INTRODUCTION

Wheelchair basketball is a variation of basketball and played by people with different physical disabilities. It has been part of the Paralympic Games (POG) since the 1960s. The International Wheelchair Basketball Federation (IWBF) organizes official world championships since 1975, which are currently played every 2 years after the Summer POG. The basic rules of wheelchair basketball are comparable to pedestrian basketball, with differences in dribbling and bouncing of the ball due to the simultaneous maneuvering of the wheelchair.

While injury epidemiology in Olympic sports has been investigated intensively,1-4 Paralympic sports have not been...
examined in such detail. The first published study reports that 79% of British basketball players suffered an injury during the 1992 POG. Curtis and Dillon found that basketball players were the second most injured athletes among wheelchair sports (after track and field). Systematic injury surveillance has been implemented and published for the Summer POG in 2012 and 2016 and the Winter POG in 2018. Wheelchair basketball was reported to have an injury incidence rate of 12.0 injuries per 1000 athlete-days (95% CI: 8.3-16.8) in 2012 and 12.8 injuries per 1000 athlete-days (95% CI: 9.5-17.4) in 2016. More traumatic than overuse injuries were reported from wheelchair basketball during the 2012 POG.

Only little data exist on details of injury, such as injury locations and risk factors, suggesting a higher injury risk for upper extremities in all wheelchair sports. Shoulder pain has been retrospectively documented to be prevalent among around half of female players during a major tournament, and prevention strategies for shoulder problems have already been implemented in a pilot study. In summary, only little is known about injury rates and characteristics in wheelchair basketball. Since such information is the first of several steps needed to develop adequate injury prevention strategies, the aim of this study was to analyze the rate and characteristics of injuries during the Wheelchair Basketball World Championships 2018 (WBWC).

2 MATERIALS AND METHODS

2.1 Study design, setting, and participants

A prospective injury surveillance study on acute and overuse injuries newly incurred during the WBWC was conducted. The overall study population comprised 28 teams from 19 different countries with a total of 336 players (male: 16 teams with 192 players; female: 12 teams with 144 players) participating in the WBWC held from August 16 to August 26, 2018, in Hamburg, Germany. During the 11 days of the championships, 94 matches were played, 48 by male and 46 by female teams. The total exposure was 940 player-matches and 3696 player-days.

2.2 Injury surveillance

For the prospective injury surveillance during the WBWC, the standardized system of the International Olympic Committee was used, which is also well established in international tournaments of other sports federations. An injury was defined as any newly incurred musculo-skeletal complaint (traumatic or overuse) and/or concussion during the tournament receiving medical attention regardless of the consequences for participation. The teams’ medical staff reported daily details of all newly incurred injuries and player details (age, sex, disability classification) on a standardized injury report form. The injury report form was an adapted version of the ones used by IOC, IAAF, and FINA with predefined categories for location, type, cause, match/training, and estimated duration of time loss. The disability scores (1-4.5) are according to the grade of disability and physical basketball-relevant functionality. Low rates represent a high grade of disability. The injury report form was paper-based and available in English and German.

2.3 Calculation of exposure time and injury rates

Team sizes and team match exposure were determined based on the publicly available roster and schedule. All teams had training sessions on days without a match before their elimination. Player-matches were calculated by multiplying the number of players by a number by matches, and player training days by multiplying number of players per team multiplied by the number of training sessions. Player-days were calculated by multiplying the number of registered players by number of days of the WBWC.

Injury rates were calculated as number of injuries per 100 players, per 1000 player-days, as training injuries per 1000 player training days, and as match injuries per match and per 1000 player-matches, and reported with 95% CIs.

