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Harmonisation and implementation of sports-related concussion guidelines in European youth football: the REFORM Erasmus+ project

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ABSTRACT

Introduction Sports-related concussions (SRCs) are frequently under-reported in youth sports, especially football, due to limited awareness, inconsistent reporting practices and a lack of medical personnel at the grassroots level. Concussion management protocols vary widely across regions, highlighting the need for a standardised approach. This study aims to harmonise SRC education and management practices in European youth football through an interdisciplinary collaboration involving football associations, healthcare professionals and academic institutions from Norway, Germany, Croatia and Turkey. The project will develop and implement educational resources (eg, toolkits, workshops and a Massive Open Online Course (MOOC)) targeted at coaches, players, parents, referees and medical personnel.

Methods and analysis Using a participatory action research design guided by the Logical Framework Approach, the project will develop, pilot and evaluate concussion education tools across diverse football contexts. Surveys, focus groups and participatory workshops will be used to assess changes in knowledge, attitudes and behaviours. Quantitative data will be analysed using descriptive statistics, while qualitative data from focus groups and interviews will undergo reflexive thematic analysis. Engagement metrics from MOOCs and toolkits will also be tracked.

Ethics and dissemination Ethics approval has been obtained in all participating countries. Informed consent (or parental consent for minors) will be secured for all participants. Dissemination will occur through UEFA, national football associations and complemented by social media outreach and presentations at sports conferences. The project is expected to enhance stakeholder awareness, improve concussion management protocols and provide a scalable model for concussion education in grassroots football across Europe.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Sports-related concussions (SRCs) in youth football are common but under-reported, with guideline implementation inconsistent at the grassroots level due to limited awareness and a lack of medical staff.

WHAT THIS STUDY ADDS

⇒ This study evaluates current awareness of SRCs in youth football among multiple stakeholder groups and develops concussion education tools (toolkits, a Massive Open Online Course and workshops) across four European countries.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The project offers a scalable framework for concussion education that can enhance grassroots safety practices, inform federation policies and inform future cross-cultural sports safety research.

INTRODUCTION

Football promotes physical health, teamwork and social development for more than 250 million players worldwide, many of whom are youth. As the sport continues to grow, so does the awareness of concussions as one of the most common brain injuries in contact sports. This highlights the importance of enhancing safety measures to protect players at all levels.

A sports-related concussion (SRC) is a mild traumatic brain injury that occurs during sports activities due to a direct impact on the head, neck or body that transmits impulsive force to the brain.[1] The potential for both immediate and long-term consequences of SRCs[2 3] warrants caution, especially in youth athletes, who typically require longer recovery periods than adults.[4]

Despite increasing recognition of the problem, SRCs in youth football remain frequently unrecognised and under-reported, largely due to limited awareness, inconsistent practices and players' reluctance to report symptoms.[5] Furthermore, concussion management protocols differ widely between countries,[6] underscoring the need for a

unified, evidence-based approach to concussion prevention and management in football.

Since the early 2000s, the Concussion in Sport Group has provided standardised protocols for assessing and recognising concussions in both adults and children. The most recent updates (2023) include the Sports Concussion Assessment Tool (SCAT6[7]), the Sports Concussion Assessment Tool for Children[8] and the Concussion Recognition Tool (CRT6[9]), along with the Sixth Consensus Statement on Concussion.[1] Although these documents are publicly accessible, their practical implementation, particularly at the grassroots level, remains uncertain. Grassroots football seldom involves on-site medical personnel, making medically oriented tools such as SCAT6 difficult to apply. In addition, volunteer coaches and parents often lack training to recognise concussion symptoms, and finally, communication between national federations and community clubs is inconsistent. Even when updated guidelines are disseminated, insufficient communication and training delivery hinder widespread adoption.

Limited research exists on how different key stakeholders, such as coaches, players, parents and referees, perceive and implement concussion guidelines in youth football. Engaging these stakeholders is essential to ensure that concussion protocols are effectively communicated, understood and applied. The current evidence reveals a persistent gap in SRC awareness and reporting, particularly at the grassroots level, where the majority of youth football participation occurs. A lack of education among coaches, parents and even health professionals contributes to under-reporting.[10] Evidence from coordinated education and policy initiatives demonstrates that inclusive, multistakeholder approaches significantly improve concussion recognition and management in youth sports.[11]

This study addresses these gaps by designing and testing an intervention aimed at harmonising concussion management practices across Europe and evaluating its impact on stakeholders' knowledge and behaviour.

