Committed to excellence in patient care, education, and research
Mission Statement

Our mission is to provide quality care for athletes with sports related concussion by utilizing an evidence-based medicine approach, conducting academic and clinical research, and educating athletes, parents, coaches, and healthcare providers on the recognition and management of sports-related concussion.

Highlights

Leadership........................................................................................................ page 3-5
Sports Concussion Presentations......................................pages 6– 10
Concussion in Sport Group 5..................................................page 11
VSCC in the Media.................................................................page 12
Return to Leaning Guide..........................................................page 13
V-SCoRe Team & Publications.........................................page 14-17
VSCC Team Members & Locations...............................page 18-23
Complex Sports Concussion Care Relationships.......page 24
Concussion Baseline Testing Program.........................page 24
Patient Volumes.................................................................page 25
Leadership

**Allen Sills, MD**

Founding Co-Director Emeritus, Vanderbilt Sports Concussion Center

Chief Medical Officer, National Football League

Professor of Neurological Surgery, Orthopedic Surgery & Rehabilitation

Member, Concussion in Sport Group 4 and 5

Consulting Neurosurgeon, Nashville Predators, Vanderbilt University, Belmont University, and Mississippi State University

Consulting Neurosurgeon, Federation Equestrian Internationale

Section Editor, Sports and Rehabilitation, *Neurosurgery*

Member, NFL International Sports Concussion Research Think Tank

Southeastern Conference (SEC) Representative to the Big 5 for Concussion

The Reporter, 2017

Vanderbilt’s Allen Sills, M.D., has been chosen by the National Football League (NFL) to be its chief medical officer, a newly created position. NFL Commissioner Roger Goodell announced his selection earlier this week.

“There is no higher priority for the NFL than player health and safety, and we continually seek to raise our standards and then surpass them,” Goodell said. “We sought a highly credentialed physician and leader with experience as a clinician researcher, and Dr. Sills’ extensive experience caring for athletes makes him the right choice for this important position.”

“Allen Sills is an exceptional leader who will bring the perspective of a practicing neurosurgeon to this important position,” said Reid Thompson, M.D., William F. Meacham Professor of Neurological Surgery and chair of the department.

“He is an avid athlete and gifted surgeon with a passion for the care of elite athletes. With a combination of energy, vision and absolute integrity, he is an inspired choice to become the first chief medical officer of the NFL.”

*We give a heartfelt thank you to our friend and co-founder, Dr. Sills, for his tireless work on behalf of the Vanderbilt Sports Concussion Center. It was his vision that made this clinic a reality.*
Leadership

**Gary Solomon, PhD**

Founding Co-Director, Vanderbilt Sports Concussion Center
Professor of Neurological Surgery, Orthopedic Surgery & Rehabilitation, and Psychiatry
Consulting Neuropsychologist, Tennessee Titans
Team Neuropsychologist, Nashville Predators
Consulting Neuropsychologist, Athletic Departments of Vanderbilt University, Belmont University, Tennessee Tech University, and University of Tennessee
Associate Section Editor, Sports and Rehabilitation, *Neurosurgery*
Editorial Board, *Archives of Clinical Neuropsychology*
*Editorial Board, Developmental Neuropsychology*
Editorial Board, *Concussion*
Editorial Reviewer: *Applied Neuropsychology: Child*
*International Journal of Sports Medicine*
*Journal of Clinical and Experimental Neuropsychology*
*The Physician and Sportsmedicine; British Journal of Sports Medicine*
*Neuropsychology: JAMAPediatrics*
*Neuroscience and Biobehavioral Reviews*
*Journal of Athletic Training*

**Andrew Gregory, MD**

Founding Co-Director, Vanderbilt Sports Concussion Center
Associate Professor of Pediatrics, Orthopedic Surgery and Rehabilitation, and Neurological Surgery
Team Physician, Vanderbilt University Athletics, Belmont University Athletics
Team Physician, Nashville Christian School
Team Physician, USA Volleyball National Teams
Leadership

Scott Zuckerman, MD, MPH

Scott L. Zuckerman completed his undergraduate education at Cornell University in 2008, graduating magna cum laude with a Bachelor of Science in Biology & Society. He graduated from Vanderbilt University School of Medicine in 2012. There, he served as class president for four years and was awarded the School of Medicine Award of Distinction. Scott holds a Masters in Public Health focusing on Epidemiology through the Harvard T.H. Chan School of Public Health. Dr. Zuckerman's research interests include complex spine and peripheral nerve surgery as well as sport-related concussion. He is a Co-Director of the Vanderbilt Sports Concussion Center and leads the efforts of the Vanderbilt Sports Concussion Center Research (V-SCoRE) group.