2.4 Data collection

The study was introduced at the educational meeting for IWBF team manager 1 day prior to the WBWC. All teams willing to participate in the injury surveillance study received information regarding the purpose and logistics of the study. During the championships, one member of the study group (FG) was present at the venue to encourage and assist with participation in cooperation with the local organizing committee. Response rates and quality of data were analyzed daily. One country was excluded completely due to insufficient and implausible reporting (ie, returning report forms without any data). Duplication of data entries (such as reporting of the same injury of the same player on more than 1 day) was resolved by consensus of AJ and KH. Injuries not caused by Wheelchair Basketball were excluded from the analysis. Confidentiality of all information was ensured, and no individual athlete or team could be identified. Ethical approval was granted by the Ethics Committee of the University of Hamburg (protocol number AZ 2018_198). All authors followed the rules of the Helsinki Declaration. The study reports according to the STROBE guidelines for reporting observational studies.

2.5 Statistical analysis

Results are described as means with standard deviation or frequencies with percentage. Differences in injury location,
type, and mechanism between groups (match vs. training and female vs. male) were analyzed using chi-square tests. All data were processed using Excel (for Mac 11, version 14.7.1, Microsoft Cooperation) and SPSS (V.23).

3 | RESULTS

3.1 | Injuries during the championships

Six female and five male teams with a total of 132 players (mean ± SD age 29.7 ± 6.1) from nine different countries participated in the study (Table 1). The response rate of participating teams was 57.9%, and coverage of all teams and players was 39.3% (for details, see Figure 1). These 11 teams played 74 matches and completed 34 training sessions during a total of 1452 player-days. Exposure time, and number and rates of injuries during the WBWC are presented in Table 2.

One hundred injuries were reported, equivalent to 75.8 injuries per 100 players (95% CI: 60.9-90.7). Forty-two injuries were incurred by female players (58.3 injuries per 100 players; 95% CI: 40.7-75.9) and 58 by male players (96.7 injuries per 100 players; 95% CI: 71.8-121.5). Sixty-eight injuries occurred during matches, equivalent to an incidence of 1.8 match injuries per match (95% CI: 1.4-2.3) or 183.8 match injuries per 1000 player-matches (95% CI: 140.1-227.5).

The predominant locations of injuries were neck/cervical spine (16.0%), thoracic spine/upper back (15.0%), and shoulder (14.0%; Table 3). The most frequent types were muscle spasms (25.0%), contusions (16.0%), and skin lesions (13.0%). Most frequent diagnoses were muscle spasms of cervical or thoracic spine, followed by skin lesion or contusion of the elbow (Table 4). The predominant injury mechanisms were overuse (52.0%) and acute trauma due to contact with other players (21.0%).

No significant differences between training and match injuries were found regarding location and type but for mechanism ($\chi^2 = 11.1, P = .05$; Table 3). Injuries of female and male players differed significantly in mechanism ($\chi^2 = 15.4, P < .01$) but not for location or type (Table 3). Male players had a higher percentage of contact injuries with players, while female players had more non-contact injuries (eg, falls). No sex difference was observed in the proportion of match and training injuries. Distribution of injury numbers and rates shows a wide range over disability classification (Table 5).

Eight time-loss injuries were reported (6.1 injuries per 100 players; 95% CI: 1.9-10.3), four in female (5.6 injuries per 100 players; 95% CI: 0.1-11.1) and four in male players (6.7 injuries per 100 players; 95% CI: 0.1-13.3). Five time-loss injuries were incurred during matches, equivalent to 13.5 injuries per 1000 player-matches (95% CI: 1.7-25.4). The eight time-loss injuries were fracture of coccyx/sacrum, ligamentous rupture in the thumb, sprain of finger, contusion of elbow, shoulder sprain, tendinopathy of cervical spine, contusion of wrist, and spasms in the neck muscles.
4 | DISCUSSION

This is the first prospective epidemiological study on injuries in wheelchair basketball during a major tournament. The overall injury rate was 75.8 injuries per 100 players or 68.9 injuries per 1000 player-days. About half of the injuries were incurred due to overuse, and a quarter were classified as muscle spasms, mainly at the cervical and thoracic spine. Two-thirds of the injuries occurred during matches, and eight injuries lead to time loss with a maximum of two days. Injury mechanisms differed between training and match, and between female and male players.