The REFORM project distinguishes itself through its multicountry collaboration, spanning Croatia, Germany, Norway and Türkiye, to develop a unified framework for SRC education and management adaptable to diverse contexts. Central to the project are innovative digital resources, including Massive Open Online Courses (MOOCs) and tailored toolkits, to ensure consistent, accessible learning opportunities across the football community.

Guided by the Logical Framework Approach (LFA), REFORM adopts a structured, outcome-oriented methodology to develop, pilot and scale these tools across European football clubs. Through collaboration with UEFA, the project aims to extend concussion awareness from elite to grassroots levels, providing evidence-based education for coaches and medical professionals while empowering young players and families to recognise and manage concussions effectively. By implementing a comprehensive, Europe-wide strategy, REFORM seeks to create sustainable educational resources and promote a culture of safety, awareness and shared responsibility in youth football.

METHODS AND ANALYSIS

Aims

Primary aim

To evaluate the effectiveness of an intervention aimed at harmonising concussion management practices in European youth football. This includes developing, pilot testing and assessing the impact of a standardised curriculum and educational resources on knowledge, attitudes and practices.

Secondary aims

1. Increase concussion recognition and management capabilities among youth coaches, parents and players.
2. Foster collaboration across football associations to improve safety protocols for concussion management.
3. Establish a framework for sustained concussion management education applicable across European football settings.

Design

This project is a multiphase observational study using a participatory action research design. It includes the identification, documentation and evaluation of educational tools to improve concussion management practices in European youth football. Each phase of the study is guided by the LFA to ensure systematic evaluation and measurable outcomes.

The project adopts a stakeholder-centred methodology, involving key stakeholders—including football associations, healthcare professionals and academia—from Norway, Germany, Croatia and Türkiye. This structured approach ensures that each phase aligns with specific objectives, outputs and outcomes, enhancing the project's coherence and impact. The LFA was chosen for its structured, outcome-oriented methodology, which aligns well with specific objectives, outputs and outcomes, enhancing the project's coherence and impact. LFA facilitates clear goal-setting, stakeholder engagement and systematic monitoring, ensuring alignment between the project's objectives and measurable outcomes. Compared with other participatory research approaches, LFA's emphasis on stakeholder-driven planning ensures that the developed educational tools are practical, culturally relevant and widely applicable across diverse European football contexts.

The project will use a stakeholder approach to collaboratively observe, assess and document innovative educational materials and resources for concussion awareness that are emerging in routine practice. This process will be interdisciplinary and transnational, ensuring that the materials are harmonised and build on each other to meet the needs of various stakeholders. The project will use surveys to articulate training and educational

standards to ensure a high-quality standard that can be scaled across European national football associations down to grassroots levels in each country.

Through a participatory process, the project will solicit expert opinion and keep an ongoing dialogue with multiple facets of stakeholders to guarantee an evidence-based joint European educational awareness set that meets the demands of the coaches and board, as well as fostering an awareness in the players and their families.

Recruitment strategy and representativeness

To ensure broad representativeness across countries, roles and genders, participants will be recruited through a coordinated strategy involving national football federations in Croatia, Germany, Norway and Türkiye. Each federation will identify youth football clubs representing diverse geographic regions (urban, suburban and rural), club size and categories (grassroots clubs or youth academies). Clubs will be selected to reflect a range of operational models and community demographics.

Within each club, stakeholder groups, including coaches, players, parents and referees, will be approached using a multichannel communication strategy. This includes direct outreach via club leadership, digital invitations (email), printed materials and public posts on the official websites and social media channels of the national federations. Recruitment messages will emphasise the value of broad participation and clarify that the study aims to evaluate the effectiveness of educational materials rather than individual performance. Recruitment materials will be tailored using accessible language and visuals to appeal to as many people and different positions in youth football as possible. Country-level clustering will be mitigated by stratifying recruitment across multiple regions within each country. Clubs will be selected to ensure proportional representation, and federations will monitor regional participation rates throughout the recruitment phase.

