

# **The health care burden and societal impact of acute otitis media in seven European countries: results of an Internet survey**

Judith H. Wolleswinkel-van den Bosch<sup>a\*</sup>, Elly A. Stolk<sup>b</sup>, Martine Francois<sup>c</sup>, Roberto  
Gasparini<sup>d</sup>, Max Brosa<sup>e</sup>

<sup>a</sup> Pallas, health research and consultancy BV, Rotterdam, The Netherlands

<sup>b</sup> Erasmus University Medical Center, Rotterdam, The Netherlands

<sup>c</sup> Robert Debré Hospital, Paris, France

<sup>d</sup> Department of Health Science, University of Genoa, Genoa, Italy

<sup>e</sup> Oblikue Consulting, Barcelona, Spain

## **\*Corresponding Author:**

Judith H. Wolleswinkel-van den Bosch, PhD

Pallas, health research and consultancy BV

PO Box 21238, 3001 AE Rotterdam, The Netherlands

Telephone: +31.10.447.4449

Fax: +31.10.447.4450

E-mail: wolleswinkel@pallas-healthresearch.com

## **ABSTRACT**

This paper estimates medical resource use, direct costs, and productivity losses and costs (indirect costs) during episodes of acute otitis media (AOM) in young children. A 24-item Internet questionnaire was developed for parents in Belgium (Flanders), France, Germany, Italy, The Netherlands, Spain, and the United Kingdom (UK) to report health care resource use and productivity losses during the most recent episode of AOM in their child, younger than 5 years. The percentage who did not seek medical help for AOM was considerable in The Netherlands (28.3%) and the UK (19.7%). Antibiotic use was high, ranging from 60.8% (Germany) to 87.1% (Italy). Total costs per AOM episode ranged from €332.00 (The Netherlands) to €752.49 (UK). Losses in productivity accounted for 61% (France) to 83% (Germany) of the total costs. AOM poses a significant medical and economic burden to society.

**Keywords:** acute otitis media, direct costs, indirect costs

**Abbreviated Article Title:** Burden of acute otitis media in seven EU countries

# 1. INTRODUCTION

Otitis media is one of the most common diseases in early infancy and childhood. A diagnosis of acute otitis media (AOM) requires a history of acute onset of signs and symptoms of middle-ear inflammation.[1, 2] Otitis media with effusion (OME) is defined as the presence of fluid in the middle ear without signs or symptoms of acute ear infection; OME frequently follows AOM.[2, 3] AOM does not usually lead to any measurable long-term consequences. In about 90% of cases in children older than 2 years, the worst symptoms subside within 3 days (range 27 days)[2, 4]; in about 40% to 60% of cases in children younger than 2 years, the worst symptoms subside within 3 days.[5] However, long-term consequences of AOM can occur; OME is the most common cause of acquired hearing loss in childhood. OME also has been associated with delayed language development and behavioral problems.[6]

The incidence of AOM peaks between the ages of 6 and 11 months.[2] In Europe, Germany and The Netherlands have reported a cumulative prevalence of 35% by the age of 2 years,[7] based on prospective birth cohorts. By the age of 3 years, 50% to 85% of children will have had at least one episode of AOM.[2] In Spain, 60% of 4-year-olds will have had AOM, based on a retrospective cohort study among pediatricians.[8] Recurrent AOM ( $\geq 4$  episodes per year) is common, affecting up to 20% of children younger than 1 year; up to 40% of older children eventually have six or more episodes in total.[2]

Although guidelines on the treatment of AOM differ between countries, the current consensus is that in most patients aged 2 years and older, symptomatic treatment (e.g., analgesics) is sufficient,[9, 10] and the use of antibiotics should be restricted to help minimise antibiotic resistance. However, some guidelines (i.e., in the United Kingdom [UK], the United States [US], and France[11]) recommend antibiotics for all children younger than 2 years, and others (i.e., in The Netherlands and Scotland)[9] recommend the use of antibiotics only in the case of

severe symptoms, persistent signs of disease, or related comorbidity. The French guidelines recommend antibiotics for those older than 2 years only in the case of severe symptoms; abstention from antibiotics at the initial visit should be followed by a reassessment at 48 to 72 hours.[11] Regional and national guidelines in Italy[12, 13] recommend giving antibiotics only if the symptoms are the same or worse after 48 to 72 hours for all children, except for those presenting with severe (otorrhea) or recurrent symptoms, or those with other conditions or underlying conditions requiring antibiotic use. There also are differences between countries with respect to surgery. In The Netherlands, a restrictive policy regarding antibiotic prescriptions is accompanied by high rates of myringotomy procedure.[10]

Differences in AOM management among different countries might be explained by differences in physicians' and patients' perceptions and expectations regarding the outcome of a physician visit or differences in the organisation of the health care system.[10] Differences in the health care system also affect the proportion of parents seeking medical care for their child with AOM symptoms. For example, in The Netherlands, patients have to see their general practitioner (GP) before accessing other physicians, and there is a strong culture of "watchful waiting." Thus, experts have estimated that only one-third of all cases of AOM would result in a GP visit in The Netherlands.[14]

For most countries, data are lacking on the use of medical resources for AOM, including the proportion of cases not seeking medical care. In addition, data are not available to estimate the impact of AOM on other direct and indirect costs. It is highly likely that parents of children with AOM, both those who do and those who do not seek medical care, will take time off work to care for their child and/or buy over-the-counter (OTC) analgesics or topical agents, such as ear drops, to ease the symptoms.

As AOM is one of the most common childhood diseases, the total societal impact of the disease can be substantial, and indirect costs associated with losses in productivity at work

and at home are likely to constitute a large part of the total costs involved. For example, indirect costs have been reported to represent 40% to 60% of the total costs of AOM, depending on country, age, and number of previous episodes (Niemela et al., 1999 [Finland][15]; Capra et al., 2000 [US][16]). The magnitude of the indirect costs will depend on the social services and socioeconomic situation in a country, such as the employment rate, proportion of part-time workers among women and men, and parental leave arrangements. For example, the proportion of part-time employees among employed women aged 20 to 49 years with children younger than 12 years ranges from 20% in Spain to 80% in The Netherlands.[17]

Given the differences in health care systems and social services among countries, there is a need for country-specific data on direct and indirect costs. Our aim is to describe the use of medical resources and the total societal impact of AOM in seven European countries to help fill these gaps in the knowledge base.

## **2. METHODS**

### **2.1. Questionnaire and Study Population**

We developed a 24-item questionnaire retrospectively asking parents about health care use and productivity losses related to the most recent episode experienced of any disease, including AOM, by their children younger than 5 years. The domains covered by the questionnaire included characteristics of the disease episode (symptoms, duration, frequency), the use of medical resources (number of physician and emergency room [ER] visits, telephone consultations, hospitalisations, prescription and OTC drug use including zero use; diagnostic tests and surgical interventions were not included), productivity loss by the caregivers (work days lost, loss of productivity at work, loss of leisure time), and travel costs. The questionnaire was sent electronically to a sample of parents with children younger than 5

years from Belgium (Flanders), France, Germany, Italy, The Netherlands, Spain, and the UK, who participated in an Internet access panel of Survey Sampling International (SSI), a market research agency in Rotterdam, The Netherlands. The panel, which consists of people who have elected to participate in surveys sent out by SSI on behalf of its clients, is a general consumer panel, not specifically set up for health-related subjects.

