Injury and Illness Surveillance at the 2021 and 2023 FIS Nordic World Ski Championships

Introduction

The 2021 surveillance covered 344 of 663 registered athletes (51.9 %) through 32 national medical teams; while the 2023 edition covered 596 registered athletes through 29 national teams (over 58 %).

This report pools the two editions into a single overview. The combined analysis base is **940 athletes.**

The 2023 paper used more site-level locations, seven injury types, and a five-category mechanism scheme, whereas the 2021 paper resolved location only to four broad regions, did not publish injury-type detail, and used a two-category mechanism classification (acute vs repetitive/gradual-onset).

Injuries

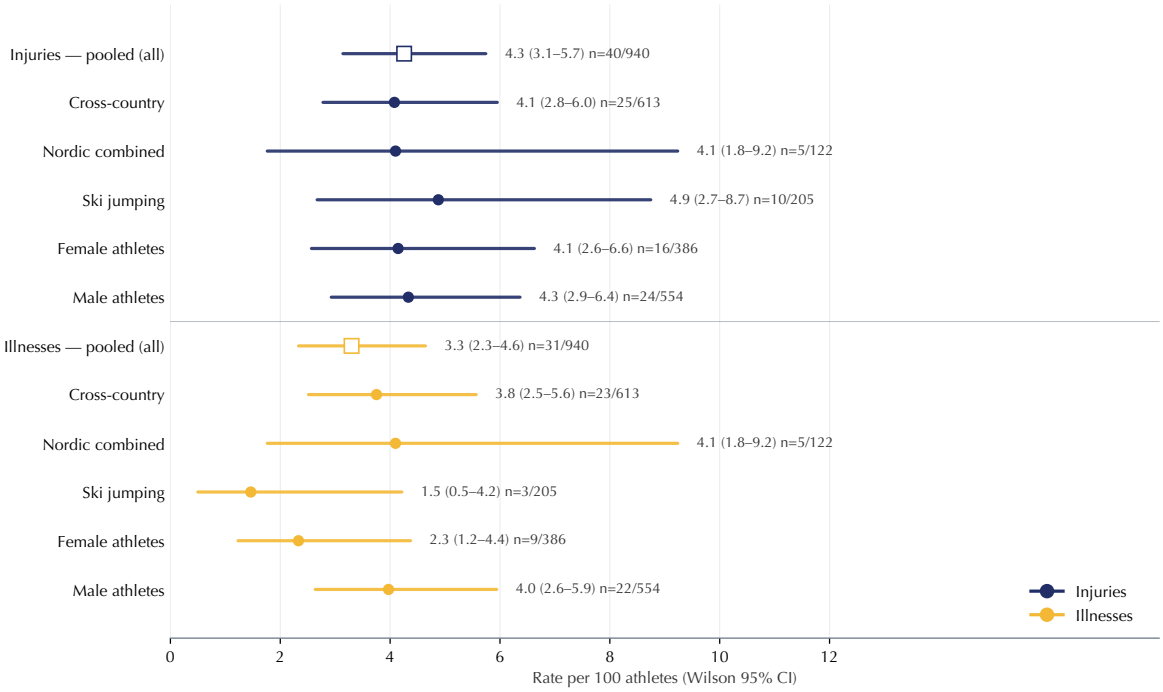
Injury incidence

Across the two editions, **40 injuries were recorded among 940 analysed athletes, a pooled incidence of about 4.3 per 100 athletes.** Edition-specific rates were 4.7 per 100 in 2021 and 4.0 per 100 in 2023.

By discipline, **cross-country skiing recorded 4.1 per 100** (25 / 613), **Nordic combined 4.1 per 100** (5 / 122), **and ski jumping 4.9 per 100 athletes** (10 / 205).). Ski jumping discipline-specific rate rose from 2.6 per 100 in 2021 to 6.3 per 100 in 2023.

By sex, **female athletes recorded 4.2 per 100** (16 / 386) and **male athletes 4.3 per 100 athletes** (24 / 554).

