

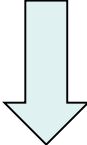
Prevalence of Paroxysmal Supraventricular Tachycardia (PSVT) in the United States in Patients Under 65 Years of Age

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Disclosures

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Paroxysmal Supraventricular Tachycardia (PSVT): Episodic, recurring medical condition

Indication	<p>Paroxysmal Supraventricular Tachycardia (PSVT)</p> <ul style="list-style-type: none"> Sporadic, sudden and recurring tachycardia due to altered electrical conductivity over the atrioventricular node of the heart 	
Diagnosis	<ul style="list-style-type: none"> Can only be diagnosed <u>during an acute episode</u> on a rhythm strip (e.g., ECG / Holter monitor) Due to transient and episodic nature, it is a difficult condition to diagnose Market dynamic - growth of wearable devices/monitors present an opportunity for easier diagnosis 	
Key symptoms <i>(during an acute event)</i>	<ul style="list-style-type: none"> Abnormally fast heart rate (often >200 bpm) Palpitations Dizziness / Syncope Anxiety 	
Therapeutic Approaches	<p>Acute Treatment <i>(treating an attack)</i></p> <p><u>At Home</u>: No Rx options, Vagal maneuver</p> <p><u>Emergency Room</u>: IV adenosine, Vagal maneuver</p>	<p>Chronic Management Strategies</p> <p>Surveillance / "Watchful waiting"</p> <p><u>Rx</u>: Beta blockers (primarily)</p> <p><u>Surgical</u>: Catheter ablation</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">  </div> <div> <p><i>Severity (in general)</i></p> <p>Mild</p> <p>Moderate</p> <p>Severe</p> </div> </div>

In the news....



McAvoy undergoes procedure for 'abnormal heart rhythm'

by NBC Sports Boston Staff | January 22, 2018 4:03 PM

BRIGHTON, Mass – As a workhorse 20-year-old hockey player, it wasn't much of a warning signal when Charlie McAvoy missed Monday's Bruins practice with what the team initially called "a doctor's appointment." But it turned out to be a fairly serious absence as the Bruins announced later in the afternoon that their prized rookie is going to miss roughly two weeks after undergoing a procedure at Mass General Hospital to address an abnormal heart rhythm.

According to the Bruins statement: "After the Nov. 26 game, Charlie told team physicians that he experienced heart palpitations during the game. Subsequently he underwent an evaluation, which diagnosed him with a supraventricular tachycardia (SVT). The type of SVT Charlie has is not considered to be dangerous to his health but can recur at any time and causes significant symptoms."

After consulting with a multitude of doctors, McAvoy and the Bruins opted for the procedure because of the high likelihood of the condition's recurrence. McAvoy will spend the night at Mass General, and is expected to return to the lineup in a couple of weeks.

PSVT: Prevalence Not Well Characterized in Literature

MESA Study¹

Orejarena et al., *J Am Coll Cardiol* 1998

STUDY & POPULATION

Prevalent PSVT cases n=31 from 600 patients' records as of July 1, 1991
Incident cases n=33 from 1,163 patients' records and ECGs July 1991 – June 1993
Marshfield, WI (55,000 residents)

RESULTS

Prevalence 2.25/1,000; projected to US population 570,000
Prevalence greater among females and age ≥ 65
Incidence 35/100,000 person years
PSVT documented at first symptomatic episode in 24% of incident cases

LIMITATIONS

1. Small size and racial homogeneity of study population
2. Patients may not be captured if episode deemed "not clinically significant"
3. Suspected, but not definitive, PSVT must be coded as Other Specified Cardiac Dysrhythmia
4. Estimates calculated relative to 1990 US census

¹Orejarena et al. Paroxysmal supraventricular tachycardia in the general population. *J Am Coll Cardiol*.1998;31:150-157.(MESA: Marshfield Epidemiologic Study Area)

PSVT Diagnosis: Challenges for Estimating Prevalence

Definitive diagnosis of PSVT on a rhythm strip (e.g., ECG, Holter monitor)

Prevalence estimates based on chart audits, including a single encounter, may underestimate prevalence, given the episodic nature of PSVT

Longitudinal data analyses may provide more accurate estimates of PSVT prevalence in the U.S.

