




Investigating coaches' recognition of symptoms of eating disorders in track athletes.

MACPHERSON, M.C., HARRISON, R., MARIE, D. and MILES, L.K.

2022

© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ. <http://creativecommons.org/licenses/by-nc/4.0>. Supplementary materials are appended after the main text of this document.

Investigating coaches' recognition of symptoms of eating disorders in track athletes

Margaret Catherine Macpherson ¹, Róisín Harrison ², Dannette Marie ¹, Lynden K Miles ¹

To cite: Macpherson MC, Harrison R, Marie D, *et al*. Investigating coaches' recognition of symptoms of eating disorders in track athletes. *BMJ Open Sport & Exercise Medicine* 2022;**8**:e001333. doi:10.1136/bmjsem-2022-001333

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjsem-2022-001333>).

MCM and RH are joint first authors.

Accepted 15 June 2022

ABSTRACT

Objective To determine the extent to which athletics coaches can identify evidence of an eating disorder in track athletes and what treatment advice they would provide.

Methods Vignettes depicting athletes portraying symptoms consistent with anorexia nervosa (AN) and bulimia nervosa (BN) were developed and used to survey 185 UK and Irish athletics coaches (and a community sample of 105 non-coaches) regarding their ability to recognise and respond to symptoms of an eating disorder.

Results Coaches were no more likely than the community sample to correctly identify an eating disorder but were more likely to suggest professional treatment for an athlete experiencing symptoms of AN (OR 1.82, 95% CI 1.02 to 3.29). For both eating disorders, higher levels of mental health literacy (AN: OR 1.06, 95% CI 1.02 to 1.11, BN: OR 1.08, 95% CI 1.04 to 1.14) and more years of coaching experience (AN: OR 1.12, 95% CI 1.03 to 1.24, BN: OR 1.07, 95% CI 1.01 to 1.16) also increased the likelihood of suggesting professional help. When considering the whole sample, participants were more likely to correctly identify an eating disorder (OR 4.67, 95% CI 2.66 to 8.20) and suggest professional treatment for AN than BN (OR 1.76, CI 1.04 to 2.97). Further, symptoms of AN were more likely to be correctly identified in female than male athletes (OR 2.26, 95% CI 1.28 to 4.06).

Conclusions Although coaches were more likely than community members to recommend professional treatment to an athlete exhibiting symptoms of an eating disorder, they were no more likely to correctly identify an eating disorder in the first instance. Further work is required to enhance coaches' capacity to identify symptoms of eating disorders to ensure athletes receive appropriate interventions.

INTRODUCTION

Athletes participating in sports where leanness confers a competitive advantage (eg, track and field events) have an elevated risk of unhealthy dietary behaviours.¹ Symptoms of such behaviour lie on a continuum ranging from disordered eating (DE; dysfunctional dietary behaviours such as fasting or binge eating) to diagnosable clinical eating disorders (ED; symptomology

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Track and field athletes have an elevated risk of engaging in disordered eating (DE) and of developing an eating disorder (ED).
- ⇒ Athletics coaches are uniquely positioned to identify unhealthy dietary behaviour in athletes. However, little is known about their capacity to do so.

WHAT THIS STUDY ADDS

- ⇒ Coaches were no more likely than non-coaches to correctly identify an ED in a fictional athlete.
- ⇒ Coaches were more likely than non-coaches to recommend professional treatment for a fictional athlete experiencing symptoms of anorexia nervosa.
- ⇒ Mental health literacy (MHL) and years of coaching experience were key predictors of coaches recommending professional treatment for athletes exhibiting signs of DE/ED.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ MHL programmes focusing on DE/ED in athletics should be embedded in national and international coaching qualification frameworks.
- ⇒ Education and intervention efforts should emphasise that male athletes are also at risk of developing DE/ED, and that irrespective of an athlete's gender, coaches have a duty of care to identify DE/ED problems in the athletics context.

that meets diagnostic criteria).¹⁻⁴ Combined with overtraining, these behaviours are key contributors to Relative Energy Deficiency in Sport (RED-S), a clinical syndrome which can lead to severe long-term health consequences.⁵⁻⁷ A recent review estimates that the prevalence of low energy availability, a core component of RED-S, ranges from 22% to 58% across various sports domains, including elite athletics.⁸ Combatting this issue requires individuals to be able to distinguish symptoms of DE/ED from behaviour that is conducive to peak performance (eg, unhealthy vs healthy dietary restrictions).⁹⁻¹¹

There is broad consensus that coaches, given their proximity to athletes and their



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹School of Psychological Science, University of Western Australia, Perth, Western Australia, Australia

²School of Psychology, University of Aberdeen, Aberdeen, UK

Correspondence to

Margaret Catherine Macpherson, margaret.macpherson@research.uwa.edu.au



awareness of sport-specific demands (eg, performance pressure, training loads), are uniquely positioned to respond when an athlete is suspected of having problems associated with DE/ED.^{12 13} However, as much as coaches may perform an integral role in an athlete's sporting life, the potential for early and effective intervention rests on two broad requirements: (1) an ability to recognise problematic behaviour associated with DE/ED in the athletics environment and (2) the knowledge to recommend treatment from a qualified professional.^{14–16} Here, we sought to provide empirical insight into the extent to which athletics coaches can identify DE/ED in track athletes, what assistance they would provide, and whether these responses differ from non-coaches. We focused on symptomology related to the two most prominent EDs: anorexia nervosa (AN) and bulimia nervosa (BN),¹⁷ and associated symptoms of RED-S.^{7 18}

We examined attributes of the coaches themselves, including coaching experience, coaching workload and mental health literacy (MHL) and how these impacted recognition and response to symptoms of DE/ED. It has been suggested that improving the MHL of coaches could be one means of facilitating early intervention for DE/ED-related problems experienced by athletes.^{11 15 19–22} As commendable as this recommendation is, presently there is limited empirical data available regarding levels of MHL held by athletics coaches and how this impacts their capacity to recognise and respond to problematic behaviour.

We also systematically varied the gender of the athlete depicted as experiencing symptoms of DE/ED. Gender stereotypes impact the recognition of DE/ED and RED-S, whereby male athletes are typically underdiagnosed compared with their female counterparts.^{3 23–25} This approach allowed us to evaluate whether athletics coaches can recognise symptoms of AN (+RED-S) and BN (+RED-S) and what treatment advice they would provide, together with consideration of key coach-specific (eg, years of experience) and contextual (eg, athlete gender) factors.

METHODS

Study design

This study employed a vignette methodology to survey a sample of UK and Irish athletics coaches and a comparison non-coach community sample, regarding their ability to recognise and respond to symptoms of EDs (AN, BN) and RED-S presented in an athletics context. As no data were collected that enabled the identification of individuals, completion of the survey was taken as consent to participate.