4.1 | Injury rates and characteristics

From the Barcelona 1992 Paralympic games, one team reported an injury rate of 79 injuries per 100 athletes in wheelchair basketball, which is similar to our rate of 75.8 injuries per 100 athletes. In another retrospective study, 71% of wheelchair basketball players reported to have sustained an injury throughout their career. During the 2012 and 2016 POG, injury rates in wheelchair basketball were 12.0 (8.3-16.8) respective 12.8 (9.5-17.4) per 1000 athlete-days.7,8 Compared to these data, the rate of all injuries during the WBWC was substantially higher (68.9 injuries per 1000 player-days). Reasons for this could lie in the excellent compliance in reporting and the high number of reported non–time-loss injuries (such as muscle spasms and skin lacerations) due to the small number of medical staff and daily presence of one member of the study group at the venue. Further, the rate of time-loss injuries (5.5 injuries per 1000 player-days) was about half of the incidence of all injuries reported from the POG 2012 and 2016. Unfortunately, rates of time-loss injuries were not reported from POG. These few publications on injury rates in wheelchair basketball reported no further differentiation of injuries according to sex, match/practice, location, or mechanism.7,8 Compared to pedestrian basketball, where injuries predominantly occurred at the ankle and knee,22 wheelchair basketball players were more likely to sustain an injury at the cervical and thoracic spine and the upper extremity.

FIGURE 1 Flow diagram of injury surveillance during the Wheelchair Basketball World Championships 2018
TABLE 2  Exposure, number, and incidence of all injuries and of time-loss (TL) injuries during the Wheelchair Basketball World Championships 2018

| Number of          | Men       | Women     | Total     |
|--------------------|-----------|-----------|-----------|
| Players            | 60        | 72        | 132       |
| Player-days        | 660       | 792       | 1452      |
| Team matches       | 29        | 45        | 74        |
| Player-matches     | 145       | 225       | 370       |
| Team training days | 21        | 13        | 34        |
| Player training days | 252     | 156       | 408       |
| All TL injuries    | 58        | 42        | 100       |
| Match injuries     | 37        | 31        | 68        |
| Training injuries  | 21        | 11        | 32        |
| TL match injuries  | 2         | 3         | 5         |
| TL training injuries | 2       | 1         | 3         |

Injuries per 100 players (± CI 95%)

| All injuries       | 96.7 (71.8-121.5) | 58.3 (40.7-76.0) | 75.8 (60.9-90.6) |
| Match injuries     | 61.7 (41.8-81.5)  | 43.1 (27.9-58.2) | 51.5 (39.3-63.8) |
| Training injuries  | 35.0 (20.0-50.0)  | 15.3 (6.2-24.3)  | 24.2 (15.8-32.6) |
| All TL injuries    | 6.7 (0.1-13.3)    | 5.6 (0.1-11.1)   | 6.1 (1.9-10.3)   |
| TL match injuries  | 3.3 (0.0-7.9)     | 4.2 (0.0-9.0)    | 3.8 (0.5-7.1)    |
| TL training injuries | 3.3 (0.0-7.9) | 1.4 (0.0-4.1) | 2.3 (0.0-4.9) |

Injuries per 1000 player-days (± CI 95%)

| All injuries       | 87.9 (65.3-110.5) | 53.0 (37.0-69.0) | 68.9 (55.4-82.4) |
| TL injuries        | 6.1 (0.1-12.1)    | 5.1 (0.1-10.1)   | 5.5 (1.7-9.3)    |
| Training injuries  | 83.3 (47.7-119.0) | 70.5 (28.8-112.2) | 78.4 (51.3-105.6) |
| TL training injuries per 1000 player trainings | 7.9 (0.0-18.8) | 6.4 (0.0-18.9) | 7.4 (0.0-18.8) |

