

## Booklet on concussion for American football players: content and appearance validation

### Cartilha sobre concussão encefálica para jogadores de futebol americano: Validação de conteúdo e aparência

#### How to cite this article:

Mendes BM, Cruzeiro DB, Chaves SCS, Melo Filho PL. Booklet on concussion for American football players: content and appearance validation. Rev Rene. 2026;27:e96426. DOI: <https://doi.org/10.36517/2175-6783.20262796426>

 Bruno Marques Mendes<sup>1</sup>  
 Débora Balmant Cruzeiro<sup>1</sup>  
 Suellen Cristina da Silva Chaves<sup>1</sup>  
 Pedro Leite de Melo Filho<sup>1</sup>

<sup>1</sup>Universidade Cesumar.  
Curitiba, PR, Brazil.

#### Corresponding author:

Pedro Leite de Melo Filho  
Rua Benjamin Constant, 242, Centro.  
CEP: 80060-020. Curitiba, PR, Brazil.  
E-mail: [pedro.filho@unicesumar.edu.br](mailto:pedro.filho@unicesumar.edu.br)

**Conflict of interest:** the authors have declared that there is no conflict of interest.

EDITOR IN CHIEF: Ana Fatima Carvalho Fernandes 

ASSOCIATE EDITOR: Suellen Cristina Dias Emidio 

#### ABSTRACT

**Objective:** to develop and validate the content and appearance of a booklet for American football players, focusing on the recognition, prevention, and management of concussion. **Methods:** this is a methodological study conducted in three stages for the development and validation of a booklet. The panel of evaluators consisted of six experts selected through snowball sampling. Data collection was performed using the Health Educational Content Validation tool and the Appearance Validation of Health Educational Technologies tool. Data analysis was performed using the content and appearance validity index, with a value equal to or greater than 0.80. **Results:** six experts participated in the study. Regarding the overall content validity index, the material achieved 0.98. The experts' suggestions were incorporated into the final version of the booklet. **Conclusion:** this informational resource in booklet format is adequate in terms of content and appearance, strengthening the understanding of preventive measures and concussion management, thereby contributing to a safer sporting environment. **Contributions to practice:** the material strengthens nursing practice by providing clear and reliable educational support focused on athlete health.

**Descriptors:** Athletes; Brain Concussion; Football; Educational Technology; Craniocerebral Trauma.

#### RESUMO

**Objetivo:** construir e validar o conteúdo e a aparência de uma cartilha para jogadores de futebol americano, com foco no reconhecimento, prevenção e manejo da concussão encefálica. **Métodos:** trata-se de um estudo metodológico conduzido em três etapas, para construção e validação de uma cartilha. O comitê de avaliadores foi formado por seis especialistas e selecionados por meio da amostragem bola de neve. A coleta de dados ocorreu por meio do instrumento de Validação de Conteúdo Educativo em Saúde e do Validação de Aparência de Tecnologias Educacionais em Saúde. A análise dos dados foi por meio do Índice de Validade de Conteúdo e Aparência com valor igual ou superior a 0,80. **Resultados:** participaram do estudo seis especialistas. Em relação ao Índice de Validade de Conteúdo geral, o material alcançou 0,98. As sugestões dos especialistas foram incluídas na versão final da cartilha. **Conclusão:** esse recurso informativo do tipo cartilha está adequado quanto ao conteúdo e aparência, fortalecendo a compreensão sobre medidas preventivas e manejo das concussões, o que colabora para um ambiente esportivo mais seguro. **Contribuições para a prática:** o material fortalece a prática de enfermagem ao oferecer um suporte educativo claro e confiável voltado à saúde do atleta.

**Descritores:** Atletas; Concussão Encefálica; Futebol Americano; Tecnologia Educacional; Traumatismos Craniocerebrais.

## Introduction

American football has been gaining increasing prominence in Brazil, to the extent that the Ministry of Sport has officially recognised the Brazilian American Football Association, which currently organises teams distributed across leagues in a number of states<sup>(1)</sup>.

However, American football presents significant challenges for traumatology since it accounts for a considerable proportion of sports-related injuries and surpasses disciplines such as athletics, rugby, and basketball. Among the most concerning conditions are sport-related concussions, which result from high-intensity impacts to the cranial region and trigger pathophysiological processes induced by biomechanical forces<sup>(2)</sup>.

Sport-related concussions represent a significant global public health issue. In the United States alone, it is estimated that between 1.6 and 3.8 million sports-related concussions occur each year, with American football emerging as one of the main sports associated with this type of injury. Data from the National Collegiate Athletic Association (NCAA) suggests that American football has one of the highest rates of concussion among collegiate sports. In countries where rugby is widely practised, such as Australia and New Zealand, the rate is also high, ranging from six to nine concussions per 1,000 hours of play — particularly in high-performance competitions. This highlights that concussions are a global issue within contact sports<sup>(3-4)</sup>.

