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# Practice-Based Research Networks, Part II: A Descriptive Analysis of the Athletic Training Practice-Based Research Network in the Secondary School Setting

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***Context:*** Analysis of health care service models requires the collection and evaluation of basic practice characterization data. Practice-based research networks (PBRNs) provide a framework for gathering data useful in characterizing clinical practice.

***Objective:*** To describe preliminary secondary school setting practice data from the Athletic Training Practice-Based Research Network (AT-PBRN).

***Design:*** Descriptive study.

***Setting:*** Secondary school athletic training facilities within the AT-PBRN.

***Patients or Other Participants:*** Clinicians (n = 22) and their patients (n = 2523) from the AT-PBRN.

***Main Outcome Measure(s):*** A Web-based survey was used to obtain data on clinical practice site and clinician characteristics. Patient and practice characteristics were obtained via deidentified electronic medical record data collected between September 1, 2009, and April 1, 2011.

Descriptive data regarding the clinician and CPS practice characteristics are reported as percentages and frequencies. Descriptive analysis of patient encounters and practice characteristic data was performed, with the percentages and frequencies of the type of injuries recorded at initial evaluation, type of treatment received at initial evaluation, daily treatment, and daily sign-in procedures.

***Results:*** The AT-PBRN had secondary school sites in 7 states, and most athletic trainers at those sites (78.2%) had less than 5 years of experience. The secondary school sites within the AT-PBRN documented 2523 patients treated across 3140 encounters. Patients most frequently sought care for a current injury (61.3%), followed by preventive services (24.0%), and new injuries (14.7%). The most common diagnoses were ankle sprain/strain (17.9%), hip sprain/strain (12.5%), concussion (12.0%), and knee pain (2.5%). The most frequent procedures were athletic trainer evaluation (53.9%), hot- or cold-pack application (26.0%), strapping (10.3%), and therapeutic exercise (5.7%). The median number of treatments per injury was 3 (interquartile range = 2, 4; range = 2–19).

***Conclusions:*** These preliminary data describe services provided by clinicians within the AT-PBRN and demonstrate the usefulness of the PBRN model for obtaining such data.

***Key Words:*** PBRN, adolescents, practice characteristics, professional practice, ICD-9, CPT

**Key Points**

- The practice-based research network and patient-oriented electronic medical records provide a mechanism to collect meaningful patient-care data.
- Secondary school athletic trainers can document patient care in a way that permits the subsequent analysis of practice characteristics.
- In the secondary school setting, the most frequent diagnoses were ankle sprain/strain, hip sprain/strain, and concussion, and the most common procedures were athletic trainer evaluation, hot- or cold-pack application, strapping, and therapeutic exercise.
- Care was most commonly provided for current injuries, followed by preventive services and new injuries.

Historically, the athletic training profession has defined the essential knowledge and skills necessary for the practice of athletic training through the *Athletic Training Educational Competencies*.[1] The competencies are derived in part from the *Role Delineation Study*,[2] which is essentially a task analysis of athletic training practice. Although this study is fundamental to our understanding of the types of tasks entry-level athletic trainers perform, it is not designed to describe athletic training practice characteristics, such as the demographic details of patients cared for by athletic trainers, the diagnoses commonly treated by athletic trainers, or the nature, extent, and quality of care provided by athletic trainers. These data are essential to the profession's ability

to prepare future clinicians, improve overall patient care, and address important professional issues. Currently, no widespread mechanism exists for obtaining data from which to characterize the practice patterns of a broad sample of athletic trainers.

Practice-based research networks (PBRNs) enable the collection of large amounts of clinical practice data from geographically diverse locations and different practice settings that can be used to accurately characterize patient variables and the practice patterns of providers within the network.[3,4] In 2009, researchers and clinicians partnered in the Athletic Training PBRN (AT-PBRN) to develop an infrastructure for engaging in multisite clinical research aimed at enhancing patient care and improving patient outcomes. The AT-PBRN first received recognition as a registered affiliate PBRN from the Agency for Healthcare Research and Quality (AHRQ) in January 2010 and is the first PBRN in the athletic training profession. The AT-PBRN is actively engaged in gathering practice pattern data for the purpose of characterizing athletic training services and patient outcomes.

Characterizing professional practice patterns is increasingly important because various stakeholder groups (eg, patients, regulators, payers) demand proof of the effectiveness, safety, and viability of care offered by health care professionals.[5] It is critical that health professions have the ability to efficiently collect and analyze information about the nature of their clinical practices. For example, the physical therapy profession used practice pattern data to identify expert physical therapists[6,7] and examine the effect of continuing education interventions on the quality of clinical care.[8] Practice patterns of health care providers are known to differ based on a variety of factors, including patient characteristics and setting.[9–11]

Patient care in the secondary school focuses on the adolescent athlete, a unique patient population cared for in a unique environment. The secondary school setting offers adolescents tremendous exposure to sports participation and its inherent risks. An estimated 7 628 377 adolescent boys and girls participate in interscholastic athletics at the secondary school level in the United States.[12] More than 1.4 million sport-related injuries are sustained by interscholastic athletes per year,[13] and recent research[14,15] has demonstrated that sport-related injuries negatively affect adolescents' health-related quality of life (HRQOL). Despite the many reasons why adolescent sports injuries are a significant public health concern, very little is known about secondary school athletic training patient and practice characteristics. The ability to define the patients and practice patterns of athletic trainers providing care in the secondary schools is fundamental to any efforts aimed at improving patient care, enhancing clinical practice, and expanding employment opportunities in this unique and important employment setting.