Parents were asked to provide details about the most recent (maximum of 12 months ago) illness episode of any type experienced by their child (younger than 5 years). When parents had more than one child younger than 5 years, they were asked to complete the questionnaire for the child who had most recently been ill. The questionnaire was generic; parents could list all kinds of symptoms and diseases. All data, including the diagnosis given by the physician, were self-reported by the parents.

As a pilot study, the questionnaire was first administered to an Internet access panel in Belgium (Flanders) and The Netherlands in January 2007. Following the pilot study, we developed and included additional questions on the number of health care visits and the number of work hours lost. This adapted version of the questionnaire was distributed to access panel members in France, Germany, Italy, Spain, and the UK in late April 2007. The Internet survey was targeted to parents of young children, and given the likely age of these parents, it was expected that they would be a very Internet-literate age group in most Western countries. The response rate in the different countries ranged from 17% (UK) to 53% (Belgium [Flanders]). The respondents were representative of the countries as a whole with respect to geographic background, education, and income, although respondents had higher education and income rates than nonrespondents in France, Italy, and Spain.

## **2.2. Case Definition and Medical and Other Direct Resource Use**

The questionnaire provided a symptom list, including, among others, earache, running ear, cold, fever, and diarrhea, and parents were asked to fill out the symptoms of their child's most

recent illness. In addition, parents were asked to indicate whether they had received a diagnosis by a physician and, if so, to provide the diagnosis. Thus, parents provided all information on the diagnosis. In the subset of the survey respondents who indicated that the most recent illness included AOM symptoms, we identified the following AOM categories:

*Category 1: Physician-Confirmed AOM*

- Parents reported symptoms of earache or running ear and reported a physician visit with a diagnosis of otitis, AOM, ear infection, running ear, or "tubes" indicative of AOM.
- Parents reported no symptoms of earache or running ear, but did report a physician visit with a diagnosis indicative of AOM.

*Category 2: Symptoms of AOM/Other Diagnosis at Physician Visit*

- Parents reported symptoms of earache or running ear and a physician visit, but did not report a medical diagnosis indicative of AOM (e.g., earache may be due to tonsillitis).

*Category 3: Symptoms of AOM/No Physician Visit*

- Parents reported symptoms of earache or running ear, but did not report a physician visit.

Results for category 1 are presented in tables and text. For countries with a high proportion of parents not visiting a physician, results for category 3 are highlighted in the text because only two countries (UK and The Netherlands) had relatively large numbers in this category. In addition, parents were asked how many episodes with the same symptoms their child experienced in the past year.

Parents were asked to report all the health care services used to treat the episode of AOM, including physician visits, ER visits, hospitalisations, prescription drugs, and out-of-pocket payments for OTC drugs (diagnostic tests and surgical interventions were not included). In

addition, they were asked to report direct nonmedical resource use, including travel time, parking, and transportation for physician or pharmacy visits.

### **2.3. Indirect Resource Use (Productivity Losses)**

Productivity losses included hours of absence from a paid or unpaid job, as well as loss of productivity at work and loss of hours of leisure time. Absence from an unpaid job was defined as not being able to (1) provide usual informal care to others; (2) carry out any other voluntary work; or (3) carry out activities around the house.[18] To investigate loss of productivity at work, we asked whether the parents felt less productive during work because of their child's illness (e.g., because they could not concentrate properly). If so, parents with a paid job were asked to estimate how many extra hours they would have needed to be as productive as when their child was not ill. This question has shown to yield conservative results for loss of productivity at work.[19] Loss of leisure time was defined as any time during free weekdays or weekends that was spent at a physician or pharmacy visit because of the child's illness. The parent who filled out the questionnaire was asked to fill out any productivity loss hours for their partner, the child's grandparents, or other informal caregivers as well. For each type of productivity loss hours (absence from work, loss of productivity at work, and loss of leisure time), the hours lost are presented for all informal caregivers combined (i.e., the total hours missed due to the disease episode).

The questionnaire was developed by the authors of this paper and programmed by SSI in close collaboration with the authors. In developing the questionnaire, both the Productivity and Disease Questionnaire (PRODISQ)[20] and the Health and Labour Questionnaire (HLQ)[21] were studied, and relevant items on productivity losses were included in the survey questionnaire. We did not use PRODISQ or HLQ because these questionnaires were developed to measure productivity loss due to health problems in the working adults and contain many items not relevant to our study.

## 2.4. Costing

Costs per episode of physician-confirmed AOM were calculated from a societal perspective using data on health care utilisation and productivity losses from the Internet questionnaire. Direct medical costs included costs related to physician visits (primary care, including telephone consultations, home visits, and outpatient visits), ER visits, hospitalisations, and out-of-pocket payments for prescription and OTC drugs (costs for diagnostic tests and surgical interventions were not included). Direct nonmedical costs included parent-reported travel costs (based on kilometres driven) and parent-reported parking costs, public transportation, and taxi fares for physician or pharmacy visits. For the direct medical costs, we used official national sources and published cost-effectiveness studies to obtain unit costs (Appendix A). Costs for OTC drugs were derived directly from the questionnaire, where we asked the respondents to estimate how much they spent on OTC drugs. In the case of prescription drugs, out-of-pocket costs were included only as obtained from the survey respondents. The information from the questionnaire on drug use was not detailed enough to estimate costs covered by the public payer. Costs for hospital admissions for all the countries included in the survey were based on diagnosis-related groups or cost per day for hospitalisations for upper respiratory tract disorder and AOM or minor ear procedures. All direct medical costs were calculated in 2007 Euros. For indirect costs associated with absence from a paid job, average hourly labor costs for the year 2006 were derived from national labor statistics. Hourly labor costs of an unpaid job or leisure time were based on net tariffs for informal care, such as housekeeping, and either derived from national statistics or estimated to be equal to the hourly minimum wage. UK cost prices in pounds were converted to Euros, using an exchange rate of £1 = €1.48 (June 12, 2007). We also asked whether any of the lost hours had been made up by the parent or a colleague during or after the disease period (except

for The Netherlands and Belgium [Flanders]). This has not been netted out in the cost calculation, but results are presented in the text.

Direct medical costs per episode were estimated by multiplying the unit costs by the mean units of medical resources used per episode (e.g., mean number of GP visits per episode) and weighted by the proportion of episodes for which this type of health care was used. In the same way, indirect costs were estimated using results for mean hours of productivity loss or leisure time loss, and the proportion of respondents reporting each type of productivity loss.

The costing was performed in accordance with the Dutch guidelines for pharmacoeconomic studies.[22]

## **2.5. Statistical Analyses**

Descriptive statistics (proportions, means, medians, standard deviations [SDs]) were generated for resources and costs. Mean values were used to estimate the costs for an episode of AOM because this allows policymakers to estimate the total costs of treatment for a population.

# **3. RESULTS**

## **3.1. Study Population**

Table 1 provides information on the characteristics of the most recent disease episodes in children younger than 5 years surveyed in the seven countries. The total numbers of completed questionnaires included in the analyses were 1,208 for Belgium (Flanders), 2,059 for Germany, 2,216 for Spain, 2,071 for France, 2,145 for Italy, 2,425 for The Netherlands, and 2,015 for the UK. The ages of the children in the total sample (all kinds of disease episodes) ranged from 0 to 4 years, with an even distribution of the sample across 1-year age groups. The time elapsed between the disease episode and filling out the questionnaire was similar for the different countries, with 64.8% (Italy) to 74.7% (Belgium [Flanders]) of the

disease episodes occurring during the previous month, and 9.4% (France) to 16.0% (The Netherlands) of the episodes occurring more than 3 months before the questionnaire.