A concussion occurs when an athlete's head is subjected to direct or indirect force, resulting in cognitive, behavioural, and physical symptoms such as headaches, nausea, vomiting, mental confusion, and memory loss (retrograde and/or anterograde amnesia). In some cases, loss of consciousness may also occur<sup>(5)</sup>; in such cases, the athlete should be removed from play immediately and undergo specialist assessment. If the athlete becomes unconscious suddenly, immobilising their upper and lower limbs and cervical region is recommended to prevent further complications<sup>(6)</sup>.

Given the high likelihood of traumatic brain injuries, safety equipment has become essential. More recent technologies are also becoming important, as they can provide coaches, referees, and health professionals with real-time physical data. While these resources do not replace human expertise, they serve as supportive tools during training and matches by providing information that cannot be obtained through observation alone<sup>(7-8)</sup>.

The National Football League (NFL) has implemented rigorous protocols for the identification and management of concussion, including standardised sideline assessments, use of the Concussion Game Day Checklist protocol, the presence of independent neurological evaluators, and formal return-to-play guidelines (Return-to-Play Protocol). In addition, it provides educational materials, clinical guidelines, and awareness campaigns aimed at athletes, coaches, and health professionals, reinforcing the importance of qualified information as a strategy for prevention and harm reduction<sup>(9)</sup>.

Unlike the sensor-based and biomechanical monitoring technologies previously mentioned, educational technologies consist of structured pedagogical strategies aimed at mediating knowledge and promoting self-care. These support educational actions in different settings and among diverse audiences. They are not limited to the transmission of content but are intended to encourage self-care practices within the community. They also organise and systematise existing scientific knowledge and evidence in the literature, translating this knowledge for the target audience. Furthermore, beyond their development, these technologies must undergo validation processes<sup>(10)</sup>.

Despite the existence of international clinical protocols and institutional materials produced by sports leagues, there is a gap in the literature regarding the availability of a validated Educational Technology with accessible language specifically targeted at athletes and beginners in American football within the Brazilian context. This gap may compromise the

early recognition of signs and symptoms, delay appropriate removal from sport, and increase the risk of complications, such as second impact syndrome and late neurological sequelae. Thus, the problem underpinning this study lies in the insufficient availability of validated and culturally adapted educational materials for this specific audience.

Therefore, investing in technological development aimed at the prevention, early detection, and appropriate management of concussions represents not only a sporting advancement but also an ethical commitment to preserving athletes' health and well-being, given that the literature does not clearly address an educational technology with clear and objective language for athletes and beginners in this sport.

Considering these issues, an educational technology entitled "Concussion – informative booklet" was developed, with the aim of providing information on the complications that American football may cause in the lives of athletes and beginners, as well as assisting in recognition, prevention, and management.

The objective of this study is to develop and validate the content and appearance of a booklet for American football players, focusing on the recognition, prevention, and management of concussion.

## Methods

### Type of study

This is a methodological study<sup>(11)</sup> aimed at the development and validation of the content and appearance of a booklet for American football players. The study was divided into three stages: project development, integrative literature review/booklet construction based on the selected literature, and content and appearance validation by a panel of experts using the following instruments: Health Educational Content Validation (IVCES, in Portuguese)<sup>(12)</sup> and Appearance Validation of Health Educational Technologies (IVATES, in Portuguese)<sup>(13)</sup>.

### Stage 1. Project development

In the first stage of the study, the researchers developed the research project, motivated by the prior experience of one of the authors with American football. The absence of clear and translated educational materials on concussion in this sport was also identified in the literature, which reinforced the need for the proposal. The entire process strictly followed the guidelines of the ethics committee, resulting in formal approval of the study.

### Stage 2. Integrative literature review and booklet development

The second stage consisted of an integrative review conducted in the databases National Library of Medicine, Latin American and Caribbean Health Sciences Literature, and Scientific Electronic Library Online, using the Health Descriptors: Athletes; Concussion; American Football; Educational Technology; Traumatic Brain Injuries, combined with the Boolean operator "AND".

The inclusion criteria for this review comprised articles published within the last ten years, with the aim of obtaining a substantial number of studies for analysis, available free of charge, in Portuguese and English, and aligned with the objective of the study, in addition to official documents. Publications that did not address concussion in American football players were excluded, as well as dissertations, theses, duplicate articles, letters to the editor, and simple or extended abstracts.

Initially, 15 studies were selected. After full-text reading, eight articles related to the topic were included in the review corpus, and the theoretical foundation of the educational technology was developed. In addition, the NFL manual was used, which allowed for greater depth on the subject<sup>(9)</sup>. Notably, no other product for this purpose was identified in the review.