Vignette development

We adapted previously published vignettes that portrayed symptoms consistent with DSM-5 criteria¹⁷ for AN²³ and BN^{26 27} to reflect behaviour relevant to an athletics context (see online supplemental materials). All vignettes mentioned that the athlete maintained a high training

load while restricting their eating and felt pain in their foot (representing an undiagnosed bone injury), both prominent symptoms of RED-S. The gender of the athlete depicted was varied by changing their name and personal pronouns. Further, in the AN vignette, it was stated that the female athlete had not menstruated for almost 6 months, while for the male athlete, this was replaced with a statement indicating that they often picked up minor illnesses.

Mental health literacy

MHL was assessed using the 35-item MHL Scale (MHLS).²⁸ Four questions were adapted slightly ('in general' replaced 'in Australia' (Qs 9 and 10), and the label 'doctor' was added next to the abbreviated form general practitioner (GP) (Qs 18 and 19)) to improve relevance and clarity.

The MHLS has strong psychometric properties (internal reliability $\alpha=0.87$; test-retest reliability $r=0.80$), successfully distinguishes groups with known differences in MHL (eg, mental health professionals vs community members), and meets the COSMIN criteria used for benchmarking the methodological quality of health measurement tools.^{28 29} Wei *et al* conducted a systematic review of tools measuring MHL and found that the MHLS performed highly favourably compared with other MHL measurement tools.³⁰ The scale ranges from 35 to 160, with higher scores reflecting better MHL.

Participant selection

This study included a sample of athletics coaches and a community sample of individuals who were not involved in athletics coaching. To recruit the coach sample, three organisations (Scottish Athletics, Sport Ireland Coaching and Aberdeen Amateur Athletics Club) were asked to circulate an invitation to participate in the research to their coaching members. Inclusion criteria for coaches comprised being 18 years of age or over and holding a recognised coaching qualification from either the Irish or UK Coach Education pathways. The non-coach sample was recruited by students enrolled in an undergraduate research methods course at the University of Aberdeen (UK) who circulated invitations to participate to friends and family. Only participants 18 years of age or over who had no coaching background were eligible to be part of this sample. Interested participants were directed to an online survey (hosted on surveyhero.com). The survey remained available to participants for 6 weeks after initial invitations were circulated.

Procedure

Participants were initially asked to report their age and gender. In addition, the coach sample was asked to report a number of coach-specific factors, namely their highest athletics coaching qualification, the average number of coaching sessions per week, years of coaching experience, and whether they coached on a paid or voluntary basis. The non-coach sample was asked to indicate if they

had any previous experience coaching athletics. Next, participants read the first vignette and responded to two open-ended questions: (Q1) Please use as few words as possible to identify what problem(s), if any, [athlete's name] is experiencing; (Q2) Imagine that [athlete's name] is an athlete that you coach. How would you help or advise her[him]? For the second question, the non-coach sample was asked to imagine the character depicted was their friend. The gender of the athlete depicted in the vignette was counterbalanced across disorder types, and vignette order (AN or BN first) was counterbalanced across participants. After reading and responding to both vignettes, participants completed the MHLS and were debriefed on the purpose of the research.

Coding

Responses to the open-ended questions were coded according to *a priori* established categories. For the first question (problem identification), we collated the number of participants who mentioned: (A) an ED in general (ie, GED); (B) the specific ED in question (ie, SED); and (C) RED-S. For the second question (treatment advice), we collated the number of participants who suggested the athlete seek relevant professional advice (ie, GP or doctor, psychologist, psychiatrist, nutritionist or dietitian). All responses were first independently coded by two trained coders (from a team of 4), who then discussed and resolved any differences in coding (<10% across the sample) until they reached full agreement.

Patient and public involvement

The vignettes were adapted to present information relevant to an athletics context by a national-level track and field athlete. Our findings will be disseminated to Scottish Athletics and Sport Ireland Coaching to raise further awareness regarding athlete well-being and EDs.

Statistical analysis

Data analysis was performed using mixed-effects logistic regression models (nested by participant). ORs were estimated for each predictor in all models. All data were analysed using R v.3.6.1³¹ using the lme4 software package v.1.2.21³² and the lmerTest software package v.3.0.1.³³ df and p values for the models were calculated using the Satterthwaite approximation from the lmerTest package. All raw data and R code for analysis are available via the Open Science Framework (<https://osf.io/p4ftz/>).³⁴

RESULTS

For the coach sample, 293 participants started the survey. We excluded 108 participants who did not respond to either vignette, resulting in a final sample of 185 participants. Where coaches only responded to one of the vignettes (8 did not respond to the AN vignette and 25 did not respond to the BN vignette), we retained their data. For the non-coach sample, 120 participants started the survey. We excluded 13 individuals who reported coaching experience and 2 who did not respond to either

Table 1 Demographics for the coach and non-coach samples

	Coach (n=185)	Non-coach (n=105)
Age		
Mean	46.12 years	24.27 years
SD	11.99 years	7.62 years
Range	18–77 years	18–55 years
Gender		
Male	99 (53.5%)	36 (34.3%)
Female	84 (45.4%)	68 (64.7%)
Other	1 (<1%)	0
Missing	1 (<1%)	1 (1%)
MHL*		
Mean	128.84	131.00
SD	10.85	10.74
Range	99–151	104–154
*MHL did not differ between the coach and non-coach samples, $t(233)=1.51$, $p=0.13$, $d=0.20$. MHL, mental health literacy.		

vignette, resulting in a final sample of 105 participants. Consistent with the coach sample, we retained data from the non-coach participants who only responded to one vignette (one did not respond to the AN vignette and one to the BN vignette). Demographic statistics for each group are displayed in [table 1](#).

Problem identification

Initially, we considered the frequency with which all participants (ie, both coaches and non-coaches) identified relevant problems as a function of vignette type. For the AN vignette, 184 (65%) participants identified an ED, 105 of whom identified anorexia specifically, while 7 participants also identified RED-S. For the BN vignette, 120 (45%) participants identified an ED, of which 32 identified bulimia and 2 RED-S. Participants were significantly more likely to identify an ED in the AN (cf. BN) vignette ($B=1.54$, $SE=0.29$, $z=5.38$, $p<0.001$, $OR=4.67$, 95% $CI=2.66$ to 8.20) as well as to name the specific disorder ($B=1.65$, $SE=0.26$, $z=6.23$, $p<0.001$, $OR=5.21$, 95% $CI=3.10$ to 8.75).

Next, we examined the predictors of correct problem identification for each vignette separately ([figure 1](#)). For the AN vignette, identification of a GED increased if the athlete was depicted as female ($OR=2.26$) or if the participant was female ($OR=1.95$). Participants were also more likely to correctly identify the SED as anorexia when the athlete was female ($OR=1.92$). For the BN vignette, only female participants were more likely to correctly identify a GED ($OR=1.82$), although both coaches ($OR=2.62$) and female participants ($OR=3.76$) were more likely to indicate that the athlete had bulimia specifically (SED).

