

# Epidemiology and Economic Burden of Conjunctivitis: A Managed Care Perspective

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## Summary

Conjunctivitis is a common condition of the eye that occurs worldwide and affects all ages and social strata, affecting more than 2 percent of the population. It is caused by a variety of bacterial or viral pathogens but may also be caused by allergies, irritants or medications. Most types are self-limiting, but some may progress and cause serious complications. Health care providers have low clinical accuracy at differentiating the various etiologies of acute conjunctivitis. In this paper we review the epidemiology and economic burden of conjunctivitis. The main methods are a comprehensive review of the literature supplemented by analysis of medical claims data.

A health plan with one million covered lives will see approximately 22,000 cases of conjunctivitis each year. At an average cost of \$218 per case, the same plan will spend close to \$5 million to treat those cases. Extrapolated to the national population of the commercially insured, these costs sum to nearly \$800 million per year in the U.S. This is an underestimate of the total societal costs, which include the indirect costs associated with work loss days, school loss days, the costs of disease spread associated with inaccurate diagnosis, and the costs of antibiotic resistance. Improvements in the accuracy and timeliness of the diagnosis may improve the management and treatment of acute conjunctivitis and result in an overall reduction in prescription drug costs, the number of follow-up visits, and the spread of disease.

## Introduction

CONJUNCTIVITIS IS A COMMON CONDITION of the eye that occurs worldwide and affects all ages and social strata.<sup>1,2</sup> Conjunctivitis can be caused by a number of different bacterial or viral pathogens but may also be caused by allergies, irritants or medications. Most types of conjunctivitis are self-limiting, but some may progress and cause serious ocular and extra-ocular complications.<sup>1</sup> Health care providers have a low clinical accuracy at differentiating the various etiologies of acute conjunctivitis.<sup>2-7</sup>

The costs of conjunctivitis are substantial. Bacterial conjunctivitis, which comprises about 50 percent of all cases of conjunctivitis, costs an estimated \$377 million to \$857 million annually in the U.S.<sup>8</sup> From a payer perspective, diagnostic uncertainty results in unnecessary antibiotic costs. Poor diag-

nostic accuracy can lead to further spread of disease, which can in turn lead to additional medical costs.

The main objective of this paper is to describe the epidemiology and economic burden of conjunctivitis, focusing on the subset of the population with private commercial health insurance. The main sources of data are a comprehensive review of the literature and descriptive analyses of a large database of U.S. commercial health insurance medical care claims.

## Methods

The literature review was conducted using PubMed, restricted to works published from January 1975 through November 2013. However, given how the body of knowledge on conjunctivitis has evolved, and the existence of several comprehensive literature

reviews published in the 1990s, the emphasis of this review is from January 2000 to November 2013.

Keywords used included the disease and condition terms “conjunctivitis” or “pink eye” combined with content terms “epidemiology,” “prevalence,” “incidence,” “cost#,” “economic#,” “burden.” After conducting preliminary searches and data analysis, the content terms “diagnosis” and “misdiagnosis” were added to account for the relationship between diagnostic uncertainty and epidemiologic research.

Articles were retained based on the following inclusion criteria: (1) published in English; (2) abstract included; (3) human study population; and (4) original research. The “original research” requirement was defined by reviewers as any published paper excluding letters, commentaries and case studies. For the purposes of this research, literature reviews were considered original research if the authors conducted calculations (e.g., meta-analyses or population cost estimates) based on the information gathered in the review.

The MarketScan Commercial Claims and Encounters Database (from Truven Analytics) was used to supplement the findings from the literature review. MarketScan data included the enrollment, claims (paid and adjudicated), and encounter records for employees and dependents who received coverage from primarily large self-insured employers. Patients are selected for this study if they had any claims with a conjunctivitis diagnosis in the 2005 calendar year. A more detailed description of the data and data analysis is provided in Appendix A.

## Epidemiology

A previous survey reported that conjunctivitis in the U.S. occurs annually in 13 of every 1,000 people between the ages of one and 74, an overall prevalence of 0.13 percent.<sup>9</sup> The prevalence in the commercially insured population, based on the MarketScan claims analysis, was 2.2 percent. Thus, for a health insurer with one million covered lives, the expected number of conjunctivitis cases per year would be approximately 22,000. Extrapolated to the whole population of the commercially insured in the U.S. (approximately 165 million in 2011),<sup>10</sup> we would expect approximately 3,630,000 cases of conjunctivitis cases per year in the commercially insured population.