Out of all the most recent disease episodes, between 13.9% (Spain) and 20.7% (Belgium [Flanders]) reported symptoms of AOM, and between 35.8% (UK) and 74.8% (France) of these cases had physician-confirmed AOM. In Germany, Italy, Spain, and the UK, about half of physician-confirmed AOM episodes were in children younger than 3 years; this proportion was higher in Belgium (Flanders) (62%), France (63%), and The Netherlands (70%). The mean duration of a physician-confirmed AOM disease episode ranged from 6.7 (SD 4.8) days (Italy) to 10.9 (SD 15.9) days (The Netherlands) (Table 1). The mean duration of symptoms of AOM for which no medical help was sought was 4.8 (SD 3.0) days in the UK and 4.9 (SD 3.3) days in The Netherlands; there were very few (< 20) cases of AOM not seeking care in the other countries. Parents reported that children who had physician-confirmed AOM experienced a mean number of between 2.2 (Germany) and 2.7 (Spain, France, Italy) episodes of AOM in the previous year (including the most recent episode). Between 14.2% (Germany) and 23.4% (France) of the cases with physician-confirmed AOM experienced four or more episodes in the previous year (Table 1), a definition consistent with recurrent AOM.

### **3.2. Health Care Use**

The proportion of parents consulting a physician when their child was ill (all illnesses combined) varied widely among countries, ranging from 47.0% (The Netherlands) to 88.7% (Spain) (Table 1). A physician was more likely to be consulted in cases with symptoms of AOM (71.7%–98.5%). Although The Netherlands (53.0%) and the UK (42.3%) were the countries with the highest proportion of cases of all illnesses that did not seek medical care, only 28.3% and 19.7%, respectively, of cases with symptoms of AOM did not consult a physician (Table 1).

The use of medical resources reflected the organisation of health services in the respective countries, with a strong role of the pediatrician in Germany, Spain, and Italy, as opposed to the dominant role of the GP in Belgium (Flanders), France, The Netherlands, and the UK. ER visits were high in Spain, which is a known feature of the Spanish health care system.[23] GP visits at home were most common in Belgium (Flanders), and telephone consultations with a physician were more frequent in Italy, The Netherlands, and the UK (Table 2).

Parents were asked whether their child was admitted to the hospital during the disease episode. Percentages were low for episodes of physician-confirmed AOM, ranging from 3.6% (Belgium [Flanders]) to 7.7% (Spain).

Antibiotics were prescribed for the majority of children with physician-confirmed AOM, ranging from 60.8% (Germany) to 87.1% (Italy) (Table 2). Data were not available for Belgium (Flanders) and The Netherlands because no question on prescription drugs was included in the pilot phase of the questionnaire. From the literature we could estimate an antibiotics prescription rate of 58% for The Netherlands[24] in children younger than 4 years, and for Belgium (Flanders) 85% antibiotic use in children with AOM has been reported.[25] The latter might be an overestimation as overall outpatient antibiotics use has declined by 36% in Belgium over the past decade.[26] Whether this decline applies to antibiotic treatment in young children with AOM is not known.

Parents were asked whether they bought OTC drugs specifically for this episode of AOM. The responses differed greatly between countries, ranging from 20.4% (France) to 75.5% (Italy), but in countries where few OTC drugs were bought, parents were better equipped at home (Table 2). When OTC drugs were bought, a wide range of expenses were reported within each country.

### 3.3. Productivity Loss

In five of the seven countries, caregiver(s) took time off from a paid job in about 20% of the physician-confirmed AOM episodes, although this was lower in The Netherlands (11.8%) and the UK (18.4%) (Table 3). For caregivers who took time off from paid employment, the mean number of hours missed from their paid jobs per episode of physician-confirmed AOM ranged from 17.3 (SD 10.4) (UK) to 35.1 (SD 98.3) (Belgium [Flanders]) (Table 3). When comparing productivity losses for episodes of physician-confirmed AOM with episodes with symptoms of AOM but no physician visit in The Netherlands and the UK (where there were enough episodes to do so), there were no differences in the percentages of episodes for which a caregiver had to take time off from a paid job. The amount of time taken off was comparable for both types of episodes in The Netherlands but longer for the group with a physician visit in the UK (mean 15.5 vs. 9.4 hours). Leave of absence from an unpaid job was generally reported less often, but the hours taken off were longer (Table 3). We also asked parents about impaired productivity at work, due to lack of sleep or worry about their child's illness. The percentage of episodes of physician-confirmed AOM for which parents reported productivity loss at work due to the illness of their child was highly variable, ranging from 23.0% (The Netherlands) to 62.4% (the UK) (Table 3), with a mean amount of time lost for those reporting a productivity loss ranging from 6.7 hours (France) to 22.7 hours (Spain). Many parents (37.6%-67.9%) reported that some free time (mean 2.7-6.7 hours) was spent on a physician or pharmacist visit(s) (Table 3). In The Netherlands, there were sizeable differences in the percentage of episodes for which parents reported leisure time loss, as well as the mean number of hours lost between episodes of physician-confirmed AOM (55.1%; 2.7 hours) and episodes with symptoms of AOM without a physician visit (17.6%; 1.0 hours); no such differences were seen for the UK.

Respondents (except in The Netherlands and Belgium) were asked whether a colleague or they themselves made up for any of the lost hours at work. Lost hours in a paid job (absenteeism) were made up for in 20% (Italy) to 38% (Germany) of the hours; in an unpaid job, in 20% (Italy) to 41% (Germany) of the hours; and lost hours due to productivity loss at work (presenteeism) were made up for in 6% (Italy) to 37% (Spain) of the hours lost.

### **3.4. Cost Analyses**

Direct medical costs ranged from €62.96 in The Netherlands to €214.91 in Spain and comprised mainly hospitalisation costs and visits to the GP or pediatrician. Costs for Belgium (Flanders) and The Netherlands were lower than for most other countries because use of prescription drugs was not recorded, and parents were not asked for the number of physician visits in their version of the survey. The direct costs in France, Germany, Italy, Spain, and the UK were mainly due to the costs of hospitalisation and visits to physicians (Table 4).

Indirect costs associated with productivity losses ranged from €267.05 in The Netherlands to €588.92 in Germany. The exact composition of these costs varied per country, but productivity loss while at work and absence from a paid job contributed greatly to these costs because of the relatively high hourly cost of labor. High indirect costs of an episode of AOM in the UK were mainly due to the high percentage of parents reporting productivity loss while at work. Indirect costs made up 61% to 83% of the total costs related to an episode of AOM (Table 4). For the UK and The Netherlands, the costs of an episode with symptoms of AOM without a physician visit were estimated. These costs included productivity losses, car travel, and out-of-pocket payments for OTC drugs. These episodes cost on average €353.12 in the UK and €192.85 in The Netherlands, which is roughly 47% of the total costs of an episode for which a physician is visited in the UK and 58% of those costs in The Netherlands.