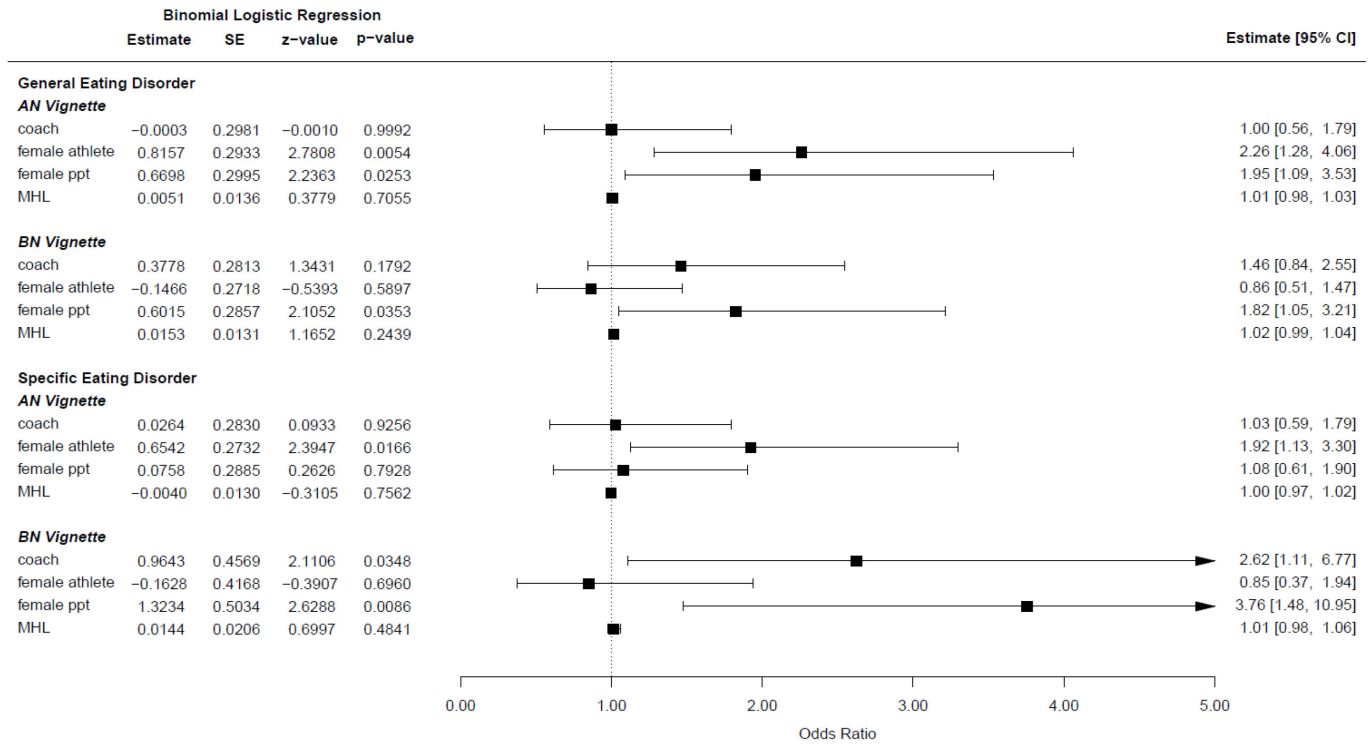


Figure 1 Logistic regression and OR values for the identification of GED and SED. AN, anorexia nervosa; BN, bulimia nervosa; GED, ED in general; MHL, mental health literacy; SED, specific eating disorder.

Problem identification: coach-specific factors

When considering the influence of coach-specific factors (figure 2), we found no significant predictors of correct problem identification for the AN vignette. Higher MHL scores were associated with

correct identification of both a GED (OR=1.05) and the SED (OR=1.06) for the BN vignette. Coach-specific demographic factors yielded a similar pattern of results to the full sample (see online supplemental analysis).

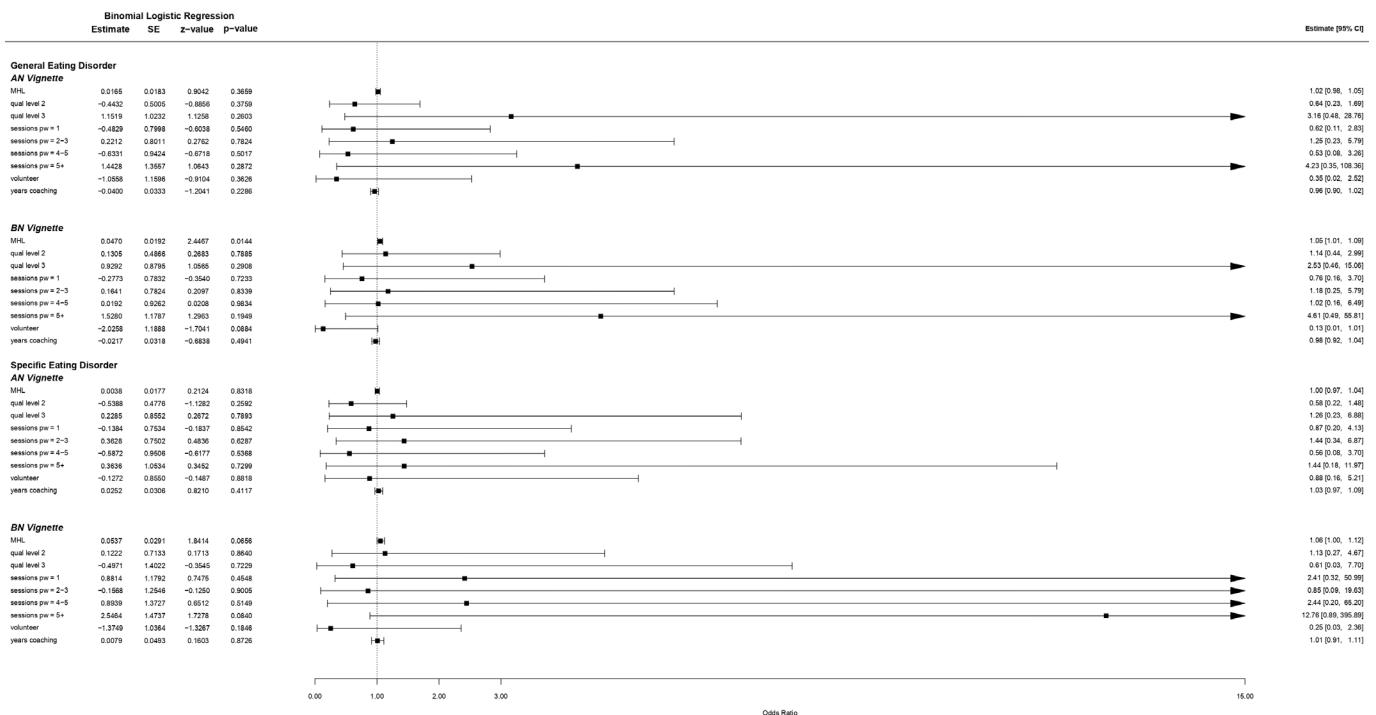


Figure 2 Logistic regression and OR values for the identification of GED and SED in the coach sample. AN, anorexia nervosa; BN, bulimia nervosa; GED, ED in general; MHL, mental health literacy; SED, specific eating disorder.

