Circus-specific extension of the International Olympic Committee 2020 consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport

Stephanie Greenspan, David Munro, Joanna Nicholas, Janine Stubbe, Melanie I Stuckey, Rogier M Van Rijn

ABSTRACT
Indepth knowledge of injury and illness epidemiology in circus arts is lacking. Comparing results across studies is difficult due to inconsistent methods and definitions. In 2020, the International Olympic Committee (IOC) consensus group proposed a standard method for recording and reporting epidemiological data on injuries and illnesses in sport and stated that sport-specific extension statements are needed to capture the context of each sport. This is the circus-specific extension to be used with the IOC consensus statement. International circus arts researchers in injury and illness epidemiology and performing arts medicine formed a consensus working group. Consensus statement development included a review of literature, creation of an initial draft by the working group, feedback from external reviewers, integration of feedback into the second draft and a consensus on the final document. This consensus statement contains circus-specific information on (1) injury definitions and characteristics; (2) measures of severity and exposure, with recommendations for calculating the incidence and prevalence; (3) a healthcare practitioner report form; (4) a self-report form capturing health complaints with training and performance exposure; and (5) a demographic, health history and circus experience intake questionnaire. This guideline facilitates comparing results across studies and enables combining data sets on injuries in circus arts. This guideline informs circus-specific injury prevention, rehabilitation, and risk management to improve the performance and health of circus artists.

INTRODUCTION
Circus arts is practised globally in various contexts, including professional companies, freelance performance, preparatory schools, recreational training centres, social circus and physical education. Circus arts has similar skill and physical demands as sports such as gymnastics as it often requires high levels of strength, balance, flexibility, agility and motor coordination. However, circus is unique in that one of its central competencies is creativity, which involves challenging the physicality of performance from an artistic perspective to imagine, create and perform new tricks to construct an engaging, and often novel, aesthetic outcome. Creative circus practice also introduces a unique element of risk not often present in other sports and
performing arts. Circus arts encompasses several disciplines, including aerial acrobatics (eg, trapeze), ground acrobatics (eg, handbalancing), manipulation (eg, juggling), character (eg, clowning) and music, which have different physical requirements that carry specific risks of injuries.17 Circus artists often train and perform multiple disciplines. For professional artists, work may be seasonal and intermittent, different from sports with predictable, competitive seasons. The complexity of circus arts participation challenges the study of injury in this field.

Circus arts has proven artistic and cultural relevance to contemporary society and holistic health, social and educational benefits.8–15 As with any physical activity, its practice presents a risk of injury. A literature review reported injury rates ranging from 7.4 to 9.7 per 1000 performances or athlete-exposures in professional circus artists,3 6 16 17 and injury incidence estimates in circus arts students ranging from 0.3 to 3.5 injuries per 1000 exposure hours. Comparison among and consolidation of research studies are limited due to lack of studies and variation in injury definitions, methodologies, target groups, discipline classification systems and reporting. Therefore, a guideline to encourage consistent reporting methods, including research in all circus arts contexts, is needed.

In February 2020, the International Olympic Committee (IOC) released a consensus statement on the methods for recording and reporting of general sports injuries and illnesses.19 This statement serves as the standard for injury surveillance in sports, but the authors indicate the need for sport-specific extensions of the statement to be written by scientists and clinicians with indepth knowledge and experience to account for sport-specific activities and contexts. The aim of the Surveillance of Injuries in Research on Circus (SIRC) consensus working group was to create an extension statement to be used as a companion document to be referred to in conjunction with the 2020 IOC consensus statement.19

METHODS

The methods in this first circus-specific consensus statement were informed by those in the IOC consensus statement on injury and illness surveillance19 and the extension statements that followed.20–22 Our process included three stages.

In the first stage, working group members were selected from circus arts researchers in injury and illness epidemiology, performing arts medicine practitioners, circus artists and coaches from around the world who presented at the International Association for Dance Medicine and Science (IADMS) Annual Conference in October 2019 and the American Circus Educators Conference in October 2020. SG invited JS, RMVR, MIS, JN and DM to a virtual meeting in December 2020. This meeting aimed to propose an SIRC working group to develop an international consensus statement for circus injuries. The SIRC working group convened at a first virtual meeting in January 2021. Members included those with significant expertise regarding circus artists’ health monitoring in Europe, North America and Australia. Specifically, members represented various backgrounds, including academic teaching and research, circus arts physical therapy, and circus coaching, training and performance (online supplemental appendix 1). Members of the working group had experience working with circus artists from different ages, genders, circus disciplines and recreational through professional levels. The working group appointed SG to chair the consensus group.

The second stage involved reviewing and discussing pertinent literature, including the IOC consensus statement,19 sport consensus statements20–31 and the technical report of the IADMS Standard Measures Consensus Initiative.32 The working group decided to provide recommendations for injury recording and reports specific to circus arts, as an extension of the 2020 IOC consensus statement. All working group meetings were virtual due to the COVID-19 pandemic and geographical distance between members. Across four meetings between January and June 2021, the SIRC working group identified circus-specific additions needed for each IOC consensus statement subsection. Then working group members were assigned to draft the sections based on their content expertise. The section drafts were presented and discussed during the virtual meetings and revised according to feedback until there was a completed initial draft of the circus-specific statement.

During the third stage, five external reviewers, Marco Bortoleto, Agathe Dumont, Chris Gatti, Evert Verhagen and Kathy Yu, were invited to join the overall SIRC consensus group (online supplemental appendix 1) to review and provide feedback on the initial draft. The reviewers included representatives from circus organisations and circus networks, including the European Federation of Professional Circus Schools and the Circus Arts Research Platform, and individuals with expertise in sports injury epidemiology, sports medicine, circus arts research and coaching. The SIRC working group integrated the external reviewer feedback into a second circus-specific statement draft. The second draft was circulated among the working group members. All feedback and remarks were incorporated into the final draft. The working group approved and accepted this final version of the circus-specific extension statement, which provides circus-specific additions to be used alongside the IOC 2020 consensus statement.19

CONSENSUS RECOMMENDATIONS

Since there were no illnesses specific to the circus context, illnesses in circus arts should be recorded and reported in the same manner as recommended in the IOC consensus statement.19 Mental illness has important implications for participation in circus and potential for injury and the working group plans to address this at a later stage.
Defining and classifying health problems

Terminology for health problems

To adapt the definition of a health problem defined by Clarsen et al.19 and described in the IOC consensus statement,19 we define a circus artist’s health problem as any physical condition that reduces a circus artist’s normal state of full health, irrespective of its consequences on the circus artist’s participation or performance, or whether the circus artist sought medical attention.