The first version of the booklet comprised 25

pages and 16 topics of interest to the target audience, including the following sections: cover, table of contents, presentation, warning signs, long-term effects, what to do?, NFL protocol, NFL flowchart, practical prevention tips, NFL-approved helmets, athletes on the field, checklist, checklist for rapid identification, further learning, games, and references. The free version of the CANVA graphic design platform was chosen for the layout of the Educational Technology (stage conducted by two authors, with consultation of a third in case of disagreement). Colours, images (extracted from the platform itself), font size, and clear and objective language were designed to make the material dynamic and attractive.

The booklet presents a sequential and didactic organisation, including an illustrative flowchart of the return-to-play protocol, explanatory images of approved helmets, informational materials, a visual checklist for rapid identification of symptoms, and QR codes linking to supplementary content. The colours used follow a contrasting and harmonious pattern, enhancing readability, highlighting essential information, and improving the visual organisation of topics, in addition to graphic elements that facilitate content retention. It also includes interactive features, such as educational games, aimed at reinforcing learning and encouraging athlete engagement in the prevention and early recognition of concussion.

### **Stage 3. Content and appearance validation by experts**

The third stage consisted of the validation of the content and appearance of the educational technology by experts, selected according to expertise criteria<sup>(14)</sup>, widely used in validation studies in the health field. According to this framework, the qualification of judges should consider academic training, professional experience, and scientific production in the thematic area.

Inclusion criteria were at least two years of teaching experience; a MSc or PhD in educational te-

chnology or related fields; and being a specialist in neurology or having proven experience in the field of concussion/traumatic brain injury. Experts who met two or more of these criteria were included in the study, as this combination ensures sufficient technical-scientific knowledge and practical experience for qualified evaluation of the material.

Professionals who were not engaged in teaching or clinical practice during the data collection period were excluded, as well as those without prior experience or familiarity with validation processes of educational technologies. Data collection took place between April and June 2025.

Participants were selected using snowball sampling<sup>(15)</sup>. The first participant was intentionally selected based on expertise criteria. After selecting the first participant, their Lattes Curriculum was assessed, and contact was made via email, including an invitation letter, the Informed Consent Form, and the data collection instrument developed using Google Forms. This instrument included questions related to socio-demographic data as well as the IVCES (organised on a Likert scale [0 = disagree, 1 = partially agree, and 2 = totally agree]) and the IVATES (organised on a Likert scale [1 = totally disagree, 2 = disagree, 3 = partially disagree, 4 = agree, and 5 = totally agree]).

Each participant indicated another participant, characterizing a chain sampling technique. Subsequently, the researchers assessed whether the referred individuals met the eligibility criteria. A 30-day period was established for responses from the selected experts. The literature recommends the participation of five to ten experts<sup>(16)</sup>. In this study, six experts were selected to ensure anonymity. Participants were identified by the letter "E", followed by the number corresponding to the order of response (E1 to E6).

### **Data analysis**

Experts' responses were organised in spreadsheets using Microsoft Excel®, version 365. Statistical

analysis was performed by calculating the content validity index (CVI). For content validation, the item-level CVI (I-CVI) was calculated as the ratio between the number of agreement responses (items marked as 1 or 2, according to the adopted 3-point Likert scale) and the total number of expert responses, using the following formula:  $I-CVI = \text{number of experts who agreed with the item} / \text{total number of experts}$ . Subsequently, the scale-level CVI (S-CVI) was calculated as the average of the I-CVI values across all items of the instrument.

Regarding appearance analysis, the Appearance Validity Index (AVI) was used, derived from the CVI, considering both the individual performance of each item and the overall instrument score. For this calculation, positive responses were defined as items rated 4 or 5 on the 5-point Likert scale, dividing the number of experts who assigned these scores by the total number of responding experts.

A validity criterion of values equal to or greater than 0.80<sup>(17)</sup> was adopted for all indices (I-CVI, S-CVI, and AVI). Items that did not reach this threshold in the first evaluation round were revised according to the experts' suggestions and submitted to a new round of assessment.

### Dissemination of the educational technology

After completion, the booklet was disseminated through open networks and specific groups. This strategy promoted wider dissemination, facilitating the sharing and circulation of the content among different audiences. Link for access to the booklet: <https://drive.google.com/file/d/1TWP4x7h6poGsDpSXSaY87i4e1l1qfGnl/view?pli=1>

### Ethical considerations

The study complied with the ethical principles established by the National Health Council, Resolution No. 466/2012, and was approved by the Research Ethics

Committee of *Universidade Cesumar – Centro de Ensino Superior de Maringá*, under Certificate of Submission for Ethical Appraisal No. 86954225.0.0000.5539 and opinion No. 7,466,214/2025.