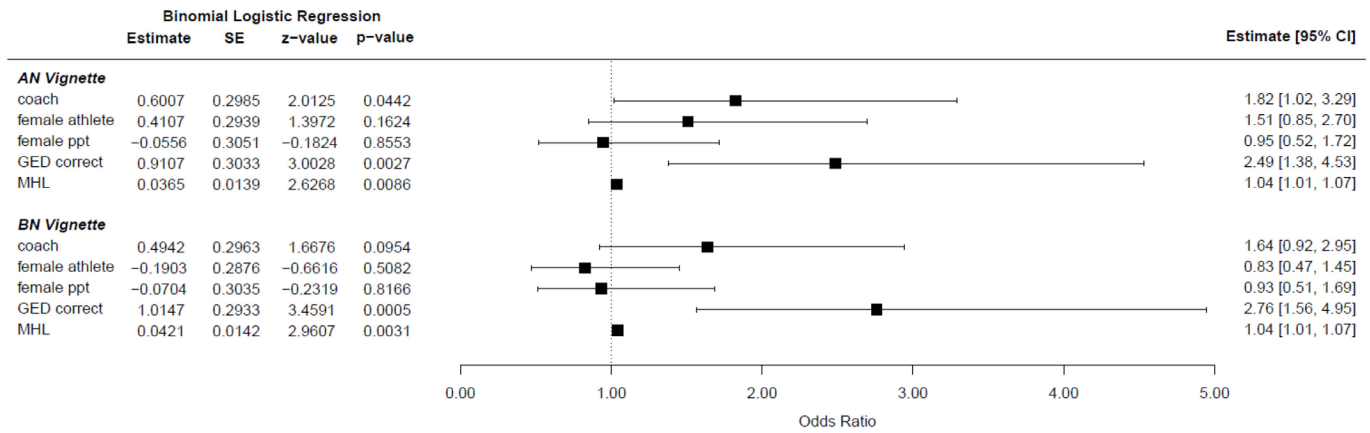


Figure 3 Logistic regression and OR values for the likelihood of suggesting professional treatment in the AN and BN vignette. AN, anorexia nervosa; BN, bulimia nervosa; GED, ED in general; MHL, mental health literacy.

Treatment advice

In terms of the advice given to the athlete, participants were more likely to suggest the athlete seek professional help after reading the AN (63%) than the BN (56%) vignette (B=0.56, SE=0.27, z=2.11, p=0.03, OR=1.76, 95% CI=1.04 to 2.97).

We then examined the factors that predicted whether participants suggested professional help for each vignette separately (figure 3). For the AN vignette, suggesting professional treatment was associated with being a coach (OR=1.82), correct identification of a GED (OR=2.49), and higher MHL scores (OR=1.04). Similarly, for the BN vignette, suggesting professional treatment was associated with the correct identification of a GED (OR=2.76) and an increased MHL score (OR=1.04). The use of SED as a predictor yielded a similar pattern of results (see online supplemental analysis).

Treatment advice: coach-specific factors

Finally, we considered the influence of the coach-specific factors on the advice given to the athlete (figure 4). For

the AN vignette, suggesting professional treatment was significantly associated with the number of years spent coaching (OR=1.12) and higher MHL scores (OR=1.06). In the BN vignette, suggesting professional treatment was also associated with the number of years spent coaching (OR=1.07) and higher MHL scores (OR=1.08).

DISCUSSION

This research aimed to identify whether coaches (cf. non-coaches) could recognise symptoms of AN (+RED-S) and BN (+RED-S) when depicted in an athletics context and whether they provided appropriate treatment advice. We also sought to identify coach-specific factors associated with the correct identification of an ED and the provision of appropriate advice.

Coach factors

Overall, the coaches we surveyed were no more likely to identify symptoms of AN or BN as reflecting an ED than the non-coach sample. One exception stood out

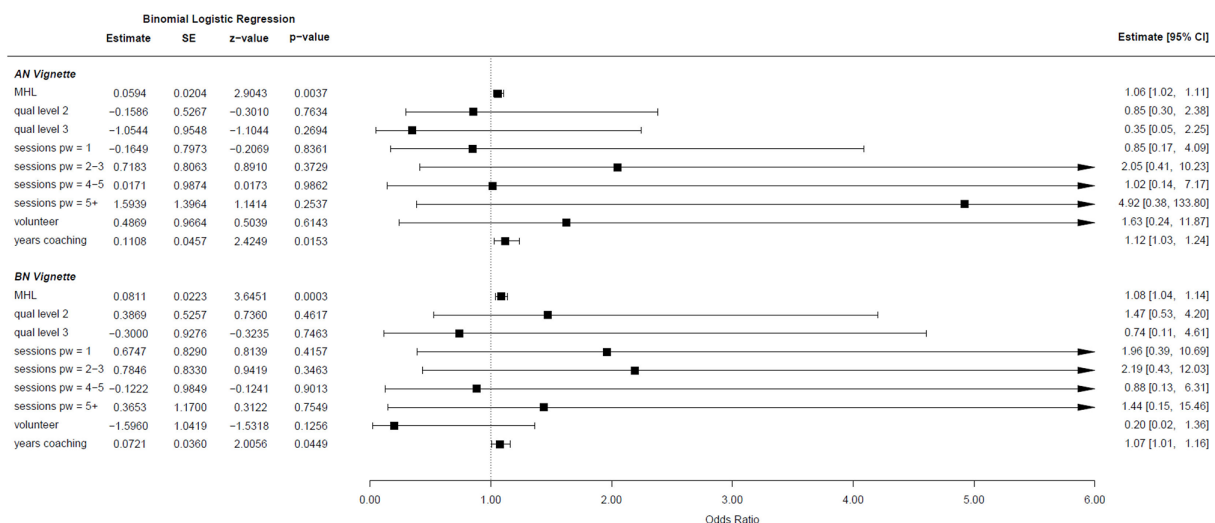


Figure 4 Logistic regression and OR values for the likelihood of suggesting professional treatment in the coach sample. AN, anorexia nervosa; BN, bulimia nervosa; MHL, mental health literacy.

in that where we considered the likelihood of naming BN correctly, coaches did exhibit higher identification rates. Further, although very few participants correctly identified RED-S (seven for the AN vignette, two for the BN vignette), these participants were exclusively from the coach sample.