Relationship to circus activity

The classification of the relationship of health problems to circus activities into three groups is deemed appropriate in the circus context. We only rephrased the wording to make it more suitable for the circus context. Health problems may result:

- **Directly** from circus participation in performance, rehearsal or training (eg, acrobat falls from a rope, faulty landing after a jump or overuse from repetitive training).
- **Indirectly** from participation in circus activities that relate to performance, rehearsal or training, but not during a performance, rehearsal or training (eg, slipping, falling and sustaining an injury when in the dressing room or air conditioning sickness during a stay in the hotel after a performance).
- Activities that are not at all related to circus activities, that is, would occur in the absence of circus participation during a performance, rehearsal or training (eg, car crash or sudden cardiac arrest at home).

We recommend reporting all health problems and their relationship to circus activities to get a complete view of the spectrum of problems encountered by circus artists. However, depending on the purposes of the study, researchers may want to report health problems in these categories separately or focus on specific categories only.

Defining injury

The definition of injury proposed by the IOC consensus statement was adapted to better suit the circus-specific context. We define injury as follows: injury is tissue damage or another derangement of normal physical function due to direct or indirect participation in circus activities, resulting from the rapid or repetitive transfer of kinetic energy.

Mode of onset

The IOC consensus statement recommends reporting injury onset as either sudden or gradual, along with the underlying or assumed mechanism of onset as acute (single traumatic event), repetitive (repetitive use or cumulative trauma) or a combination of both. These classifications are deemed appropriate in the context of circus arts, and circus-specific examples are provided in table 1.

Classifying the mechanism of injury

The IOC consensus statement recommends additional injury mechanism subclassifications to allow researchers and healthcare practitioners to gain a deeper understanding of the potential circumstances that may be related to causation. The mechanism subclassifications according to the type of contact (direct contact, indirect contact or non-contact) outlined in the IOC consensus statement are suitable in the circus context. Further, we recommend the inclusion of ‘no single identifiable event’, where it is not possible to determine the type of contact (table 2). For injuries resulting from direct and indirect contact, we recommend reporting the source of contact as either from the ground, object (to include mats) or another circus artist.

We also recommend recording the circus arts skill (which we define as a specific movement, manoeuvre, or component of the movement or manoeuvre), the discipline involved at the time of injury, and relevant

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**Table 1** Examples of circus-specific injury mode of onset

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Presentation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>Sudden onset</td>
<td>► An aerial acrobat loses hand grip while inverted on a trapeze and falls, hitting their head on an 8-inch crash mat, resulting in concussion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>► A ground acrobat inverts their ankle when landing from a back tuck on the trampoline, resulting in a lateral ankle sprain.</td>
</tr>
<tr>
<td>Repetitive</td>
<td>Sudden onset</td>
<td>► A contortionist experiences sudden onset of low back pain related to end-range spinal extension when training. Radiographs show an L4/L5 pars interarticularis fracture with spondylolisthesis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>► A ground acrobat has been complaining of soreness in the Achilles tendon over the last few weeks. After a tumbling pass, the acrobat has sudden onset of sharp posterior ankle pain. Imaging reveals rupture of the Achilles tendon.</td>
</tr>
<tr>
<td>Repetitive</td>
<td>Gradual onset</td>
<td>► An aerial acrobat has been intensively rehearsing new choreography, including dynamic beats on a rope, over the last month. Over the last 2 weeks, she developed shoulder pain related to rotator cuff tendinopathy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>► A juggler experiences gradual onset of neck pain that progresses into numbness in his thumb after an increased workload related to more performances per week and is diagnosed with cervical radiculopathy.</td>
</tr>
</tbody>
</table>
training patterns or factors that appear related to the injury (eg, participation in a workshop or drilling a new skill repeatedly). Injuries are often multifactorial, particularly gradual-onset injuries. Therefore, collecting additional information can assist in identifying potential factors related to the mechanism of injury.

Classifying circus arts injury diagnoses

The IOC consensus statement provides recommendations for classifying injuries based on body area, tissue and pathology type. We support the IOC statement for using sport-specific coding systems such as the Sport Medicine Diagnostic Coding System and the Orchard Sports Injury and Illness Classification System in relation to circus arts injury and illness classification. Injury recording should include as much detail as possible to allow for the most accurate classification level. Examples of circus-specific injury categorisation are provided in Table 2. As noted in the IOC consensus statement, some injuries will be reported by the healthcare practitioner, while others may be reported by non-medically trained staff, coaches, parents or athlete self-reporting. In instances of ‘non-expert’ reporting, Gabbe et al suggested that reporting should be limited to body area as their reporting of tissue type and pathology is unreliable. We recommend that additional information about the side of the body part injured should also be recorded if applicable. Examples of reporting forms are provided in online supplemental appendices 2 and 3.

When one incident results in more than one specific body part being injured, the IOC consensus statement suggests that each diagnosis should be recorded and classified separately. However, for actual incidence and prevalence reporting, such examples should be recorded as one injury. Severity, if being recorded, should be reported based on the most severe/significant injury.

Given the unusual nature of some circus acts, the potential for unique circus-specific injuries exists, for example tracheal burns sustained during a fire breathing performance or oesophageal injuries resulting from sword swallowing acts. New codes may need to be added to classify certain circus injuries.

Severity of health problems

The IOC consensus statement recommends using the duration of time lost, clinical assessment and severity score to quantify injury severity. Time-loss from all participation may not accurately describe circus-specific injury severity as participation is often modified, for example participating in some but not all disciplines, without complete cessation. To be more comprehensive, we recommend reporting full and partial time-loss, no
time-loss, and the degree and urgency of medical attention.

Injury severity is captured with either a healthcare practitioner report or the weekly self-report of health complaints and exposure to circus arts training and performance (online supplemental appendices 2 and 3). Time-loss injury severity should be reported as full time-loss from all circus participation or partial time-loss from at least one discipline for at least 1 day after the injury. Circus-specific examples are provided in table 4. Following the IOC consensus statement,19 time-loss duration should be counted as the day after injury onset (ie, the first full day of time-loss) through to the day before the artist resumes participation in all sessions of all circus disciplines or the day before they would have resumed full participation if they were not training due to other reasons, such as vacation. Injury severity should be categorised as mild (1–7 time-loss days), moderate (8–28 time-loss days) and severe (>28 time-loss days) as per the IOC consensus statement.19 To further characterise the most severe injuries, we recommend reporting on injuries causing disability and death as fatal, non-fatal disability or severe, as per catastrophic injury guidelines.39

Injuries not resulting in time-loss include activity modification without time-loss or full participation but with symptoms. Questions 1–4 on the self-report form (online supplemental appendix 3) capture no time-loss injuries using a modification of the Oslo Sports Trauma Research Center Questionnaire on Health Problems (OSTRC-H2).33 Questions 21, 22 and 23 differentiate complete time-loss, partial time-loss and no time-loss.