## 4. DISCUSSION

The goal of the study was to estimate the total costs of an episode of AOM as reported by the parents of young children from seven European countries. As expected, the use of medical resources for physician-confirmed AOM very much reflects the organisation of health services in the respective countries. The survey responses revealed a substantial burden of AOM in terms of both direct medical costs and indirect costs. In particular, the results of our study showed that a physician is consulted for most episodes with symptoms of AOM and the frequency of antibiotic use was high for AOM, ranging from 60.8% (Germany) to 87.1% (Italy). The percentage of children with physician-confirmed AOM admitted to the hospital was low, and ranged from 3.6% (Belgium [Flanders]) to 7.7% (Spain). In most of the countries studied, the caregiver took time off from a paid job in about 20% of the physician-confirmed AOM episodes. In addition to time missed from work, reduced productivity at work by the parents was reported for around 40% to 47% of physician-confirmed AOM episodes. Loss of leisure time ranged from 37.6% to 67.9% of the episodes. The total costs of a physician-confirmed AOM episode varied from €332.00 (The Netherlands) to €752.49 (UK), with indirect costs representing 61% to 83% of the total episode. Episodes for which no medical help was sought generated costs of 54% to 58% of a physician-confirmed AOM episode. A strength of this Internet survey is that this study determined the costs related to episodes with symptoms of AOM for which medical care was not sought as well, which were still considerable. This is an important source of information for countries with a relatively high percentage of cases treated at home (e.g., The Netherlands and the UK).

Methodological issues that might limit the generalisability of the survey results include the following: the surveyed population may not be representative of the general population because of the need for Web access; AOM diagnoses by physicians were not confirmed using the medical record; the population was not representative of the whole population; there was a

bias toward children with recurrent episodes; there were differences in employment rates across countries. These limitations are discussed in detail below.

#### **4.1. Representativeness of the Surveyed Population**

The results of this study are based on an Internet panel survey on childhood diseases, which has shown adequate response rates (i.e., comparable to more conventional postal questionnaires) for most countries. The response rate depends on how well the parents with young children could be targeted by the market research agency. This again depends on the background data available at the market research agency. When this background is incomplete, a larger, less targeted wave of invitations is sent out, which will result in lower response rates (e.g., Spain and UK).

The demographics of the sample showed that the geographical distribution of the respondents was representative of the population in all countries. Indicators of socioeconomic status (education and income) were fairly representative for Italy and The Netherlands. The Belgium (Flanders) and German samples were less educated than the population in general, while the French and UK samples were more educated. Median income levels were higher in our samples for France and Spain.

#### **4.2. Accuracy of Self-Reported Data**

All data were self-reported, including the medical diagnoses, which were not validated with medical records. However it is common for burden-of-disease studies to use patients as the only source of information. Studies have shown that the reliability of patients for this purpose is adequate.[27-29]

The symptoms listed were earache, running ear, cold, fever, and diarrhea. Earache is generally due to AOM. When earache is due to tonsillitis or pharyngitis, there is also a dysphagia.

Running ear in young children is mainly due to an AOM spontaneously perforated, or

discharge through a myringotomy tube. The other causes of otorrhea are rarer (otitis externa and chronic otitis with or without cholesteatoma). Thus the parents are often able to correctly diagnose an ear infection without the help of a physician. Vernacchio and colleagues[30] have shown that parents' reporting of their child's AOM episode occurring in the previous month was accurate (positive predictive value: 85%; negative predictive value: 99%).

Severens and colleagues[31] studied the precision and accuracy of a retrospective, self-administered questionnaire on sick leave compared with the employer's absence records. They showed that at least 87% of the self-reported results matched with the employer's data if the recall period was 2 months or less. In our surveys, the vast majority of episodes (at least 78%, depending on country) occurred in the previous 2 months.

### **4.3. Bias Toward Recurrent AOM Episodes**

Parents were asked to report on the most recent disease episode. This could have created a bias toward recurrent cases of AOM. Children with multiple AOM episodes are more likely to have an AOM episode as their most recent disease episode as compared with children who had just one AOM episode that year. Furthermore, parents were not asked to differentiate the type of otitis media (i.e., AOM, chronic, OME), although the vast majority of otitis media cases are generally AOM. Information on the prevalence of recurrent AOM is scarce in the medical literature. It is generally agreed that 10% to 20% of children younger than 1 year will have recurrent disease (three episodes within 6 months or four episodes within 1 year) and that 40% of children will have more than six episodes in their childhood.[2] In our survey, 14.2% to 23.4% of the children reported four or more episodes in the previous year. The mean number of episodes per year obtained from our survey (2.2 to 2.7) seems to be higher than reported elsewhere, but there are little data for comparison. In Finland, an average of 2.1 episodes per child in the first 2 years of life has been reported in the control group of a vaccine study.[32] In Spain, 2.2 episodes were reported in the first 5 years of life.[8]

However, these studies report an average number of episodes for the entire child population investigated, while we report an average number of episodes in children with episodes of AOM. A study in older children (mean 3.5 years old) attending day care centres in Finland reported an overall average of 1.5 episodes of AOM per year.[15] However, only 41.7% of the 736 children had an episode of AOM; therefore, children with AOM had an average of 3.6 episodes in a year. A large survey of US parents showed that children younger than 5 years who had an AOM episode in the previous year had an average of 2.8 episodes per year.[33] These last two figures are closer to ours.

The proportion of physician-confirmed AOM cases occurring in children younger than 1 year was low in our study, ranging from 5% (Italy) to 19% (The Netherlands). This finding was striking in view of the fact that we had an equal distribution of the sample among the 1-year age groups and that the peak incidence of AOM is between 6 and 11 months.[2] This finding might have been caused by our focus on the most recent disease episode. Infants frequently experience bouts of diarrhea or fever, and therefore chances are high that one of those episodes was the most recent one. In Italy and the UK (where the proportion of children 0 to 6 months old with AOM was lowest), symptoms of diarrhea were reported at least twice as often as symptoms of AOM, which seems to confirm this assumption.

#### **4.4. Differences in Employment Rates Across Countries**

The mother was the respondent in most cases, ranging from 56% (Italy) to 84% (the UK). This could have biased the results on productivity loss toward the mother's perspective, although we explicitly asked the respondent to fill out the data on productivity loss for other possible caregivers (e.g., father, grandparents) as well. Work days lost from a paid or unpaid job largely depend on the labor-force participation of parents with young children, and in large part, on the participation of women. In some countries, the employment rate is low, but when women do work, they work full-time; in other countries, employment rates are high, but

the large majority of women with children work part-time. Employment rates of women aged 20 to 49 years with children younger than 12 years range from as low as 50% in Italy and Spain to as high as 70% in Belgium (Flanders) and The Netherlands.[17] The proportion of part-time employees among this group of women ranges from 20% in Spain to 80% in The Netherlands. No such large differences between countries exist for men with children younger than 12 years; they have an employment rate of around 90%, and only 5% work part-time. The high proportion of part-time work in The Netherlands is likely to explain the low percentage (13%) of caregivers who needed to stay home from a paid job. The length of parental leave also varies greatly among countries in Europe, and is likely to influence the results on productivity losses. If respondents with no job or a part-time job were over-represented in our sample, productivity losses might have been too low, but this does not seem to be the case in our samples. For Belgium (Flanders) (65% mothers) and The Netherlands (81% mothers), we asked for employment status of the respondent and the number of working hours per week, this being 69% and 26 hours in the former and 84% and 35 hours in the latter country. For only a relatively small percentage of the physician-confirmed AOM episodes, caregivers reported some kind of productivity loss (around 20% for paid work days loss, around 10% of unpaid job loss); therefore, estimates of the mean amount of working time lost show a large spread (Table 3). We also estimated productivity losses at work. These productivity losses without absence are potentially important, yet almost neglected in economic evaluations of health care.[19] A young child's illness might wake a parent in the middle of the night, leaving the parent tired and leading to productivity loss at work. The results of the Internet survey show that a large proportion of the parents reported this type of productivity loss. The variation between countries probably relates to the employment rates in the different countries, but does not explain the high percentage for the UK. Nonetheless, in the Yawn and colleagues' US survey,[33] 31.4% of parents reported

having to take some time off work (0.5-1 day only), but in the Finnish day care study, the parental leave of absence reached 1.9 days.[32] Another US study[16] found that 45% of parents had to take some time off work, for a mean of 5.9 hours. Our estimations seem to be lower for the proportion of caregivers needing to take time off, but higher in the amount of time not worked.

