

**ASTTitle: Seasonal Variations and Risk Factors of *Streptococcus Pyogenes* Infection — a
Multicenter Research Network study**

Authors: Matthew Kennis¹, Alex Tagawa², Vanessa M. Kung³, Gabrielle Montalbano¹, Isabella
Narvaez¹, Carlos Franco-Paredes⁴, Lilian Vargas Barahona³, Nancy Madinger³, Leland
Shapiro^{3,5}, Daniel B. Chastain⁶, Andrés F. Henao-Martínez³

¹School of Medicine, ³Division of Infectious Diseases, University of Colorado, Anschutz
Medical Campus, Aurora, CO, 80045, USA

²Center for Gait and Movement Analysis CGMA; Children's Hospital Colorado

⁴Hospital Infantil de México, Federico Gómez, México City, México

⁵Division of Infectious Diseases, Rocky Mountain Regional Veterans Affairs Medical Center,
Aurora, CO, USA

⁶Department of Clinical and Administrative Pharmacy, University of Georgia College of
Pharmacy, Albany, GA, 31701, USA

*Corresponding author: Andrés F. Henao-Martínez, MD, University of Colorado Anschutz
Medical Campus. 12700 E. 19th Avenue, Mail Stop B168. Aurora, CO 80045, USA; Email:
andres.henaomartinez@cuanschutz.edu. Tel.: +1 (720)-848-0820; fax: +1 (720)-848-0191.

ORCID number: 0000-0001-7363-8652

Abstract

Background: *Streptococcus pyogenes*, or Group A Streptococcus (GAS), causes acute pharyngitis and type II necrotizing fasciitis. Seasonal variations in GAS infections are not characterized in detail. We assessed seasonal variation and risk factors of GAS pharyngitis and ICD-10 diagnosed cases of necrotizing fasciitis.

Methods: From 2010 to 2019, we identified laboratory-confirmed cases of adult and pediatric GAS pharyngitis and cases of necrotizing fasciitis by ICD-10 codes using a federated research network. We extracted seasonal (quarterly) incidence rates. We used an autoregressive integrated moving average (ARIMA) model to assess seasonal variations. Demographic characteristics and 1-month outcomes were compared among adult patients with or without diagnosed GAS pharyngitis.

Results: We identified 224,471 adult cases of GAS pharyngitis (test-positive) and 546,142 adult cases without it (test-negative). GAS pharyngitis adults were younger (25.3 vs. 30.2 years old, $p<0.0001$), more likely to be Hispanics (10% vs. 8%, $p<0.0001$), and slightly more likely to be African American (14% vs. 13%, $p<0.0001$). Propensity score matching found adult test-positive cases of GAS pharyngitis had a significantly higher risk of rheumatic fever while having no significant differences in risk of ICU admission and mortality compared to test-negative cases. GAS pharyngitis weighted average incidence rates peaked in the winter while dipping in the summer (0.32 vs. 0.18 and 4.07 vs. 1.78 per 1,000 adult and pediatric patients, respectively). ICD code-based Necrotizing fasciitis diagnoses were highest during summer (0.032 per 1,000 adults). There was a significant ARIMA seasonal variation in the time series analysis for adult and pediatric GAS pharyngitis ($p<0.0001$ and $p=0.014$, respectively). However, necrotizing fasciitis diagnosis was not associated with seasonal variation ($p=0.861$).

Conclusions: Peaks in GAS pharyngitis occur in the winter months. ICD code-based necrotizing fasciitis did not show a quarterly seasonal variation. Younger age and African American or Hispanic origin increased the risk of GAS pharyngitis.

Keywords: *Streptococcus pyogenes*, Group A Streptococcus, Pharyngitis, Necrotizing fasciitis, seasonal variation