The IOC guideline recommends reporting injuries according to degree and urgency of medical attention.19 In the self-report form (online supplemental appendix 3), question 20 captures the type and degree of medical attention. Further details could be provided to capture urgency with the type of care needed (eg, diagnostic test, emergency room visit or ambulance ride).

**Table 4** Examples of circus-specific full and partial time-loss after injuries

<table>
<thead>
<tr>
<th>Case</th>
<th>Full time-loss (days)</th>
<th>Partial time-loss (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A circus performer falls during the act and cannot complete the act due to pain in the back. The performer returns for the remaining acts in the show.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A circus student is learning a new aerial inversion skill and notices progressively worsening shoulder pain. The student cannot finish the class session due to pain but can return to class the next day with some modifications.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A circus performer injured their shoulder during a performance on Thursday. The next day, the performer could not perform at all, and for the rest of the weekend cannot perform aerial act but can perform character role. On Monday, the performer resumes aerial act.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>A circus student injured their ankle practising a tumbling pass in class on Monday and has to sit out for the rest of the class. The student joins aerial class right after and can participate with modifications in class. The student misses tumbling classes for the rest of the week due to ankle injury but continues participating in other disciplines. The student returns to tumbling class the following Monday.</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>
supplemental appendix 4A). Training includes participation in the following: (1) physical conditioning for muscle performance or flexibility/joint mobility; (2) skill practice, artistic creation or choreography across all circus disciplines that occurs during classes or independent training; and (3) rehearsal (table 5). Activities such as warm-up or cool-down would also be considered training, even if occurring before or after a performance. All the time an artist is present on stage, including performing their primary discipline as well as any ensemble, character or supportive roles, is included in performance exposure.

Due to the complexity of the circus arts, we recommend, in addition to hours, also recording exposure as the number of sessions for each exposure type (eg, class, independent training, physical conditioning, rehearsal or performance; table 5) by specific circus discipline. We recommend recording disciplines by session since, in circus arts, it is common to train multiple disciplines within the same session. Therefore, calculating the time spent on each discipline within the class becomes cumbersome and prone to error. Depending on the size and objectives of the study, exposure might be recorded by a single discipline or discipline subgroup (table 6). Artist exposures are counted as individual sessions that may (1) be separated in time (eg, between classes or rehearsals on the same day); (2) include a separate warm-up; or (3) be a different discipline (eg, a single independent training practice that included silks and trapeze would be coded as two sessions, one of each discipline) and/or a different exposure type. Recording exposure should distinguish between the skill-based contortion discipline and general flexibility training. Exposure to performances should be recorded separately, similar to sports competition, and by specific circus discipline. An example of calculating 1 week of exposure for a single artist is provided in online supplemental appendix 4. To capture the intensity of the exposure, internal training load can be quantified using session rating of perceived exertion or other similar measures.41-43

Table 5  Artist exposure types in circus arts

<table>
<thead>
<tr>
<th>Exposure type</th>
<th>Definition</th>
<th>Exposure data recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class (student)*</td>
<td>This could include an individual or group class in which the artist is a student. May include warm-up, cool-down or discipline-specific conditioning activities, as well as arts, artistic creation and choreography.</td>
<td>Number of sessions by specific circus discipline.</td>
</tr>
<tr>
<td>Class (teacher)*</td>
<td>This could include individual or group classes in which the artist is in the role of a teacher and physically demonstrates warm-up, cool-down or discipline-specific conditioning activities, as well as arts, artistic creation and choreography.</td>
<td>Number of sessions by specific circus discipline.</td>
</tr>
<tr>
<td>Independent* training</td>
<td>This includes skill-specific training, artistic creation or choreography practice without a teacher guiding the session. May also include warm-up, cool-down or discipline-specific conditioning activities.</td>
<td>Number of sessions by specific circus discipline.</td>
</tr>
<tr>
<td>Rehearsal*</td>
<td>This includes practising a choreographed piece, act or entire show in preparation for a performance. This includes warm-up and cool-down.</td>
<td>Number of sessions by specific circus discipline.</td>
</tr>
<tr>
<td>Performance</td>
<td>This includes presenting a piece, act or entire show in front of an audience or recorded for an audience.</td>
<td>Number of performances by specific circus discipline. Please note time for a warm-up and cool-down would be recorded as training rather than performance exposure.*</td>
</tr>
<tr>
<td>Physical conditioning for muscle performance*</td>
<td>Physical conditioning to improve muscle activation, endurance, strength, power and/or coordination that is separate from training specific circus skills and not on a circus apparatus. This could include modes of exercises such as high-intensity interval training, where muscle performance exercises are used to achieve an elevated heart rate response.</td>
<td>Number of sessions. Could also specify the target body region or mode of training (eg, resisted training with weights, bodyweight exercise, etc).</td>
</tr>
<tr>
<td>Physical conditioning for flexibility/joint mobility*</td>
<td>Physical conditioning with the intent of increasing joint mobility or muscle flexibility. Please note this is different from contortion skill training.</td>
<td>Number of sessions. Could also specify the target body region or mode of training (eg, passive stretching, dynamic stretching/active flexibility, etc).</td>
</tr>
<tr>
<td>Other sports or fitness</td>
<td>Any sports or fitness activities that do not fit the above categories (eg, running, swimming, rock climbing, cycling, yoga).</td>
<td>Number of sessions. Could also specify the type of fitness training.</td>
</tr>
</tbody>
</table>

*Included in measuring exposure in hours to circus training.

Expressing risk: prevalence and incidence

Prevalence refers to the proportion of injured circus artists at any given point in time (eg, the start of the
Typically, prevalence is used to describe the overall extent of the circus injury problem and is a more appropriate measure for gradual-onset conditions. Prevalence can also be calculated for specific groups, such as per circus discipline.

Incidence describes the risk of developing a new injury among a population at risk during a specified time interval. Injury incidence is typically used to estimate academic year) or in a defined period (eg, show run, lifetime) for all circus artists in the study population.