#### **4.5. Comparison of the Estimates with Published Data**

The estimates of direct medical care use from the survey were not always consistent with results from other published studies. For example, the survey indicated that a physician was consulted in 72% of episodes of AOM in The Netherlands, while the Bos and colleagues study[14] indicated that only 30% of AOM episodes resulted in a visit to a GP. The percentage of cases visiting an ear, nose, and throat (ENT) specialist in The Netherlands from the survey (4.3%) was consistent with the referral rate reported by Plasschaert and colleagues.[24] However, the ENT specialist visit rates from the survey in Spain (12.0%) were much higher than previously reported (3.5%).[34] The latter were proper referral rates; however, the percentages in our survey take into account more severe or recurrent AOM cases, for which an ENT specialist had probably already been consulted. The high use of antibiotics found in the survey, from 60.8% to 87.1%, is comparable to what has been reported for the UK,[35] Italy,[36] and Spain[8, 34] but is of some concern because antibiotics provide only marginal benefit and promote antibiotic resistance.[9] For example, a study in Italy[13] showed that delayed prescription of antibiotics as recommended in Italian guidelines resulted in a significant reduction in the number of children who received antibiotics; only 34.9% of those eligible for delayed treatment received antibiotics within 28 days, without an increase in complications.

The survey found that indirect costs represented 61% to 83% of the total costs per episode, somewhat higher than previous estimates of 40% to 60%,[15, 16] which can probably be at

least partly explained by the fact that our indirect costs included a broad interpretation of productivity loss (e.g., at work and leisure time). In addition, the human capital approach was used to estimate the value of time lost from work rather than the more conservative friction cost approach. Furthermore, the direct costs were slightly underestimated as diagnostic tests and costs of surgical intervention (if any) were not included in the costing.

## **5. CONCLUSIONS**

AOM is one of the most common childhood diseases and as such poses a significant medical and economic burden to society. The survey approach used in this study allowed a comprehensive estimate of the burden of AOM, including direct medical costs, costs for OTC drugs, and indirect costs associated with productivity losses. The results showed that indirect costs are generally higher than the direct costs and indicate that estimates of the burden of AOM that do not include indirect costs underestimate the cost to society of this disease. The findings from this study provide valuable input for economic evaluation of new treatments, as they estimated both direct medical costs and productivity losses for AOM in seven European countries.

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**Table 1. Characteristics of Most Recent (< 12 Months) Disease Episodes**

Characteristic	Country						
	Belgium (Flanders)	France	Germany	Italy	The Netherlands	Spain	United Kingdom
Response rate (%)	65	36	47	41	44	29	17
No recent (< 12 months) disease episodes, n	99	181	185	307	375	344	135
Recent disease episodes, n	1,208	2,071	2,059	2,145	2,425	2,216	2,015
Episodes with physician visit, n (%)	929 (76.9)	1,785 (86.2)	1,624 (78.9)	1,877 (87.5)	1,140 (47.0)	1,965 (88.7)	1,162 (57.7)
Episodes with symptoms of AOM, n (% of total episodes)	250 (20.7)	400 (19.3)	374 (18.2)	327 (15.2)	481 (19.8)	308 (13.9)	349 (17.3)
Physician-confirmed AOM, n (% of total episodes with symptoms of AOM)	140 (56.0)	299 (74.8)	204 (54.5)	155 (47.4)	187 (38.9)	183 (59.4)	125 (35.8)
Symptoms of AOM—other diagnosis, n (% of total episodes with symptoms of AOM)	91 (36.4)	95 (23.8)	156 (41.7)	157 (48.0)	158 (32.8)	119 (38.6)	155 (44.4)
Symptoms of AOM—no physician consultation, n (% of total episodes with symptoms of AOM)	19 (7.6)	6 (1.5)	14 (3.7)	15 (4.6)	136 (28.3)	6 (1.9)	69 (19.7)
Duration (days) of episode of physician-confirmed AOM, mean (median)	6.9 (5.0)	7.5 (5.0)	9.2 (7.0)	6.7 (6.0)	10.9 (7.0)	9.8 (6.0)	8.4 (5.0)

<b>Characteristic</b>	<b>Country</b>						
	<b>Belgium (Flanders)</b>	<b>France</b>	<b>Germany</b>	<b>Italy</b>	<b>The Netherlands</b>	<b>Spain</b>	<b>United Kingdom</b>
Number of episodes of physician-confirmed AOM per child per year, mean	NA	2.7	2.2	2.7	NA	2.7	2.4
Children with physician-confirmed AOM with $\geq 4$ episodes in previous year, %	NA	23.4	14.2	21.9	NA	22.4	14.4

AOM = acute otitis media; NA = not available because not asked in pilot study.

**Table 2. Use of Medical Resources for Episodes of Physician-Confirmed Otitis Media**

Medical Resource	Country						
	Belgium	France	Germany	Italy	The Netherlands	Spain	United Kingdom
	(Flanders)						
	(n = 140)	(n = 299)	(n = 204)	(n = 155)	(n = 187)	(n = 183)	(n = 125)
Physician consulted, %							
General practitioner practice	60.7	71.6	17.2	3.2	87.2	8.7	82.4
General practitioner home visit	17.1	5.0	2.0	9.0	1.1	1.6	1.6
Pediatrician	26.4	25.1	79.9	87.7	3.7	90.2	19.2
Emergency room	2.1	4.3	10.3	15.5	2.1	27.9	10.4
Ear, nose, and throat	1.4	10.7	28.9	19.4	4.3	12.0	4.8
Other	0.7	7.4	0.5	1.9	4.3	4.4	8.0
Telephone consult	2.1	1.7	0.5	12.3	7.0	1.1	8.8
Hospitalisation, %	3.6	6.7	4.4	3.9	4.3	7.7	4.0
Duration, days							
Mean (SD)	3.6 (5.8)	1.6 (0.9)	2.6 (2.1)	6.8 (2.5)	1.4 (0.5)	2.9 (2.4)	2.8 (2.7)
Median	1.0	1.0	1.0	6.5	1.0	2.0	1.0
Antibiotics, %	NA	76.3	60.8	87.1	NA	82.5	84.8
Other prescribed drugs, %	NA	21.7	19.1	9.0	NA	14.8	6.4

	Country						
	Belgium				The		United
	(Flanders)	France	Germany	Italy	Netherlands	Spain	Kingdom
Medical Resource	(n = 140)	(n = 299)	(n = 204)	(n = 155)	(n = 187)	(n = 183)	(n = 125)
Episodes with out-of-pocket payment for prescription drugs, %	NA	17.7	9.3	70.3	NA	82.5	0.8
Over-the-counter drugs							
Bought for this episode, %	60.7	20.4	32.4	75.5	61.5	63.9	60.0
Already in house, %	24.3	61.9	44.6	18.7	16.0	29.0	30.4

NA = not available; SD = standard deviation.