Incidence of match injuries (± CI 95%)

| Match injuries per match | 2.6 (1.7-3.4) | 1.4 (0.9-1.9) | 1.8 (1.4-2.3) |
| TL match injuries per match | 0.1 (0.0-0.2) | 0.1 (0.0-0.2) | 0.1 (0.0-0.2) |
| Match injuries per 1000 player-matches | 255.2 (173.0-337.4) | 137.8 (89.3-186.3) | 183.8 (140.1-227.5) |
| TL match injuries per 1000 player-matches | 13.8 (0.0-32.9) | 13.3 (0.0-28.4) | 13.5 (1.7-25.4) |

Abbreviations: 95% CI, 95% confidence interval, TL, time loss.

No differences in match and training injuries were found regarding location and type but in mechanism. An increase in injury risk during matches can be assumed, which has been reported in pedestrian basketball and other team sports.\(^2\)\(^2\)\(^\text{22-25}\) However, comparing the injury rates to data during a regular season is not possible at the moment and should be investigated in future studies.

Most injuries occurred at the neck, back, and upper extremity, especially at the shoulder. This is consistent with other reports on wheelchair sports\(^5\)\(^,\)\(^26\) and could be explained by the fixation of the lower back and lower extremity in the wheelchair. A shoulder injury prevention program has already been investigated in a pilot study and should be further evaluated in future studies.\(^13\) In the present study, 52% of the injuries were due to overuse, while during the 2012 London Paralympic games, acute traumatic injuries have been reported to be more prevalent (65%).\(^7\) Therefore, both injury mechanisms (trauma and overuse) seem to be a problem in wheelchair basketball and should be addressed in injury prevention.

In this study, we provide data on injury numbers and rates according to disability classification. There seem to be differences in the injury rates, even though numbers were too small for a proper analysis. Unfortunately, these data cannot be compared to other research in wheelchair basketball. Future prospective studies in wheelchair basketball should consider including the disability classification as a relevant factor.\(^27\)

Eight time-loss injuries (6.1 injuries per 100 players) were reported in our study, which is similar to pedestrian basketball during major tournaments.\(^3\) Furthermore, in contrast to a retrospective study on concussions in wheelchair basketball reporting that 6.2% of players had sustained a concussion during the 2012 London Paralympic games, acute traumatic injuries have been reported to be more prevalent (65%).\(^7\) No concussion was reported in our study. However, unreported minor concussions have been estimated to be prevalent in about half of the cases.\(^29\)

4.2 | Strengths and limitations/methodological considerations

This study was the first that reported details on rates and characteristic of injuries of wheelchair basketball players during a major tournament. Injury surveillance is an important step to develop injury prevention measures and reduce the athlete’s injury risk.\(^30\) Nonetheless, this study has some limitations that should be addressed in future studies. Selection bias might have occurred, since teams with more medical personal could have been more willing to participate in the study. Therefore, we do not know whether this population is representative of all elite wheelchair basketball players, and it might not be representative of all non-elite players. Regarding exposure data, training days were documented on a team level, and thus, training injury rates
might be underestimated if single players missed a training session. Female teams had to play more games during the tournament compared to male teams, which increased the match exposure for female players. Furthermore, only newly incurred injuries were monitored, while illnesses were not surveyed, even though illnesses in athletes with disabilities are very relevant\(^3\) especially urinary tract infections, decubitus ulcers, and temperature regulation disorders have been reported scientifically and anecdotally by team physicians.\(^6\,3^\) The Oslo Sports Trauma Research Center (OSTRC) questionnaire could be a potential tool to conduct such studies.\(^3^5\,3^6\)