The purpose of our 2-part series is to define and discuss the value of PBRNs for engaging in multisite studies that bring clinicians and scientists together with the goal of improving patient care and optimizing patient outcomes and to present a model of an athletic training PBRN in the secondary school setting. The specific aims of part II of this series are to (1) describe the secondary school clinical practice sites (CPSs) within the AT-PBRN, (2) identify the characteristics of the secondary school clinicians practicing within the AT-PBRN, (3) portray the characteristics of the patients treated within the secondary school sites of the AT-PBRN, and (4) discuss the practice characteristics of the athletic training services provided at secondary school sites within the AT-PBRN.

## METHODS

### Design

Both prospective and retrospective designs were used to perform a descriptive analysis of the AT-PBRN. A prospective survey was used to obtain data regarding the participating secondary school clinicians and their CPS characteristics. A retrospective analysis of patient records within a Web-based electronic medical record (EMR) used by all clinicians was evaluated for patient and practice characteristics.

### Participants

Participants included clinicians at secondary school sites participating in the AT-PBRN and the patients whom they evaluated and treated between September 1, 2009, and April 1, 2011. The study was approved by the A.T. Still University Institutional Review Board. Patient data obtained from the EMR were deemed exempt by the Board due to a Certification of Honest Broker System/Processes provided by the EMR developer, Essentialtalk (Calgary, AB, Canada), to the AT-PBRN research team. This agreement details the provision of a limited dataset from the EMR to the research team that is stripped of all federally defined personal identifiers (ie, protected health information).[16]

### Instrumentation

**Clinician Survey.** A customized, Web-based clinician survey (SurveyMonkey, Palo Alto, CA) was used to describe characteristics related to the CPS (where treatment is provided), clinician (who is providing the treatment), patients (who is being treated and for what reason), and practice (what treatments and procedures were provided to the patient). The survey consisted of 21 multiple-choice questions and was completed by each clinician within the AT-PBRN.

**Patient-Oriented Electronic Medical Record.** The CORE-AT EMR (www.core-at.com) is a patient-oriented EMR that was designed by athletic trainers and developed in partnership with Essentialtalk. The EMR is a fully functional electronic clinical documentation system for use by athletic trainers and includes integrated injury-surveillance and patient-based clinical outcomes components. The EMR system uses orthopaedic and illness (eg, diabetes, heat illness) ICD-9-CM diagnosis codes for conditions that are commonly seen by athletic trainers. Additionally, American Medical Association Current Procedural Terminology (CPT)[17] codes for athletic trainer evaluation and reevaluation (CPT codes 9005 and 9006, respectively) and for physical medicine and rehabilitation treatment codes used by athletic trainers (eg, therapeutic exercise [CPT 97110], strapping [29540]) are integrated in the documentation system. Standard athletic injury documentation components, including initial injury

evaluation, daily treatment, and discharge summary documentation, are integrated into the system, which was designed to be intuitive for practicing clinicians to minimize burden and optimize data acquisition.

Documentation capabilities include individual patient or athlete registration (eg, sex, age, grade), injury demographics (eg, sport, season, position), comprehensive patient evaluation (eg, diagnosis, injured body part, side, mechanism of injury), and daily treatment notes, progress reports, and discharge summaries (eg, athletic training interventions, rehabilitation services, date of return to play).

A daily sign-in log for patient encounters not requiring a full evaluation (eg, taping, icing) is used for documentation and subsequent data collection. The daily sign-in log is useful in identifying preventive treatments delivered to otherwise healthy athletes and requires the reason for seeking treatment to be classified as care for a current injury, preventive treatment, or care for a new injury. The daily sign-in log was added in December 2010, so analyses of those data include cases from December 2010 through April 1, 2011, only.

The EMR is compliant with the data-acquisition, -storage, and -transmission standards set forth by the Health Insurance Portability and Accountability Act (HIPAA).[18] Health information obtained using the EMR is not stored locally on computers. Instead, data are uploaded in real time and transmitted to secure, redundant servers. Therefore, all clinicians who practice within the AT-PBRN must have a computer with Internet access.

## Procedures

**PBRN Development and CPS Recruitment.** The AT-PBRN is administered through A.T. Still University and consists of partnerships with professional and post-professional athletic training education programs as well as hospital groups, clinic groups, and independent athletic training clinics for a diverse group of clinical sites. Faculty from academic centers, hospitals, and clinic groups serve as regional coordinators for clusters of CPSs. Each cluster consists of an average of 2 secondary school CPSs.