**Table 3. Productivity Loss and Travel-Related Costs for Episodes With Physician-Confirmed Acute Otitis Media**

	<b>Belgium</b>				<b>The</b>		<b>United</b>
<b>Productivity Loss and Travel-Related Cost</b>	<b>(Flanders)</b>	<b>France</b>	<b>Germany</b>	<b>Italy</b>	<b>Netherlands</b>	<b>Spain</b>	<b>Kingdom</b>
	<b>(n = 140)</b>	<b>(n = 299)</b>	<b>(n = 204)</b>	<b>(n = 155)</b>	<b>(n = 187)</b>	<b>(n = 183)</b>	<b>(n = 125)</b>
Caregiver stayed at home from a paid job, %	20.0	23.1	20.1	23.9	11.8	26.2	18.4
Hours <sup>a</sup>							
Mean (SD)	35.1 (98.3)	21.0 (20.9)	26.1 (47.8)	22.5 (17.1)	28.9 (37.4)	22.5 (30.1)	17.3 (10.4)
Median	13.0	16.0	10.0	16.0	16.0	12.0	16.0
Caregiver stayed at home from an unpaid job, %	7.1	10.0	26.5	23.2	5.9	18.6	16.8
Hours <sup>a</sup>							
Mean (SD)	30.8 (25.5)	14.6 (15.9)	39.2 (70.6)	26.0 (24.3)	59.7 (96.5)	21.4 (23.7)	26.8 (29.9)
Median	23.0	8.0	18.0.0	20.0	30.0	12.0	15.0
Parent-reported productivity loss at work, %	40.7	46.5	40.7	43.9	23.0	47.0	62.4
Hours <sup>a</sup>							
Mean (SD)	6.9 (10.1)	6.7 (9.5)	19.2 (37.5)	14.8 (19.4)	14.9 (46.5)	22.7 (53.3)	13.7 (15.2)
Median	4.0	4.0	10.0	7.5	4.0	10.0	8.0

	<b>Belgium</b>				<b>The</b>		<b>United</b>
<b>Productivity Loss and Travel- Related Cost</b>	<b>(Flanders)</b>	<b>France</b>	<b>Germany</b>	<b>Italy</b>	<b>Netherlands</b>	<b>Spain</b>	<b>Kingdom</b>
	<b>(n = 140)</b>	<b>(n = 299)</b>	<b>(n = 204)</b>	<b>(n = 155)</b>	<b>(n = 187)</b>	<b>(n = 183)</b>	<b>(n = 125)</b>
Parent-reported leisure time loss, %	67.9	41.8	52.5	58.7	55.1	59.6	37.6
Hours <sup>a</sup>							
Mean (SD)	2.9 (3.9)	3.5 (5.5)	5.8 (10.5)	3.8 (4.3)	2.7 (5.6)	6.7 (16.9)	3.5 (7.4)
Median	2.0	2.0	2.5	2.5	1.3	2.5	2.0
Episodes requiring travel by car, %	81.4	67.6	77.0	80.6	76.6	58.5	64.0
Car kilometres							
Mean (SD)	11.5 (11.8)	13.9 (22.6)	24.2 (40.0)	16.4 (54.0)	11.4 (21.1)	22.3 (41.5)	14.4 (56.8)
Median	6.0	7.5	12.0	8.0	5.0	10.0	4.0

SD = standard deviation.

Percentage of episodes with physician-confirmed acute otitis media for which caregiver(s) stayed home from a paid job or parent(s)-reported productivity loss or leisure time loss; <sup>a</sup> Applies to the subgroup of episodes for which this type of productivity loss was reported.

**Table 4. Direct and Indirect Costs per Episode of Physician-Confirmed Otitis Media**

	<b>Belgium</b>						
	<b>(Flanders)</b>	<b>France</b>	<b>Germany</b>	<b>Italy</b>	<b>The Netherlands</b>	<b>Spain</b>	<b>United Kingdom</b>
<b>Costs</b>	<b>(n = 140)</b>	<b>(n = 299)</b>	<b>(n = 204)</b>	<b>(n = 155)</b>	<b>(n = 187)</b>	<b>(n = 183)</b>	<b>(n = 125)</b>
Direct medical, €	98.99 <sup>a</sup>	169.82	107.88	163.94	62.96 <sup>a</sup>	214.91	157.35
Direct nonmedical, €	2.41	6.17	8.76	10.87	1.99	4.68	10.82
Indirect, €	327.05	270.46	588.92	351.65	267.05	388.37	584.32
Total, €	428.45	440.45	705.56	526.46	332.00	607.96	752.49
Indirect/Total	76%	61%	83%	67%	80%	64%	78%

<sup>a</sup>Prescription drugs and frequency of physician visits are not included (frequency was set to 1 visit).

# **Appendix A: Summary Costing**

**Appendix Table 1a. Distribution of Survey and Reference Data by Region**

<b>Country</b>	<b>Region</b>	<b>Survey (%)</b>	<b>Reference Data (%)</b>
Belgium (Flemish provinces)	Antwerpen	29.2	27.7
	Limburg	12.8	13.9
	Oost Vlaanderen	22.2	22.9
	Vlaams Brabant	16.4	17.1
	West Vlaanderen	19.5	18.5
Germany (Nielsen regions) <sup>a</sup>	Hamburg, Bremen, Schleswig-Holstein, Niedersachsen	17.7	15.8
	Nordrhein-Westfalen	19.1	21.6
	Hessen, Rheinland-Pfalz, Saarland, Baden-Württemberg	24.3	26.4
	Bayern	15.0	15.0
	Berlin	4.9	4.4
	Brandenburg, Sachsen-Anhalt, Mecklenburg-Vorpommern	8.3	10.7
	Thüringen, Sachsen	10.8	6.1

Country	Region	Survey (%)	Reference Data (%)
Spain (Nielsen regions) <sup>a</sup>	Barcelona	14.3	11.9
	Centro	3.5	12.2
	Este	3.1	6.2
	Levante	7.0	15.6
	Madrid	17.5	13.4
	Nord-oeste	2.5	9.2
	Norte	2.7	7.7
	Sud	49.5	22.8
France (Nielsen regions) <sup>a</sup>	Parisienne: Ile de France	23.8	19.6
	Nord Est: Picardie, Haute Normandie, Nord Pas de Calais, Champagne Ardennes, Lorraine, Alsace	20.7	20.7
	Grand Ouest: Haute Normandie, Basse Normandie, Bretagne, Centre, Pays de Loire, Poitou	20.6	18.9
	Centre + Est: Centre, Bourgogne, Limousin, Auvergne, Franche Comté, Rhône Alpes	14.2	16.5

Country	Region	Survey (%)	Reference Data (%)
	Sud Ouest + Sud Est: Aquitaine, Midi Pyrenees, Rhône Alpes, Languedoc Roussillon, Provence Alpes Côte d'Azur/ Corse	20.6	24.3
Italy (ISTAT regions) <sup>b</sup>	Nord Occidentale	34.7	26.8
	Nord Orientale	18.5	18.6
	Centrale	23.2	19.3
	Meridionale	15.6	23.9
	Insulare	8.1	11.4
The Netherlands (Nielsen regions) <sup>a</sup>	Amsterdam, Den Haag, Rotterdam	10.1	15.2
	Noord-Holland, Zuid-Holland, Utrecht	32.5	29.1
	Friesland, Groningen, Drenthe	12.5	10.5
	Overijssel, Gelderland, Flevoland	22.3	20.9
	Zeeland, Brabant, Limburg	22.7	24.3
UK (Combination of Nielsen regions) <sup>c</sup>	South England	14.2	13.3
	London	18.1	20.4
	Central England	23.6	22.4
	Yorkshire	11.2	10.2

Country	Region	Survey (%)	Reference Data (%)
	North England	16.0	16.3
	Scotland	8.1	9.2
	Wales	9.0	8.2

ISTAT = Italian National Statistics Institute; UK = United Kingdom.

