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Global cardiac screening practices among youth and adult football players: the FIFA cardiac screening survey

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ABSTRACT

Objective To investigate global cardiac screening practices among elite male and female football players.

Methods We surveyed all 211 FIFA Member Associations (MAs) between February and July 2024 using a 21-point questionnaire.

Results A total of 165/211 (78%) MAs completed the survey. Cardiac screening was recommended or mandated by 81% (134/165) of responding MAs, with a variation between FIFA Confederations ranging from 33% (3/9 of MAs within the Oceania Football Confederation) to 100% (10/10 MAs within the South American Football Confederation). The majority of MAs use a protocol inclusive of at least medical history, physical examination and 12-lead ECG for adult male (123/134, 92%), adult female (119/134, 89%), youth male (112/134, 84%) and youth female (108/134, 81%) players. The inclusion of echocardiography was more common among adult male (91/134, 68%) and female (84/134, 63%) players compared with youth male (59/134, 44%) and youth female players (59/134, 44%). Among youth players, the age at initial cardiac screening (median age (IQR)=14 (4) years, range: 6–17 years) and the interval of serial screening were highly variable.

Conclusion Routine cardiac screening is widely, but not uniformly, applied across football associations globally. There is considerable variation in cardiac screening practices based on geography and player age, suggesting that standardised global recommendations for cardiac screening in both adult and youth football are needed.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ While cardiac screening is recommended by most medical and sports organisations, clinical application of these recommendations among elite football players globally remains unknown.

WHAT THIS STUDY ADDS

⇒ Most FIFA Member Associations (81%) recommend or mandate some form of cardiac screening. However, this varies both between and within confederations.

⇒ A cardiac screening protocol consisting of a medical history, physical examination and 12-lead ECG is common in global football. Echocardiography, as an adjunct to routine screening, is more frequently performed among adult players than youth players.

⇒ Compared to adults, cardiac screening is less prevalent among youth football players, and both the age of initial cardiac screening and the interval of serial screening are highly variable.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Causes of regional differences in cardiac screening for elite football players remain unclear and should represent the focus of future work. Potential explanations include variable financial resources and access to trained medical professionals.

⇒ The variance in cardiac screening practices suggests that standardised global recommendations for cardiac screening in both adult and youth football are needed and may require greater clinician education and investment in infrastructure to properly carry out the recommendations.

⇒ Standardisation of screening practices coupled with the accrual of data documenting the impact of cardiac screening in adult and youth football players represents a scientific and clinical imperative to address current knowledge gaps.

INTRODUCTION

Cardiac screening is performed in athletes to detect underlying conditions associated with adverse outcomes, including sudden cardiac arrest/death (SCA/D), during sports participation.[1 2] The primary goal of cardiac screening is to identify athletes who may benefit from disease-specific treatment and individualised clinical decision-making regarding the risks and benefits of future sports participation.[3]

Many sports governing bodies, including the IOC[4] and other professional sports leagues,[5] either mandate or recommend cardiac screening.[6 7] For the sport of football, FIFA introduced pre-competition cardiac screening at the FIFA World Cup 2006,[8] and cardiac screening was made mandatory prior to all FIFA competitions in 2010.[9]

Cardiac screening recommendations are not universal across sports governing bodies and medical organisations. While all cardiac screening recommendations consistently propose the use of a personal and family medical history and a focused physical examination, the inclusion of additional testing, such as a 12-lead ECG, transthoracic echocardiogram, exercise stress testing and laboratory screening, is inconsistent.[2 6 10 11] This variability stems from both the lack of data documenting a clear clinical impact of specific screening techniques on

SCA/D outcomes and considerations about cost and feasibility.[12] In addition, compliance with cardiac screening recommendations may not be universal. In global sports, such as football, regional differences in financial resources and the availability of trained medical personnel may influence cardiac screening practices. At present, the global variance and regional differences in cardiac screening practices in football are unknown. Therefore, we sought to identify and describe adult and youth cardiac screening practices across the 211 FIFA Member Associations (MAs).