**TABLE 3** Characteristics of match and training injuries during the Wheelchair Basketball World Championships 2018

| Number of injuries | Match n = 68 n (%) | Training n = 32 n (%) | Women n = 42 n (%) | Men n = 58 n (%) | Total n = 100 n (%) |
|--------------------|-------------------|----------------------|------------------|----------------|-------------------|
| **Location**       |                   |                      |                  |                |                   |
| Head               | 1 (1.5)           | 0                    | 1 (2.4)          | 0              | 1 (1)             |
| Neck/cervical spine| 7 (10.3)          | 9 (28.1)             | 5 (11.9)         | 11 (19.0)      | 16 (16.0)         |
| Thoracic spine/upper back | 9 (13.2)     | 6 (18.8)             | 5 (11.9)         | 10 (17.2)      | 15 (15.0)         |
| Lumbar spine/lower back | 7 (10.3)    | 1 (3.1)              | 3 (7.1)          | 5 (8.6)        | 8 (8.0)           |
| Abdomen            | 2 (2.9)           | 0                    | 0                | 2 (3.4)        | 2 (2.0)           |
| Pelvis/sacrum/buttock | 1 (1.5)       | 2 (6.3)              | 2 (4.8)          | 1 (1.7)        | 3 (3.0)           |
| Shoulder           | 11 (16.2)         | 3 (9.4)              | 9 (21.4)         | 5 (8.6)        | 14 (14.0)         |
| Upper arm          | 2 (2.9)           | 0                    | 0                | 2 (3.4)        | 2 (2.0)           |
| Elbow              | 8 (11.8)          | 3 (9.4)              | 7 (16.7)         | 4 (6.9)        | 11 (11.0)         |
| Upper or lower arm | 6 (8.8)           | 0                    | 0                | 6 (10.3)       | 6 (6.0)           |
| Wrist              | 6 (8.8)           | 2 (6.2)              | 4 (9.5)          | 4 (6.9)        | 8 (8.0)           |
| Hand/finger        | 6 (8.8)           | 4 (12.5)             | 4 (9.5)          | 6 (10.3)       | 10 (10.0)         |
| Thigh              | 2 (2.9)           | 0                    | 0                | 2 (3.4)        | 2 (2.0)           |
| Knee               | 0                 | 2 (6.3)              | 2 (4.8)          | 0              | 2 (2.0)           |
| **Type**           |                   |                      |                  |                |                   |
| Fracture           | 0                 | 2 (6.3)              | 1 (2.4)          | 1 (1.7)        | 2 (2.0)           |
| Tendon/ligament rupture | 1 (1.5)     | 0                    | 0                | 1 (1.7)        | 1 (1.0)           |
| (Sub-)luxation/sprain | 6 (8.8)     | 3 (9.4)              | 5 (11.9)         | 4 (6.9)        | 9 (9.0)           |
| Strain             | 5 (7.4)           | 1 (3.1)              | 2 (4.8)          | 4 (6.9)        | 6 (6.0)           |
| Contusion           | 13 (19.1)         | 3 (9.4)              | 7 (16.7)         | 9 (15.5)       | 16 (16.0)         |
| Laceration, skin lesion | 10 (14.7)   | 3 (9.4)              | 10 (23.8)        | 3 (5.2)        | 13 (13.0)         |
| Tendinosis, arthritis, or similar | 4 (5.9) | 5 (15.6)             | 5 (11.9)         | 4 (6.9)        | 9 (9.0)           |
| Impingement        | 4 (5.9)           | 1 (3.1)              | 1 (2.4)          | 4 (6.9)        | 5 (5.0)           |
| Muscle spasm       | 18 (26.5)         | 7 (21.9)             | 8 (19.0)         | 17 (29.3)      | 25 (25.0)         |
| Others             | 7 (10.3)          | 7 (21.9)             | 3 (7.1)          | 11 (19.0)      | 14 (14.0)         |
| **Mechanism**      |                   |                      |                  |                |                   |
| Overuse            | 32 (47.1)         | 20 (62.5)            | 20 (47.6)        | 32 (55.2)      | 52 (52.0)         |
| Non-cont. trauma (eg, fall) | 4 (5.9)  | 5 (15.6)             | 8 (19.0)         | 1 (1.7)        | 9 (9.0)           |
| Recurrent injury   | 2 (2.9)           | 1 (3.1)              | 3 (7.1)          | 0              | 3 (3.0)           |
| Contact with player | 20 (29.4)  | 1 (3.1)              | 5 (11.9)         | 16 (27.6)      | 21 (21.0)         |
| Contact with object others | 6 (8.8) | 4 (12.5)             | 4 (9.5)          | 6 (10.3)       | 10 (10.0)         |
| Other              | 4 (5.9)           | 1 (3.1)              | 2 (4.8)          | 3 (5.2)        | 5 (5.0)           |
| **Time loss (in days)** |          |                      |                  |                |                   |
| 0                  | 63 (92.6)         | 29 (90.6)            | 38 (90.5)        | 54 (93.1)      | 92 (92.0)         |
| 1-2                | 5 (7.4)           | 3 (9.4)              | 4 (9.5)          | 4 (6.9)        | 8 (8.0)           |
The sample size of our study was not high enough for an in-depth analysis of the effect of disability classification on injury risk, and this should be taken into consideration in future prospective studies in wheelchair basketball.

