### Abstract 427

**APPLYING BAYESIAN NETWORKS TO INJURY OCCURRENCE IN PROFESSIONAL FOOTBALL**

1^1^,2^2^Kate Kai-Yee Yang, 3^3^Paul Pao-Yen Wu, 4^4^,5^5^,6^6^,7^7^Clare Arden, 2^2^Tobias Tröß, 2^2^Abed Hadji, 2^2^Karen aus der Fünten, 2^2^Anne Hecksteden, 2^2^Fabio Serpiello, 1^1^Sam Robertson. 1^1^Institute for Health and Sport (IHES), Victoria University, Melbourne, Australia; 2^2^Institute for Sports and Preventive Medicine, Saarland University, Saarbrücken, Germany; 3^3^School of Mathematical Sciences, Queensland University of Technology, Brisbane, Australia; 4^4^ARC Centre of Excellence in Mathematical and Statistical Frontiers (ACEMS), Melbourne, Australia; 5^5^Musculoskeletal and Sports Injury Epidemiology Centre, Department of Health Promotion Science, Södahlhemmet University, Stockholm, Sweden; 6^6^Sport and Exercise Medicine Research Centre, La Trobe University, Melbourne, Australia; 7^7^Department of Family Practice, University of British Columbia, Vancouver, Canada

Background Bayesian networks (BN) are directed acyclic graphs derived from empirical data that describe the dependency and probability structure. It may facilitate understanding of complex epidemiology by presenting the data in a multi-dimensional visual representation, and guiding inferences on the likelihood of the severity based on new information.

Objective To provide a brief overview of BN and demonstrate its utility on a practical example of making inferences on days of absence when hypothetically new information was introduced.

Design Retrospective analysis of prospectively collected injury data.

Participants All male football players who were playing in the highest German professional league (Bundesliga) from 2014/15 to 2019/20 seasons were included. Players were identified from a publicly available database.

Data analysis A BN structure was inferred using GeNiE 2.0. A search and score algorithm and existing empirical evidence knowledge were used to identify the structure. The variables included were age, height, weight, main position, part of the season, injury type, the injured body part, days of absence. The parameters were calculated with the expectation-maximization algorithm.

Main Outcome Measurements Injury severity based on days of absence (mild: <4, minimal >4–7, moderate >7–28, severe >28).

Results 3,030 player seasons were registered over the six seasons (age: 25.5±4.0, height (cm): 183.3±6.4 and weight (kg): 78.3±6.8), with 5,883 time-loss injuries. A network structure with distribution probability was built.

A hypothetical scenario is used to illustrate how a BN makes inferences regarding injury severity. Case 1, a defender, 20 years old, suffered from a groin muscle injury. Case 2, a defender, 27 years old, suffered from a thigh muscle injury. Based on the BN constructed, we can infer the likelihood of the injury severity and the result is shown in Table 1. The result is based on the Bundesliga dataset and is specific to the study population. Counterfactual analysis may be used to inform coaches and clinicians about the likelihood of severity of an injury based on the features of the injury, for example, the characteristics of the player and the game.

Conclusions The BN may offer an enhanced insight into the complex epidemiological systems and guide inferences on injury severity based on new information. This may potentially help clinicians in creating hypothetical scenarios on the severity and facilitate shared decision making.

| Abstract 427 Table 1 The probability of injury severity of two hypothetical cases |
|---------------------------|-----------------|-----------------|-----------------|-----------------|
|                         | Mild | Minimal | Moderate | Severe |
| Case 1                  | 0.26 | 0.41    | 0.24    | 0.09    |
| Case 2                  | 0.19 | 0.31    | 0.32    | 0.17    |