To encourage participation, participants will receive non-monetary incentives, such as access to the SRC management toolkit, exclusive workshops and webinars, as well as a certificate of participation.

Inclusion criteria

- *Clubs*: youth football clubs in the four countries will be invited to participate. Clubs must have:
  - The ability to implement new concussion protocols with support from the project team. This will include basic resources such as access to digital platforms (eg, internet connectivity, devices to access training materials).
  - A willingness to engage with and integrate educational materials into their regular operations. Federations will support clubs in understanding these expectations before participation.
- *Stakeholders*: key stakeholder groups involved in youth football will be included:
  - Coaches of youth teams, regardless of prior experience in concussion management.
  - Players actively participating in youth football (targeting diverse age groups and genders).
  - Parents of youth players to ensure comprehensive inclusion of perspectives.
  - Referees involved in officiating youth football matches.

  Medical personnel, including team doctors and physiotherapists.

Exclusion criteria

- Clubs that lack the basic resources or logistical capacity to access digital learning platforms or implement concussion protocols (as determined by federations).
- Stakeholders who are unwilling to participate or unable to provide informed consent (or for minors, parental/guardian consent).

Cultural adaptation of educational materials

To ensure the educational materials are effective across the diverse cultural contexts of the participating countries, the project will implement a robust process of cultural adaptation. This will involve the translation of educational materials into the native languages of each participating country, ensuring accuracy and clarity in communication. UEFA-approved translators will be used to maintain the integrity of the content.

Additionally, local experts, football stakeholders and national football federations will play an active role in providing culturally specific insights throughout the development phase. This collaborative approach ensures that the content resonates with the distinct cultural contexts, communication styles and practices of each country. Focus group discussions and pilot testing will be conducted in each country to refine the materials further, ensuring their relevance and effectiveness in addressing regional nuances related to concussion management.

Patient and public involvement

Youth players, parents, coaches, referees and medical staff were actively involved in this study through a participatory action research design. Stakeholders contributed to identifying needs, shaping the development of concussion education materials (toolkits, workshops and a MOOC) and providing feedback through surveys, focus groups and pilot testing. Their perspectives directly informed the cultural adaptation and practical implementation of the intervention across the participating countries. Stakeholders will also be engaged in dissemination activities through national football federations to ensure broad accessibility and sustainability.

Data management

The REFORM project will fully comply with the General Data Protection Regulation, ensuring that all participant data, particularly that of minors, is handled securely and ethically. Personal data will be collected only with informed and explicit consent, and parental consent

will be obtained for participants under the age of 18. All data will be securely stored, with access limited to authorised personnel. Data anonymisation techniques will be employed to protect participant identities. Aggregated, anonymised data may be shared with the broader scientific community through open-access platforms, promoting transparency while safeguarding participant confidentiality. These practices will align with European Union data protection regulations as well as the specific data protection laws of the countries involved in the study.

Data collection

Data will be collected through surveys, focus group interviews and participatory workshops.

Key data points include:

- Knowledge and awareness of concussion prevention and management.
- Confidence levels among coaches and parents regarding concussion management.
- Preferred methods of providing educational materials.
- Pretest and post-test will be used to measure the effectiveness of the workshops, MOOCs and toolkits.

Survey distribution and validation

Surveys will quantify baseline knowledge, attitudes and behaviours regarding SRCs across a broad sample of stakeholders, enabling cross-country comparisons and identification of key knowledge gaps. In particular, the survey will be distributed among players, coaches, parents and referees. For each stakeholder group, our goal is to achieve a total of 350–400 respondents. Particularly, the aim is to achieve sufficient statistical power to detect meaningful differences and adequate precision in the estimates of key variables (knowledge, attitudes and behaviours) across the four countries and stakeholder groups. A power analysis, assuming a moderate effect size (Cohen's d=0,5) and an alpha level of 0.05, suggests that the sample size is appropriate for identifying differences, within a margin of error of about 5% at a 95% CI.