<sup>a</sup> Nielsen regions: regions as defined by AC Nielsen, a marketing intelligence service. Reference data for the regions were provided by Survey Sampling International.

<sup>b</sup> ISTAT regions: regions as defined by the Italian National Statistics.

<sup>c</sup> For the UK, 13 Nielsen regions were combined into 7 regions.

**Appendix Table 1b. Comparison of Educational Level Between Survey and Reference Data**

Country	Survey (%)			Reference Data <sup>a</sup> (%)		
	Low	Medium	High	Low	Medium	High
Belgium	6	88	6	31	36	33
Germany	51	35	14	16	62	22
Spain	20	37	43	48	21	31
France	2	44	54	28	43	29
Italy	9	87	4	46	42	11
The Netherlands	22	48	31	29	46	24
UK	7	29	64	37	35	28

UK = United Kingdom.

<sup>a</sup> Data for the age group 25 to 44 years of age.

Sources: Belgium: Levensstandaard—Inkomsten en Bezoldigingen, 2009[1]; Oostenbrink et al., 2004[2]; Germany: Statistisches Bundesamt Deutschland, 2003[3]; Spain: Instituto Nacional de Estadística, 2001[4]; France: National Institute of Statistics and Economic Studies, 2003[5]; Italy: ISTAT demographic analysis, 2000[6]; The Netherlands: Het Centraal Bureau voor de Statistiek, 2004[7]; UK: Office of National Statistics, 2001[8].

**Appendix Table 1c. Comparison of Gross Yearly Household Income Between Survey and Reference Data**

<b>Country</b>	<b>Survey (Median €)</b>	<b>Reference Data<sup>a</sup> (Median €)</b>
Belgium	NA	
Germany	23,969	37,178
Spain	28,586	18,000
France	31,734	24,065
Italy	28,611	28,783
The Netherlands	NA	
UK	35,500	30,434

NA = not available, because data on household income were not asked for in the pilot survey in Belgium and The Netherlands; UK = United Kingdom.

<sup>a</sup> Data for the age group 25 to 44 years of age.

Sources: Belgium: Levensstandaard—Inkomsten en Bezoldigingen, 2009[1]; Oostenbrink et al., 2004[2]; Germany: Statistisches Bundesamt Deutschland, 2003[3]; Spain: Instituto Nacional de Estadística, 2001[4]; France: National Institute of Statistics and Economic Studies, 2003[5]; Italy: ISTAT demographic analysis, 2000[6]; The Netherlands: Het Centraal Bureau voor de Statistiek, 2004[7]; UK: Office of National Statistics, 2001[8]9.

**Appendix Table 2. Belgium**

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	31.80	26.0	1.00	8.40
GP visit weekday	20.79	55.0	1.00	11.43
GP visit night	50.57	1.0	1.00	0.36
GP visit weekend	31.18	7.0	1.00	2.23
Home visit	28.00	17.0	1.00	4.80
Telephone consult	10.40	2.0	1.00	0.22
Emergency visit	36.38	2.0	1.00	0.78
Specialist (ENT)/ other visit	31.80	2.0	1.00	0.68
Hospitalisation/LOS	468.00	4.0	3.60	60.17
OTC medicines	16.32	61.0		9.91
<b>Total medical</b>				<b>98.99</b>

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Nonmedical</b>				
Travel	2.96	81.0		2.41
<b>Total direct cost</b>				<b>101.40</b>
<b>Indirect cost</b>				
Absence from paid work (hours)	30.55	20.0	35.09	214.38
Absence from unpaid work (hours)	6.37	7.0	30.75	13.99
Productivity time lost at work (hours)	30.55	41.0	6.91	86.01
Leisure time lost (hours)	6.37	68.0	2.93	12.67
<b>Total Indirect</b>				<b>327.05</b>
<b>TOTAL COSTS</b>				<b>428.45</b>
<b>% of costs indirect costs</b>				<b>76.0</b>

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter.

Sources for unit costs: Institut National d'Assurance Maladie-Invalidité, 2007 tariff[9]; Financiële Feedback per Pathologie, 2003 tariff inflated for 2006[10];

Levensstandaard—Inkomsten en Bezoldigingen, 2009[1]; Oostenbrink et al., 2004[2]; Nationale Bank van België, 2009[11]; Jaarlijkse Inflatie, 1991-2008[12].

**Appendix Table 3. France**

<b>Resource</b>	<b>Cost per Unit (Euros)</b>	<b>% Users</b>	<b>Mean Units/User</b>	<b>Cost Per Episode (Euros)</b>
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	23.00	25.0	1.64	9.43
GP visit	22.00	72.0	1.63	25.82
Home visit	31.00	5.0	1.33	2.07
Telephone consult	0.00	2.0	1.40	0.00
Emergency visit	28.00	4.0	1.31	1.47
Specialist (ENT) visit	23.00	11.0	1.81	4.58
Other doctor visit	23.00	7.0	1.36	2.19
Hospitalisation/LOS	1,080	7.0	1.58	119.45
Out-of-pocket for prescription	12.67	17.0		2.20
OTC medicines	12.85	20.0		2.62
<b>Total medical</b>				<b>169.82</b>

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Nonmedical</b>				
Travel	9.00	69.0		6.17
<b>Total direct cost</b>				<b>175.99</b>
<b>Indirect cost</b>				
Absence from paid work (hours)	30.30	23.0	21.04	147.09
Absence from unpaid work (hours)	10.00	10.0	14.63	14.68
Productivity time lost at work (hours)	30.30	46.0	6.69	94.24
Leisure time lost (hours)	10.00	42.0	3.45	14.44
<b>Total Indirect</b>				<b>270.46</b>
<b>TOTAL COSTS</b>				<b>440.45</b>
<b>% of costs indirect costs</b>				<b>60.58%</b>

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter.

Source for unit costs: Sécurité Sociale L'Assurance Maladie, 2009[13].

**Appendix Table 4. Germany**

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	19.40	80.0	1.89	29.28
GP visit	19.40	17.0	2.20	7.32
Home visit	35.40	2.0	1.00	0.69
Telephone consult	1.40	0.0	2.00	0.01
Emergency visit	20.00	16.0	1.09	3.49
Specialist (ENT) visit	20.40	29.0	2.10	12.40
Other doctor visit	13.04	0.0	12.00	0.77
Hospitalisation/LOS	1,205.98	4.0	1.00	48.24
Out-of-pocket for prescription	28.54	9.0		2.66
OTC medicines	10.11	30.0		3.02
<b>Total medical</b>				<b>107.88</b>

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Nonmedical</b>				
Travel	10.64	82.0		8.76
<b>Total direct cost</b>				<b>116.64</b>
<b>Indirect cost</b>				
Absence from paid work (hours)	29.05	20.0	26.12	152.51
Absence from unpaid work (hours)	15.60	26.0	39.20	161.89
Productivity time lost at work (hours)	29.05	41.0	19.22	227.13
Leisure time lost (hours)	15.60	52.0	5.79	47.39
<b>Total Indirect</b>				<b>588.92</b>
<b>TOTAL COSTS</b>				<b>705.56</b>
<b>% of costs indirect costs</b>				<b>83.47</b>

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter.