Membership in the AT-PBRN requires that the CPS include at least 1 certified athletic trainer who provides care to interscholastic or intercollegiate athletes. This study included only those CPSs in the secondary school setting. Initially, CPSs were recruited through direct communication with potential regional coordinators (eg, academic program directors, clinic supervisors, hospital and outreach administrators). Academic site coordinators were identified and approached by a member of the AT-PBRN administrative team and asked to identify the CPSs within their cluster that would join the AT-PBRN. After the official launch of the AT-PBRN in 2009, recruitment strategies expanded to indirect communications (eg, professional presentations, word of mouth, AT-PBRN Web site: www.coreat.org) with potential regional coordinators and independent CPSs.

To ensure data accuracy and integrity, clinicians were required to complete a formal training session before EMR use. The 2-hour training session was supervised by the Clinical Practice Site Coordinator of the AT-PBRN and administered either in person or via Web conferencing (eg, Webinars). The global aims of the training session included (1) describing the primary goals of the AT-PBRN, (2) identifying major components and forms of the system, (3) emphasizing system features that increased documentation efficiency (eg, drop-down menus, auto-populated fields), (4) highlighting fields that required special entry (eg, height is reported as total inches as opposed to feet and inches), and (5) explaining proper documentation of athletic training services (eg, CPT units: 1 unit = 15 minutes). After the training session, clinicians were given access to the EMR to begin documenting patient cases. The administrative team of the AT-PBRN periodically reviewed the EMR database to evaluate the quality of data and address problems related to data entry.

## Data Acquisition

**Secondary School CPS Characteristics.** Information regarding CPS characteristics was obtained prospectively through a survey directed at participating clinicians. Additionally, a member of the research team gathered data from each of the CPS Web sites. Data related to each CPS included school type (eg, public, private, charter), school size, socioeconomic level of the area in which the school is located, school zip code, number of male and female athletes, and number of male and female sports. Clinicians were asked to identify the primary method by which they signed onto the EMR at their CPS (computer: desktop, laptop, or netbook; Internet connection: hardwired, wireless, or broadband mobile card).

**Secondary School Clinician Characteristics.** Clinician characteristic information was obtained prospectively using a clinician survey. Characteristics related to the clinician included age, sex, position or title at CPS, years certified, highest educational degree obtained, length of employment at current CPS, and length of PBRN membership. In addition, clinicians were asked to describe characteristics related to their employment (eg, employment model, average hours of work per week, teaching responsibilities).

**Secondary School Patient and Practice Characteristics Data.** Patient and practice characteristics were obtained through a retrospective review of deidentified data collected within the CORE-AT EMR from September 1, 2009, through April 1, 2011. The daily sign-in log was added in December 2010; therefore, data were available from December 2010 through April 1, 2011, only. In accordance with the terms of agreement for using the EMR, participants within the AT-PBRN grant access to the deidentified data from the EMR to the research team. Data from all of the AT-PBRN sites were stripped of any personal identifiers by the database engineers at Essentialtalk in accordance with federal guidelines for safe-harbor access to health care information.[16] Clinicians within the AT-PRBN use the EMR as a routine documentation system to record initial injury evaluations, daily treatment notes, injury reevaluations, and discharge summaries. Patients may also enter data into the daily sign-in log of the EMR. Patient-entered data must be reviewed and validated by the athletic trainer. Data acquisition using the EMR enables the real-time collection of data as it is being entered into a clinical documentation system.

**Table 1. Number of Athletes at Participating Clinical Practice Sites**

| Number of Athletes per Site | Sex of Athletes, % (n) | |
|---|---|---|
| | Male | Female |
| <200 | 60.9 (14) | 65.2 (15) |
| 200–399 | 30.4 (7) | 26.1 (6) |
| 400–599 | 4.3 (1) | 4.3 (1) |
| >600 | 4.3 (1) | 4.3 (1) |

### Statistical Analysis

Data were analyzed using descriptive statistics (percentages and frequencies) for all variables of interest. The variables analyzed in this study were classified into 4 groups: CPS characteristics (location, school type, enrollment, number of sports, number of athletes), clinician characteristics (age, sex, years certified, level of education, employment model, years at CPS, supervisor, average work hours, teaching duties), patient characteristics (age, sex, grade level, sport, reason for visit, initial evaluation diagnosis), and practice characteristics (treatments provided at initial evaluation, treatments provided by diagnosis, treatments as a function of reason for the visit).

## RESULTS

### Secondary School CPS Characteristics

Secondary school clinicians within the AT-PBRN practiced in 23 distinct CPSs across 7 states (Arizona, Connecticut, Massachusetts, Minnesota, New Hampshire, Vermont, Virginia). Most CPSs were associated with a regional coordinator (athletic training academic program = 13, clinic center = 2, hospital center = 5), with the remaining 3 CPSs acting as independent sites.