Approximately 3 percent of all emergency department visits are ocular related, and of these, conjunctivitis is indicated in 30 percent of cases.<sup>11</sup> Among patients visiting primary care physicians, 2 percent of all visits are for eye complaints with 54 percent of these cases being diagnosed as conjunctivitis or corneal abrasion.<sup>12</sup> Several studies have reported that

the majority of these cases-- as much as 2 percent of all general practice consultations-- are cases of acute infective conjunctivitis.<sup>13-18</sup> An analysis of several clinical studies suggests that the U.S. prevalence of adenoviral conjunctivitis ranges from 20 to 62 percent of all cases of acute conjunctivitis and adenovirus is thought to represent 80 to 90 percent of all viral conjunctivitis.<sup>19-24</sup>

Variation in how patients experience and tolerate the symptoms of conjunctivitis is likely the main contributor to the wide variation in prevalence estimates. However, another important factor is clinical uncertainty in differentiating the various etiologies of acute conjunctivitis. Studies have found that health care providers have a clinical accuracy of only 40 to 72 percent in differentiating acute conjunctivitis.<sup>2-7,25,26</sup> Data from a questionnaire administered to British general practitioners, for example, reveal that only a third of physicians are confident in differentiating viral from bacterial conjunctivitis.<sup>27</sup>

These findings may be reflected in the claims analysis-- the vast majority of cases (90%) are recorded as one of the four categories of “unspecified” (see Appendix B). According to the claims analysis, this diagnosis pattern holds for patients over age 65 as well. The literature suggests that adenoviral conjunctivitis represents 40 to 50 percent of all cases of conjunctivitis but was only found to represent 0.37 percent of coded cases in the claims analysis. While the clinical diagnosis remains uncertain, most clinicians empirically treat patients with acute conjunctivitis despite the availability of a rapid immunoassay<sup>4,28</sup> and rarely perform conjunctival cultures.<sup>5</sup> The claims analysis shows that less than 1 percent of conjunctivitis patients received a bacterial or virus culture.

## Economic Burden

Due to its common occurrence, contagiousness, and potentially debilitating morbidities, conjunctivitis is a global economic burden.<sup>2</sup> The bulk of conjunctivitis-related costs include physician consults, supportive care, prescription drugs, diagnostic tests, and productivity losses associated with time away from work or school.<sup>29</sup> Misdiagnosed cases (which constitute approximately 50% of all cases<sup>24,30</sup>) typically have substantially higher costs, including repeat physician visits, additional diagnostic testing, referrals to specialists, and other medical costs associated with inappropriate treatment.<sup>31,32</sup> Misdiagnosis may also imply that precautions were not taken to prevent the spread of infection (especially in the case of viral conjunctivitis), thereby adding additional cases and costs. Moreover, misdiagnosis of the causative agent of conjunctivitis may lead to

misdiagnoses of associated morbidities or underlying systemic diseases.

Misdiagnosis is also likely to result in the prescribing of antibiotics, a substantial proportion of which are likely unnecessary. Studies have shown that as many as 95 to 99 percent of physicians prescribe antibiotics empirically for all cases of acute conjunctivitis.<sup>27,33</sup> Prescription antibiotic utilization constitutes a large proportion of conjunctivitis costs. Unnecessary or inappropriate antibiotic prescribing is in part attributable to clinical challenges in the differential diagnosis of viral and bacterial conjunctivitis.<sup>4,34</sup> Consequently, the standard of care for conjunctivitis, regardless of causative agent, continues to be antibiotics prescribed empirically.<sup>35,36</sup> However, routine use of antibiotics in bacterial conjunctivitis is often unnecessary as bacterial infections are self-limiting and complications are rare.<sup>37,38</sup> Overutilization of antibiotics is likely to result in substantial unnecessary costs, contribute to antibiotic resistance, and expose patients to drug-related topical allergies and toxicity.

Antibiotic resistance is a growing problem.<sup>34</sup> Several studies have shown high rates of broad antibiotic resistance among ocular pathogens,<sup>39-41</sup> and one study suggests that topical treatment for conjunctivitis may lead to systemic antibiotic resistance.<sup>42</sup> A recent study out of Japan demonstrates antibiotic resistance occurring in the newest generation of antibiotics.<sup>43</sup> Older topical antibiotics, though less expensive, have more resistance associated with them,<sup>39-41</sup> increased risk of toxicities, and higher rates for allergic reactions that may lead to confounding clinical pictures.