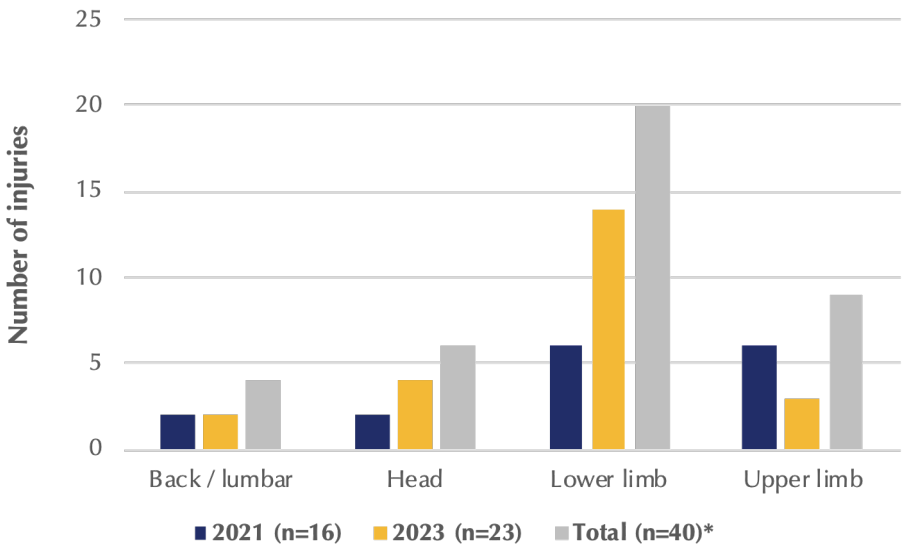
Of the 40 pooled injuries, **12 (30 %) caused any time loss and 6 (15 %) sidelined athletes for more than seven days.** These episodes were: three ski-jumping concussions and a metacarpal fracture in 2021; a ruptured Achilles tendon and a severe muscle contusion in 2023.



Pooled incidence rates (with Wilson 95 % confidence intervals). Top half: injuries; bottom half: illnesses.

Injury locations and types

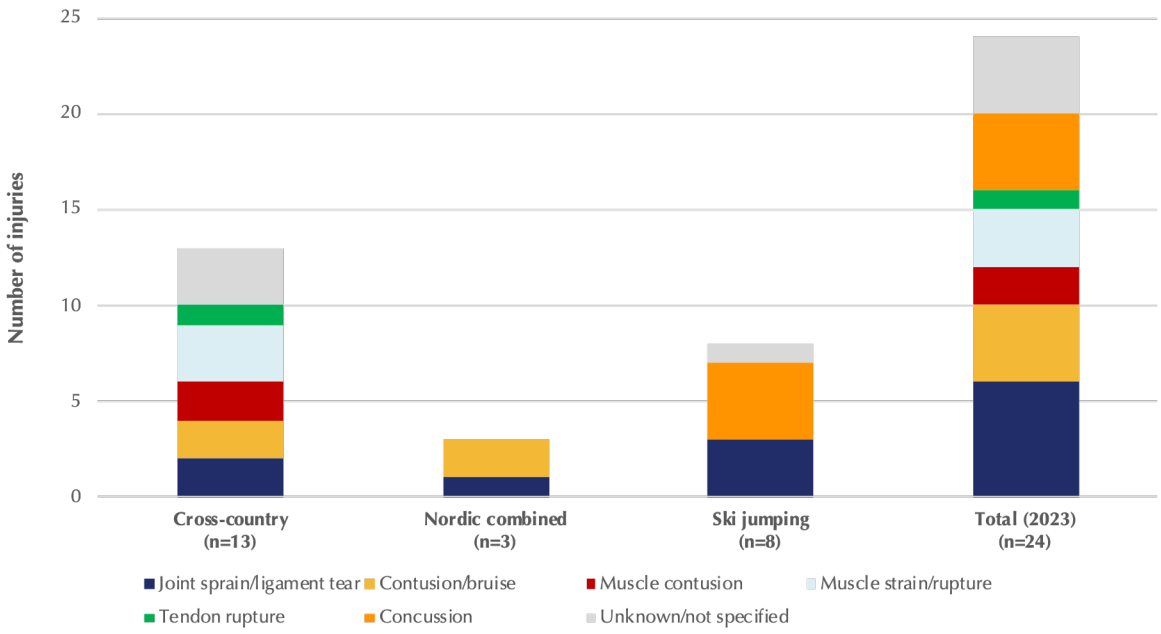
In the pooled anatomical distribution, **the lower extremity accounts for 20 of 39 classified injuries (51 %)**, the upper extremity 9 (23 %), the head 6 (15 %), and the back or lumbar region 4 (10 %). In the site-level 2023 data, the **knee alone accounts for 8 of 24** injuries.