Most secondary school CPSs were located in public or public charter schools (n = 19, 82.6%), with the remainder in private parochial or private charter schools (n = 4, 7.4%). Most CPSs had a school enrollment of more than 1000 (n = 14, 60.9%). The numbers of male and female athletes at the CPSs are shown in Table 1. At the time of the study, the AT-PBRN captured 17 male and 20 female sports. The most common male and female sports were soccer (n = 22, 95.7%) and softball (n = 22, 95.7%), respectively (Table 2). The most common methods of signing on to the CORE-AT EMR were through a laptop or netbook computer (n = 15, 65.2%) and wireless or broadband mobile card (n = 14, 60.9%).

### Secondary School Clinician Characteristics

At the time the data were analyzed, the AT-PBRN consisted of 23 secondary school clinicians (men = 7, women = 16, age = 27.3 ± 7.0 years). Most clinicians (n = 18, 78.3%) had a 4-year college degree and 21.7% (n = 5) had a master's degree as the highest level of education. The majority of clinicians had been certified for less than 2 years (n = 13, 56.5%), with 21.7% (n = 5) being certified for 3–5 years, 13.0% (n = 3) for 6–10 years, and 8.6% (n = 2) for more than 10 years. Most had been employed at their current CPS for less than 2 years (n = 20, 87.0%), whereas 13% had been employed at their CPS for 6–10 years. The title or position of participating clinicians was primarily graduate assistant/resident (n = 12, 52.2%) or head athletic trainer (n = 9, 39.1%); 8.6% (n = 2) were assistant athletic trainers.

**Table 2. Male and Female Sports Captured Within the Athletic Training Practice-Based Research Network[a]**

| Sport | Male Teams | Female Teams |
|---|---|---|
| Alpine skiing | 3 | 3 |
| Badminton | 1 | 4 |
| Baseball | 21 | 2 |
| Basketball | 20 | 19 |
| Cheerleading | 0 | 15 |
| Crew | 2 | 2 |
| Cross-country | 21 | 21 |
| Dance | N/A | 11 |
| Field hockey | N/A | 6 |
| Football | 21 | N/A |
| Golf | 16 | 11 |
| Gymnastics | 0 | 5 |
| Ice hockey | 7 | 4 |
| Lacrosse | 6 | 5 |
| Rugby | 1 | 1[b] |
| Soccer | 22 | 21 |
| Softball | 1 | 22 |
| Swimming and diving | 13 | 14 |
| Tennis | 0 | 16 |
| Track and field | 21 | 21 |
| Volleyball | 6 | 20 |
| Wrestling | 14 | N/A |

Abbreviation: N/A indicates not applicable.
[a] Total clinical practice sites = 23.
[b] Touch rugby.

Secondary school clinicians were typically employed on a part-time (n = 11, 47.8%) or full-time (n = 7, 30.4%) basis through the school or through a clinic-based outreach program (n = 5, 21.7%). The majority of clinicians reported to an athletic director for their duties as an athletic trainer (n = 15, 65.2%), with 30.4% (n = 7) reporting to the head athletic trainer and 4.3% (n = 1) reporting to the student activities director. Most clinicians indicated they worked 20–30 hours per week (n = 12, 52.2%), with 17.4% (n = 4) working less than 20 hours, 17.4% (n = 4) working 31–40 hours, and 13.0% (n = 3) working more than 40 hours. None of the clinicians had teaching duties at the school. On average, clinicians had been members of the AT-PBRN for 9.3 ± 3.9 months.

### Secondary School Patient Characteristics

Between September 2009 and April 2011, 2523 patients were entered into the EMR. Patients had a mean age of 15.9 ± 1.3 years. Males represented a larger percentage of total patients than females (n = 1500 [59.9%] versus n = 1023 [40.5%], respectively). Patients were fairly evenly distributed across all grade levels: freshmen (n = 735, 29.1%), sophomores (n = 741, 29.4%), juniors (n = 563, 22.3%), and seniors (n = 484, 19.2%). The majority of injured patients participated in football (n = 407, 34.2%), followed by soccer (n = 209, 17.6%), basketball (n = 147, 12.4%), track (n = 107, 9.0%), wrestling (n = 61, 5.1%), and baseball (n = 56, 4.7%), with the remaining 18% (n = 214) participating in 10 other sports.

The daily sign-in log records show a total of 3140 patient encounters between December 2010 and April 2011, with the majority relating to care sought for an athlete's current