## Results

Six expert judges participated in this study, of whom 4 (66.7%) were female and 2 (33.3%) were male. Regarding age group, one (16.7%) was between 26 and 35 years old, one (16.7%) between 36 and 45 years, 2 (33.3%) between 46 and 50 years, and two (33.3%) were over 50 years old. In terms of professional background, two were nurses with experience in the validation of educational technologies and practice in neurology, three were physiotherapists with experience in sports physiotherapy, and one was a neurologist, all with thematic proximity to concussion. Regarding highest academic qualification, one (16.7%) held a MSc, three (50.0%) a PhD, and two (33.3%) a postdoctoral qualification. With respect to teaching experience, one (16.7%) had between 1 and 5 years, one (16.7%) between 5 and 10 years, and four (66.7%) had more than 10 years of teaching experience.

Regarding the content validation process of the 18 items assessed using the IVCES instrument, a CVI equal to or greater than 0.80 was adopted as the acceptability criterion, as recommended in the literature. Of the analysed items, 16 (88.9%) achieved a CVI of 1.0, which demonstrates complete agreement among experts. The remaining two items presented a CVI of 0.83, which is also considered satisfactory as it exceeds the established cut-off point ( $\geq 0.80$ ) (Table 1).

With regard to qualitative suggestions, four experts indicated minor adjustments to the wording of the content (Figure 1). These contributions were analysed by the researchers and incorporated into the material, and a second round of evaluation was not required, as all items reached the minimum agreement index in the first round.

**Table 1** – CVI according to the Health Educational Content Validation tool. Curitiba, PR, Brazil, 2025

| Item  | Strongly agree | Partially agree | Disagree | CVI* |
|---|----------------|-----------------|----------|------|
| <b>Objectives: purposes, goals, and aims</b>  |                |                 |          |      |
| 1. Covers the proposed topic  | 6              | 0               | 0        | 1.00 |
| 2. Appropriate to the teaching-learning process   | 6              | 0               | 0        | 1.00 |
| 3. Clarifies doubts about the topic addressed   | 6              | 0               | 0        | 1.00 |
| 4. Promotes reflection on the topic   | 6              | 0               | 0        | 1.00 |
| 5. Encourages behaviour change  | 5              | 1               | 0        | 0.83 |
| <b>Structure/presentation: organisation, structure, strategy, coherence, and adequacy</b> |                |                 |          |      |
| 6. Language appropriate to the target audience  | 6              | 0               | 0        | 1.00 |
| 7. Language appropriate to the educational material                                       | 6              | 0               | 0        | 1.00 |
| 8. Interactive language, allowing active involvement in the process                       | 5              | 1               | 0        | 1.00 |
| 9. Accurate information   | 6              | 0               | 0        | 1.00 |
| 10. Objective information   | 6              | 0               | 0        | 1.00 |
| 11. Clear information   | 6              | 0               | 0        | 1.00 |
| 12. Necessary information   | 6              | 0               | 0        | 1.00 |
| 13. Logical sequence of ideas   | 6              | 0               | 0        | 1.00 |
| 14. Up-to-date topic  | 6              | 0               | 0        | 1.00 |
| 15. Appropriate text length   | 6              | 0               | 0        | 1.00 |
| <b>Relevance: significance, impact, motivation, and interest</b>                          |                |                 |          |      |
| 16. Stimulates learning   | 6              | 0               | 0        | 1.00 |
| 17. Contributes to knowledge in the area  | 6              | 0               | 0        | 1.00 |
| 18. Arouses interest in the topic   | 6              | 0               | 0        | 1.00 |

\*CVI: Content validity index

| Suggested item   | Accepted? |
|--|-----------|
| My field is biomechanics. I noticed that the introductory text used the term “biomechanical”, but in this case it was not appropriately applied; however, simply removing the term preserves the meaning of the sentence.                  | Yes       |
| It is recommended to expand its pedagogical function by including clearer representations of symptoms, correct actions, as well as more evident and contextualised visual elements.  | Yes       |
| It is possible to include the recommendation of static postural assessment, as it has been used as a criterion for return to activities. <a href="https://www.mdpi.com/2076-3417/14/7/2885">https://www.mdpi.com/2076-3417/14/7/2885</a> . | Yes       |
| I would like to make a suggestion. If considered appropriate, avoid leaving “NFL” abbreviated... it should first be written in full: National Football League.   | Yes       |

**Figure 1** – Experts’ suggestions regarding content validation. Curitiba, PR, Brazil, 2025

Regarding appearance validation using the IVATES tool, nine items achieved agreement (AVI = 0.83) and three items achieved agreement (AVI = 1.0) among the experts, within the study cutoff point, de-

monstrating the reliability of the material submitted for evaluation (Table 2). In addition to achieving the level of agreement established in literature, suggestions were made by the experts and accepted (Figure 2).