### Table 6 Circus arts discipline subgroup classification

<table>
<thead>
<tr>
<th>Circus arts discipline subgroups</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Aerial acrobatics | Circus discipline in which the artist is often suspended from an apparatus by various body parts and commonly uses pulling movements, for example, to invert on or climb the apparatus. | ▶ Silks (or tissue, fabric).  
▶ Rope (or corde lisse), Spanish web.  
▶ Trapeze (static, dance, flying).  
▶ Aerial hoop (or Lyra).  
▶ Cloud swing/sling/hammock.  
▶ Straps/loop straps.  
▶ Rings (Russian or gymnastic).  
▶ Chains.  
▶ Hair hanging.  
▶ Air cradle.  
▶ Aerial pole.  
▶ Russian cradle (flyer).  
▶ Iron jaw. |
| Aerial acrobatics (with ground elements) | A subset of aerial acrobatics that often include impact and/or pushing movements in contact with the floor or apparatus. | ▶ Chinese pole/lollipop/pole dance.  
▶ Russian cradle (base).  
▶ High bar. |
| Ground acrobatics (human propulsion) | Discipline that involves repetitive skills such as jumping, diving, rotational or other gymnastics-type movements where height from the ground is the result of human propulsion. | ▶ Tumbling/parkour.  
▶ Jump rope.  
▶ Icarian games.  
▶ Hoop diving.  
▶ Cyr/German wheel.  
▶ Dance.  
▶ Banquine. |
| Ground acrobatics (apparatus propulsion) | Similar to the above, except that repetitive movements are performed on an apparatus or with a device that imparts an acceleration of the artists' movement, often resulting in landing from a significant height. | ▶ Teeterboard (Korean plank and Hungarian).  
▶ Russian swing.  
▶ Trampoline/tramp wall.  
▶ Wheel of death.  
▶ Trick riding (bicycle, motorcycle).  
▶ Bungee/harness. |
| Ground acrobatics (balance/control) | Includes disciplines where the artist is typically weight-bearing on a stable or unstable surface (apparatus or human), focusing on creating postures or shapes with control and balance. It may involve some impact transitioning into and out of postures or on and off the base or apparatus. | ▶ Contortion.  
▶ Handbalancing.  
▶ Hand to hand/adagio/acrodance.  
▶ Human stacking/pyramid.  
▶ Acrobatic chair/chair stacking.  
▶ Ladder.  
▶ Rola bolla/rolling globe.  
▶ Wire (tight, slack, high).  
▶ Stilts.  
▶ Trick riding (unicycle/horse).  
▶ Perch. |
| Manipulation | This discipline involves the artist creating repetitive movements with an object, often requiring significant coordination and fine motor skills. | ▶ Juggling.  
▶ Diabolo/poi.  
▶ Foot juggling/antipodism.  
▶ Contact juggling.  
▶ Flowerstick.  
▶ Hooping.  
▶ Fire.  
▶ Knife throwing.  
▶ Plate spinning.  
▶ Bullwhip.  
▶ Baton twirling. |
| Character | Discipline that often includes significant acting and theatrics. It may also include some acrobatic skills but typically with low physical demand. | ▶ Clown.  
▶ Ringmaster.  
▶ Mime. |
| Music | Discipline that involves singing or playing a musical instrument. | ▶ Vocals.  
▶ Instrumentalists. |

Adapted from Greenspan.³⁵
the risk of circus injuries and is a more appropriate measure for sudden-onset conditions. As described in the IOC consensus statement, several incidence-based measures can be applied. We recommend expressing risk as to the number of injuries per 1000 hours of circus activities because it takes into account relative exposure among circus artists and allows for comparisons between, for example, different sports (e.g., circus and gymnastics), types of activities (e.g., performances and classes), circus discipline subgroups (e.g., aerial acrobatics and ground acrobatics) or specific types of injury (e.g., ankle sprains and shoulder subluxations). It can be of interest to present the clinical incidence, which reflects the average number of injuries per circus artist during a certain period (e.g., school semester or the month following a holiday break) and can thus be used as an indicator for determining healthcare needs.

**Study population characteristics**

**Classification of circus arts disciplines**

To fully understand injuries among circus artists, differences among circus arts disciplines must be considered. Greenspan introduced an acrobatic circus arts discipline classification informed by the previous categorisations to define subgroups of circus disciplines where artists have similar physical demands. The classification was expanded to be more comprehensive for this consensus statement (table 6) and provides a framework for analysing injury patterns by subgroups of circus disciplines that could lead to interventions to decrease injury risk. Different subgroups of circus arts may have different injury risks, but within subgroups the individual disciplines may also have different injury risks. We recommend using this classification system for reporting circus arts injuries by discipline subgroup. To analyse injury patterns in smaller studies, combining all aerial and all ground acrobatics subgroups may be necessary.

**Demographics**

We recommend using the demographic, health history, and circus experience intake questionnaire (online supplemental appendix 5) to record the demographics and characteristics of the study population relevant to the circus context. In addition, we recommend including a standard health history questionnaire appropriate for the culture and language of the target population, such as sports participation history forms.

**Physical examination**

By performing physical assessments, we may determine if particular physical characteristics are associated with injury risk. We recommend including baseline physical examination tests and measures if qualified assessors are available. Measures might include joint hypermobility, joint range of motion, flexibility and strength. When possible, use tests similar to the functional requirements of circus activities, such as pull-ups for upper body strength or the double leg lowering test for abdominal strength. Functional performance measures may also be included, such as the star excursion test or the lower extremity Y balance test and the Landing Error Scoring System for lower extremity, or the upper extremity Y balance, closed kinetic chain upper extremity test and the seated shot put for upper extremity assessment.

**Data collection methods**

Guidelines for data collection methods proposed by the IOC consensus statement are generally appropriate for circus arts. Different methods to capture injuries and exposure are available, such as the traditional pen and paper approach or web-based solutions (e.g., the Performing Artist and Athlete Health Monitor). We recommend the use of a web-based surveillance system. A recent prospective study investigating injuries and health problems among circus arts students shows that such a methodology may contribute to a higher response rate. The medical report of injuries and illnesses form published with the IOC consensus statement was modified for circus arts (online supplemental appendix 2). The report forms published with the IOC consensus statement are for healthcare practitioners only, and injuries that do not receive medical attention might be under-reported. Therefore, we developed, next to a healthcare practitioner report form for circus injuries (online supplemental appendix 2), self-report forms for (1) collection of baseline demographic, individual health history and circus experience information; and (2) weekly self-report of health complaints and exposure to circus arts training and performance (online supplemental appendices 3 and 5).