Dr. Zuckerman has served as an ad-hoc reviewer in the area of sport-related concussion for the following journals:

- New England Journal of Medicine
- Journal of American Medical Association: Pediatrics
- Brain Injury
- American Journal of Sports Medicine
- British Journal of Sports Medicine
- Journal of Neurotrauma
- The Physician and Sports Medicine
- Concussion

He has been awarded the 2016 ThinkFirst Injury Prevention Award and the 2015 Depuy Synthes Award for Brain and Craniofacial Injury. In 2016, he received a $5,000 grant from the Vanderbilt Institute for Clinical and Translational Research to study genetic predictors of sport-related concussion. Scott also serves on the Board of Advisors for MomsTeam, an organization that promotes youth sports safety.

Tim Lee, MHA, MS, ATC

Coordinator, Vanderbilt Sports Concussion Center

Tim oversees the day to day administrative duties of the VSCC while participating in clinical patient care and research.
Sports-Related Concussion Presentations by Gary Solomon, PhD

**Concussion Protocols in the NFL and NHL: Where We Were and Where We Are Now.**
Presented at the American Association for Pediatric Ophthalmology and Strabismus Conference Nashville, TN, April, 2017. (Invited)

**Chronic Traumatic Encephalopathy in Professional Football.**
Presented at the Frontotemporal Lobar Degeneration Association (FTLDA) Scientific Conference San Antonio, TX, March, 2017. (Invited)

**Chronic Traumatic Encephalopathy in Sports.**

**Early Years of Exposure to Football and Later Life Outcomes.**

**Chronic Traumatic Encephalopathy in Football.**
Presented at the Meeting of the Canadian Football League Medical Staffs Ottawa, Ontario, February, 2017. (Invited)

**Early Years of Exposure to Football and Later Life Outcomes.**


**Decisions Regarding Return to Play Following Repeat Injury.**
Presented at Pediatric Concussion Workshop, NINDS/NIDA/NCMRR/NICHD Bethesda, October, 2016. (Invited)
Concussion 101: The Value of Inkblots.
Presented at Neurosurgery Grand Rounds, Department of Neurological Surgery, VUMC
Nashville, TN, October, 2016.


Chronic Traumatic Encephalopathy in Football.
Presented at Sports Medicine Grand Rounds, Department of Orthopedic Surgery, VUMC

Sports Concussions.
Presented at the South Central Telehealth Forum
Nashville, TN, August, 2016. (Invited)

Age of First Exposure to Football and Later Life Effects in NFL Retirees.
Presented at the Annual Meeting of the Tennessee Neurosurgical Society
Sports-Related Concussion Presentations by Andrew Gregory, MD

Concussion in Youth Sports
Presented at Vanderbilt University Medical Center, Pediatric Resident Lecture Series.
Nashville, TN. July 2016

Concussion Testing and Return to Play Scientific Session
Presented at Pediatric Research in Sports Medicine (PRISM).
Dallas, TX. January 2017

Concussion in Youth Sports
Presented at Vanderbilt University Medical Center, Emergency Nurse Practitioner Program.
Nashville, TN. February 2017

Appropriate Age for Contact in Youth Sports
Presented at the American Academy of Sports Medicine Annual Meeting.
Denver, CO. June, 2017

Sports-Related Concussion Presentations by Ashley Karpinos, MD

Primary Care of the Athlete.
Presented at the VUMC Department of Internal Medicine and Public Health Grand Rounds
Nashville, TN, May 2017
Sports-Related Concussion Presentations by Scott Zuckerman, MD


Sports-Related Concussion Presentations by Tim Lee, ATC

**Return to Learn/Return to Play: Concussion Management Guide**
Presented at the Tennessee Coordinated School Health Institute Murfreesboro, TN, May 2017