**Table 2** – CVI according to the Appearance Validation of Health Educational Technologies tool. Curitiba, PR, Brazil, 2025

| Item  | Strongly agree | Agree | Partially disagree | Dis-agree | Strongly disagree | CVI* |
|---|----------------|-------|--------------------|-----------|-------------------|------|
| 1. The illustrations are appropriate for the target audience                                  | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 2. The illustrations are clear and facilitate understanding                                   | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 3. The illustrations are relevant for comprehension   | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 4. The colours of the illustrations are appropriate for the type of material                  | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 5. The shapes of the illustrations are appropriate for the type of material                   | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 6. The illustrations reflect the daily context of the target audience of the intervention     | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 7. The layout of the figures is harmonious with the text                                      | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 8. The figures used clarify the content of the educational material                           | 5              | 1     | 0                  | 0         | 0                 | 0.83 |
| 9. The illustrations support the presentation of the topic and follow a logical sequence      | 6              | 0     | 0                  | 0         | 0                 | 1.0  |
| 10. The illustrations are provided in an appropriate quantity in the educational material     | 6              | 0     | 0                  | 0         | 0                 | 1.0  |
| 11. The illustrations are of appropriate size in the educational material                     | 6              | 0     | 0                  | 0         | 0                 | 1.0  |
| 12. The illustrations contribute to behavioural and attitudinal change in the target audience | 6              | 0     | 0                  | 0         | 0                 | 1.0  |

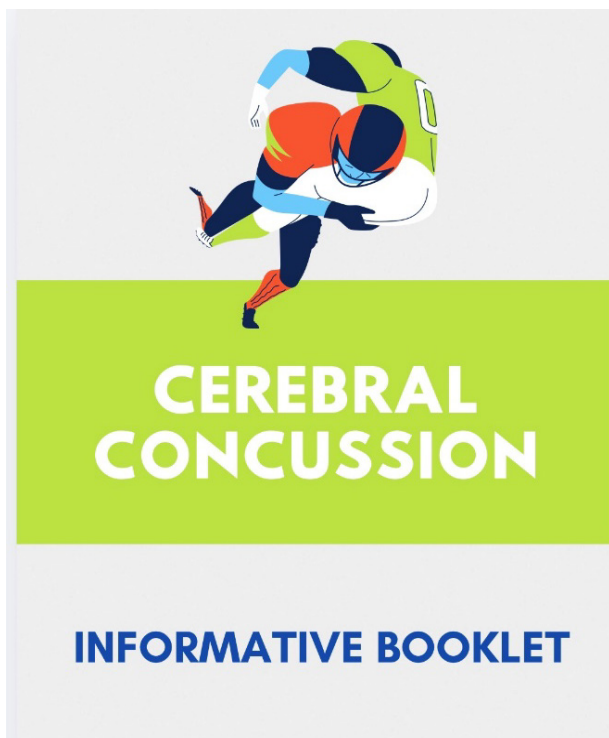
\*CVI: Content validity index

| Suggested item   | Accepted? |
|--|-----------|
| The inclusion of infographics and flowcharts could further enhance understanding of concussion care, promoting more visual, direct, and memorable learning.  | Yes       |
| Some images are generic or not very expressive, which does not make it entirely clear what is being represented. There appears to be a lack of diversity of scenes, such as representations of concussion care or physical/behavioural symptoms. | Yes       |
| Visual elements that stimulate engagement could be included, such as infographics, emojis, alert icons, or "player attention" symbols.   | Yes       |
| This is a matter of personal preference, and potential athletes would be better suited to assess it. From a personal perspective, not as a senior researcher, I would prefer coloured images such as those on page 12 rather than those on p. 8. | Yes       |

**Figure 2** – Experts' suggestions regarding appearance validation. Curitiba, PR, Brazil, 2025

The final version of the booklet, following the experts' suggestions, consisted of 27 pages (Figure 3). The overall S-CVI of the booklet in relation to content was calculated as the mean of the items evaluated by the experts, yielding a value of 0.98. These results demonstrate that the booklet achieved a satisfactory

level of agreement among the experts, indicating consistency and adequacy of the proposed material. Considering that values equal to or greater than 0.80 are accepted as indicators of content validity, the overall S-CVI obtained confirms the relevance and appropriateness of the Educational Technology for the health context.



**Figure 3** – Booklet cover. Curitiba, PR, Brazil, 2025

## Discussion

The development of the informational booklet on concussion is an essential strategy for promoting the health of American football athletes, considering the high incidence of cranial impacts and traumatic brain injuries in this sport. The results obtained from the IVCES and IVATES indicate that all evaluated items were satisfactory, demonstrating that the booklet meets the criteria of clarity, relevance, and applicability. The overall index (S-CVI = 0.98) shows that the content was considered understandable and appropriate, ensuring effective communication regarding risks and preventive measures.