4.3 | Perspective

A shoulder injury prevention program focussing on flexibility and strength has been shown to improve shoulder rotational range of motion (ROM) in a pilot study on seven wheelchair basketball players. Internal and external shoulder rotation ROM is considered to be a risk factor for shoulder pain and injury; however, its impact on prevention has not been investigated in wheelchair athletes. In addition, future injury prevention should try to influence the high numbers of muscle spasms by investigating their pathophysiology and etiology. To date, only little is known about the pathophysiology of muscle spasms in athletes with disabilities, especially spinal cord injured athletes who have problems regarding their thermoregulatory function. Adequate rehydration, supplementation of electrolytes (sodium), or stretching strategies during the competition period have been reported to be possible prevention strategies of exercise-associated muscle spasms.

It is known that injuries differ between sport disciplines and that injury surveillance during tournaments is essential to determine sport-specific risk factors for injuries. Since tournaments are just a small part of the athlete’s life, routine monitoring of injuries and health complaints throughout the athletic season is recommended. A more complex approach regarding the nonlinear interaction of risk factors (“web of determinants”) and pattern recognition techniques should be implemented in future studies to improve prediction and prevention of injuries as proposed by Bittencourt et al (2016).

In conclusion, a higher injury rate was found compared to the rates reported from POG. A more detailed analysis of injuries characteristics revealed a high number of non–time-loss injuries, such as muscle spasms and skin laceration. Most injuries occurred at the neck, upper back, and shoulder. Eight minor time-loss injuries and no moderate or severe injuries were reported. High injury rates could be reduced targeting preventable injuries such as muscle spasms, strains, and sprains.