This approach will provide a robust sample size and ensure diverse perspectives from various roles within youth sports, enabling us to gather comprehensive insights that reflect the unique experiences and needs of each group across different cultural contexts. The survey will be developed based on established concussion awareness and management frameworks (eg, SCAT6, CRT6), as well as on previous literature,[12–14] and reviewed by a panel of subject-matter experts, including healthcare professionals, educators and football stakeholders. A pilot study will be conducted with a subset of participants from one country to assess the clarity, relevance and reliability of the survey questions. Adjustments will be made based on pilot feedback before full-scale deployment.

Focus group interview plan

Focus groups are integral to the intervention evaluation, providing qualitative insights into stakeholders' experiences with the educational tools. These groups will explore how the intervention impacts concussion awareness and management practices, and findings will be used to refine materials before scaling up.

Focus groups will offer qualitative insights into stakeholders' lived experiences, cultural nuances and contextual challenges, helping to interpret and enrich the survey findings. We plan to conduct focus group interviews to gain deeper insights into the experiences and perspectives of key stakeholders in youth football. Although the sample size will be flexible and adaptive, we aim to hold 12 focus groups (ie, 3 per country), with approximately 4–8 participants in each group, with consideration of gender distribution (50% female, 50% male). The goal is to recruit enough participants to reach saturation, to ensure that no new information emerges. These groups will be segmented by stakeholder type (coaches, referees, healthcare providers, parents and players) and organised across the four countries: Norway, Croatia, Germany and Türkiye. Participants will be selected based on their willingness to engage and their potential to provide unique insights into concussion management practices within their local context.

The focus group discussions will be facilitated by the football federation in each respective country, ensuring that the interviews are conducted in the native language of the respondents. This approach will allow participants to express themselves more freely, ultimately enhancing the validity and reliability of our research findings. By gathering qualitative data from diverse groups, we hope to enrich our understanding of current knowledge, attitudes and behaviours regarding sport-related concussions in youth football.

Workshops, MOOCs and webinars participatory

A series of workshops and MOOCs will be incorporated to enhance concussion awareness and management among key stakeholders in youth football. The educational material will focus on guiding stakeholders in using the REFORM toolkits. By the end of the project, a minimum of 8 coaches and health professionals will be educated and certified through a 'teach the teacher' approach to cascade concussion prevention knowledge regionally, while at least 50 coaches and health professionals will complete the REFORM MOOC for certification on concussion management. The MOOC will focus on how to prevent and manage concussions in youth football, as well as how to effectively use the REFORM toolkits. Additionally, 200 players, 50 parents and 20 coaches and health professionals will be trained using the REFORM toolkits by the end of the project. To ensure effective knowledge transfer, each workshop and MOOC will be accompanied by pretest and post-test. These tests will assess participants' knowledge, attitude and confidence in concussion management before and after the interventions. The study will also organise three awareness-raising webinars as part of the European Week of Sport, with a goal of engaging at least 150 participants in each

session. These workshops, MOOC interventions and webinars will be central to promoting concussion awareness across multiple levels of youth football, ensuring a broad, sustainable impact on concussion prevention and management.

Outcome measures

Primary outcomes:

1. Concussion awareness

Changes in attitudes regarding concussion management among youth players, coaches, parents and referees.

- Measurement: preintervention and postintervention surveys administered online in each participating country.
- Instrument: Likert-scale items (1=strongly disagree to 5=strongly agree) measuring confidence in recognising concussions, perceived importance of concussion management and willingness to take appropriate action.
- Indicator: An overall attitude score will be calculated as the mean of all items (range: 1–5), with higher scores reflecting more positive attitudes toward concussion safety.

2. Concussion knowledge

Changes in knowledge regarding concussion management among youth players, coaches, parents and referees.

- Measurement: preintervention and postintervention surveys administered online in each participating country. Knowledge will be assessed through asking study participants knowledge questions on SRC, such as symptom recognition or optimal clinical treatment.
- Instrument: the Concussion Knowledge and Attitudes Survey (adapted from previous literature) validated through expert review and pilot testing.
- Indicator: concussion knowledge score, following Rosenbaum and Arnett,[12] where correct answers will be scored as 1, incorrect answers as 0, and summed to derive the concussion knowledge score. Surveys with incomplete responses will be excluded.

3. Concussion management

Improvement in concussion recognition and response protocols in participating football clubs.