**One injury was recorded as unclassified.*

In ski jumping 2023, **all eight injuries were either knee or head injuries.** Four knees and four heads, with **three head injuries/concussions of more than seven days' time loss.** No concussions were recorded in ski jumping in 2021. Interestingly, no concussion were either recorded at the 2010 or 2018 Winter Olympics, and only one at the 2022 Winter Olympics.

Injury-type detail is available only for 2023 (the 2021 data did not publish that breakdown). Within 2023, the leading types were **joint sprains and ligament tears (6 of 24, 25 %)**, contusions or bruises (4, 17 %), concussions (4, 17 %), and muscle strains or ruptures (3, 13 %). The remainder were muscle contusion, tendon rupture, peripheral nerve injury and unclassified injuries.



***Injury types by discipline from Planica 2023**. Oberstdorf 2021 did not publish injury-type detail.*

Edition-to-edition shift in injury location.

- Lower-extremity injuries moved from 37.5 % of all injuries in 2021 to 58.3 % in 2023.
- Knee cases accounted for 7 of 14 lower-extremity injuries in 2023.
- Upper-extremity injuries from 37.5 % to 12.5 %.
- Head injuries held at 12.5 % both years, with zero concussions in 2021 and four in 2023.

Onset, mechanism and severity

Approximately 72 % of injuries occurred via acute mechanisms; 28 % were repetitive or gradual-onset. The 2023 injury mechanisms records 13 of 24 injuries (54 %) as acute contact with an object. Neither edition recorded any injury from direct contact with another athlete.

Illnesses

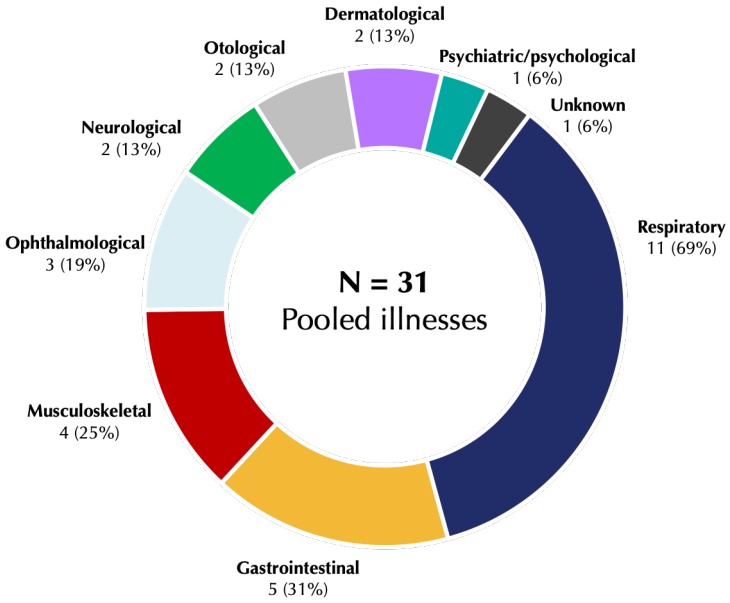
Illness incidence and COVID-19 context

In 2023 specifically, **8 of 24 injuries (33 %) were classified as repetitive or overuse**.

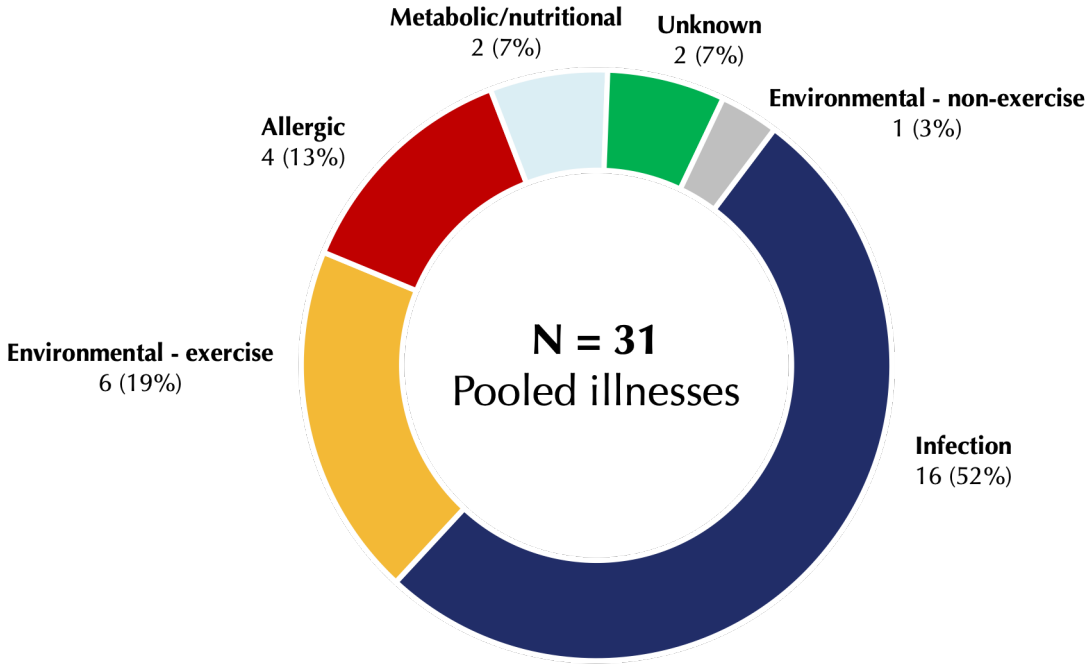
Across the two editions, **31 illnesses were recorded among 940 analysed athletes, with a pooled incidence of about 3.3 per 100 athletes.**