**Table 3. Most Frequent Injury Diagnoses Recorded Across All Patients at Time of Intake (n = 877)**

| Diagnosis | ICD-9 Code | n (%) |
|---|---|---|
| Sprain/strain: ankle | 845, 845.01, 845.03 | 157 (17.9) |
| Sprain/strain: hip, thigh, groin | 843.9, 844.9 | 110 (12.5) |
| Concussion | 310.2, 850.0, 850.5, 850.9 | 105 (12.0) |
| Knee pain | 719.46 | 22 (2.5) |
| Sprain/strain: neck | 847 | 21 (2.4) |
| Low back pain | 724, 846, 846.1 | 20 (2.3) |
| Sprain/strain: hand/finger | 842.1 | 19 (2.2) |
| Sprain/strain: wrist | 842.0 | 18 (2.1) |
| Medial collateral ligament sprain: knee | 844.1 | 16 (1.8) |
| Contusion: knee | 924.11 | 16 (1.8) |
| Cruciate ligament sprain: knee | 844.2 | 15 (1.7) |
| Meniscal tear: knee | 717, 717.41, 836.1, 836.2 | 15 (1.6) |
| Contusion: hip | 924.01 | 14 (1.5) |
| Contusion: elbow | 923.11 | 14 (1.5) |
| Sprain/strain: rotator cuff | 840.4 | 12 (1.4) |
| Sprain/strain: foot | 845.1 | 12 (1.4) |
| Contusion: hand | 924.30 | 12 (1.4) |
| Acromioclavicular joint sprain | 840 | 11 (1.3) |
| Dislocation/subluxation: shoulder | 831.00 | 11 (1.3) |
| Labral tear: shoulder | 840.0 | 11 (1.3) |
| Achilles strain, tendinitis | 726.71, 845.09 | 11 (1.3) |
| Fibular fracture | 824.3 | 9 (1.0) |

injury (n = 1925, 61.3%). Care sought for preventive services (n = 754, 24.0%) was the second most common reason noted in the daily sign-in, followed by encounters relating to a new injury (n = 461, 14.7%).

Among the patients entered into the system, 877 encounters consisted of a complete initial evaluation, with the remaining patient encounters documented as daily treatment or rehabilitation sessions, follow-up evaluations, or discharge notes. The percentages and frequencies of the most common diagnoses recorded at the time of the initial evaluation are shown in Table 3.

### Secondary School Practice Characteristics

A total of 1491 treatments or procedures were reported at the initial evaluation and were recorded into the patient-oriented EMR system. The percentages and frequencies of the treatments or procedures provided at the time of the initial evaluation are listed in Table 4. The treatments and procedures provided to athletes with regard to their daily treatment status are described in Table 5, and the percentages and frequencies of treatments for each of the top diagnoses are listed in Table 6. These percentages were calculated independently for each diagnosis, using the number of total treatments as the denominator. The median number of treatments per injury was 3 (interquartile range = 2, 4; range = 2–19).

## DISCUSSION

In this study, we provide an overview of the AT-PBRN and describe the secondary school CPS, clinician, patient, and practice characteristics for the initial launch and implementation period of the network. This study is an important first step for the AT-PBRN before the initiation of more complex studies of practice characteristics or comparative effectiveness. As with other PBRNs,[19–21] identifying basic information regarding the clinicians, patients, and practice characteristics of providers within the PBRN is a critical first step in developing the research agenda for the network. This study provides the first estimates of the types of conditions seen and treatments performed by secondary school clinicians participating in the AT-PBRN.

### Secondary School CPS Characteristics

Currently, no published athletic training data describe a typical secondary school setting. The most inclusive survey of secondary school athletic training practice is the National Sports Safety Secondary School Benchmark (N4SB) study[22] of 4232 athletic trainers commissioned by the National Athletic Trainers' Association. In that unpublished report, 80.9% of respondents worked in a public school and 13.2% in a private or parochial school, with 57.7% of schools having more than 1000 students enrolled and 42.3% having a student enrollment of less than

**Table 4. Evaluations and Treatments or Procedures Recorded at Initial Evaluation (n = 1491)**

| Treatment or Procedure | CPT Code | n (%) |
|---|---|---|
| Athletic trainer evaluation | 97005 | 803 (53.9) |
| Hot or cold pack | 97010 | 387 (26.0) |
| Strapping (tape or wrap) | 29240, 29260, 29280, 29520, 29530, 29540, 29550 | 153 (10.3) |
| Therapeutic exercise or activities | 97110, 97530 | 85 (5.7) |
| Massage ormanual therapy | 97124, 97140 | 21 (1.4) |
| Electric stimulation | 97014 | 18 (1.2) |
| Other | | 24 (1.6) |

**Table 5. Daily Sign-In Log Evaluations, Treatments, and Procedures for New Injuries, Current Injuries, and Preventive Services (n = 3140)**

| Injury or Service | Athletic Trainer Evaluation | Treatment or Procedure, n (%) | | | | |
|---|---|---|---|---|---|---|
| | | Treatment | Tape | Ice or Heat | Wound Care | Other |
| New (n = 461) | 199 (43.2) | 132 (28.6) | 91 (19.7) | 247 (53.6) | 22 (4.8) | 19 (4.1) |
| Current (n = 1925) | 145 (7.5) | 780 (40.5) | 882 (45.8) | 754 (39.2) | 44 (2.2) | 94 (4.9) |
| Preventive (n = 754) | 11 (1.5) | 346 (45.9) | 489 (64.9) | 185 (24.5) | 27 (3.6) | 29 (3.2) |

999. Data from the N4SB study suggest that 71.8% of schools had fewer than 399 male athletes, while 26% reported more than 400 male athletes. A total of 79.4% of respondents indicated that their school had fewer than 399 female athletes, and 18.6% had more than 400 female athletes.[22] The secondary schools in the AT-PBRN are similar to those in the N4SB sample with respect to the public and private or parochial status and school enrollment but tended to have smaller numbers of both male and female athletes.