**Sports-Related Concussion and Clinical Pathways of the VSCC**
Presented at Vanderbilt Children’s Hospital Pediatric Trauma PM&I Meeting Nashville, TN, February 2017
Sports-Related Concussion Presentations by Alex Diamond, DO

**Returning to Learn after Sports-Related Concussion.**
Tennessee School Speech Language Pathology Conference.
Nashville, TN, August 2, 2016

**Returning to School After Sports-Related Concussion.**
San Francisco, CA. October 22, 2016

**Return to School After Sports-Related Concussion.**
Philadelphia, PA. November 17, 2016

**Concussions in Youth Sports.**
MPCC Nursing Grand Rounds.
Nashville, TN. December 14, 2016

**Returning to Learn after Sports-Related Concussion.**
Southern Orthopedics Association at the Southeastern Conference: Sports Injury Update.
Nashville, TN. March 11, 2017

**Pediatric Injury Prevention and Sports Safety.**
Vanderbilt School of Medicine Interest Group Lecture Series.
Nashville, TN. May 16, 2017

**Concussion in Youth Athletes.**
VUMC Physical Medicine & Rehabilitation Lecture Series.
Nashville, TN. May 25, 2017
Concussion in Sport Group 5

The 5\textsuperscript{th} international conference on concussion in sport was held in Berlin, Germany in late October of 2016. This international meeting has been held every fourth year since 2000, and is designed to set the international guidelines and practice parameters for the evaluation and management of sport-related concussion. The Vanderbilt Sports Concussion Center was well represented.

VSCC Members of CISG5

Allen Sills, M.D.: Member of the Organizing Group, Executive Committee, and Scientific Group
Gary Solomon, Ph.D.: Member of the Observer Group and 2 Scientific Working Groups
Scott Zuckerman, M.D.: Presenter of 3 posters
**VSCC in the Media**

**NFL names Dr. Allen Sills first ever Chief Medical Officer.**
Reported in USA Today.
March 26, 2017

**Sports Concussion: The State of the Science. With Dr. Gary Solomon from Vanderbilt Seminar focuses on latest concussion research.**
Reported in: Sports Neuropsychology Society.
July 30, 2016

**Concussion Study using the HS-1000 Device.**
Reported by Channel 4 News, WSMV.com.
February 16, 2016

**Guidelines to Help Concussed Students Return to School.**
Reported by: VUMC, The Reporter.
October 13, 2016

**Concussion baseline testing now available for younger children.**
Reported by: VUMC, The Reporter.
March 16, 2017
Return to Learn/Return to Play: Concussion Management Guidelines
Tennessee Department of Health

The VSCC was instrumental in the implementation of formal return to learn guidelines recently adopted by the Tennessee Department of Health and the Tennessee Department of Education. The guidelines were created to assist the school systems with basic education on concussions, the creation of concussion management teams within the schools, and the integration of children who have suffered concussions back into the learning environment. The guide is housed in the Tennessee Department of Health at: [https://www.tn.gov/assets/entities/health/attachments/Return_to_Learn_Guidelines_-_final.pdf](https://www.tn.gov/assets/entities/health/attachments/Return_to_Learn_Guidelines_-_final.pdf)
The purpose of the Vanderbilt Sports Concussion Research (V-SCoRe) is to improve our knowledge in the area of sports-related concussion (SRC) and the outcome of these injuries in athletes. Goals also include identifying pre and post-concussion variables that influence recovery from a SRC and management approaches that can optimize an athlete’s return to the pre-injury level of function and performance. We hope to further expand our research efforts to the following areas that affect SRC outcomes:

Age
Gender
Return to play
Neurocognitive assessment
Number of prior concussions
Seizures
Anxiety/depression

Achieving these goals will be possible by:

Utilizing a prospective athlete registry of neurocognitive tests to identify factors associated with SRC outcomes. Obtaining long-term patient reported outcome measures to evaluate the longitudinal impact of SRC. Communicating directly with local coaches and school personnel to identify the important issues surrounding young athletes today.