Edition-specific contrast

- In 2021, **illness incidence was 4.7 per 100** athletes, with 31.3 % of illnesses attributed to infection. The 2021 event ran under strict COVID-19 protocols (frequent PCR testing, FFP2 masks, team-bubble separation).
- In 2023, **overall illness incidence fell to 2.5 per 100** athletes, and the rate of infection-related illness rose to 73.3 %.
- Infection-specific incidence was 1.5 per 100 athletes in 2021 and 1.9 per 100 athletes in 2023; the pre-pandemic 2018 Winter Olympics recorded 5.8 per 100.



Illness by afected organ system



Illness by aetiology

Severity and time loss

In 2021, approximately 69 % of illnesses caused no time loss. **In 2023, the proportion of time-loss illnesses rose to 53 % (8 of 15 cases)**, where no illness exceeded seven days. The 2023 **male time-loss rate was 2.0 per 100 athletes versus 0.4 per 100 athletes in female athletes**. Pooled across editions, approximately 40 % of all illnesses involved any time loss.

Affected systems and demographics

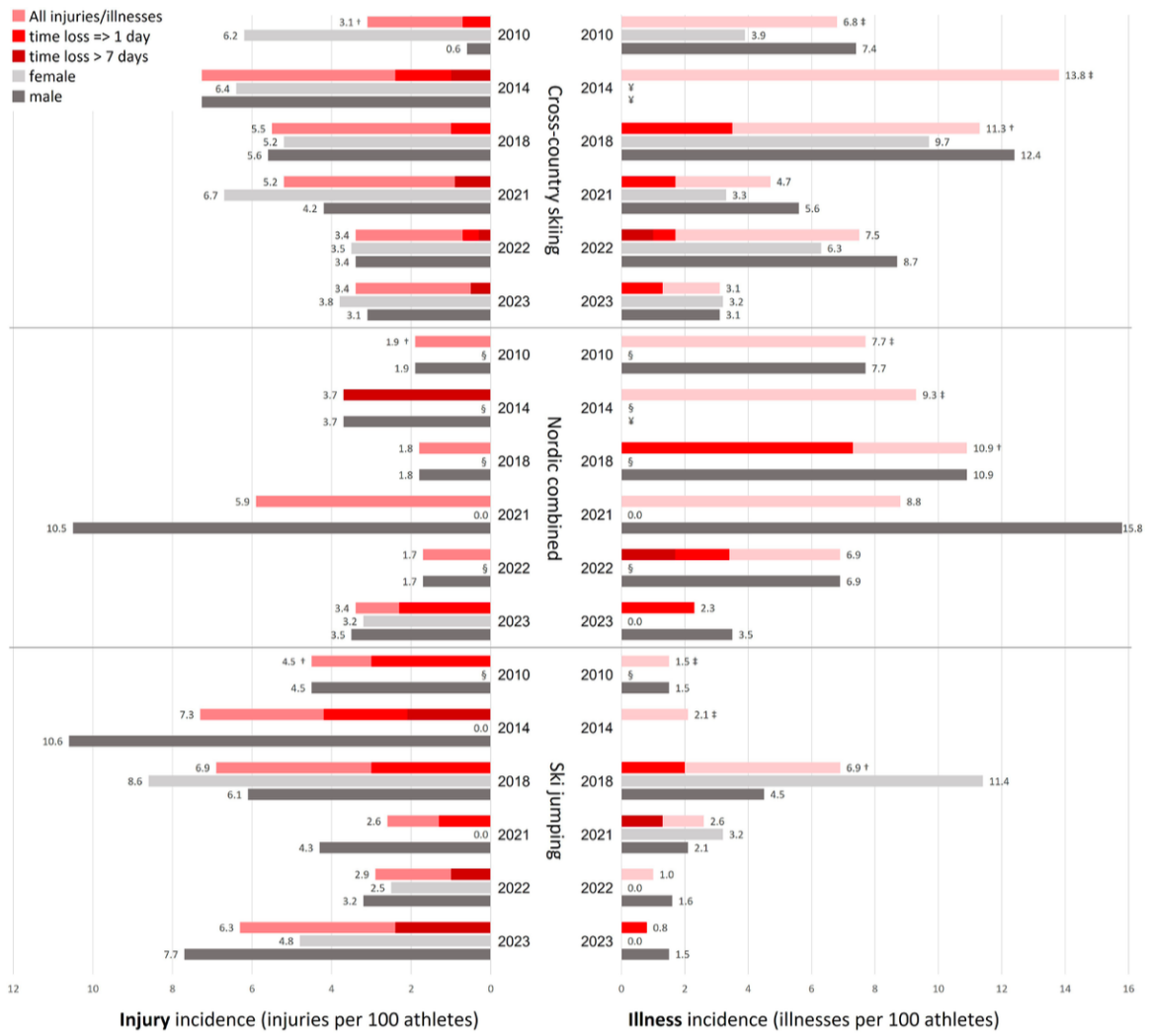
Of the 31 pooled illnesses, **the respiratory tract accounted for 11 cases (36 %)**, followed by the gastrointestinal system (5, 16 %), musculoskeletal (4, 13 %), ophthalmological (3, 10 %), and smaller groups in otological, dermatological, neurological, psychiatric and unknown categories.