- Measurement: structured postintervention reporting by club representatives documenting actual response procedures after suspected SRCs.
- Indicators: proportion of clubs adopting the REFORM concussion protocol after a suspected SRC.

Secondary outcomes (*measured via MOOC platform and follow-up surveys*):

1. Engagement
   - Measurement: automated analytics from the MOOC platform and toolkit website, including enrolment rates, module completion rates and mean time on platform.
   - Indicators: workshop attendance (via attendance registers) and toolkit utilisation (downloads, self-reported use on a 5-point Likert scale: 1=never to 5=very frequently).
2. Satisfaction
   - Measurement: postintervention questionnaire with Likert-scale items (1=strongly disagree to 5=strongly agree) assessing clarity, relevance and usefulness of materials.
   - Indicator: mean satisfaction score (≥4.0 = satisfied).
3. Scalability
   - Measurement: follow-up surveys (6 and 12 months).
   - Indicators: number of clubs adopting educational materials and the geographic spread across countries and regions. Adoption rate = percentage of clubs implementing REFORM resources after exposure to dissemination activities.

Data analysis

The study will employ both quantitative and qualitative data analysis to provide a comprehensive understanding of concussion awareness and management practices across participating countries.

The study employs two distinct analytical approaches corresponding to different study components: (1) descriptive and exploratory analysis of cross-sectional baseline survey data and focus group interviews, and (2) preintervention and postintervention analysis of MOOC/workshop participants using mixed-effects models to account for repeated measures and hierarchical data structure.

Quantitative analysis

Cross-sectional baseline survey

Descriptive statistics (means, SD and frequencies) will characterise knowledge and attitudes across stakeholder groups (coaches, players, parents and referees) and countries (Norway, Germany, Croatia and Türkiye). If the sample size permits and preliminary descriptive findings suggest meaningful patterns, we will conduct exploratory analyses to examine associations between baseline knowledge/attitudes and participant characteristics. Specifically:

- Between-group comparisons: one-way ANOVA (or Kruskal-Wallis test for non-normal distributions) will compare knowledge scores across stakeholder groups and countries.
- Covariate exploration: univariable analyses (eg, t-tests, correlation analysis) will explore associations between outcomes, such as the concussion knowledge score, and potential covariates, including age, gender, prior concussion, years of experience, etc.

Clustering considerations: participants are nested within clubs, which are nested within countries. However, for baseline cross-sectional surveys, we do not anticipate fitting multilevel models due to the descriptive nature of the analysis. Instead, 'country' will be included as a fixed effect in any exploratory regression models. Intraclass correlation coefficients will be calculated where possible to quantify the proportion of variance attributable to

club- and country-level clustering, which will inform the design of future studies.

Missing data: for descriptive analyses, available case analysis will be used (ie, all available data for each variable will be included). Missing data patterns will be examined and reported.

Multiplicity: because the cross-sectional analysis is exploratory and descriptive, no adjustment for multiple comparisons will be applied beyond pairwise post-hoc tests, where Bonferroni correction will be used.

Preinterventionand postintervention of MOOC/workshops

Engagement metrics (see above) will be analysed to measure user engagement. These metrics will be correlated with survey outcomes to explore the relationship between resource utilisation and knowledge gains. Linear mixed-effects models will be used to evaluate changes in outcomes from preintervention to postintervention, accounting for the hierarchical structure of the data and repeated measurements. The models will assess:

1. Time effect: overall change from preintervention to postintervention (primary hypothesis).
2. Intervention×time interaction: differential effects across intervention modalities (eg, MOOC versus in-person workshops, if applicable).
3. Stakeholder×time interaction: whether intervention effects vary by stakeholder group.

In cases of significant main effects, pairwise post-hoc comparisons will be performed using estimated marginal means with Tukey or Bonferroni adjustment to control for multiplicity.

Qualitative analysis

Focus groups interviews

Qualitative data from focus groups will be analysed using reflexive thematic analysis, a framework informed by Braun and Clarke.[15] Thematic analysis will be conducted within each subgroup (stakeholders' groups, levels of football and countries) and then compared across groups to identify patterns, differences and shared challenges. Coding will be done inductively, with initial codes identified through repeated readings of the interview transcripts. We will then group the codes into themes, allowing for the identification of patterns. A combination of manual coding and software tools (eg, NVivo) will be employed. Reflexivity will be addressed by maintaining awareness of the positionality of interviewers. The emphasis will be on transparency and interpretative depth, rather than seeking inter-rater reliability.