Coaches were, however, significantly more likely to recommend professional treatment for an athlete exhibiting symptoms of AN (with a consistent but non-significant pattern for BN) than non-coaches. Underpinning these findings, coaches with more experience and better MHL were more likely to suggest appropriate treatment options. Crucially, participants who correctly identified that the athlete was experiencing symptoms of an ED (ie, GED correct) were also more likely to suggest professional treatment regardless of disorder type.

Considered in the context of athletics environments, these findings shed light on how coaches can be better positioned to respond to symptoms of DE/ED among athletes.^{11 15 35–37} On one hand, the link between higher MHL and suitable treatment advice suggests that work to improve MHL among coaches will enhance the likelihood that athletes experiencing DE/ED will receive professional treatment. Of concern, however, the present data also indicate that increasing MHL is unlikely to impact initial problem identification, another important predictor of recommending professional treatment. While the factors underlying the lack of relationship between MHL and problem identification are currently unknown, it is possible that the MHL is not sufficiently sensitive to variation in knowledge of DE/ED to provide a useful predictor in this context. Thus, in support of wider calls to improve education and MHL within the athletics domain,^{11 16} we recommend that an emphasis be placed on DE/ED and RED-S literacy. If implemented at the early stages of coach education programmes, this strategy may also mitigate the influence of coaching experience by equipping novice coaches with the knowledge to recognise DE/ED among athletes.

Additional findings

Consistent with the prevailing literature, symptoms relating to AN were more likely to be identified as an ED and were also associated with a greater likelihood of receiving advice to seek professional treatment when compared with BN.^{3 10 25 38} Furthermore, the likelihood of successful identification of an ED was higher in the AN vignette when the athlete was presented as female. This reflects previous findings that EDs are more likely to be associated with females showing symptoms of AN.³⁹ We caution against accommodating the gender stereotype that simultaneously circumscribes and characterises EDs to females exhibiting symptoms of AN. Recent research shows that the prevalence of DE/ED in male athletes is increasing,³ that male athletes with DE/ED represent an under-researched area,²⁴ and

male athletes may be particularly averse to seeking help through fear of stigmatisation.¹⁹ Indeed, the broadening of concept and change in acronym from Female Athlete Triad to RED-S was largely motivated by the recognition that male athletes also experienced negative health issues associated with DE/ED.⁷ As such, further work to decrease gender stereotyping and draw attention to issues related to male athletes with DE/ED is likely to enhance the experience of all athletes.

Limitations

Some caution is warranted when extrapolating beyond the current results. Our coach sample was drawn from members of athletics organisations in the UK and Ireland. The results, therefore, may be limited in their generalisability beyond these regions, particularly if athletics organisations elsewhere provide different training opportunities for their coaches. Moreover, the representativeness of the coach sample could not be estimated as information regarding the total number of eligible coaches was not available.

Two limitations associated with the survey methodology we employed also merit consideration. First, the data were obtained from self-selected samples. Second, coaches were invited to participate by the athletics organisations of which they were members. To this end, we suggest that if present in the current sample, these forms of selection bias would likely result in an elevated level of MHL (eg, knowledge and interest in the topic, or commitment to the organisation, may have led to an increased motivation to participate). Consistent with this claim, when compared with community-based norms²⁸ ($M=127.38$, $SD=12.63$), the current sample ($M=129.74$, $SD=10.85$) had a higher level of MHL ($p<0.001$). Future research should, therefore, look to replicate and extend this work with a focus on establishing the representativeness of the sample.

We also note some minor differences between the coach and non-coach samples. There were discrepancies in the demographic profile of the respective samples with respect to age and gender. However, it is important to note that these groups did not differ in terms of MHL. Furthermore, completion rates differed between coaches (63.1%) and non-coaches (87.5%). Although it is unclear why the samples differed in this respect, informal feedback suggested that at least one coach chose not to complete the survey as they felt that conducting this research implied that coaches should have a certain level of requisite knowledge regarding DE/ED. They did not agree with this position. While this misapprehension is regrettable, we feel it also highlights a potential barrier to the progress of efforts to decrease the risk of DE/ED within the athletics community. EDs constitute a significant concern in the sporting environment and continue to be recognised as one of the most common psychiatric pathologies experienced by elite athletes.¹⁴ The responsibility of coaches to help address this concern should not be dismissed.

Conclusion

This study demonstrated that coaches with more years of experience and higher MHL were more likely to recommend professional treatment for a fictional athlete exhibiting symptoms of an ED. Yet, despite correct identification of an ED acting as a key predictor for suggesting professional treatment, coaches did not exhibit a greater likelihood of correct disorder identification than the community sample of non-coaches. On this basis, we recommend that increased emphasis be placed on early and specific education of athletics coaches regarding identifying symptoms of DE/ED and RED-S. Increasing the frequency with which DE/ED is identified will also enhance the likelihood of appropriate intervention and successful treatment.

Acknowledgements Thank you to Scottish Athletics, Sport Ireland Coaching, and the Aberdeen Amateur Athletics Club for assisting with recruitment and to all participants, coaches and non-coaches alike, who took part in this research. Thanks also to Jenna Lehtinen, Jelly Qian Li, and Abigail Stephen for their assistance with coding the open-ended questions.

Contributors All authors contributed to the conceptualisation and design of the research. Data collection and coding were led by RH and LKM, and data analysis was conducted by MCM. All authors contributed to the writing and revision of the manuscript and approved the final version. All authors had full access to the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. LKM is the guarantor. The corresponding author MCM attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by University of Aberdeen School of Psychology Ethics Committee. Reference number for ethics approval is PEC/3933/2018/7.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Margaret Catherine Macpherson <http://orcid.org/0000-0003-3434-9334>
 Róisín Harrison <http://orcid.org/0000-0003-0746-8362>
 Dannette Marie <http://orcid.org/0000-0001-9768-8451>
 Lynden K Miles <http://orcid.org/0000-0002-4164-3470>