Cardiovascular, dental, endocrinological, haematological, thermoregulatory, urinary/gynaecological systems recorded zero cases across both editions.

Pooled illness rate is higher in male than female athletes (4.0 vs 2.3 per 100).

In 2023, men accounted for 9 of 11 infections and 7 of 8 respiratory illnesses. Cross-country skiers contributed 23 of 31 pooled illnesses, Nordic combined athletes 5, and ski jumpers 3.

Summary: Overall injury and illness picture



Extracted from the original scientifc publication (b).

Practical implications

Targeted injury prevention: knees across disciplines, concussions in Ski Jumping

- **Knee protection is a cross-discipline priority**: in 2023, knee trauma accounted for half of all lower-extremity injuries and a third of all injuries in that edition, spread across cross-country skiing, Nordic combined, and Ski Jumping.
- **Concussion prevention in ski jumping**: all four concussions occurred in ski jumping in 2023, and each sidelined an athlete for at least 14 days. Given athlete-to-athlete contact is a non-injury factor, prevention work sits in equipment, technique, and event conditions.

Infection control as year-round operational habit

- The lesson is that **targeted, practical hygiene protocols work**, and that they should be maintained in a feasible form outside of pandemic conditions. Respiratory infections remain the single biggest illness threat to Nordic athletes at championship events, with male athletes and cross-country skiers carrying most of that burden.

Enhancing surveillance: habituation, LOC integration, registration

- Athlete coverage rose from 51.9 % in 2021 to 58.2 % in 2023; the local organising committee's (LOC) successful integration in 2023 captured cases that would have been missed in 2021, particularly from smaller nations without on-site medical teams.
- The operational priorities for future editions are to continue standardised documentation (habituation effects), integrate LOC data from day one, register national medical staff officially, and communicate objectives and interim results to participants.

Sources

- Kastner T, Junge A, Weith M, et al. **Injuries and illnesses during the 53rd FIS Nordic World Ski Championships 2021 in Oberstdorf: a prospective cohort study**. Clinical Journal of Sport Medicine. 2023 Mar 1;33(2):e1-7.
- Kastner T, Dandrieux P-E, Fohrmann D, et al. **Injuries and illnesses during the 54th FIS Nordic World Ski Championships 2023 in Planica: a prospective cohort study**. BMJ Open Sport & Exercise Medicine 2025;11:e002156. doi:10.1136/bmjsem-2024-002156.