Sources for unit costs: Einheitlicher Bewertungsmaßstab für ärztliche Leistungen, 2009[14]; G-DRG browser version, 2007[15]; German statistical office, 2001 and 2007[16].

**Appendix Table 5. Italy**

<b>Resource</b>	<b>Cost per Unit (Euros)</b>	<b>% Users</b>	<b>Mean Units/User</b>	<b>Cost Per Episode (Euros)</b>
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	20.90	88.0	1.58	28.99
GP visit	15.24	3.0	1.00	0.49
Home visit	25.82	9.0	1.57	3.66
Telephone consult	15.24	12.0	1.47	2.75
Emergency visit	141.00	15.0	1.29	27.28
Specialist (ENT) visit	20.66	19.0	1.30	5.20
Other doctor visit	20.66	2.0	2.00	0.80
Hospitalisation/LOS	263.91	4.0	6.83	69.81
Out-of-pocket for prescription	14.08	68.0		9.63
OTC medicines	20.44	75.0		15.33
<b>Total medical</b>				<b>163.94</b>

Resource	Cost per Unit (Euros)	% Users	Mean Units/User	Cost Per Episode (Euros)
<b>Nonmedical</b>				
Travel	13.59	80.0		10.87
<b>Total direct cost</b>				<b>174.81</b>
<b>Indirect cost</b>				
Absence from paid work (hours)	22.70	24.0	22.49	121.85
Absence from unpaid work (hours)	10.00	23.0	26.00	60.39
Productivity time lost at work (hours)	22.70	44.0	14.79	147.33
Leisure time lost (hours)	10.00	59.0	3.76	22.08
<b>Total Indirect</b>				<b>351.65</b>
<b>TOTAL COSTS</b>				<b>526.46</b>
<b>% of costs indirect costs</b>				<b>66.80</b>

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter.

Sources for unit costs: Approvazione Della Tariffa Minima Nazionale Degli Onorari Per Le Prestazioni Medico-Chirurgiche Ed Odontoiatriche, 1992[17]; Thiry et al., 2004[18]; Panatto et al., 2009[19]; DRG national tariffs[20]; ISTAT demographic analysis, 2002[21].

**Appendix Table 6. The Netherlands**

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	81.16	4.0	1.00	3.04
GP visit weekday	21.02	78.0	1.00	16.30
GP visit night	21.02	1.0	1.00	0.22
GP visit weekend	21.02	13.0	1.00	2.70
Home visit	42.04	1.0	1.00	0.45
Telephone consult	10.51	7.0	1.00	0.73
Emergency visit	144.63	2.0	1.00	3.09
Specialist (ENT)/other visit	81.16	9.0	1.00	6.94
Hospitalisation/LOS	422.97	4.0	1.38	24.88
OTC medicines	7.48	61.0		4.60
<b>Total medical</b>				<b>62.96</b>

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Nonmedical</b>				
Travel	2.55	78.0		1.99
<b>Total direct cost</b>				<b>63.95</b>
<b>Indirect cost</b>				
Absence from paid work (hours)	32.21	16.0	21.58	108.03
Absence from unpaid work (hours)	8.64	6.0	72.62	34.34
Productivity time lost at work (hours)	32.58	23.0	14.93	111.85
Leisure time lost (hours)	8.64	55.0	2.70	12.84
<b>Total Indirect</b>				<b>267.05</b>
<b>TOTAL COSTS</b>				<b>332.00</b>
<b>% of costs indirect costs</b>				<b>80.0</b>

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter.

Sources for unit costs: Oostenbrink et al., 2004[2].

**Appendix Table 7. Spain**

<b>Resource</b>	<b>Cost per Unit (Euros)</b>	<b>% Users</b>	<b>Mean Units/User</b>	<b>Cost Per Episode (Euros)</b>
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	33.40	90.16	1.71	51.36
GP visit	33.40	8.74	2.13	6.21
Home visit	81.50	1.64	1.00	1.34
Telephone consult	33.40	1.09	1.00	0.37
Emergency visit	135.75	27.87	1.20	45.25
Specialist (ENT) visit	58.54	12.02	1.50	10.56
Other doctor visit	33.40	4.37	2.14	3.13
Hospitalisation/LOS	315.53	7.65	2.93	70.69
Out-of-pocket for prescription	19.68	80.87		15.92
OTC medicines	15.79	63.93		10.10
<b>Total medical</b>				214.92

Resource	Cost per Unit (Euros)	% Users	Mean Units/User	Cost Per Episode (Euros)
<b>Nonmedical</b>				
Travel	7.58	61.75		4.68
<b>Total direct cost</b>				
<b>Indirect cost</b>				
Absence from paid work (hours)	18.60	26.23	22.54	109.97
Absence from unpaid work (hours)	10.00	18.58	21.35	39.67
Productivity time lost at work (hours)	18.60	46.99	22.72	198.60
Leisure time lost (hours)	10.00	59.56	6.74	40.12
<b>Total indirect</b>				388.37
<b>TOTAL COSTS</b>				607.96
<b>% of costs indirect costs</b>				63.88

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter.

Sources for unit costs: Asensi et al., 2004[22]; Navas et al., 2005[23]; Diari Oficial de la Generalitat de Catalunya, 2007[24]; Indicador laboral de comunidades autonomas IESE-ADECCO (ILCA), 2006[26]; Oblikue Database (eSalud)[26] (costs adjusted to 2007).

**Appendix Table 8. UK**

<b>Resource</b>	<b>Cost per Unit (Euros)</b>	<b>% Users</b>	<b>Mean Units/User</b>	<b>Cost Per Episode (Euros)</b>
<b>Direct cost</b>				
<b>Medical</b>				
Pediatrician visit	123.40	19.0	1.50	35.17
GP visit	41.91	82.0	1.44	49.49
Home visit	67.52	2.0	1.00	1.35
Telephone consult	25.61	9.0	1.45	3.34
Emergency visit	67.52	10.0	1.15	7.76
Specialist (ENT) visit	123.40	5.0	2.17	13.39
Other doctor visit	123.40	8.0	1.40	13.82
Hospitalisation (for total stay)	715.92	4.0	1	28.64
Out-of-pocket for prescription	23.68	1.0		0.19
OTC medicines	7.00	60.0		4.20
<b>Total medical</b>				<b>157.35</b>

Resource	Cost per Unit			Cost Per Episode (Euros)
	(Euros)	% Users	Mean Units/User	
<b>Nonmedical</b>				
Travel	15.36	70.0		10.82
<b>Total direct cost</b>				<b>168.17</b>
<b>Indirect cost</b>				
Absence from paid work (hours)	46.03	18.0	17.26	146.19
Absence from unpaid work (hours)	7.92	17.0	26.76	35.61
Productivity time lost at work (hours)	46.03	62.0	13.65	392.18
Leisure time lost (hours)	7.92	38.0	3.47	10.34
<b>Total indirect</b>				<b>584.32</b>
<b>TOTAL COSTS</b>				<b>752.49</b>
<b>% of costs indirect costs</b>				<b>77.65</b>

ENT = ear, nose, and throat; GP = general practitioner; LOS = length of stay; OTC = over-the-counter; UK = United Kingdom.

Sources for unit costs: Personal Social Services Research Unit, 2008[27]; National Schedule of Reference Costs, 2005-2006[28]; Office of National Statistics, 2006[29]; Department for Business, Enterprise and Regulatory Reform, 2007[30]. Exchange rate, July 18, 2009: £1 = €1.16410.

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