Based on our analysis of claims, average net payments for 60-day episodes of conjunctivitis were \$612. Excluding inpatient visits, which are likely to be the result of comorbid conditions, average net payments for 60-day episodes of conjunctivitis were \$218 per episode. Based on the previously calculated conjunctivitis prevalence for a health plan with one million covered lives ( $n = 22,000$ ), the average annual expected costs of conjunctivitis would be \$4,796,000.

Extrapolated to the whole population of the U.S. commercially insured, annual costs sum to nearly \$800 million. This amount is consistent with the findings of Smith and Waycaster (2009), though their analysis focused only on bacterial conjunctivitis and included all ages.<sup>44</sup> Were their analysis to have included viral conjunctivitis, their estimates would have been substantially higher given that at least 50 percent of all infective cases are viral. Moreover, given that patterns of misdiagnosis extend to patients over age 65, extrapolated to the whole popu-

lation these costs would be substantially higher.

The bulk of outpatient episode costs (81%) consisted of physician office visits. The mean number of physician office visits per episode was 2.4 per year. Typically, a properly diagnosed and managed case of infectious conjunctivitis does not require a follow-up clinic visit.<sup>3,45-47</sup> Thus, these findings suggest that for many cases the initial treatment to some extent failed, thereby warranting at least one additional outpatient visit. Given the relatively low costs of other outpatient services occurring during the episode (e.g., prescription drugs and lab tests), the additional visits to providers explain most of the \$218 per case. Although prescription drug costs were only \$11 per episode, 57 percent of episodes included at least one prescribed antibiotic.

Given the relatively high prevalence of conjunctivitis in the U.S., the number of lost days of school and work attributable to the disease has been a concern.<sup>3,7,8,25,48,49</sup> Unfortunately, formal analysis of work and school absenteeism represents a gap in the literature. A simple analysis using conjunctivitis incidence rates and U.S. Census population data demonstrates the extent of the burden of lost work and school days. If all patients were to follow recommended “stay home” days for adenoviral conjunctivitis,<sup>5</sup> the condition would cause approximately 8.5 million missed work days and 3.5 million missed school days in the U.S. annually. Based on prevailing average hourly wages in the U.S., estimated lost wages associated with missed work days is approximately \$1.9 billion.

## Conclusions

Consistent with the literature on difficulties in properly diagnosing conjunctivitis, we find that a surprisingly high 90 percent of the conjunctivitis cases in the MarketScan database were coded as “unspecified.” Challenges in differentiating viral and bacterial conjunctivitis have several important implications for managed care plans, including the overprescription of antibiotics, which adds to the direct costs of drugs, the indirect costs of misdiagnosis (such as repeat physician visits), and the indirect costs of increased antibiotic resistance. Moreover, much of the research on conjunctivitis has focused on bacterial rather than viral, in spite of the relatively high prevalence of viral cases.

A health plan with one million covered lives will see approximately 22,000 cases of conjunctivitis each year. At an average cost of \$218 per case, the same plan will spend close to \$5 million to treat those cases. Extrapolated to the national population of the commercially insured, these costs sum to nearly \$800 million per year in the U.S. This is

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#### **Funding/Acknowledgements**

This project was funded in part by an unrestricted grant from Rapid Pathogen Screening, Inc. The views expressed in the article are not necessarily those of the funding organizations or the institutional affiliations of the authors. We would like to thank Zack Mower, Megan Roy and Janet Benton for valuable research assistance.

#### **Appendix A**

This Appendix describes in greater detail the methods used to analyze the MarketScan<sup>®</sup> Commercial Claims and Encounters Database. In order to assess the extent to which misdiagnosis adds costs, we conducted a 60-day episode-of-care analysis. The episode-of-care approach captures repeat visits to care providers, lab tests, and prescription drug costs. It only looks at outpatient costs and excludes inpatient hospitalizations.

The MarketScan data included the enrollment, claims (paid and adjudicated), and encounter records for employees and dependents who received coverage from primarily large self-insured employers. Patients are selected for this study if they had any claims with a conjunctivitis diagnosis in 2005. Patients who had this diagnosis on a laboratory claim (CPT Procedure 80000-89999) and no other claims were not included, as these are likely to be rule-out diagnoses. In addition, patients were required to have been enrolled in the MarketScan database for the entire 2005 calendar year ( $n = 10.5$  million).