REFERENCES

- Sundgot-Borgen J, Torstveit MK, Klungland Torstveit M. Prevalence of eating disorders in elite athletes is higher than in the general population. *Clin J Sport Med* 2004;14:25–32.
- Schaal K, Tafflet M, Nassif H, et al. Psychological balance in high level athletes: gender-based differences and sport-specific patterns. *PLoS One* 2011;6:e19007.
- Karrer Y, Halioua R, Mötteli S, et al. Disordered eating and eating disorders in male elite athletes: a scoping review. *BMJ Open Sport Exerc Med* 2020;6:e000801.
- Mancine RP, Gusfa DW, Moshrefi A, et al. Prevalence of disordered eating in athletes categorized by emphasis on leanness and activity type - a systematic review. *J Eat Disord* 2020;8:47.
- Nattiv A, Loucks AB, Manore MM, et al. American College of Sports Medicine position stand. the female athlete triad. *Med Sci Sports Exerc* 2007;39:1867–82.
- De Souza MJ, Nattiv A, Joy E. 2014 female athlete triad coalition consensus statement on treatment and return to play of the female athlete triad. *Br J Sports Med* 2014;48:289–309.
- Mountjoy M, Sundgot-Borgen J, Burke L, et al. The IOC consensus statement: beyond the Female Athlete Triad-Relative Energy Deficiency in Sport (RED-S). *Br J Sports Med* 2014;48:491–7.
- Logue DM, Madigan SM, Melin A, et al. Low energy availability in athletes 2020: an updated narrative review of prevalence, risk, within-day energy balance, knowledge, and impact on sports performance. *Nutrients* 2020;12:835.
- Joy E, Kussman A, Nattiv A. 2016 update on eating disorders in athletes: a comprehensive narrative review with a focus on clinical assessment and management. *Br J Sports Med* 2016;50:154–62.
- Nazem TG, Ackerman KE. The female athlete triad. *Sports Health* 2012;4:302–11.
- Reardon CL, Hainline B, Aron CM, et al. Mental health in elite athletes: international Olympic Committee consensus statement (2019). *Br J Sports Med* 2019;53:667–99.
- Wells KR, Jeacocke NA, Appaneal R, et al. The Australian Institute of sport (AIS) and national eating disorders collaboration (NEDC) position statement on disordered eating in high performance sport. *Br J Sports Med* 2020;54:1247–58.
- Sundgot-Borgen J, Meyer NL, Lohman TG, et al. How to minimise the health risks to athletes who compete in weight-sensitive sports review and position statement on behalf of the Ad Hoc research Working group on body composition, health and performance, under the auspices of the IOC Medical Commission. *Br J Sports Med* 2013;47:1012–22.
- Bissett JE, Kroshus E, Hebard S. Determining the role of sport coaches in promoting athlete mental health: a narrative review and Delphi approach. *BMJ Open Sport Exerc Med* 2020;6:e000676.
- Breslin G, Shannon S, Haughey T, et al. A systematic review of interventions to increase awareness of mental health and well-being in athletes, coaches and officials. *Syst Rev* 2017;6:177.
- Castaldelli-Maia JM, Gallinaro JGdeME, Falcão RS, et al. Mental health symptoms and disorders in elite athletes: a systematic review on cultural influencers and barriers to athletes seeking treatment. *Br J Sports Med* 2019;53:707–21.
- American Psychiatric Association. *Diagnostic and statistical manual of mental disorders, fifth edition (DSM-5)*. Washington, DC: American Psychiatric Publishing, 2013.
- Brown KA, Dewoolkar AV, Baker N, et al. The female athlete triad: special considerations for adolescent female athletes. *Transl Pediatr* 2017;6:144–9.
- Gulliver A, Griffiths KM, Christensen H. Barriers and facilitators to mental health help-seeking for young elite athletes: a qualitative study. *BMC Psychiatry* 2010;10:113.
- Schinke RJ, Stambulova NB, Si G, et al. International society of sport psychology position stand: Athletes' mental health, performance, and development. *Int J Sport Exerc Psychol* 2018;16:622–39.
- Sebbens J, Hassmén P, Crisp D, et al. Mental health in sport (MHS): improving the early intervention knowledge and confidence of elite sport staff. *Front Psychol* 2016;7:911.
- Sullivan P, Murphy J, Blacker M. The level of mental health literacy among athletic staff in intercollegiate sport. *J Clin Sport Psychol* 2019;13:440–50.
- Griffiths S, Mond JM, Murray SB, et al. Young peoples' stigmatizing attitudes and beliefs about anorexia nervosa and muscle dysmorphia. *Int J Eat Disord* 2014;47:189–95.
- Tenforde AS, Barrack MT, Nattiv A, et al. Parallels with the female athlete triad in male athletes. *Sports Med* 2016;46:171–82.
- Bullivant B, Rhydderch S, Griffiths S, et al. Eating disorders "mental health literacy": a scoping review. *J Ment Health* 2020;29:336–49.



- 26 Mond JM, Hay PJ, Paxton SJ, *et al.* Eating disorders “mental health literacy” in low risk, high risk and symptomatic women: implications for health promotion programs. *Eat Disord* 2010;18:267–85.
- 27 Worsfold KA, Sheffield JK. Eating disorder mental health literacy: what do psychologists, naturopaths, and fitness instructors know? *Eat Disord* 2018;26:229–47.
- 28 O'Connor M, Casey L. The mental health literacy scale (MHLS): a new scale-based measure of mental health literacy. *Psychiatry Res* 2015;229:511–6.
- 29 Mokkink LB, Terwee CB, Knol DL, *et al.* The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: a clarification of its content. *BMC Med Res Methodol* 2010;10:22.
- 30 Wei Y, McGrath PJ, Hayden J, *et al.* Measurement properties of tools measuring mental health knowledge: a systematic review. *BMC Psychiatry* 2016;16:297.
- 31 R Core Team. R: a language and environment for statistical computing. R foundation for statistical computing, Vienna, Austria, 2019. Available: <https://www.R-project.org/>
- 32 Bates D, Maechler M, Bolker B. Fitting linear mixed-effects models using lme4. *J Stat Softw* 2015;677:1–48.
- 33 Kuznetsova A, Brockhoff PB, Christensen RHB. lmerTest package: Tests in linear mixed effects models. *J Stat Softw* 2017;82:1–26.
- 34 Macpherson MC, Harrison RE, Marie D, *et al.* Data from: Investigating coaches' recognition of symptoms of eating disorders in track athletes, 2022. Available: <https://osf.io/p4ftz/>
- 35 Chang C, Putukian M, Aerni G, *et al.* Mental health issues and psychological factors in athletes: detection, management, effect on performance and prevention: American Medical Society for Sports Medicine Position Statement-Executive Summary. *Br J Sports Med* 2020;54:216–20.
- 36 MacIntyre TE, Jones M, Brewer BW, *et al.* Editorial: mental health challenges in elite sport: balancing risk with reward. *Front Psychol* 2017;8:8.
- 37 Rice SM, Purcell R, De Silva S, *et al.* The mental health of elite athletes: a narrative systematic review. *Sports Med* 2016;46:1333–53.
- 38 Mond JM. Eating disorders “mental health literacy”: an introduction. *J Ment Health* 2014;23:51–4.
- 39 Blackstone SR, Sangiorgio C, Johnson AK. Peer recognition of disordered eating behaviors: implications for improving awareness through health education. *Am J Health Educ* 2020;51:142–50.

Investigating coaches' recognition of symptoms of eating disorders in track athletes.