### Table 4

| Injured body part | Fracture | Tendon/ligament rupture | (Sub-)luxation/sprain | Strain | Contusion | Laceration, skin lesion | Tendinosis, arthritis, or similar | Impingement | Muscle spasms | Others |
|------------------|----------|-------------------------|-----------------------|--------|-----------|------------------------|---------------------------------|--------------|--------------|--------|
| Head             | 0        | 0                       | 0                     | 0      | 1         | 0                      | 0                               | 0            | 0            | 1      |
| Neck/cervical spine | 0     | 0                       | 0                     | 0      | 0         | 1                      | 2                               | 0            | 9            | 4      |
| Thoracic spine/upper back | 0 | 0                       | 0                     | 1      | 0         | 0                      | 4                               | 1            | 8            | 1      |
| Lumbar spine/lower back | 0 | 0                       | 0                     | 3      | 0         | 0                      | 0                               | 0            | 3            | 2      |
| Abdomen          | 0        | 0                       | 0                     | 0      | 0         | 0                      | 0                               | 2            | 0            | 2      |
| Pelvis/sacrum    | 1        | 0                       | 0                     | 0      | 0         | 0                      | 0                               | 1            | 0            | 1      |
| Shoulder         | 0        | 0                       | 2                     | 1      | 3         | 4                      | 1                               | 0            | 1            | 2      |
| Upper arm        | 0        | 0                       | 0                     | 1      | 0         | 1                      | 0                               | 0            | 0            | 2      |
| Elbow            | 0        | 0                       | 0                     | 5      | 6         | 0                      | 0                               | 0            | 0            | 11     |
| Upper or lower arm | 0      | 0                       | 0                     | 1      | 0         | 0                      | 3                               | 2            | 6            |        |
| Wrist            | 0        | 0                       | 2                     | 0      | 4         | 0                      | 2                               | 0            | 0            | 8      |
| Hand/finger      | 1        | 1                       | 4                     | 0      | 1         | 0                      | 0                               | 1            | 1            | 10     |
| Thigh            | 0        | 0                       | 0                     | 0      | 1         | 0                      | 0                               | 0            | 0            | 1      |
| Knee             | 0        | 0                       | 1                     | 0      | 1         | 0                      | 0                               | 0            | 0            | 2      |
| Total            | 2        | 1                       | 9                     | 6      | 16        | 13                     | 9                               | 5            | 25           | 14     |
TABLE 5 Number of injuries and injury rates during the Wheelchair Basketball World Championships 2018 according to disability classification

| Disability classification | Match n = 68 | Training n = 32 | Women n = 42 | Men n = 58 | Total n = 100 | Injuries/100 players n = 100 | Injuries/1000 player-h n = 100 |
|---------------------------|-------------|----------------|-------------|------------|---------------|-----------------------------|-------------------------------|
|                           | n (%)       | n (%)          | n (%)       | n (%)      | IR (95% CI)   | IR (95% CI)                 |                               |
| 1.0 (n = 26)              | 14 (20.6)   | 6 (18.8)       | 5 (11.9)    | 15 (25.9)  | 20 (20.0)     | 76.9 (43.2-110.6)           | 69.9 (39.9-100.6)             |
| 1.5 (n = 11)              | 2 (2.9)     | 1 (3.1)        | 2 (4.8)     | 1 (1.7)    | 3 (3.0)       | 27.3 (0.0-58.1)             | 24.8 (0.0-52.8)              |
| 2.0 (n = 11)              | 4 (5.9)     | 5 (15.6)       | 3 (7.1)     | 6 (10.3)   | 9 (9.0)       | 81.8 (28.4-135.3)           | 74.4 (25.8-123.0)            |
| 2.5 (n = 17)              | 16 (23.5)   | 5 (15.6)       | 9 (21.4)    | 12 (20.7)  | 21 (21.0)     | 123.5 (70.7-176.4)          | 112.3 (64.3-160.3)           |
| 3.0 (n = 18)              | 10 (14.7)   | 5 (15.6)       | 4 (9.5)     | 11 (19.0)  | 15 (15.0)     | 83.3 (41.2-125.5.0)         | 75.8 (37.4-114.1)            |
| 3.5 (n = 7)               | 3 (4.4)     | 1 (3.1)        | 1 (2.4)     | 3 (5.2)    | 4 (4.0)       | 57.1 (1.1-113.1)            | 51.9 (1.0-102.9)             |
| 4.0 (n = 21)              | 10 (14.7)   | 5 (15.6)       | 7 (16.7)    | 8 (13.8)   | 15 (15.0)     | 71.4 (35.3-107.6)           | 64.9 (32.1-97.8)             |
| 4.5 (n = 21)              | 9 (13.2)    | 3 (9.4)        | 11 (26.2)   | 1 (1.7)    | 12 (12.0)     | 57.1 (24.8-89.5)            | 51.9 (22.6-81.3)             |

Abbreviations: 95% CI, 95% confidence interval; IR: injury rate.

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