Retrospective, Longitudinal Study of PSVT Prevalence Age < 65

Employer-Based Claims Data Analysis

Objective

Estimate PSVT prevalence among patients < age 65 in the U.S. using longitudinal data from a large employer-based claims data set

Aims

- Elucidate the prevalence of PSVT given the unpredictable onset and transient nature of episodes through a longitudinal analysis
- Better understand the patient characteristics of PSVT

Health insurance claims were used to estimate the prevalence of PSVT

Projection Methodology

Data Source

Truven Health MarketScan Commercial research database: demographic, enrollment, medical and prescription drug claims data for 89,800,000 nationally representative, commercially insured individuals over 4 years

Study Population

Patients < age 65 with a PSVT diagnosis (ICD-9: 427.0; ICD-10: I47.1) from October 2012 to September 2016

Study Years

October 2012 – September 2016

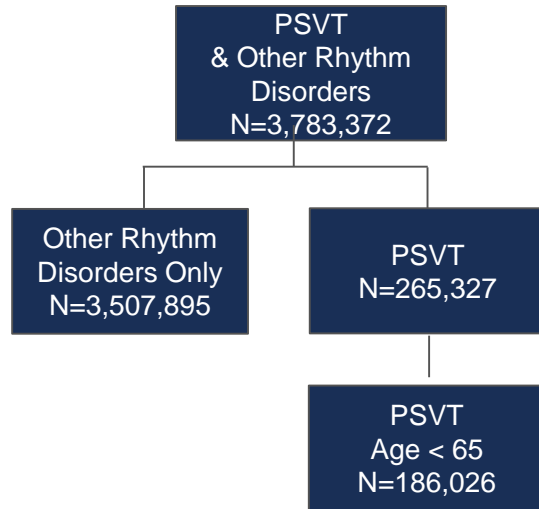
Prevalence Estimates

- Age- and sex-adjusted ratios of PSVT patients to total number of individuals with insurance coverage in each year were used to calculate prevalence in the U.S. population
- Patients with a PSVT diagnosis were counted in each year they were observable
- Estimates were projected to the U.S. population by age and gender using U.S. census data
- Additional calculations were done to estimate prevalence based on patients with one or more PSVT diagnosis in a given year

Estimated PSVT Prevalence Among Patients Age < 65 Using 4-year and Single Year Study Windows

Estimating prevalence

Identify Unique Patients from Longitudinal Data



Count unique patients with PSVT diagnosis code 427.0 or I47.1
(N=186,026)

1

Count unique patients with a PSVT diagnosis over the **4-year study period** in each year they were observable.

2

Count unique PSVT patients in **single study year** with a claim with a PSVT diagnosis.

Prevalence (%) in period 'X' =

$$\frac{\text{\# of PSVT patients during period 'X'}}{\text{Total \# of individuals in insurance data during period 'X'}}$$

Project to U.S. population taking into account age and gender distribution in longitudinal claims data

4 year study period:
Oct 2012 – Sept 2016

Results

Results: PSVT Prevalence Estimates for Age < 65 from Truven Claims Projected to US Population Using 4-year and Single Year Study Periods

4-year Observation Period

Unique patients with a PSVT diagnosis over the 4-year study period in each year they were observable.

Study Period	Unique Patients
2015-2016	1,242,666
2014-2015	1,396,182
2013-2014	1,200,969
2012-2013	1,107,101

A, B

Single Year Observation Period

Unique PSVT patients only in study year(s) with a claim with a PSVT diagnosis.

Study Period	Unique Patients
2015-2016	734,437
2014-2015	456,001
2013-2014	449,322
2012-2013	444,400

A, B

^A ICD-10 coding started Oct 2015; the data for this study year starts Oct 2015; the ICD-9 code is more specific for PSVT than the ICD-10 code

^B Truven sample lost a major plan as of January 2016

A total of 186,026 PSVT patients < age 65 were identified in the claims data. These results were projected to the U.S. population, taking into account age and gender distribution in Truven claims data. Annual prevalence estimates ranged from 1,107,101 to 1,396,182.

Using estimates from Medicare claims data for patients age 65 and older and Truven claims data for patients under age 65, projected prevalence for all ages ranged for 2.7 to 3.1 million using 4 year and 1 to 1.7 million using 1 year observation period

Projected PSVT Prevalence Estimates by Age and Sex from Truven Claims Data 2015-2016 (Age < 65)

	Female	Male	Total
Age < 18	37,959 (3%)	36,648 (3%)	74,606 (6%)
Age 18-40	271,015 (22%)	127,250 (10%)	398,265 (32%)
Age 41-64	443,825 (36%)	325,969 (26%)	769,794 (62%)
Total	751,489 (60%)	491,177 (40%)	1,242,666 (100%)

- **The majority of PSVT patients are female, and the largest proportion are older, age 41-64, in this study**
- **Orejarena et al. found similar trends but those findings are limited by small number of PSVT patients used for prevalence estimates (n=31)**

PREEMPT STUDY (Age 18 and older)

Population-Based Risk and Epidemiology of Paroxysmal Supraventricular Tachycardia

Adjudicated medical records, ECGs, other monitoring data to establish positive predictive values (PPVs) for single medical encounters of patients seen at Kaiser Permanente Northern California with a diagnosis of PSVT or another cardiac arrhythmia 2010-2015