Macpherson, M.C., Harrison, R.E., Marie, D., & Miles, L.K.

Supplementary Materials

Vignettes

Anorexia Nervosa Vignette for Female Character

Olivia is a 19-year-old competitive athlete who has struggled with her weight over the last few years due to the perceived need to be lean for sport. Olivia's current weight is well below the normal range for her age and height but she *thinks* she is overweight for a competitive athlete.

Olivia moved away for university a year ago and in doing so, began to work with a new coach. She began to train more than ever and would often go for extra runs without the knowledge of her coach. Olivia began to lose weight as a result of the increased training load. She then became stricter with her diet; avoiding all fatty foods, restricting her food intake by skipping meals, and eating small, set amounts of "healthy foods" each day. These healthy foods consisted mostly of fruit and vegetables, and bread or rice.

Olivia sometimes finds it difficult to control her eating and training but then will increase her efforts to overcome her temptation by eating even less than normal and running even more. Olivia has reported some pain in her left foot but tries to train through the pain. She has also developed an intense fear of gaining weight and has not menstruated in almost six months.

Q1: Please use as few words as possible to identify what problem(s), if any, Olivia is experiencing.

Q2 (coach sample): Imagine that Olivia is an athlete that you coach. How would you help or advise her?

Q2 (community sample): Imagine that Olivia is your friend. How would you help or advise her?

Anorexia Nervosa Vignette for Male Character

Josh is a 19-year-old competitive athlete who has struggled with his weight over the last few years due to the perceived need to be lean for sport. Josh's current weight is well below the normal range for his age and height but he *thinks* he is overweight for a competitive athlete.

Josh moved away for university a year ago and in doing so, began to work with a new coach. He began to train more than ever and would often go for extra runs without the knowledge of his coach. Josh began to lose weight as a result of the increased training load. He then became stricter with his diet; avoiding all fatty foods, restricting his food intake by skipping meals, and eating small, set amounts of "healthy foods" each day. These healthy foods consisted mostly of fruit and vegetables, and bread or rice.

Josh sometimes finds it difficult to control his eating and training but then will increase his efforts to overcome his temptation by eating even less than normal and running even more. Josh has reported some pain in his left foot but tries to train through the pain. He has also developed an intense fear of gaining weight and often reports having little energy - often picking up minor illnesses, such as coughs and colds.

Q1: Please use as few words as possible to identify what problem(s), if any, Josh is experiencing.

Q2 (coach sample): Imagine that Josh is an athlete that you coach. How would you help or advise him?

Q2 (community sample): Imagine that Josh is your friend. How would you help or advise him?

Bulimia Nervosa Vignette for Female Character

Megan is a 19-year-old competitive athlete. Although Megan struggled with her weight throughout adolescence, her current weight is within the normal range for her age and height. However, Megan *thinks* she is overweight and often reports feeling quite down about her weight and shape.

Since beginning university, Megan has increased her training load without consulting her coaches. She gradually began to lose weight as a result of the extra training and felt guilty if she missed any training (either set by her coaches or the supplementary sessions she set for herself).

Megan then became stricter with her diet. She reported avoiding fatty foods, not eating between meals and trying to eat daily set portions of “healthy foods”, consisting of mainly fruit, vegetables and lean protein. Megan continued with the elevated training load during her dieting and consequently lost several more kilograms. She has also reported pain in her left foot, which prevents her from running sometimes, despite her best efforts to run through the pain.

Although Megan is still within the normal weight range for an athlete of her age and height, she has found it difficult to maintain the weight loss and control her eating over the last 6 months. While able to restrict her dietary intake during the day, Megan is sometimes unable to stop eating during the night. She may consume, for example, a block of chocolate or several slices of toast.

Megan is worried that she is going to gain weight again and to counteract the effects of her bingeing, she will run a few extra miles than planned the following day and aim to eat even more “healthily”. Due to Megan’s increasing focus on her exercise and eating routines, she has become isolated from her friends.

Q1: Please use as few words as possible to identify what problem(s), if any, Megan is experiencing.

Q2 (coach sample): Imagine that Megan is an athlete that you coach. How would you help or advise her?

Q2 (community sample): Imagine that Megan is your friend. How would you help or advise her?

Bulimia Nervosa Vignette for Male Character

Mark is a 19-year-old competitive athlete. Although Mark struggled with his weight throughout adolescence, his current weight is within the normal range for his age and height. However, Mark *thinks* he is overweight and often reports feeling quite down about his weight and shape.

Since beginning university, Mark has increased his training load without consulting his coaches. He gradually began to lose weight as a result of the extra training and felt guilty if he missed any training (either set by his coaches or the supplementary sessions he set for himself).

Mark then became stricter with his diet. He reported avoiding fatty foods, not eating between meals and trying to eat daily set portions of “healthy foods”, consisting of mainly fruit, vegetables and lean protein. Mark continued with the elevated training load during his dieting and consequently lost several more kilograms. He has also reported pain in his left foot, which prevents him from running sometimes, despite his best efforts to run through the pain.

Although Mark is still within the normal weight range for an athlete of his age and height, he has found it difficult to maintain the weight loss and control his eating over the last 6 months. While able to restrict his dietary intake during the day, Mark is sometimes unable to stop eating during the night. He may consume, for example, a block of chocolate or several slices of toast.

Mark is worried that he is going to gain weight again and to counteract the effects of his bingeing, he will run a few extra miles than planned the following day and aim to eat even more “healthily”. Due to Mark’s increasing focus on his exercise and eating routines, he has become isolated from his friends.

Q1: Please use as few words as possible to identify what problem(s), if any, Mark is experiencing.

Q2 (coach sample): Imagine that Mark is an athlete that you coach. How would you help or advise him?