The participation of experts enabled the inclusion of different perceptions and understandings of concussion, preventing the analysis from being limited solely to the researchers' perspective. The multi-professional composition of the evaluation committee strengthened the methodological robustness of the study, increasing the reliability of the material produced and reducing potential disciplinary bias.

The NFL Concussion Protocol, reviewed annually, provides clear steps for evaluation, monitoring, and safe return to play, and is mandatory for all teams. The incorporation of recommendations aligned with well-established international protocols enhances the technical credibility of the booklet and demonstrates alignment with evidence-based practices. Using such international standards strengthens the reliability of the booklet, promoting awareness of early identification, appropriate management, and safety strategies in American football<sup>(9)</sup>.

Adequate knowledge of concussion is essential for the prevention and management of brain injuries in athletes. Early detection and adoption of return-to-play protocols can reduce neurological complications. Thus, by providing clear information on signs, symptoms, and recommended actions, the educational technology developed directly contributes to raising awareness among players, coaches, and family members, reinforcing the need for continuous education<sup>(18)</sup>.

American football athletes may present cumulative neuropsychological changes, even following impacts considered mild. Therefore, educational materials that encourage early recognition of concussion and the search for specialised medical evaluation are essential. By detailing subtle symptoms and potential consequences, the educational technology helps athletes and beginners minimise long-term effects and supports informed decisions regarding continued sports participation<sup>(19)</sup>.

The training of professionals and coaches is equally relevant, as the literature highlights gaps in the management of concussions in sports contexts. The care and attention of the researchers in including practical guidance within the educational technology contribute to reducing errors, such as underestimating symptoms or allowing premature return to activity, thereby promoting a consistent culture of prevention within teams<sup>(20)</sup>.

Awareness of concussion remains limited and is often underestimated by athletes and health professionals<sup>(21)</sup>. The validation of the Educational Technology's content and appearance through the

IVCES and IVATES tools demonstrates that materials adapted to the local context overcome barriers to understanding and engagement, fostering athletes' active role in their own health.

The prevention of brain injuries is even more relevant considering evidence linking repeated concussions to chronic traumatic encephalopathy<sup>(22)</sup>. The educational technology was designed to act in primary prevention, warning about risk behaviours and encouraging standardised assessment protocols, becoming a strategic tool to reduce neurological morbidity, increase sports safety, and prolong athletic careers.

Another relevant point concerns the association between repetitive impacts and long-term neuropathological changes. Studies have demonstrated a correlation between cumulative exposure to cranial impacts and an increased risk of neurodegenerative changes, reinforcing the importance of preventive interventions based on education and continuous monitoring<sup>(23)</sup>.

Modifiable factors can reduce the incidence of concussions, such as proper tackling techniques and the use of appropriate protective equipment<sup>(24)</sup>. By integrating such recommendations with the validation obtained through content indices, the educational technology reinforces its reliability, promoting safe practices from the early stages of the sport and encouraging behavioural change regarding risk factors.

Furthermore, in the appearance validation stage, the feedback provided by experts proved relevant for improving the material. The suggestions allowed for revisions in language, visual organisation, information layout, and communicative adequacy, enhancing clarity, objectivity, and attractiveness of the booklet. The adjustments made based on these contributions improved the final version of the Educational Technology, making it more understandable, coherent, and aligned with its intended educational purpose.

The literature demonstrates a significant evolution in attention to brain safety in American football, with more precise recommendations on education, prevention, and clinical management<sup>(25)</sup>. The developed and validated educational technology fits within this context, providing an evidence-based educational

resource with the potential to positively impact the culture of sports safety, promoting informed decision-making in American football.

The development and validation of the concussion booklet provide a practical tool for athletes, coaches, health professionals, and family members by facilitating access to clear, up-to-date information adapted to the Brazilian context. The material can be incorporated into educational programmes for sports teams, health prevention initiatives, and clinical assessment protocols, contributing to the reduction of risks associated with cranial injuries.

## Study limitations

One limitation of this study refers to the booklet validation process, which was conducted exclusively by specialists according to the established criteria. However, this is justified because content and appearance validation aims to assess scientific relevance, clarity, internal organisation, and technical-pedagogical adequacy of the material. Therefore, football players or other representatives of the target audience were not included, as this initial stage requires expert judgement.

Although the number of specialists was within the range recommended by literature (5-10 judges), future studies may expand the evaluation panel to further strengthen the generalisability of the findings.