V-SCoRe Research Team:

- Black = faculty
- Blue = resident
- Red = student

Gary Solomon   Allen Sills   Andrew Gregory
Tim Lee        Scott Zuckerman
Aaron Yengo-Kahn Andrew Kuhn   Brian Zalneraitus
Aaron Jeckell  Doug Totten    Micheal de Riesthal
Ryan Gardner   Alec Pawlukiewcz Benjamin Brett
Title: **Sport-related structural brain injury associated with arachnoid cysts: a systematic review and quantitative analysis.**

Authors: Zuckerman, S.L., Prather, C.T., Yengo-Kahn, A., Solomon, G.S., Sills, A.K., Bonfield, C.M.


Title: **Mechanisms of injury as a diagnostic predictor of sport-related concussion severity in football, basketball, and soccer: Results from a regional concussion registry.**

Authors: Zuckerman, S.L., Totten, D.J., Rubel, K.E., Kuhn, A.W., Yengo-Kahn, A.M., & Solomon, G.S.


Title: **Alterations in default-mode network connectivity may be influenced by cerebrovascular changes within one week of sports related concussion in college varsity athletes: a pilot study.**


Journal: Brain Imaging and Behavior, 10(2), 559-568. (2016)

Title: **Statements of Agreement from the Targeted Evaluation and Active Management (TEAM) Approaches to Treating Concussion Meeting Held in Pittsburgh, October 15-16, 2015**


Title: **Obesity and neurocognitive recovery after sports-related concussion in athletes: A case-control study.**


Title: **Comparison of baseline and post-concussion ImPACT test scores in young athletes with stimulant-treated and untreated ADHD**

Authors: Gardner, R.M., Yengo-Kahn, A., Bonfield, C.M., & Solomon, G.S.

Scientific Publications

Title: The influence of validity criteria on ImPACT test-retest reliability among high school athletes
Authors: Brett, B.L., & Solomon, G.S.
Journal: Journal of Clinical and Experimental Neuropsychology, in press.

Title: Interrelationships among neuroimaging biomarkers, neuropsychological test data, and symptom reporting in a cohort of retired National Football League (NFL) players.

Title: Comparison of neurocognitive performance in contact and noncontact non-concussed high school athletes across a two-year period.
Authors: Brett, B.L., & Solomon, G.S.
Journal: Developmental Neuropsychology, in press.

Title: Outcomes after sport-related concussion: Does socioeconomic status matter?
Authors: Zuckerman, S.L., Zalneraitis, B.H., Totten, D.J., Rubel, K.E., Kuhn, A.W., Yengo-Kahn, A.M., Bonfield, C.M., Sills, A.K., & Solomon, G.S.

Title: Factors associated with playing through a sports-related concussion.
Authors: Kuhn, A.W., Zuckerman, S.L., Yengo-Khan, A.M., Kerr, Z.Y., Totten, D.J., Rubel, K.E., Sills, A.K., & Solomon, G.S.
Journal: Clinical Neurosurgery, in press.

Title: What domains of clinical function should be assessed after sports-related concussion?
Journal: British Journal of Sports Medicine, in press.

Title: Predictors of clinical recovery from concussion: A systematic review
Authors: Iverson, G.L., Gardner, A. J., Terry, D.P., Ponsford, J.L., Sills, A.K., Broshek, D.K., & Solomon, G.S.
Journal: British Journal of Sports Medicine, in press.
Scientific Publications

Title: Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016


Title: The Concussion Recognition Tool 5th Edition (CRT5): Background and rationale

Authors: Ruben J Echemendia,1,2 Willem Meeuwisse,3 Paul McCrory,4 Gavin A Davis,5,6 Margot Putukian,7,8 John Leddy,9,10 Michael Makdissi,6,11 S John Sullivan,12 Steven P Broglio,13 Martin Raftery,14 Kathryn Schneider,15,16,17,18 James Kissick,19 Michael Mccrea,20 Jiří Dvořák,21 Allen K Sills,22 Mark Aubry,23 Lars Engebretsen,24,25 Mike Loosemore,26 Gordon Fuller,27 Jeffrey Kutcher,28 Richard Ellenbogen,29 Kevin Guskwiewicz,30 Jon Patricios,31,32 Stanley Herring


Title: The Child Sport Concussion Assessment Tool 5th Edition (Child SCAT5)