**CONCLUSION**

This statement extends and adapts the recommendations of the IOC consensus statement to circus arts. Relatively small sample sizes challenge injury research in circus arts, and consolidation or meta-analyses are limited due to heterogeneity in methodology and reporting. Published research is also limited to only certain regions of the world and in the future should include the global circus population. Implementation of this guideline would increase the consistency of reporting, thus enabling comparison and consolidation of research to allow for more valid, representative and applicable findings. It also provides a framework for a circus injury registry. Finally, this guideline should be used by researchers, clinicians and circus professionals to inform circus-specific injury prevention strategies, rehabilitation approaches and industry-level risk management with the ultimate aim of enhancing the performance and health of circus artists and the circus arts industry at large.

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3 National Institute of Circus Arts, Swinburne University of Technology - Prahran Campus, Hawthorn, Victoria, Australia
REFERENCES


## Appendices

### Appendix 1. Background and expertise of consensus group members

<table>
<thead>
<tr>
<th>Initials</th>
<th>Country</th>
<th>Degree (area)</th>
<th>Work title</th>
<th>Work institution</th>
<th>Expertise</th>
</tr>
</thead>
</table>
| SG       | United States | DPT (Physical Therapy)             | Associate Professor                            | Samuel Merritt University                                                                                             | Physiotherapist with specialties in orthopaedic and neurologic physical therapy, and owner of performing arts clinical practice  
Author of injury surveillance study in circus arts  
Co-editor of science section of the Journal of Circus Arts, Life and Science  
Former circus artist and coach |
| DM       | Australia     | PT, PhD                            | Head Physiotherapist at the National Institute of Circus Arts (NICA) |                                                                                                                      | Author of injury surveillance study in circus arts and co-author on 2 studies on rehabilitation in circus  
Co-editor of science section of the Journal of Circus Arts, Life and Science |
| JN       | Australia     | BSc (Hons), PhD (Dance and exercise science) | Postdoctoral Research Fellow and Lecturer Western Australian Academy of Performing Arts |                                                                                                                      | Lead author of research related to injuries, physiologic demand, fitness and psychologic benefits in pole dance  
Pole artist and coach |
| JS       | The Netherlands | PhD Medicine                      | Professor Performing Arts Medicine  
Director of the Performing Artist and Athlete Research Lab (PEARL)  
Codarts University of the Arts, Rotterdam. |                                                                                                                      | Lead author of injury surveillance research in circus arts and co-author of several injury/illness studies in sport and performing arts  
Member Editorial Board Journal of Dance Medicine and Science |
| MS       | Canada        | PhD                                | Research associate in human performance and social innovation at Centre for Circus Arts Research, Innovation and Knowledge Transfer (CRITAC) |                                                                                                                      | Lead author of injury burden in circus arts study  
Co-editor-in-chief, Journal of Circus Arts, Life and Science  
Co-chair, American Circus Educators Health & Wellness committee  
Pole/circus artist and coach |
| RvR      | The Netherlands | PhD Medicine                      | Associate professor of Performing Arts Medicine  
Codarts University of the Arts, Rotterdam. |                                                                                                                      | Co-author of several injury/illness studies in sport and performing arts  
Board member of the Dutch Performing artist and Athlete Research Lab (PEARL)  
Member Editorial Board Journal of Dance Medicine and Science |
| MB       | Brazil        | PhD Anthropology/Sport Science     | Associate Professor  
Director/Senior Researcher at Circus Research Lab |                                                                                                                      | Former professional circus artist  
Former acrobatics teacher at Barcelona Circus School |

**External Reviewers**

<table>
<thead>
<tr>
<th>Initials</th>
<th>Country</th>
<th>Degree (area)</th>
<th>Work title</th>
<th>Work institution</th>
<th>Expertise</th>
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</table>
| MB       | Brazil  | PhD Anthropology/Sport Science     | Associate Professor  
Director/Senior Researcher at Circus Research Lab |                                                                                                                      | Former professional circus artist  
Former acrobatics teacher at Barcelona Circus School |
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<th>Position/Role</th>
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<tr>
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<td>University of Campinas (UNICAMP)</td>
<td>Resident Researcher at CRITAC</td>
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<td></td>
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<td>Board Member of Circus Arts Research Platform (CARP)</td>
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<td></td>
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<td>Member of International Circus Studies PhD Directors Network</td>
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<td>Consultant for Brazilian Arts Foundation (FUNARTE)</td>
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<td>Associated Researcher, circusnext</td>
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<td>Professor and Researcher Ecole supérieure d’art de design Centre national des arts du cirque (CNAC) cirкусnext</td>
<td>Former Associated Researcher and Author, European Federation of Professional Circus Schools (FEDEC)</td>
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<td>Former teacher, Centre national des arts du cirque</td>
</tr>
<tr>
<td>United States</td>
<td>BSE Mechanical Engineering, MSE Biomedical Engineering, PhD Decision Sciences and Engineering Systems</td>
<td>Former artist, head coach, and consultant for Cirque du Soleil</td>
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<tr>
<td></td>
<td>Data scientist for CRITAC Circus coach/consultant/researcher New England Center for Circus Arts</td>
<td>Independent/freelance coach and ProTrack coach at New England Center for Circus Arts</td>
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<td>PhD Epidemiology</td>
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<tr>
<td></td>
<td>Professor Dept of Public and Occupational Health, Amsterdam UMC</td>
<td>Co-author of IOC injury/illness consensus</td>
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<tr>
<td></td>
<td></td>
<td>Co-author of tennis and cycling-specific extensions of IOC consensus</td>
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<tr>
<td></td>
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<td>Highly published sports epidemiologist</td>
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<tr>
<td>Australia</td>
<td>MBBS, Master Public Health (occupational), Grad Dip Sports Medicine, Fellow of the Royal Australian College of General Practitioners Sports Doctor NICA Chief Medical Officer Australian Sailing</td>
<td>Physician working with elite gymnasts, circus and performing artists</td>
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<td>Consulting physician for NICA</td>
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<td></td>
<td></td>
<td>Participation in injury consensus guidelines for The International Federation of Gymnastics (FIG)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Former Chief Medical Officer Gymnastics Australia</td>
</tr>
</tbody>
</table>
Appendix 2. Healthcare practitioner report form for circus injuries

Date of report: __/__/____ (dd/mm/yy)
Organisation/Company/Group affiliation: _______________________
Artist identification: __________________________ Date of onset__/__/____

Report completed by:
Name: __________________________________ Qualifications: __________________________
Email: __________________________________ Phone:_____________________
_____________________________________________________________________

One report should be completed for each injury even if related to same incident.
Please select the appropriate option(s) for each bolded category based on your assessment.