Regarding snowball sampling, this may represent another limitation of the study since it may result in a homogeneous sample. The participation of end users will be considered in a subsequent stage, when usability, comprehension, and practical applicability of the booklet will be evaluated.

## Contributions to practice

The concussion booklet represents an essential resource for nursing practice, as it provides clear and reliable information that supports health promotion, prevention of injuries, and educational actions directed at athletes. Its use facilitates the early identification of concussion signs, guides appropriate initial

management, and supports safe referrals, while also expanding the educational role of nurses with players and technical staff. In this way, it contributes to a culture of safety in sport, reduces risks associated with premature return to play, and reinforces the strategic role of nursing in protecting the physical and mental health of athletes.

## Conclusion

The concussion booklet for American football players presented consistent and appropriate content and appearance, as assessed by specialists. Furthermore, the material fills a gap identified in the literature, given the scarcity of educational technologies specifically targeted at American football players, a population exposed to a high risk of concussions and often with limited access to qualified information on the topic.

It is expected that the booklet will provide American football players with access to reliable, clear, context-appropriate material capable of increasing knowledge about concussions, facilitating early identification of signs and symptoms, and guiding the adoption of safe measures in response to potential injuries. Thus, the proposed Educational Technology may significantly contribute to preserving the physical and mental health of athletes, as well as promoting safer sports practices.

## Author contributions

Conception and design or data analysis and interpretation: **Mendes BM, Cruzeiro DB**. Manuscript drafting or critical revision of intellectual content: **Mendes BM, Cruzeiro DB, Chaves SCS, Melo Filho PL**. Final approval of the version to be published: **Chaves SCS, Melo Filho PL**. Agreement to be accountable for all aspects of the manuscript related to accuracy or integrity and to ensure that any issues are appropriately investigated and resolved: **Melo Filho PL**.

## Data availability

The dataset supporting the results is available within the article.

## References

1. Franco GBD, Silva LFN, Scaglia AJ. Iniciação ao futebol americano: um olhar a partir dos pilares da pedagogia do esporte. *Corpoconsciência*. 2022; 26(2):178-92. doi: <https://dx.doi.org/10.51283/rc.v26i2.13589>
2. Bayram JM, Hamilton DF, Saunders DH. Epidemiology of American football injuries at universities in the United Kingdom. *Orthop J Sports Med*. 2020;8(10):2325967120960206. doi: <http://doi.org/10.1177/2325967120960206>
3. Centers for Disease Control and Prevention (CDC). Sports-Related Concussions in Youth. 2024 [cited Oct 20, 2025]. Available from: [https://www.cdc.gov/headsup/basics/concussion\\_what.html](https://www.cdc.gov/headsup/basics/concussion_what.html)
4. Badenhorst M, Romanchuk J, Salmon D, Brown JC, Hendricks S, Walters S. Concussion risk and the need for prevention: an exploration into the complexity of community perspectives in rugby union. *Sports Med*. 2025;55(12):3129-42. doi: <https://doi.org/10.1007/s40279-025-02243-0>
5. Carneiro HB, Jeremias LS, Souza NS, Alves DPA. Concussão cerebral relacionada ao esporte: uma revisão narrativa da literatura. *Rev Neurocienc*. 2024;32:1-20. doi: <https://dx.doi.org/10.34024/rnc.2024.v32.16482>
6. Ntikas M, Stewart W, Ietswaart M, Hunter AM, Maas AIR, Menon DK, et al. Contrasting characteristics and outcomes of sports-related and non-sports-related traumatic brain injury. *JAMA Netw Open*. 2024;7(1):e2353318. doi: <http://doi.org/10.1001/jamanetworkopen.2023.53318>
7. Arzehgar A, Seyedhasani SN, Ahmadi FB, Baravati FB, Hesar AS, Kachooei AR, et al. Sensor-based technologies for motion analysis in sports injuries: a scoping review. *BMC Sports Sci Med Rehabil*. 2025;17(1):15. doi: <https://doi.org/10.1186/s13102-025-01063-z>
8. Holcomb TD, Marks ME, Pritchard NS, Miller LE, Rowson S, Bullock GS, et al. On-field evaluation of mouthpiece- and helmet-mounted sensor data from head kinematics in football. *Ann Bio-*