PPV calculated to estimate probability of true symptomatic PSVT based on diagnosis (PSVT or other arrhythmia †), diagnosis position and setting (Outpatient/ED/Inpatient) combinations

Point estimate of PSVT prevalence in U.S., **adults ages ≥ 18** : 398,810

Point estimate of PSVT prevalence in U.S., **< age 65**: ~200,871

Go AS et al. Contemporary burden and correlates of symptomatic paroxysmal supraventricular tachycardia. *J Am Heart Assoc.* 2018;7:e008759

† ICD-9/ICD-10 Encounters Assessed for PPV

PSVT 427.0

SVT I47.1

Palpitations 785.1/R.002

Other cardiac dysrhythmias 427.2, 427.89, 427.9/I47.9, I49.8, I49.9

Tachycardia, unspecified 785.0/R00.0

SVT premature beats 427.61

Anomalous AV excitation 426.7

Pre-excitation syndrome I45.6

Atrial premature depolarization I49.1

Maximum PREEMPT PPV Weights Applied to Truven Data Set for Patient Encounters for PSVT and Other Cardiac Rhythm Disorders

- PREEMPT PPV weights were assigned to all patient encounters for PSVT and other cardiac rhythm disorders
- The encounter with the maximum weight was used to estimate prevalence
- Medical encounters were examined over a 1-year period and over the full study period

PREEMPT Kaiser Permanente NC (Age 18-65)	Applied PREEMPT PPV weight to Truven Unique Patients (Age <65)		
	One Year	4-Year	
200,871	2015-2016	463,215	986,504
	2014-2015	334,811	1,109,923
	2013-2014	325,274	943,891
	2012-2013	311,934	851,253
PREEMPT PSVT weight – single medical encounter	Maximum PREEMPT PSVT weight in study year only	Maximum PREEMPT PSVT weight in all years patient observable	

Projected prevalence estimates where the maximum PSVT weight over a one-year period generated results that were at least 1.5x greater than the single-episode based PREEMPT estimates. Estimating prevalence across multiple years generated estimates that were 4 to over 5 times higher.

*Using estimates from Medicare claims data for patients age 65 and older and Truven claims data for patients under age 65, projected prevalence for all ages ranged for 1.7 to 2.0 million using encounter with maximum PPV weight over 4 years and 582,000 to 894,000 using maximum PPV weight over 1 year

Summary of Findings

- Based on coded clinical diagnoses, PSVT affects 1.1 to 1.4 million individuals < age 65 in the U.S. annually
- Of these, 444,400 to 734,437 present with a PSVT diagnosis each year
- Estimates that rely on a single medical encounter may underestimate PSVT prevalence, including chart audits that use a single encounter to adjudicate PSVT, due episodic nature of disease
- Longitudinal analyses may be more appropriate, given the diagnosis journey and the clinical course of PSVT
- These analyses of longitudinal data suggest that, from a public and private payer perspective, PSVT diagnoses are prevalent in the US population

Appendix

Estimated PSVT prevalence in U.S. for all ages, based on encounter with maximum PREEMPT PPV weight over 4- and 1 year study windows

2015-2016

2014-2015

2013-2014

2012-2013

4 Study Years			Study Year only		
Age < 65 (from Truven)	Age 65+ (from LDS)	Total	Age < 65 (from Truven)	Age 65+ (from LDS)	Total
986,504	858,893	1,845,397	463,215	430,916	894,131
1,109,923	887,227	1,997,150	334,811	283,008	617,819
943,891	887,909	1,831,800	325,274	270,816	596,090
851,253	854,457	1,705,710	311,934	270,407	582,341

Estimated PSVT Prevalence in the U.S., based on presence of PSVT diagnosis in 4-year and single-year study windows

	4 Study Years			Study Year only		
	Age < 65 (from Truven)	Age 65+ (from LDS)	Total	Age < 65 (from Truven)	Age 65+ (from LDS)	Total
2015-2016	1,246,766	1,655,362	2,902,128	734,437	934,225	1,668,662
2014-2015	1,396,182	1,706,414	3,102,596	456,001	592,487	1,048,488
2013-2014	1,200,969	1,707,172	2,908,141	449,322	567,561	1,016,883
2012-2013	1,107,101	1,649,790	2,756,891	444,400	574,814	1,019,214

PREEMPT Study Results: PSVT Prevalence Estimates From Kaiser Permanente Northern California Projected To U.S. Population by Age Group

Age Group	Prevalence estimates per 100,000	2010 Census Data
18-24	23.2	30,767,034
25-44	59.1	82,201,016
45-64	177.5	81,776,168
65+	479.6	40,480,643

Age Group	Point Estimate
18-24	7,138
25-44	48,581
45-64	145,153
18-64	200,871
65+	194,145
Total	395,017