All transcripts will be reviewed in their original languages by native-speaking translators at UEFA and will be back-translated to ensure cultural and linguistic accuracy and maintain data quality. Themes will be validated through member-checking to ensure participants' experiences and views are accurately represented. Discrepancies will be resolved through iterative analysis and discussion among the research team.

Finally, the whole process will be documented comprehensively to create an auditable trail. All coding decisions, theme development and analytical steps will be carefully recorded and stored. This will allow transparency, allowing for the possibility of future audit or verification of the whole process by other researchers.

By combining quantitative rigour with qualitative depth, the data analysis process will generate actionable insights into improving concussion education and management in youth football.

Intervention and dissemination

The intervention uses a structured, four-phase approach to address gaps in concussion awareness and management in youth football (see figure 1). This approach ensures systematic development, implementation and evaluation of educational resources.

The dissemination phase employs a multichannel strategy, combining direct stakeholder engagement with digital tools and institutional partnerships to reach diverse audiences across Europe. Resources will be shared with national football associations for scaling across Europe, leveraging social media platforms to enhance outreach. The findings of this project will be analysed and published in peer-reviewed journals, as well as presented at key conferences. All findings will be disseminated to accurately inform future practices. This will occur immediately after the completion of the final analysis.

Evaluation metrics

The success of the intervention will be assessed based on:

1. *Engagement metrics*: the number of participants completing workshops, the MOOC and attending webinars.
2. *Knowledge gains*: measured by improvements in pretest and post-test scores.
3. *Certification and training*: the number of stakeholders certified in concussion management.
4. *Qualitative feedback*: insights from participants on the applicability and relevance of the educational materials.

Insights from participants on the applicability and relevance of the educational materials.

CONCLUSION

A collaborative, transparent approach between football federations and stakeholders is necessary. Federations play a vital role in educating without enforcing strict mandates, fostering a culture where player safety is the shared responsibility of all involved. Concussions, while an inherent risk in contact sports, should be managed rather than feared; while preventing them entirely may not be possible, all individuals involved must know how to respond swiftly and appropriately to suspected concussions, safeguarding the health and future of young athletes.

The use of MOOCs and toolkits represents a novel aspect of the project, allowing for scalable, interactive learning that can reach large numbers of

Figure 1 Graphical representation of the four phases of the project, from needs analysis and resource development to piloting, validation and full-scale implementation and dissemination. MOOC, Massive Open Online Course.

stakeholders while also providing ongoing updates and resources for long-term impact.

This project demonstrates the importance of a collaborative and structured approach to harmonising concussion management in youth football. By developing, piloting and evaluating educational resources, the project creates a foundation for safer football environments across Europe. The outcomes will inform future strategies to ensure sustainable impact and scalability.

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Contributors GG and AN conceived the study. GG led the development of the protocol. GG, GM, TEA, DD, NK-G, IPD, TM and AN contributed to the study design and methodology. GG drafted the first version of the manuscript. GM, TEA, DD, NK-G, IPD, TM and AN provided critical revisions and intellectual input. AN secured funding for the project, including formal support from UEFA. All authors reviewed and approved the final manuscript. AN is the guarantor.

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Competing interests TM is the current chairman of UEFS's and the German FA's (DFB) Medical Committee. TM also chairs the working group, Sports Medicine in Professional Football of the German League Organisation (DFL). The rest of the authors declare no competing interests.

Patient and public involvement Patients and/or the public were involved in the design, conduct, 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 it will adhere to ethical guidelines as mandated by the participating countries' regulations. Ethics approval has been obtained for the REFORM project in Germany (Saarland University, No: 24-21), Croatia (No: 2182-198-03-04-24-0081) and Türkiye (No: 2024–10/454). In Norway, ethical approval was not required as the data will be collected in a fully anonymous manner, ensuring participant confidentiality. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available upon reasonable request. Not applicable.

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