Patient counts were reported by ICD-9 diagnosis codes and by place of service (ER, urgent care, physician office, inpatient hospital), provider specialty, and receipt of culture (CPT procedure 87070 and 87252). For a patient to be counted, the medical claim must have included the appropriate procedure, specialty, or setting, plus the diagnosis code

of interest. Patients with more than one type of diagnosis will appear in multiple rows of the tables. These counts were weighted to reflect the national distribution of 165.1 million individuals with employer-sponsored health insurance, as captured by the most recent year of the Medical Expenditure Panel Survey (MEPS).<sup>\*</sup> The MarketScan commercial insurance weights were constructed using the Household Component of the MEPS. This survey, conducted by the Department of Health and Human Services' Agency for Healthcare Research and Quality (AHRQ), provided the national estimates of the number of people with employer-sponsored private health insurance (ESI). These estimates were used to weight individuals in MarketScan to reflect the national ESI distribution. Weighted counts and averages appear in most tables in brackets beneath the raw counts.

To construct national weights, MEPS respondents were stratified using combinations of demographic variables that account for substantial differences in utilization and expenditures. These variables were: region (north east, north central, south, west); age (three groups: 0-17, 18-44, 45-64); sex (male, female); Metropolitan Statistical Area (MSA) classification (urban, rural); and insurance policy holder status (policy holder, spouse / dependent). The weight was the ratio of MEPS-based national estimates in the different age/gender/region categories to the MarketScan number of persons in the same categories. (i.e., the numerator is the MEPS estimate of the size of the cell population and the denominator is the number of covered lives in the MarketScan data).

Sixty-day episodes were constructed for patients identified in the patient counts. Each episode began with a claim that had a diagnosis of interest and ended 60 days thereafter. Episodes were based on a 60-day episode as viral conjunctivitis may frequently lead to the development of corneal deposits, otherwise known as sub-epithelial infiltrates, chronic tearing, or the development of an acute dry eye state for approximately 30 days after the resolution of symptoms.<sup>50-58</sup> The majority of the corneal infiltrates resolve over six weeks.<sup>50-52,56-58</sup> While the patient count tables stratified patients by ICD-9 diagnosis code, the episode-of-care analysis reports on all conjunctivitis diagnoses as one group. Multiple diagnoses may occur within each episode. The analysis summarized each episode by number of visits/admissions, number of laboratory tests (CPT codes 87070 and 87252), number of prescription drugs and total costs. Utilization, laboratory tests, and costs were summarized only if a conjunctivitis diagnosis appeared on the claim. Costs were reported as net payments (i.e.,

## Appendix B:

National Estimates for Patients by Diagnosis, 2006 (1)			
ICD-9 Code	Description	Total Patients	Percent
077.3	Adenovirus	844	0.37%
077.8	Other virus	724	0.32%
077.98	Chlamydiae	61	0.03%
077.99	Other viral diseases of conjunctiva	5,220	2.29%
372.30	Unspecified or follicular conjunctivitis	114,905	50.44%
372.00	Acute conjunctivitis, unspecified	85,063	37.37%
372.01	Non-viral conjunctivitis, unspecified	5,050	2.22%
372.02	Acute follicular conjunctivitis (3)	4,751	2.09%
372.03	Mucopurulent	11,472	5.04%
372.04	Pseudomembranous	225	0.10%
372.10	Unspecified	3,098	1.36%
372.11	Simple	2,381	1.05%
372.12	Follicular	1,687	0.74%
372.39	Other conjunctivitis	2,954	1.30%
	Total	227,787	100.00%

Sources and Notes: (1) Based on continuously enrolled members with Rx benefit; MarketScan Commercial Claims and Encounters and Medicare COB and Supplemental Databases, 2006; (2) CPT 87070, 87252 with appropriate diagnosis; (3) excludes adenovirus, EKC, pharyngoconjunctival fever

amount the primary health plan/insurer paid to the provider, excluding patient out-of-pocket and co-ordination of benefits). Total costs were the sum of inpatient, outpatient and prescription drug costs and are reported as the overall total payments (regardless of diagnosis code).<sup>\*</sup> Episode-level data were summarized as mean per patient per episode. To avoid right and left censoring of episode length, only episodes that begin on or after March 1, 2005 or end before November 1, 2005 were reported.

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<sup>\*</sup>Prescription drug costs were counted only if the prescription corresponded to a drug that might conceivably be used to treat conjunctivitis. We identified 25 prescription drugs meeting those criteria: Amoxicillin; Augmentin; Azithromycin; Bacitracin-neomycin; Bleph10; Blephamide; Ciloxan; Erythromycin; Garamycin; Genoptic; Gentamycin; Keflex; Levaquin; Maxitrol; Ofloxacin; Polytrim; Quixin; Sulamyd; Sulfacetamide sodium; Tobradex; Tobramycin; Vigamox; Zylet; and Zymar.

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