Activity associated with the injury onset (select all that apply)
□ Circus arts training (specify specific circus arts discipline, equipment/apparatus & skill/movement involved)
□ Performance (specify specific circus arts discipline, equipment/apparatus & skill/movement involved)
□ Rehearsal (specify specific circus arts discipline, equipment/apparatus & skill/movement involved)
□ Warm-up
□ Conditioning training (Physical training to improve muscle activation, endurance, strength, power, flexibility and/or coordination separate from training of specific circus skills and not on a circus apparatus)
  □ Strength
  □ Aerobic
  □ Flexibility (contortion skills training should be reported as circus arts training)
□ Circus-related but not discipline specific (specify eg, spotting, pulling lines, walking over mats) __________
□ Non-circus (eg, participation in other sports or life activities where injury occurs)
□ Unknown, or not specified

Type of Injury (select the single best option)
□ New injury
□ Exacerbation of existing injury
□ Subsequent recurrent injury (same site, same type)
□ Subsequent local injury (same site, different type)
□ Unknown, or not specified

Mode of Onset (select the single best option)
□ Acute- Sudden onset
□ Repetitive – Sudden onset
□ Repetitive- Gradual onset

Mechanism of Injury (select the single best option)
□ No identifiable single event (eg, acrobat that trains in hand balancing and Chinese pole has gradual onset of wrist pain, or juggler has the gradual onset of neck pain radiating into the arm)
□ Noncontact (single event) (eg, a banquine base feels the sudden elbow pain after tossing their flyer into the air.)
□ Indirect contact with an object (eg, trapeze artist overturns in release manoeuvre catching the trapeze with hands late in the turn, or musician rolls their ankle after being thrown off balance by a stage prop bumping into them)
□ Indirect contact with ground (eg, a stilt walker steps into a hole while doing an outdoor roaming act and has acute knee joint pain, or a Chinese pole artist falls on outstretched arm resulting in fractured clavicle)
□ Indirect contact with another artist (eg while performing ensemble dance choreography, one acrobat contacts another’s shoulder, resulting in the second acrobat losing their balance and twisting their knee).
Direct contact with an object (eg, fracture of their radius due to direct contact from cyr wheel or skin abrasion following training on rope, or an aerial acrobat loses hand grip on a trapeze and falls hitting their head on a crash mat)
Direct contact with the ground (eg, fall from tightwire results in acrobat’s knee hitting the ground, or aerial acrobat misjudges height with drop hitting head on the ground)
Direct contact with another artist (eg, hoop diver kicks another diver in the thigh while passing through same hoop in opposite directions, or during a doubles trapeze act, the base’s wrist is forced into hyperextension when catching the flyer from a dynamic release move)

Injured body region (select the single best option)

- Head and neck
  - head/face
  - neck/cervical spine
- Trunk
  - chest
  - thoracic spine/upper back
  - abdomen (incl. organs)
  - lumbosacral
- Upper limb
  - shoulder
  - upper arm
  - elbow
  - forearm
  - wrist
  - hand
- Lower limb
  - hip/groin
  - thigh
  - knee
  - lower leg/Achilles tendon
  - ankle
  - foot
- Other (please specify)

Body Side (Select one option)

- Left
- Right
- Both
- Not applicable

Tissue & pathology type (Select the single best option)

Nervous
- Concussion/brain injury
- Spinal cord injury
- Radiculopathy
- Peripheral nerve injury

Bone
- Fracture
- Bone stress injury
- Bone contusion
- Physis injury

Muscle/tendon
- Muscle strain/tear
- Muscle contusion
- Tendinopathy
- Tendon rupture

Cartilage/synovium/bursa
- Cartilage injury
- Arthritis
- Synovitis
- Bursitis
- Chondral pain (eg, patellofemoral pain)

Ligament/joint capsule
- Joint sprain/ligament tear
- Acute subluxation/dislocation
- Chronic instability
☐ Contracture ☐ Capsulitis

Superficial tissues/skin
☐ Contusion/bruise (superficial) ☐ Laceration ☐ Abrasion ☐ Burn
☐ Internal organ trauma (please specify)_______________________
☐ Vascular trauma (please specify)_______________________
☐ Other not specified above (please specify)_______________________

[Enter the appropriate diagnostic code(s)]

Diagnosis and diagnosis code: __________________ OSIICS __________________ SMDSC

Provide diagnosis and diagnosis code from the Orchard Sports Injury and Illness Classification System (OSIICS), the Sports Medicine Diagnostic Coding System (SMDSC)

Time loss in circus due to injury: ☐ Yes ☐ No

Date of full return to circus training and performance: __/__/____ (dd/mm/yy)
☐ No return to circus possible (specify reason below)
  ☐ permanent disability
  ☐ fatality
  ☐ other reason (please specify): ______________________________

The following fields are optional, depending on the research question

Use of safety equipment (Select all that apply)
☐ Mat (specify type)____________
☐ Lines
☐ Nets
☐ Spotter(s)
☐ Foam pit
☐ Helmet
☐ Pads
☐ Other (Please specify)_________________

Role:
☐ Solo ☐ Base ☐ Flyer
Appendix 3. Weekly self-report of health complaints and exposure to circus arts training and performance (adapted from Murray et al., 2020 and Clarsen et al., 2021)

**Note:** Users can change the questionnaire title to suit the aims and context of the study.

Epidemiological studies that collect information directly from artists are likely to use electronic questionnaires. This document can be used to creating an electronic questionnaire with logic (i.e. artists’ path through the questionnaire is determined by their answers). All questions should have single select answer except where otherwise noted. Questionnaire logic and other notes are written in **red** and **blue**. Electronic questionnaires with logic should not present red and blue text to artists. For paper-based questionnaires red notes should be deleted but blue notes kept to guide the athlete through the questionnaire.

Researchers are encouraged to use responses to the following questions to classify mechanism of injury:

- **Q8** body part, **Q10** suddenly or gradually, **Q12** single event, **Q14** contact source, **Q15** contact bodily area, **Q16** direct contact. The following questions may provide insight into factors contributing to the injury: **Q11** activity, **Q13** event details, **Q17** safety equipment.

### Circus artist identification:  
**Week of report:**

Please answer all questions regardless of whether you have experienced health problems in the past 7 days. Select the option that is most appropriate for you, and in the case that you are unsure, try to answer as best you can anyway.