Despite similarities to the N4SB sample, the AT-PBRN is limited geographically because the majority of its secondary school CPSs are located in Arizona and the northeast region of the country. In order to achieve its overarching mission of improving quality of care and patient outcomes, the AT-PBRN must establish a collection of geographically diverse and nationally representative secondary school CPSs throughout the country. This is important for future studies of practice characteristics, comparative effectiveness research, and injury surveillance and will allow for comparisons of injuries, treatments, and interventions across geographic location and socioeconomic status.

## Secondary School Clinician Characteristics

The secondary school clinicians represented in this study were primarily young professionals who had completed their bachelor's degrees and were currently pursuing master's degrees. Their average age was lower than the mean age of the N4SB respondents (27.3 ± 7.0 years versus 35.7 ± 9.9 years, respectively), and only 21.7% held a master's degree, compared with 55% of the N4SB sample.[22] Most secondary school clinicians practicing in the AT-PBRN had less than 5 years of clinical experience (78.2%); only 30.7% of the N4SB sample reported practicing for less than 5 years. These findings are not surprising considering that the AT-PBRN partnered with postprofessional athletic training education programs to enroll secondary schools associated with these educational programs during the initial development of the AT-PBRN. Athletic trainers joining the AT-PBRN during their postprofessional studies provide a potential advantage to future data-collection efforts, as they are being trained and socialized to use the patient-oriented EMR as part of their educational programs and have translated that to use in their clinical practice. One of the aims of the AT-PBRN is to produce consistent use of the EMR with these graduate student clinicians. That is, we hope that, with ongoing education, these clinicians will continue to use the patient-oriented EMR and participate in the network once they earn their master's degrees and find full-time employment.

Clinicians participating in the AT-PBRN also tend to be younger and have practiced fewer years than clinicians in other PBRNs. For example, only 5% of clinicians in the Northwest PRECEDENT Dental PBRN were 30 years of age or younger, and 12.9% of dentists had been in practice for 5 years or less.[20] Similarly, only 28% of Dietetics PBRN members reported 7 or fewer years of clinical experience.[21] Experience has been shown to play a role in the interest of clinicians to participate in a PBRN. One study of nurse practitioners (NPs) found that those NPs who were interested in PBRN participation had 9.3 ± 7.6 years of experience as NPs and 11.0 ± 7.7 years as RNs before becoming NPs.[23] Differences in age and years of experience may be a direct result of the professions involved in the other PBRNs. Both dentistry and NPs have post-baccalaureate entry-level degrees; many athletic trainers take the Board of Certification examination and practice after completing a bachelor's degree, whereas fewer take the entry-level master's route to certification.

Although educational requirements may explain some of the differences in clinician characteristics among the health care professions, data from the N4SB sample suggest that

**Table 6. Daily Evaluations and Procedures for the Most Prevalent Diagnoses[a]**

| Diagnosis (n)[a] | Evaluation or Procedure, n (%) | | | | |
|---|---|---|---|---|---|
| | Athletic Trainer Evaluation/ Reevaluation | Hot or Cold Pack | Strapping | Therapeutic Exercise or Activities | Other[c] |
| Sprain/strain: ankle (n = 750) | 308 (41.1) | 149 (19.9) | 105 (14.0) | 93 (12.4) | 95 (12.7) |
| Sprain/strain: hip, thigh, groin (n = 405) | 184 (45.4) | 101 (24.9) | 32 (7.9) | 55 (13.6) | 33 (8.1) |
| Concussion (n = 139) | 122 (87.8) | 5 (3.6) | 0 (0.0) | 7 (3.6) | 7 (5.0) |
| Knee pain (n = 54) | 31 (57.4) | 5 (9.3) | 4 (7.4) | 11 (20.4) | 3 (5.6) |
| Sprain/strain: neck (n = 56) | 34 (60.7) | 4 (7.1) | 0 (0.0) | 15 (26.8) | 3 (5.4) |
| Low back pain (n = 27) | 14 (51.9) | 4 (14.8) | 0 (0.0) | 5 (18.5) | 4 (14.8) |
| Sprain/strain: hand/finger (n = 62) | 30 (48.4) | 0 (0.0) | 23 (37.1) | 9 (14.5) | 0 (0.0) |
| Sprain/strain: wrist (n = 59) | 30 (50.8) | 1 (1.7) | 17 (28.8) | 11 (18.6) | 0 (0.0) |
| Medial collateral ligament sprain: knee (n = 59) | 30 (50.8) | 6 (10.2) | 3 (5.1) | 16 (27.1) | 4 (6.8) |