Authors: Gavin A Davis,1,2 Laura Purcell,3 Kathryn J Schneider,4,5,6 Keith Owen Yeates,7 Gerard A Gioia,8,9 Vicki Anderson,1 Richard G Ellenbogen,10 Ruben J Echemendia,11 Michael Makdissi,2,12 Allen Sills,13 Grant L Iverson,14 Jiri Dvorak,15 Paul McCrory,2 Willem Meeuwisse,16 Jon Patricios,17,18 Christopher C Giza,19 Jeffrey S Kutcher


Title: The Sport Concussion Assessment Tool 5th Edition (SCAT5): Background and rationale

Authors: Ruben J Echemendia,1,2 Willem Meeuwisse,3 Paul McCrory,4 Gavin A Davis,5,6 Margot Putukian,7,8 John Leddy,9,10 Michael Makdissi,6,11 S John Sullivan,12 Steven P Broglio,13 Martin Raftery,14 Kathryn Schneider,15,16,17,18 James Kissick,19 Michael McCrea,20 Jiří Dvořák,21 Allen K Sills,22 Mark Aubry,23 Lars Engebretsen,24,25 Mike Loosemore,26 Gordon Fuller,27 Jeffrey Kutcher,28 Richard Ellenbogen,29 Kevin Guskwiewicz,30 Jon Patricios,31,32 Stanley Herring

VSCC Team Members & Clinical Locations

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Phone: (615) 936-7846

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Assistant Professor of Emergency Medicine; Assistant Professor of Orthopaedics and Rehabilitation; Vanderbilt Head Team Physician

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Fax: (615) 794-8845

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Nashville, TN 37232-8774
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**VSCC Team Members & Clinical Locations**

**Ashley Jo Rowatt Karpinos, MD, MPH**  
Assistant Professor of Medicine; Assistant Professor of Pediatrics

![Image of Ashley Jo Rowatt Karpinos]

- Vanderbilt Adult Primary Care  
  - 1215 21st Avenue South  
  - 7th floor  
  - Nashville, TN 37232

- Vanderbilt Student Health Services  
  - 1211 21st Avenue  
  - Nashville, TN 37212

**Ryan Timothy Raburn, PA**  
Assistant in Neurological Surgery

![Image of Ryan Timothy Raburn]

- Vanderbilt Neurosurgery Cool Springs  
  - 2009 Mallory Lane  
  - Suite 230  
  - Franklin, TN 37067

- Vanderbilt Neurosurgery  
  - 1500 21st Avenue South  
  - Suite 1506, Village at Vanderbilt  
  - Nashville, TN 37212
Post-Concussion Headache Team

Pediatric Neurology

Susan E Beaird, DNP, CPNP
Pediatric Nurse Practitioner

Location:
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2200 Children’s Way
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Nashville, TN 37232

Lauren E King, BSN, MSN, NP, PNP
Pediatric Nurse Practitioner

Jane Miller Hearnsberger, RN, MSN, CPNP
Pediatric Nurse Practitioner

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Stacy Marie Bishop Stark, DO
Assistant Professor, Physical Medicine & Rehabilitation; Residency Director,
Physical Medicine & Rehabilitation

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Nashville, TN 37212

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Assistant Professor of Neurology

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Franklin, TN 37067
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E. Haley Vance, DNP, APN, CPNP-AC
Pediatric Nurse Practitioner

Location:
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Nashville, TN 37232

Christopher Michael Bonfield, MD
Assistant Professor of Neurological Surgery

John Clifton Wellons III, MD
Professor of Neurological Surgery; Chief, Pediatric Neurological Surgery
## Baseline Concussion Testing Program

**Metro Nashville Public Schools (191)**
- Antioch High School
- Cane Ridge High School
- East Literature High School
- Glencliff High School
- Hillsboro High School
- Hillwood High School
- Hume-Fogg Magnet
- Hunters Lane High School
- Maplewood High School
- McGavock High School
- MLK Magnet
- Overton High School
- Pearl-Cohn High School
- Stratford High School
- Whites Creek High School

**Williamson County Schools (1,691)**
- Brentwood High School
- Centennial High School
- Fairview High School
- Franklin High School
- Independence High School
- Nolensville High School
- Page High School
- Ravenwood High School
- Summit High School

**Private Schools (262)**
- Battle Ground Academy
- Brentwood Academy
- Nashville Christian School
- University School of Nashville