A health problem is any condition that you consider to be a reduction in your normal state of full health, irrespective of its consequences on your circus participation or performance, or whether you have sought medical attention. This may include, but is not limited to, injury, illness, pain or mental health conditions.

If you have several health problems, please begin with your worst problem in the past 7 days, and then fill in another questionnaire for each problem.

1. Have you had any difficulties **participating in training, rehearsal or performance** due to injury, illness or other health problems during the past 7 days?
   - ☐ full participation without health problems *(if this answer is selected skip to #23)*
   - ☐ full participation, but with a health problem
   - ☐ reduced participation due to a health problem
   - ☐ could not participate due to a health problem
   - ☐ did not participate due to a vacation or other personal reasons *(if this answer is selected, end survey)*
   - ☐ did not participate due to scheduled rest week *(if this answer is selected, end survey)*

2. To what extent have you **modified your training, rehearsal or performance** due to injury, illness or other health problems during the past 7 days?
   - ☐ no modification
   - ☐ to a minor extent
   - ☐ to a moderate extent
   - ☐ to a major extent

3. To what extent has injury, illness or other health problems **affected your training, rehearsal or performance** during the past 7 days?
   - ☐ no effect
   - ☐ to a minor extent
   - ☐ to a moderate extent
   - ☐ to a major extent

4. To what extent have you **experienced symptoms/health complaints** during the past 7 days?
   - ☐ no symptoms/health complaints
5. When did this health problem occur or when did you first notice symptoms? If this is a recurrent problem, please refer to the most recent episode. If you have multiple injuries or health problems there will be an opportunity to enter each.
   \_/\____ (dd/mm/yy) (Enter date or select from calendar)

6. Have you reported this health problem previously?
   - Yes (Artist chooses from list of previously reported problems and continues with question 17.)
   - No

7. Which type of health problem are you reporting?
   - injury defined as damage to a body part resulting in pain, numbness, weakness or other symptoms with or without other reduction of normal physical function
   - physical illness defined as physical complaint or disorder not related to injury. Illnesses include health-related problems (e.g. influenza). (if this answer is selected skip to #19)
   - mental health problem (e.g. depression, anxiety) or social well-being (if this answer is selected, end survey)

8. What body part was/is injured? If more than one injury please complete the following questions for one body part and you will be asked to complete questions again for other injured body parts. (Body part can be recorded using either the list below or a body chart)
   - head/face
   - neck/cervical spine
   - chest/ribs (incl. chest organs)
   - thoracic spine/upper back
   - abdomen (incl. abdominal organs)
   - low back/lumbosacral spine
   - buttock
   - shoulder
   - upper arm
   - elbow
   - forearm
   - wrist
   - hand/finger/thumb
   - hip/groin
   - thigh
   - knee
   - lower leg/Achilles tendon
   - ankle
   - foot
   - others, please specify (free text entry can be added here)

9. Which body side of your body was injured?
   - right
   - left
   - both
   - not applicable

10. Did your injury come on suddenly or gradually?
11. **What were you doing when** the injury **occurred?**
- Circus arts training (specify specific circus arts discipline & skill/movement involved) ____________ *(Free text entry can be added here.)*
- Performance (specify specific circus arts discipline & skill/movement involved) ____________ *(Free text entry can be added here.)*
- Warm-up
- Strength training
- Flexibility training *(please note contortion skills training should be reported as circus arts training)*
- Circus-related but not discipline specific (specify eg, spotting, pulling lines, walking over mats) ____________ *(Free text entry can be added here.)*
- Non-circus
- Unknown, or not specified

12. Was the **injury caused by a clearly identifiable, single event** (eg, a fall or rolling your ankle on a mat)?
- Yes
- No *(Please continue with question 13)*

13. **How did the injury happen?** Please provide a detailed account of how the injury occurred including series of events leading up to the injury *(specify specific discipline, skill/movement involved, whether other people were involved (eg, base or flyer), whether apparatus was stationary or moving)*:

14. When your injury occurred did your body **contact** something external (eg, another person, apparatus, mat or the ground)?
- Yes *(please specify)*: ____________ *(Free text entry can be added here.)*
- No *(Please continue with question 17)*

15. Where on your body did contact occur *(specify body part)*? ____________ *(Free text entry can be added here.)*

16. Was this contact point the same as where your injury occurred e.g., landed on head and injury occurred at head?
- Yes
- No
- Unsure

17. Were there any **safety measures or equipment** in use?
- Yes
- Mat (specify type) ____________  □Lines  □Nets  □Spotter
- No

18. Did you have any of the following **roles** at the time of injury?
- Base
- Flyer
- Spotter
- Other (specify) *(Free text entry can be added here.)*
- No

19. What **kind of illness complaints** or symptoms do/did you have? *(multiple selections possible)*
- □ fever  □ diarrhea  □ numbness/pins and needles
- □ fatigue/malaise  □ constipation  □ anxiety
☐ swollen glands  ☐ symptoms of hay fever  ☐ depression/sadness
☐ sore throat  ☐ muscle cramps  ☐ irritability
☐ blocked/running nose/sneezing  ☐ fainting  ☐ sleep problems
☐ cough  ☐ rash/itchiness  ☐ eye symptoms
☐ breathing difficulty/tightness  ☐ irregular pulse/arrhythmia  ☐ ear symptoms
☐ headache  ☐ chest pain/angina  ☐ urinary tract/genitalia symptoms
☐ nausea  ☐ abdominal/menstrual pain
☐ vomiting  ☐ Other pain
☐ others, please specify ____________________________________________ (Free text entry can be added here.)

20. Have you seen a **physician, physiotherapist/physical therapist, psychologist or another qualified healthcare practitioner** because of this health problem in the past 7 days?

☐ No, what is the reason for not seeing a practitioner?
  ☐ Not needed
  ☐ Not possible/accessible
  ☐ I prefer to treat myself
  ☐ Prefer not to say
  ☐ Other, please specify ____________________________________________

☐ Yes, physician __ visits in the past 7 days (A number between 0 and 7 should be entered here.)

☐ Yes, physical therapist __ visits in the past 7 days (A number between 0 and 7 should be entered here.)

☐ Yes, psychologist or psychiatrist __ visits in the past 7 days (A number between 0 and 7 should be entered here.)

☐ Yes, other qualified healthcare practitioner, please specify: __ visits in the past 7 days (A number between 0 and 7 should be entered here.) (multiple selections possible)

21. On **how many** of the past 7 days, would you have been **completely unable to train, practice or perform in all circus disciplines** due to this health problem?