[a] Percentages calculated for each diagnosis using the total number of treatments for that diagnosis as the denominator.
[b] Patients may have had more than 1 daily treatment (n = number of treatments for each diagnosis).
[c] *Other* includes various therapeutic modalities, neuromuscular reeducation, gait training, massage, manual therapy, and physical performance tests.

the AT-PBRN may not currently capture a nationally representative sample of athletic trainers and may include a greater proportion of CPSs that are affiliated with postprofessional AT education programs. As mentioned previously, a nationally representative sample of CPSs and clinicians is essential to the long-term goals of the AT-PBRN. In order to address this limitation, the AT-PBRN has expanded its recruiting efforts to include CPSs that are not associated with postprofessional AT education programs. In fact, none of the 22 CPSs added to the AT-PBRN since the end of data analysis are associated with a postprofessional AT education program.

### Secondary School Patient Characteristics

Injury-surveillance data in the secondary school setting are currently available, with efforts focused primarily on particular sports,[24–30] types of injuries,[31–34] participation levels (practice versus competition),[35] and legality of sport maneuvers.[36] However, these studies often do not track the patient after the initial injury to determine the type, frequency, or duration of subsequent treatments. Better identification and reporting of the patient characteristics and types of injuries evaluated and treated by athletic trainers are important for many professional areas, including injury-prevention efforts and policy development. Injury surveillance is the first step in the model to study risk factors and interventions,[37] and investigations addressing these issues through surveillance methods are much needed.[38] The Reporting Injuries Online (RIO) studies[25,26,29–31] and others[27] have produced invaluable information regarding injury rates and risk factors in interscholastic athletes; however, these data are not linked in a meaningful way to patient care and clinical outcomes. Therefore, although these data are important for understanding injury trends and improving safety in the secondary school setting, the fact that they are collected independently of the health care services provided by athletic trainers severely limits their use.

To our knowledge, the only published investigation of athletic training outcomes is from Albohm and Wilkerson.[39] In that investigation, patients were older (27.3 years) than those in the present study (15.9 ± 1.3 years), but similar to the current study, 60% were male.[39] Not surprisingly, this sex bias toward males may be explained by the highest number of patient encounters documented within the AT-PBRN being with football athletes. According to the National Federation of State High School Associations 2009–2010 athletics participation survey,[12] football was the boys' sport that had the largest number of participants, with more than 1.1 million student-athletes. Further, studies of secondary school sports injury epidemiology have shown that football players also sustain the highest injury rates.[27,34,40,41]

Although we did not aim to address injury rates and risks, variables often found in surveillance and epidemiologic studies, the best comparative data come from epidemiologic studies of secondary school sports injuries. In a 3-year study of high school sports injuries, Powell and Barber-Foss[41] reported 23 566 total injuries (59.9% to the lower extremity and 20.8% to the upper extremity) among athletes in 150 secondary schools. This equates to approximately 52 reportable injuries in each of the participating schools for each year of the study. The data collected within the EMR for the current study resulted in approximately 79 documented injuries per school per year. Discrepancies in the reported injuries between the studies may result from methodologic differences, including the definition of injury, which should be considered when reviewing the data. However, the larger point is that the data-collection system within the AT-PBRN is capable of documenting the large number of injuries evaluated by athletic trainers. We as well as Powell and Barber-Foss[41] reported that football, soccer, and basketball resulted in more reportable injuries than other sports. Another area of interest is body location of injury. Fernandez et al[34] found that football for boys and soccer for girls resulted in the most lower extremity injuries over the course of 1 year in a nationally representative sample of 100 secondary schools. In this study, 4350 injuries were reported, with 52.8% of these affecting the lower extremity. The most common diagnoses reported were ligament sprain (95% of all lower extremity injuries), strain (17.1%), contusion (12.1%), fracture (5%), and tendon strain (3.1%).[34] These injuries were primarily reported at the ankle (40.3%) and knee (25.3%). Our data are similar in that ankle sprain/strain was the most common injury diagnosis.

Although these epidemiologic investigations have begun to describe the incidence of injuries in different sports, they often do so by categorizing injuries either by body part or injury type,[34,40–42] which makes it difficult to evaluate the occurrence of specific injuries, such as ankle sprains. Including an EMR as part of the data-collection infrastructure allows all injuries to be linked directly to an ICD-9 code to provide more precise information about the specific injuries being evaluated and treated by athletic trainers.

