# Dose-effect relationship between self-reported concussive impacts and the point prevalence of elevated mental health symptom burden in elite male ice-hockey players

**MITCHELL ANDERSSON[1,2], GÖRAN KENTTÄ[3-5], EMMA CLAESDOTTER-KNUTSSON[1,6], ANDERS HÅKANSSON[1,2]**

[1]LUND UNIVERSITY, FACULTY OF MEDICINE, DEPARTMENT OF CLINICAL SCIENCES LUND, SECTION OF PSYCHIATRY, LUND, SWEDEN; [2]MALMÖ ADDICTION CENTER, REGION SKÅNE, MALMÖ, SWEDEN; [3]THE SWEDISH SCHOOL OF SPORT AND HEALTH SCIENCES, STOCKHOLM, SWEDEN; [4]THE SWEDISH SPORTS CONFEDERATION, STOCKHOLM, SWEDEN; [5]SCHOOL OF HUMAN KINETICS, UNIVERSITY OF OTTAWA, OTTAWA, ON, CANADA; [6]CHILD AND ADOLESCENT PSYCHIATRY OUTPATIENT CLINIC, REGION SKÅNE, LUND, SWEDEN

## Aims

- Compare the prevalence of elevated mental health symptoms in elite ice hockey players to other athlete and general population samples
- Assess the association between concussive impacts and mental health symptoms, including depression, anxiety, burnout, as well as addictive behaviors like hazardous alcohol consumption and problematic social media use

## Background

- Several studies in elite athlete sample indicate that they experience similar levels of mental health symptoms compared to the general population
- However, some studies indicate that suffering multiple concussions may lead to the worsening of mental health
- Concussion is a traumatic brain injury (TBI) that results in short-term neurological dysfunction
- Symptoms typically resolve within one month, but approximately 15% experience persisting symptoms
- Studies in retired NFL players report a dose-effect relationship between recurrent concussion and depressive symptoms, but it is unclear when these symptoms developed
- Studies in active athletes report mixed results for various outcomes, including depression, anxiety, and alcohol misuse, while other outcomes have not been explored, such as problematic social media use or burnout

## Method

- Cross-sectional design using online survey
- In collaboration with SICO, the union representing players from the two top tiers of Swedish ice hockey, we presented the study to players at informational meetings between SICO and the players
- Surveys distributed via QR-code or survey link
- The Swedish Ethical Review Board approved this study (Dnr:2019-03393).
- Measures included:
  - Patient Health Questionnaire-9 (PHQ; Depression)
  - Generalized Anxiety Disorder Questionnaire-7 (GAD; Anxiety)
  - Gothenburg Institute of Stress Medicine's Self-Reported Exhaustion Syndrome (s-ES; Burnout)
  - Alcohol Use Disorder Identification Test-Consumption (AUDIT; Hazardous alcohol use)
  - Bergen Social Media Addiction Scale (BSMAS; Problematic social media use)
  - Concussion History (CHx; based on number of times dizziness, loss of balance, amnesia, and/or loss of consciousness occurred post-collision)

## Participants

- 504 players entered and provided digital consent, 500 competed survey items and were included in the analysis
- 56.4% of respondents were 26 years or older, 95.4% completed the survey in Swedish
- 43.4% reported no CHx, 34.0% reported 1-2 CHx, 22.6% reported 3+ CHx, (*Mdn* = 1.0 [Q1 0.0 - Q3 2.0]
- 30.1% endorsed hazardous alcohol use, 7.9% endorsed at-risk problematic social media use, 16.3% endorsed mild-to-severe symptoms of depression, 16.3% endorsed mild-to-severe symptoms of anxiety, 8.3% endorsed at-risk or clinical burnout symptoms.
- Comorbidity profiles are illustrated in Figure 1

