs to the NHS, the total annual cost of RSV is £130.2m in the 18–49 age group (accounting for 41% of the total across all age groups), £95.3m in the 50–64 age group (30%), £32.1m in the 65–74 age group (10%) and £61.1m in the 75+ age group (19%). The mean total costs per case are £75.59, £97.55, £63.04 and £141.04, respectively (see Figure 5).

3.4. RSV is particularly an issue for people with a respiratory or cardiovascular condition and people who are immunocompromised

Certain groups within the adult population are at considerably higher risk of serious illness from RSV, with higher morbidity and mortality rates than other adults of the same age. These include adults with severe lung disease, those with underlying cardiopulmonary disease and severely immunocompromised individuals (Stein et al. 2017; Tin Tin Htar et al. 2020). Evidence of the higher incidence of RSV among adult populations with other illnesses is largely drawn from single-site studies in the literature, rather than population-based studies (see Annex A), but interviewees reinforced the importance of comorbidities (see Annex B).

Those who are both elderly and living with comorbidities experience incidence rates that are reported to be higher than their peers from the same age group. For example, a
statistical analysis by Fleming and colleagues of UK data collected between 1995 and 2009 found that in the 65+ population the presence of a diagnosis indicative of severe influenza risk was associated with a doubling in the proportion of GP episodes and deaths for respiratory disease that were attributable to RSV, and a quadrupling in the proportion of RSV-attributable hospitalisations for respiratory disease (Fleming et al. 2015). Severe influenza risk was defined in line with UK recommendations for influenza vaccination, which include living with any of the following conditions: chronic obstructive respiratory disease; cardiovascular, central nervous system, renal and liver disorders; diabetes; immunosuppressive conditions or stroke (Department of Health 2012).

In another example, whilst those aged 65–74 in England experience 0.9 hospitalisations for RSV per 1,000 population per year (Johannesen et al. 2022), that same age group with MI (i.e. those that have experienced heart attacks) in England experience a 20 per 1,000 per year incidence of RSV hospitalisations (Blackburn et al. 2018; Wilkinson et al. 2023). Similarly, Johannesen et al. found an annual rate of RSV hospitalisations of 2.8 per 1,000 population aged 75–84 per year and 6.0 per 1,000 population aged 85+ per year (Johannesen et al. 2022). This general rate compares with estimates in other studies for the elderly aged 75+ with stroke of 7–9 RSV hospitalisations per 1,000 per year and with ischaemic stroke of 10–12 RSV hospitalisations per 1,000 per year (Blackburn et al. 2018; Wilkinson et al. 2023). In other words, having had a stroke increases the risk of hospitalisation due to RSV.
RSV is a major health problem for both children and adults. In our study we have focused on the burden of the disease in adults (aged 18+) in the UK. We adopted a societal perspective, attempting to estimate the size of the burden in multiple dimensions: the reductions in quality of life and the premature deaths it causes; the direct costs that fall on the NHS in caring for patients with RSV; the direct costs (to the limited extent possible with the evidence available) on individuals who self-care with over-the-counter medicines or incur costs travelling to healthcare appointments; and the indirect costs to the UK economy that result from people taking time off work.

We used both qualitative and quantitative methods to estimate the burden of RSV in adults in the UK. We reviewed the published literature to search for evidence about the various components of the burden of RSV in adults, and as far as possible specifically in a UK context. We also consulted key informants — clinicians and an organisation representing the interests of patients with respiratory diseases — and thereby qualitatively confirmed our understanding of the evidence in the literature. Finally, we constructed a model to quantify, as far as the published evidence and consultations permit, the numbers of deaths, the loss of QALYs, and the direct and indirect economic costs of RSV in adults in the UK.

This work goes beyond studies published hitherto by:

- Providing an estimate for the total cost to the NHS of RSV among adults in the UK;
- Including estimates of the productivity losses to the UK economy imposed by RSV in adults.

Our modelled estimates of the direct and indirect costs of RSV in adults omit losses to the ability to do voluntary work and to act as unpaid carers for family members and friends, and omit lost leisure activities. All of these are likely to be negative consequences of RSV illness. We estimate 3.6 million cases of RSV in adults per year, and many of these arise in the older population who are unlikely to be in paid employment, but whose lives are impacted negatively all the same. However, we were unable to find any evidence in the literature that would have enabled reasonable estimates of the size of these impacts.

The outputs of our model are necessarily estimates, not exact figures, and we indicate in Annex C the scale of some of the main uncertainties around the estimates. Some conclusions are clear, however, regardless of the inevitably approximate nature of any particular estimate.
First, the burden of RSV in adults in the UK is large, and indeed is considerably larger than the burden of RSV in children aged up to five years that we estimated in an earlier study to be £80m (Fusco et al. 2022).

Second, a large number of adults in the UK are affected by RSV each year and although approximately five-sixths of them do not seek NHS care, approximately 600,000 GP visits, 460,000 NHS 111 calls and 24,000 hospital admissions every year are attributable to adult cases of RSV.

Third, the consequences of RSV for some adults, especially the elderly or those with comorbidities or compromised immune systems, can be severe. We estimate that 11,800 adult deaths per year in the UK are due to RSV, and further deaths may have RSV as a contributory factor.

Finally, while the incidence of severe, even fatal, illness and of high NHS costs is seen disproportionately in the 65+ population, which may have implications for the UK’s ageing population (Centre for Ageing Better 2024), there is also a large cost to the UK economy in terms of lost productivity of adults in the working population who are affected by RSV.

Overall, RSV in adults in the UK imposes an economic cost burden each year of approximately £319m, of which £140m are direct costs to the NHS and £179m are indirect costs to the UK economy through lost work. This is on top of 11,800 deaths and a loss of 87,000 QALYs annually. We conclude that RSV in adults imposes a large burden.
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