### Secondary School Practice Characteristics

Establishing the clinical outcomes and effectiveness of athletic training services is a critical issue facing the profession.[43–48] Lack of information regarding the effectiveness of athletic training practice has been highlighted,[43,46,49] yet obtaining this important information takes time, training, and resources. Agencies such as the National Institutes of Health and Agency for Healthcare Research and Quality recognize these obstacles and have advocated the development and implementation of large-scale PBRNs, which take advantage of strong academic and community partnerships and shared resources and expertise. The PBRN infrastructure provides a highly successful mechanism for determining the clinical outcomes of care provided for numerous conditions and for translating research findings into clinical practice, ultimately improving patient care.[50–52]

To date, successful, large-scale efforts to obtain clinical outcomes data regarding athletic training services in any setting have been limited.[39,53] Albohm and Wilkerson[39] reported the largest multisite effort to evaluate the effectiveness of athletic trainers for improving HRQOL outcomes of their patients. They evaluated athletic training practice in a variety of health care settings (clinics, secondary school athletic training clinics, college or university athletic training clinics, and industrial settings) across the country. These data provide preliminary evidence that athletic trainers are effective at improving

the function and HRQOL of their patients; however, they did not provide additional information related to athletic trainers' practice characteristics beyond stating that 90% of all treatments were performed by athletic trainers.[39]

In the current investigation, the most common treatments provided were hot or cold pack and strapping or bracing, with less common treatments related to therapeutic exercise, massage, and modalities. These results are not surprising given the typical schedule of a secondary school athletic trainer. Significant social pressure is focused on quickly preparing athletes for practice, and little time is devoted to services that are more time consuming, such as manual therapy. In addition, injured athletes often do not report to practice and may be absent until the injury is healed, providing less opportunity for delivery of treatments such as functional exercise. The availability of athletic training supplies in the secondary school setting may also affect reported treatments. For example, not all schools have access to therapeutic modalities, such as electric stimulation, which may make their use in daily clinical practice less likely and, as a result, less often reported. Data are not available to evaluate the reasons for the practice patterns observed in this study. Future research is warranted to investigate the influences upon secondary school athletic training practice.

Another interesting finding was that of preventive treatments performed by the athletic trainer, captured through the daily sign-in log. Nearly half of all athletes who signed in for injury prevention received athletic training treatment, and almost 65% of individuals received taping or strapping. We are unaware of any other investigation that has captured the types of preventive treatments athletic trainers provide to secondary school athletes. These data will be helpful in characterizing the components of athlete care that often go unreported in the medical record because the athlete is uninjured.

Of particular interest regarding treatment data, although there were 877 new injuries recorded in the EMR, only 53.9% of these were coded for receiving an athletic trainer evaluation. All new injuries should have received a code for evaluation by an athletic trainer. Interestingly, among diagnoses and associated treatments (Table 6), concussive injuries were the most frequent (87.8%) injury to receive an injury evaluation by the athletic trainer code. In contrast, the most commonly diagnosed injury, the ankle sprain or strain, received the athletic trainer evaluation code for fewer than half of the reported injuries. Lack of coding for athletic trainer evaluation was also noted in the daily sign-in log, with less than half of new injuries receiving the evaluation code. The reason for this inconsistency warrants further investigation, but the coding of athletic training services is rarely required by employers because records are not being scrutinized by third-party payers, which may be part of the reason for poorly coded records. However, the finding that concussions were more often coded correctly with the athletic trainer evaluation code suggests that documenting and coding a thorough evaluation for some injuries may be viewed as more meaningful or important than with other, perhaps less serious conditions (eg, sprains).

In addition to the poor coding for the actual evaluation by the athletic trainer, poor coding was noted for other treatments as well. For example, approximately 19% of patients with sprains and strains reportedly received an ice or hot pack. This percentage is likely low given the common practice of rest, ice, compression, and elevation for the treatment of acute injuries, especially ankle sprains and strains. Clinicians may view treatments such as ice to be standard components of care that do not warrant detailed reporting, although this idea warrants further study. This is one area in which the AT-PBRN must further emphasize in training and education provided to participating clinicians that all treatments be appropriately documented within the EMR and that clinicians understand the value and benefit of complete documentation.

Concerns about medical coding are not new, even in professions with a long history of coding practice.[54] One study[55] reported on the accuracy of administrative data in health records, focusing specifically on diagnosis information, and found that the primary diagnosis was correctly recorded in only 57% of visits. Errors in coding were attributed to physician diagnostic error, missing forms, and inaccurate data entry. Lack of coding for standard, routine components of athlete health care, such as the actual injury evaluation or the administration of ice for an acute injury, is not surprising. The majority of secondary school athletic trainers do not bill for services; thus, they have less incentive to code their care and may not fully appreciate the value coding could bring to their practice. Incomplete documentation is problematic, and efforts should be made to better educate and inform athletic trainers as to the importance of documentation and proper medical record coding to facilitate accuracy in these essential health records.

## CONCLUSIONS

This 2-part series is intended to provide an overview of PBRNs and the initial descriptive data of secondary school CPSs from the AT-PBRN. Our findings demonstrate that secondary school ATs are capable of documenting patient care in a manner that allows for the subsequent analysis of practice characteristics in the secondary school setting. The most common diagnoses of ankle sprain/strain, hip sprain/strain, and concussion and the most common treatment or procedure of athletic trainer evaluation provide additional information regarding the injuries evaluated and documented most frequently in the secondary school setting and can serve as a starting point for future prospective studies aimed at evaluating the effectiveness of treatment options for injuries sustained by adolescent patients.

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