**Club Sports (121)**
- Brentwood LAX
- Ravenwood LAX
- Woodland MS LAX

**Cheatham County Schools (101)**
- Harpeth High School

**Universities (319)**
- Belmont University Athletics
- Vanderbilt University Athletics

**Clinical (24)**
- VOI

The VSCC performed a total of 2,711 baseline ImPACT tests for FY16-17

### Complex Sports Concussion Care Relationships

- **Knoxville Orthopedics Clinic, Knoxville, TN**
- **St. Mary’s Concussion Alliance, Evansville, IN**
**Patient Volumes:**

- 18 Access points to VSCC providers
- 1094 New patient visits

**VSCC Access Point**

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<tr>
<th>VSCC Access Point</th>
<th>TOTAL</th>
<th>% of patients</th>
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<tr>
<td>NEUROSURGERY MT JULIET</td>
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<tr>
<td>NEUROSURGERY LEBANON</td>
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<td>NEURSG-CONCUSSION VAV</td>
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<td>ORTHO SPORTS-HAND</td>
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<td>AG Sports Concussion Clinic</td>
<td>20</td>
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<tr>
<td>ORTHO SPORTS MT JULIET</td>
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<tr>
<td>ORTHO SPORTS MED</td>
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<tr>
<td>VBJ AFTER HOURS</td>
<td>34</td>
<td>3.1%</td>
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<tr>
<td>VBJ BRENTWOOD SPORTS</td>
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<tr>
<td>VBJ ROYAL OAKS CLINIC</td>
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<tr>
<td>VBJ SPRING HILL</td>
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<tr>
<td>WMSON BW PRIMARY CARE</td>
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<tr>
<td>WMSON NEURO SURG CLINIC</td>
<td>27</td>
<td>2.5%</td>
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</tbody>
</table>

**FY17 TOTAL**

| FY17 TOTAL | 1094 |

**FY16 TOTAL**

| FY16 TOTAL | 1031 |

**FY17 VS FY 16**

| FY17 VS FY 16 | 63 |

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**VSCC Total Visits**

<table>
<thead>
<tr>
<th>VSCC Total Visits</th>
<th>TOTAL</th>
<th>% of patients</th>
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<tr>
<td>NEUROSURGERY MT JULIET</td>
<td>1</td>
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<td>6</td>
<td>0.5%</td>
</tr>
<tr>
<td>NEURSG-CONCUSSION VAV</td>
<td>308</td>
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<tr>
<td>NEURSG-NEURO SURG CLINIC</td>
<td>19</td>
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</tr>
<tr>
<td>ORTHO 100 PED SPORT OHO</td>
<td>101</td>
<td>8.6%</td>
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<tr>
<td>ORTHO SPORTS 4TH FL</td>
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<tr>
<td>ORTHO PEDIATRICS VCH</td>
<td>4</td>
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<tr>
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<tr>
<td>AG Sports Concussion Clinic</td>
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<tr>
<td>ORTHO SPORTS MT JULIET</td>
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<tr>
<td>ORTHO SPORTS MED</td>
<td>204</td>
<td>17.4%</td>
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<tr>
<td>VBJ AFTER HOURS</td>
<td>37</td>
<td>3.2%</td>
</tr>
<tr>
<td>VBJ BRENTWOOD SPORTS</td>
<td>40</td>
<td>3.4%</td>
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<tr>
<td>VBJ CLINICAL PRACTICE</td>
<td>149</td>
<td>12.7%</td>
</tr>
<tr>
<td>VBJ ROYAL OAKS CLINIC</td>
<td>1</td>
<td>0.1%</td>
</tr>
<tr>
<td>VBJ SPRING HILL</td>
<td>52</td>
<td>4.4%</td>
</tr>
<tr>
<td>WMSON BW PRIMARY CARE</td>
<td>27</td>
<td>2.3%</td>
</tr>
<tr>
<td>WMSON NEURO SURG CLINIC</td>
<td>27</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

**FY17 TOTAL**

| FY17 TOTAL | 1173 |

**FY16 TOTAL**

| FY16 TOTAL | 1117 |

**FY17 VS FY 16**

| FY17 VS FY 16 | 56 |