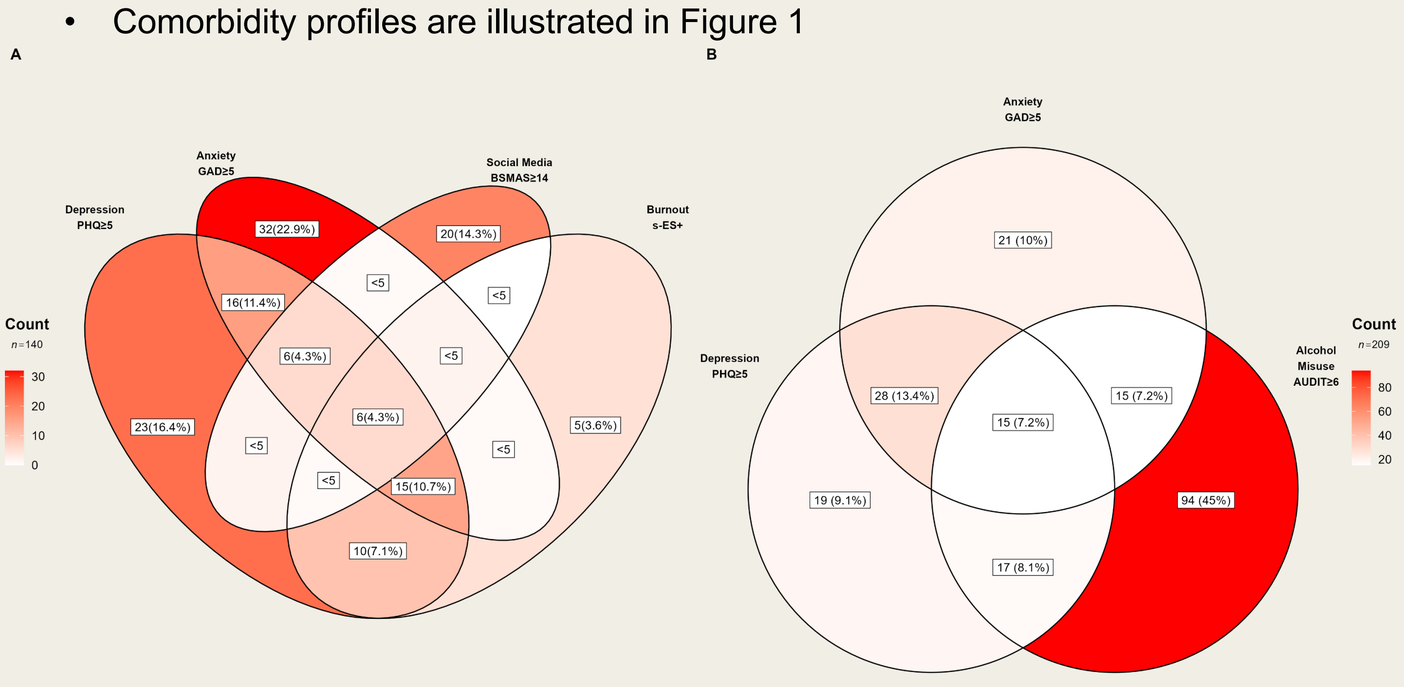


**Figure 1**. *Outcome prevalence and comorbidity in participants with at least one outcome*

## Findings

- Compared to other male athlete and general population samples, our sample endorsed a high prevalence of hazardous alcohol use but a lower prevalence for all other outcomes (Figure 2)

