ORIGINAL ARTICLE

# Cardiovascular comorbidities of pediatric psoriasis among hospitalized children in the United States

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***Background:*** Psoriasis has been shown to be associated with cardiovascular disease in adults. Little is known about cardiovascular risk in pediatric psoriasis.

***Objective:*** To determine if there is an association between pediatric psoriasis and cardiovascular comorbidities.

***Methods:*** Data were analyzed from the 2002-2012 Nationwide Inpatient Sample, which included 4,884,448 hospitalized children aged 0-17 years. Bivariate and multivariate survey logistic regression models were created to calculate the odds of psoriasis on cardiovascular comorbidities.

***Results:*** In multivariate survey logistic regression models adjusting for age, sex, and race/ethnicity, pediatric psoriasis was significantly associated with 5 of 10 cardiovascular comorbidities (adjusted odds ratio [95% confidence interval]), including obesity (3.15 [2.46-4.05]), hypertension (2.63 [1.93-3.59]), diabetes (2.90 [1.90-4.42]), arrhythmia (1.39 [1.02-1.88]), and valvular heart disease (1.90 [1.07-3.37]). The highest odds of cardiovascular risk factors occurred in blacks and Hispanics and children ages 0-9 years, but there were no sex differences.

***Limitations:*** The study was limited to hospitalized children. We were unable to assess the impact of psoriasis treatment or family history on cardiovascular risk.

***Conclusion:*** Pediatric psoriasis is associated with higher odds of multiple cardiovascular comorbidities among hospitalized patients. Strategies for mitigating excess cardiovascular risk in pediatric psoriasis need to be determined. (J Am Acad Dermatol http://dx.doi.org/10.1016/j.jaad.2017.08.034.)

***Key words:*** arrhythmia; cardiovascular risk factors; comorbidities; diabetes; hyperlipidemia; hypertension; obesity; psoriasis; racial differences.

Psoriasis affects between 0%-2.15% of children in Europe and Asia.[1] Previous studies demonstrated a consistently increased risk for cardiovascular comorbidities among adults with psoriasis, including ischemic heart disease, peripheral vascular disease, atherosclerosis, diabetes, hypertension, dyslipidemia, obesity, and metabolic syndrome.[2] Less is known about cardiovascular risk factors and events in childhood psoriasis.

In a recent meta-analysis using 7 studies including 965 children, the metabolic and cardiovascular risks of children with psoriasis were assessed.[3] This study found significantly higher rates of metabolic syndrome in 3 studies (with only 60 children), lower high-density lipoprotein cholesterol levels in 6 of 7 studies, and higher fasting glucose levels in 4 studies (with only 40 children), but no significant differences in triglyceride levels,

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waist circumference, or blood pressure.[3] These studies were limited by insufficient power to detect metabolic and cardiovascular risk.

We hypothesized that children with psoriasis are at higher risk for cardiovascular risk factors and even cardiovascular disease. Demographic factors (eg, age, sex, and race/ethnicity) are associated with differential risk of both psoriasis and cardiovascular disease. We hypothesized that cardiovascular risk in childhood psoriasis is influenced by demographic factors. In this study, we examined the association between psoriasis and cardiovascular risk factors and disease in a nationwide cohort of hospitalized children.

**CAPSULE SUMMARY**

- Little is known about cardiovascular risk in pediatric psoriasis.
- This study of hospitalized patients found that pediatric psoriasis was associated with obesity, hypertension, diabetes, arrhythmia, and valvular heart disease.
- Children with psoriasis might benefit from increased surveillance and interventions aimed at reducing cardiovascular risk.

## METHODS

We analyzed data from the 2002-2012 Nationwide Inpatient Sample (NIS) provided by the Healthcare Cost and Utilization Project from the Agency for Healthcare Research and Quality. Each year of NIS data contains an approximately 20% stratified representative sample of all hospitalizations in the United States. Sample weights were created by NIS that factored the complex sampling design and were used to provide representative estimates of discharges across the United States. Data were deidentified and no attempts were made to identify individuals in the database. Patient consent was not obtained as the databases were received deidentified. All parties with access were compliant to Healthcare Cost and Utilization Project's formal data use agreement. The study was approved by the institutional review board at Northwestern University.

### Identification of psoriasis and comorbidities

Psoriasis and comorbidities were determined through the use of the International Classification of Disease Ninth Clinical Modification (ICD-9-CM) and Clinical Classification Software codes provided by the NIS for each patient discharged (Table I). A previous study validated the use of the discharge diagnosis code 696.1 in the inpatient setting for the study of psoriasis.[4,5] The control group included all pediatric patients without a diagnosis of psoriasis, yielding a representative cohort of hospitalized children in the United States. Newborn infants were excluded from the cohort.

### Statistics

All data analyses and statistical processes were performed using SURVEY procedures in SAS version 9.4 (SAS Institute Inc, Cary, NC). Analyses were limited to ages 0-17 years. Summary statistics were generated. Adjusted $P$ values are presented, with values $\leq .05$ considered significant.

Survey weighted binary logistic regression models with strata and cluster analysis were constructed to determine the association of psoriasis (independent variable) with various comorbidities (dependent variables). Crude odds ratios and 95% confidence intervals are presented. Multivariate logistic regression models included age (continuous); sex (male, female); and race/ethnicity (white, nonwhite) as covariates. Regression models were also stratified by race/ethnicity (white, black, Hispanic, multiracial/other); sex (male, female); and age (0-9 years, 10-17 years). In models stratified by race/ethnicity, covariates included age and sex. In models stratified by sex, covariates included age and race/ethnicity. In models stratified by age, covariates included sex and race/ethnicity. Multivariate regression models were also constructed that included age (continuous); sex (male, female); and race/ethnicity (white, nonwhite) as above, as well as obesity (yes, no); hypertension (yes, no); and diabetes (yes, no). Adjusted odds ratios and 95% confidence intervals are presented.

## RESULTS

Overall, there were 4,884,448 hospital discharges captured in the NIS data set between 2002 and 2012 for children (ages 0-17 years). There were 126 admissions with a primary and 1380 admissions with a secondary diagnosis of pediatric psoriasis, which was equivalent to a weighted prevalence of 25.8 and 287.4 admissions per 1 million persons, respectively. Pediatric inpatients with a diagnosis of psoriasis were 47.5% male, 64.9% white, 11.9% black, and 14.2% Hispanic.

### Cardiovascular comorbidities

In bivariate survey logistic regression models, 6 of 10 cardiovascular comorbidities analyzed were significantly associated with pediatric psoriasis (Table II). Obesity was the most common comorbidity in childhood psoriasis, occurring in 7.5%