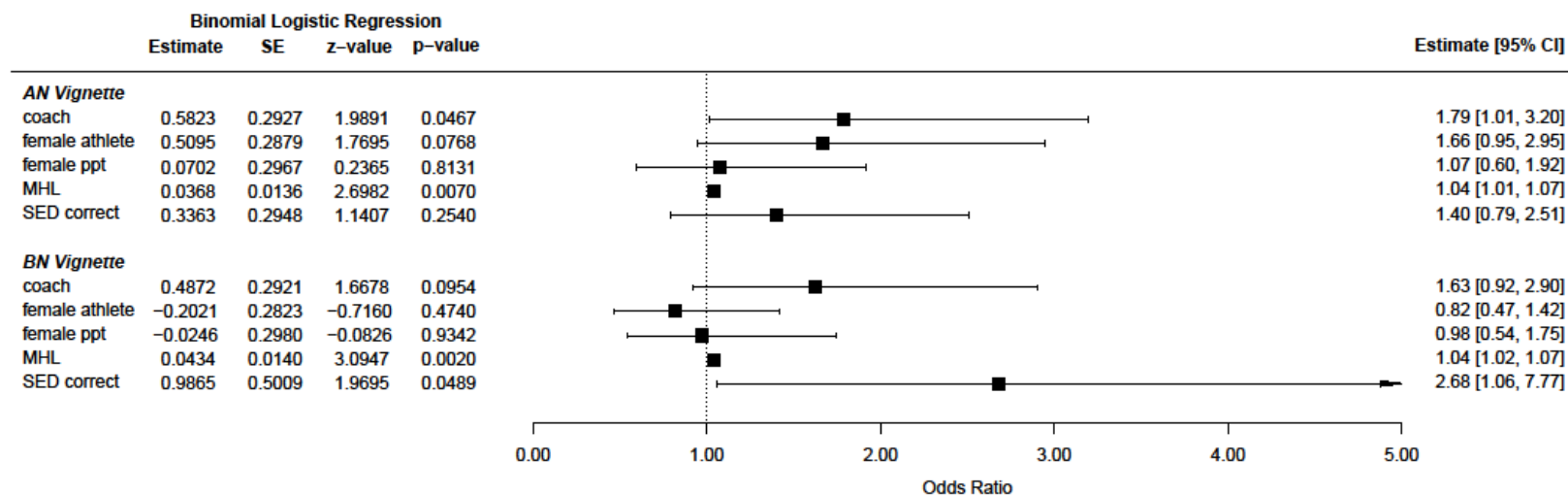
Q2 (community sample): Imagine that Mark is your friend. How would you help or advise him?

Supplementary Analyses

Predicting the likelihood of suggesting professional treatment as a function of SED

Identification of the SED compared with a GED was not associated with a change in the likelihood of suggesting professional treatment, for either the AN vignette ($B=-0.49$, $SE=0.34$, $z=-1.43$, $p=0.15$) or the BN vignette ($B=-0.53$, $SE=0.49$, $z=1.09$, $p=0.28$). Further, as shown in Figure S1, correct identification of the SED was associated with a greater likelihood of suggesting professional treatment for the BN vignette (and a trend in this direction for the AN vignette), consistent with the patterns of results found for GED.

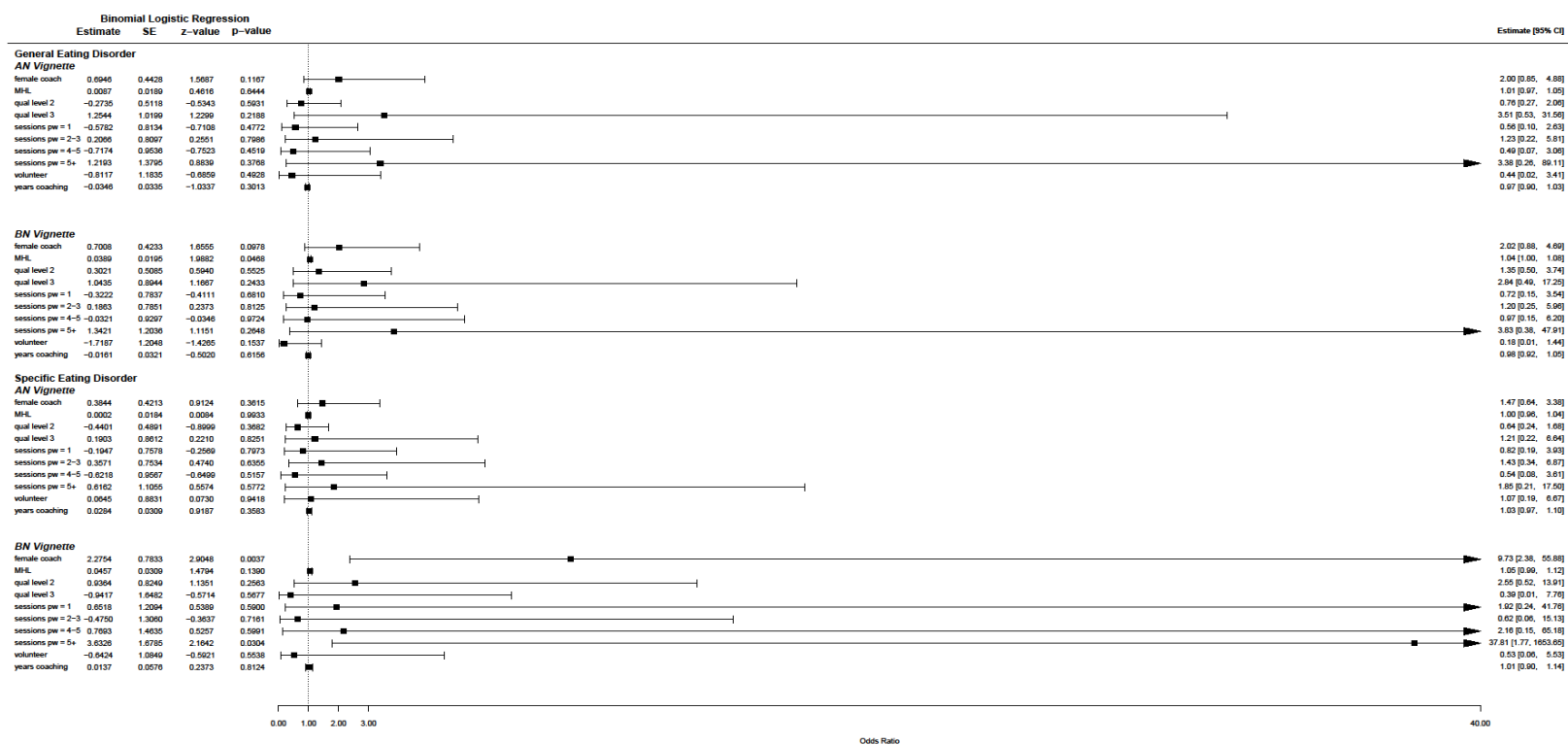
Figure S1. Logistic regression and odds ratio values for the likelihood of suggesting professional treatment in the AN and BN vignette, using the SED data.



Predicting the likelihood of correct problem identification as a function of coach gender

When considering the likelihood of correct identification of a GED and the SED as a function of participant gender, the coach-specific sample showed effects consistent those found in the full sample. For both the AN and BN vignette, there was a general pattern whereby female coaches were associated with a greater likelihood of correct problem identification.

Figure S2. Logistic regression and odds ratio values for the likelihood of correct problem identification in the AN and BN vignette, when coach gender is included in the model.



Predicting the likelihood of suggesting professional treatment as a function of coach gender

When considering the likelihood of suggesting professional treatment as a function of participant gender, the coach-specific sample showed patterns of effects consistent to those found in the full sample (in both the AN and BN vignette).

Figure S3. Logistic regression and odds ratio values for the likelihood of suggesting professional treatment in the AN and BN vignette, using the coach gender data.