*Please consider all 7 days, even if no training, practice or competition was planned.*

___ days of the past 7 days (A number between 0 and 7 should be entered here.)

22. On **how many** of the past 7 days, would you have been **completely unable to train, practice or perform in at least 1 circus discipline but not all usual circus disciplines** due to this health problem?

*Please consider all 7 days, even if no training, practice or competition was planned.*

___ days of the past 7 days (A number between 0 and 7 should be entered here.) (specify specific circus arts discipline(s) _____________) (Dropdown list with multiple selections possible or free text entry can be added here.)

23. On **how many** of the past 7 days, did you have to **modify or reduce your normal training, practice or performances** due to this health problem?

*Please consider all 7 days, even if no training, practice or competition was planned.*

___ days of the past 7 days (A number between 0 and 7 should be entered here.)

24. Would you like to add any **additional information** about this problem that you think may be important?

*(Free text entry can be added here.)*

25. Have you had any **other health problems** during the past 7 days?

☐ No

☐ Yes *(please describe your other health problems using another questionnaire)*

(The questionnaire loops back to question 5 as many times as is necessary to record all the athlete’s health problems. In subsequent rounds, question 1 should begin with “Please refer your second-worst health problem” or third worst etc. depending on the loop.)

For optimal internal consistency, questions 23 and 24 should not be presented to athletes who reported complete inability to participate in question 1 and 7 days of time loss in question 18.
26. How many hours did you train or perform circus arts in the past 7 days?
___ (A number should be entered here) Enter hours of training (includes classes, independent training, and rehearsal)
___ (A number should be entered here) Enter hours of performing (associated warm-up/cool-down should be counted under training)

27. How many sessions of training or performances did you participate in during the past 7 days?
Select a circus discipline and then enter the sessions for each category of training and performances. Repeat for all disciplines participated in this week.
(Free text for each circus discipline or drop down list of circus disciplines. Can also choose to add a category for other sports/fitness training.)
___ Classes taken
___ Classes taught (where demonstrated exercise or skills)
___ Independent training
___ Rehearsals
___ Performances (A number should be entered for each)

Thank you for taking the time to fill in the questionnaire!
Appendix 4. Example of recording training and performance exposure

Below are examples of how to measure training and performance in circus.

- Part A represents circus artist’s weekly training summary and corresponding hours of circus training and performance hours
- Part B represents a reporting of weekly training and performance sessions by discipline for the same training week

<table>
<thead>
<tr>
<th>Weekday</th>
<th>Summary of training</th>
<th>Training Exposure* (hours)</th>
<th>Performance Exposure (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Rest day – no training</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Independent training including warm-up, handbalancing, rope and trampoline x 3 hours total</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Wednesday</td>
<td>Took two 1-hour classes back-to-back, one in handbalancing and one in rope</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Thursday</td>
<td>Taught a 1-hour handbalancing class (demonstrating warm-up and skills), independent training including warm-up, handbalancing, rope, and trampoline x 3 hours total</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Friday</td>
<td>Rehearsal of rope, handbalancing and dance acts x 2 hours</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Saturday</td>
<td>Performed rope, handbalancing and dance acts in a show; 30 minutes warm-up 30 minutes performance time</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Sunday</td>
<td>Took a 90-minute restorative yoga class</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total hours/week</td>
<td></td>
<td>11.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*This includes all time for training (classes taken and taught, additional training, rehearsal and warm-up for performance)

<table>
<thead>
<tr>
<th>Circus disciplines</th>
<th>Total classes taken</th>
<th>Total classes taught</th>
<th>Total rehearsals</th>
<th>Additional training sessions</th>
<th>Total performances</th>
<th>Training exposure (sessions)</th>
<th>Performance exposure (sessions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dance</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Handbalancing</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Rope</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Trampoline</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other Sports/Fitness</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</table>
Appendix 5. Demographic, health and circus experience intake questionnaire

Demographics

Current Age: ___ years

Gender Identity: □ Male  □ Female  □ Nonbinary/other/self-identify (free text entry)

Assigned Sex at Birth: □ Male  □ Female

Country(ies) where you lived and trained for last year: -

Hand dominance: □ Right  □ Left  □ Ambidextrous

Circus arts experience prior to start of study participation

<table>
<thead>
<tr>
<th>Activity</th>
<th>Age at start</th>
<th>Current Participation</th>
<th>If no, age when stopped training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circus (self-taught or formal training)</td>
<td></td>
<td>□ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Gymnastics</td>
<td></td>
<td>□ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Dance</td>
<td></td>
<td>□ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Parkour</td>
<td></td>
<td>□ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>□ Yes □ No</td>
<td></td>
</tr>
</tbody>
</table>

What is/are your primary circus discipline(s)? ____________________________

Over the last 6 months:

- On average, how many hours have you trained circus arts per week? (including classes, independent training and rehearsals)
- On average, how many hours have you spent in circus arts coaching/teaching per week?
- On average, how many circus arts classes have you taken per week? (including private or group classes)
- How many total performances have you performed at least one circus act in? (including student shows, competitions, community events, freelance or professional company shows)
- Have you been part of a pre-professional or professional circus training program?
- Have you been part of a performing arts university degree program? Please specify degree (eg, dance, circus arts, theatre)
- On average, how many hours have you participated in other fitness activities per week? (conditioning activities for strength flexibility, or cardiovascular endurance, sports, etc.)

Additional Screening

Do you identify as a person with disability? □ No □ Yes, please describe:

_________________________________________
Over the last 4 weeks, on average, how many hours of sleep do you get each night? _____ hours

<table>
<thead>
<tr>
<th>How often do you use?</th>
<th>Never</th>
<th>&lt;1/mo</th>
<th>1/mo</th>
<th>2-3x/mo</th>
<th>1/wk</th>
<th>2-3x/wk</th>
<th>4-6x/wk</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannabis/marijuana</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Other drugs</td>
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</tbody>
</table>

Have you ever been diagnosed with a mental illness or eating/exercise disorder? □ Yes □ No

If yes:
- Have you ever been diagnosed with an eating disorder? □ Yes □ No
- Have you ever been diagnosed with a depressive disorder? □ Yes □ No
- Have you ever been diagnosed with an anxiety disorder? □ Yes □ No
- Have you ever been diagnosed with a different mental health disorder? □ Yes □ No

Have you had any major life events last 12 months?
- □ relocation
- □ loss/change of job
- □ change of relationship status
- □ death/serious illness of close family or friend □ other ____________________________