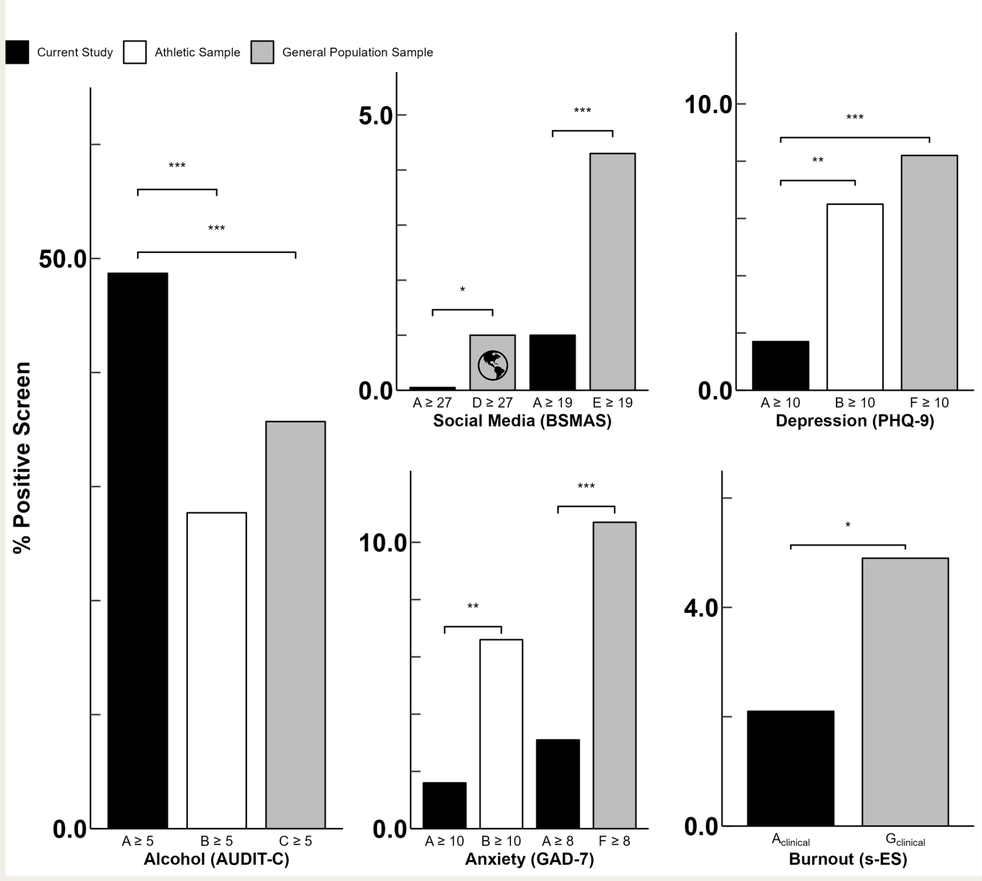


**Figure 2**. *Point prevalence of mental health outcomes across studies*

- Crude and adjusted models predicting mental health outcomes by CHx are presented in Table 1 below
- Bold odds ratios are statistically significant ($p < .05$)

| Concussion Group | Crude OR [95% CI] | Adjusted OR (Diagnosis) [95% CI] | Adjusted OR (Diagnosis + Age) [95% CI] |
|---|---|---|---|
| | Hazardous Alcohol Use (AUDIT ≥ 6) | | |
| 0 CHx | (REF) | (REF) | (REF) |
| 1-2 CHx | 0.91 [0.57,1.44] | 0.92 [0.58,1.45] | 0.94 [0.59,1.49] |
| 3+ CHx | 1.19 [0.72,1.95] | 1.21 [0.73,2.01] | 1.32 [0.79,2.20] |
| | At-Risk/Problematic Social Media Use (BSMAS ≥ 14) | | |
| 0 CHx | (REF) | (REF) | (REF) |
| 1-2 CHx | 1.74 [0.74,4.07] | 1.75 [0.75,4.11] | - |
| 3+ CHx | **3.08 [1.33,7.10]** | **3.16 [1.36,7.34]** | - |
| | Mild-to-Severe Depression (PHQ ≥ 5) | | |
| 0 CHx | (REF) | (REF) | (REF) |
| 1-2 CHx | 1.14 [0.64,2.03] | 1.08 [0.60,1.94] | 1.08 [0.60,1.95] |
| 3+ CHx | 1.79 [0.99,3.23] | 1.55 [0.85,2.86] | 1.58 [0.85, 2.92] |
| | Mild-to-Severe Anxiety (GAD ≥ 5) | | |
| 0 CHx | (REF) | (REF) | (REF) |
| 1-2 CHx | **2.14 [1.21,3.81]** | **2.06 [1.15,3.70]** | **2.04 [1.14,3.67]** |
| 3+ CHx | **1.99 [1.05,3.76]** | 1.70 [0.88,3.26] | 1.65 [0.86,3.20] |
| | At-Risk and Clinical Burnout (s-ES+) | | |
| 0 CHx | (REF) | (REF) | (REF) |
| 1-2 CHx | **2.77 [1.15,6.64]** | **3.38 [1.36,8.38]** | - |
| 3+ CHx | **4.21 [1.74,10.17]** | **5.24 [2.58,10.64]** | - |

**Table 1**. *Models predicting screening for mental health outcomes*

## Conclusions

- Adverse mental health outcomes less prevalent in elite ice hockey players, excluding alcohol misuse
- Dose-effect relationship (CHx → poor mental health) not supported across all outcomes
- No increase in depressive symptoms incongruent with other studies in retired and active athlete samples
- Relationship with burnout and problematic social media should be explored further

## Conflicts of interest

Co-author AH received funding from AB Svenska Spel, a Swedish state-owned gambling provider, and the state-owned alcohol monopoly, Systembolaget. Neither were involved in the planning, execution, or publication decision for this abstract. The remaining authors report no competing interests.

## Contact

Mitchell J. Andersson
Lund University, Faculty of Medicine, IKVL Psychiatry, Lund, Sweden
Malmö Addiction Center, Region Skåne, Malmö, Sweden
mitchell.andersson@med.lu.se