- med Eng. 2024;52(10):2655-65. doi: <https://doi.org/10.1007/s10439-024-03583-0>
9. National Football League. NFL Rulebook. In: NFL Football Operations [Internet]. 2025 [cited Dec 8, 2025]. Available from: [https://operations.nfl.com/the-rules/nfl-rulebook?utm\\_source=chatgpt.com](https://operations.nfl.com/the-rules/nfl-rulebook?utm_source=chatgpt.com)
  10. Nietsche EA, Teixeira E, Medeiros HP. Tecnologias cuidativo-educacionais: uma possibilidade para o empoeiramento do/a enfermeiro/a? Porto Alegre: Moriá; 2014.
  11. Echer IC. Elaboração de manuais de orientação para o cuidado em saúde. *Rev Latino-Am Enfermagem*. 2005;13(5):754-7. doi: <https://doi.org/10.1590/S0104-11692005000500022>
  12. Leite SS, Áfio ACE, Carvalho LV, Silva JM, Almeida PC, Pagliuca LMF. Construction and validation of an educational content validation instrument in health. *Rev Bras Enferm*. 2018;71(Suppl 4):1635-41. doi: <https://dx.doi.org/10.1590/0034-7167-2017-0648>
  13. Souza ACC, Moreira TMM, Borges JWP. Development of an instrument to validate the face validity of health educational technology. *Rev Bras Enferm*. 2020;73e20190559. doi: <https://doi.org/10.1590/0034-7167-2019-0559>
  14. Fehring R. The Fehring Model. In: Carrol-Johnson R, Paquete M, editores. Classification of nursing diagnoses: proceedings of the tenth conference of North American Nursing Diagnosis Association. Philadelphia: Lippincott; 1994. p. 55-62.
  15. Portella RJ, Szczecinski ML, Sá LME. Técnica de amostragem “bola de neve virtual” na captação de participantes em pesquisas científicas. *J Nurs Health*. 2024;14(1):e1426636. doi: <https://doi.org/10.15210/jonah.v14i1.26636>
  16. Coluci MZ, Alexandre NMC, Milani D. Construção de instrumentos de medida na área da saúde. *Ciênc Saúde Colet*. 2015;20(3):925-36. doi: <https://doi.org/10.1590/1413-81232015203.04332013>
  17. Polit DF, Beck CT. The content validity index: are you sure you know what’s being reported? Critique and recommendations. *Res Nurs Health*. 2006;29(5):489-97. doi: <http://doi.org/10.1002/nur.20147>
  18. Bazarian JJ, Zetterberg H, Buki A, Dengler BA, Diaz-Arrastia R, Korley FK, et al. Blood-based biomarkers for improved characterization of traumatic brain injury: recommendations from the 2024 National Institute for Neurological Disorders and Stroke Traumatic Brain Injury Classification and Nomenclature Initiative. *J Neurotrauma J Neurotrauma*. 2025;42(11):13-4. doi: <https://doi.org/10.1089/neu.2024.0581>
  19. Alosco ML, Barr WB, Banks SJ, Wethe JV, Miller JB, Pulukuri SV, et al. Neuropsychological test performance of former American football players. *Alzheimers Res Ther*. 2023;15(1):1. doi: <https://doi.org/10.1186/s13195-022-01147-9>
  20. Baker R, Bond B, Irwin G, Connelly S, Williams G. A systematic review of concussion education, knowledge, and attitudes in football. *Sci Med Footb*. 2025;13:1-20. doi: <https://doi.org/10.1080/24733938.2025.2488521>
  21. Oliveira RS, Moura FA. Concussão esportiva no futebol americano: revisão narrativa e perspectivas de prevenção. *Rev Bras Med Esporte*. 2021;27(3):240-6. doi: [https://doi.org/10.1590/1517-8692202127032020\\_0028](https://doi.org/10.1590/1517-8692202127032020_0028)
  22. Mez J, Daneshvar DH, Abdolmohammadi B, Chua AS, Alosco ML, Kiernan PT, et al. Duration of American Football Play and Chronic Traumatic Encephalopathy. *Ann Neurol*. 2020;87(1):116-31. doi: <https://doi.org/10.1002/ana.25611>
  23. Qi B, Tan J, Feng D, Guan L, Li J, Cao M, Zou Y. Prevalence of chronic traumatic encephalopathy in athletes with repetitive head impacts: a systematic review and meta-analysis. *Scand J Med Sci Sports*. 2025;35(4):e70047. doi: <https://doi.org/10.1111/sms.70047>
  24. Pankow MP, Srydiuk RA, Kolstad AT, Hayden AK, Dennison CR, Mrazik M, et al. Head games: a systematic review and meta-analysis examining concussion and head impact incidence rates, modifiable risk factors, and prevention strategies in youth tackle football. *Sports Med*. 2022;52(6):1259-72. doi: <http://doi.org/10.1007/s40279-021-01609-4>
  25. Herring S, Kibler WB, Putukian M, Solomon GS, Boyajian-O’Neill L, Dec KL, et al. Selected issues in sport-related concussion (SRC mild traumatic brain injury) for the team physician: a consensus statement. *Br J Sports Med*. 2021;20(8):420-31. doi: <https://doi.org/10.1136/bjsports-2021-104235>



This is an Open Access article distributed under the terms of the Creative Commons