METHODS

Study design

This cross-sectional survey examining cardiac screening practices among the 211 FIFA MAs was conducted between February 2024 and July 2024. Results were reported according to the Checklist for Reporting Results of Internet E-Surveys (online supplemental material S1).[13] Medical representatives from all 211 FIFA MAs were invited to complete a questionnaire on cardiac screening practices. All participants were informed about the purpose of the survey, the estimated completion time (5–10 min) and the option to withdraw from the research at any time. All participants gave written informed consent. No incentives were offered for participation. All personal information was deidentified.

Survey development

A survey on cardiac screening practices comprising 21 questions (online supplemental material S2) was developed by FE, AS, AM, KG and ALB. Survey questions were based on personal experiences with cardiac screening practices and on the structure of a prior FIFA survey.[14] Closed-ended, open-ended and grouped-answer questions were used. Questions on cardiac screening addressed the following areas: (1) medical personnel within the MA, (2) degree of cardiac screening obligation (ie, recommendation vs mandatory), (3) specific assessments included in screening protocols (medical and family history, physical examination, ECG and additional testing), (4) target cardiac screening population (ie, level of competitive play, sex), (5) age of onset for cardiac screening and (6) time intervals of repeat screening. All questions were directed towards MA's medical representatives. Youth football was defined as age <18 years. Participants were able to return to the survey to review their responses before submission. The wording, relevance and potential generalisability of each question were assessed by all authors. Several rounds of draft revisions were conducted until consensus on the final survey was reached. The survey was developed in English and translated by FIFA into French and Spanish before distribution.

Survey administration

An online platform (Qualtrics XM, V.1 2024, Provo, Utah, USA), which is compliant with the General Data Protection Regulation requirements, was used to distribute the survey. Technical functionality of the survey was assessed by AS and CFW. An initial invitation to participate in the study was sent by email to all medical representatives participating in the FIFA Medical Conference held in Boston, USA, on 6–7 February 2024, at which two medical representatives from each of all the 211 FIFA MAs were invited. Additionally, a link to the survey was displayed using a QR code in the opening session of the conference and subsequently several times throughout the conference, as well as through a dedicated conference mobile application. Medical representatives of the MAs who did not attend or did not participate in the survey during the conference received an individualised invitation by email that detailed the aims, ethical considerations and survey access information. Participation reminders were sent every 1–2 months over a 6-month period. In cases of duplicate or triplicate responses, representatives of the respective MA were contacted directly for clarification.

Statistics

Only fully completed surveys were stored and analysed. Raw data were exported to Microsoft Excel (Microsoft Corporation, V.16.93.1, Redmond, Washington, USA). Overviews were created using descriptive statistics. Results were sub-grouped according to the six member confederations of FIFA (AFC, Asian Football Federation; CAF, Confédération Africaine de Football; CONCACAF, Confederation of North, Central America and Caribbean Association Football; CONMEBOL, Confederación Sudamericana de Fútbol; OFC, Oceania Football Confederation). Statistical analyses were performed using SPSS (V.18.0) and corollary figures were generated using GraphPad (V.9.0).

Patient and public involvement

This study did not involve patients or members of the public in the planning, design, data collection, analysis or interpretation of results.

Equity, diversity and inclusion statement

Our study population consists of medical representatives from 165 FIFA MAs from all 6 FIFA Confederations and reflects a broad geographical, demographic and socioeconomic spectrum of diversity. The author team consists of two women and five men from various countries and disciplines (sports cardiology, sports medicine, internal medicine, sports science, athletic training and physiotherapy).

RESULTS

Of 227 survey responses received, 62 responses were excluded as they were deemed to represent duplicate or triplicate responses from an individual MA. Accordingly, responses from 165 out of 211 MAs (78%) were included in the final analyses, with the following FIFA Confederation representation (CONMEBOL=10/10 MAs, 100%; CAF=46/54 MAs, 85%; UEFA=46/55 MAs, 84%; OFC=9/11 MAs, 82%; CONCACAF=25/35 MAs, 71%; AFC=29/46 MAs, 63%; online supplemental material S3). Survey respondents identified their personal role(s) for their respective MA as team physician (n=116, 70%), MA medical committee member (n=76, 46%), MA chief medical officer (n=14, 8%) and/or physiotherapist (n=3, 2%).

Medical personnel and cardiac screening practices

An overview of the medical infrastructure and the number of MAs mandating or recommending cardiac screening within each of the six FIFA Confederations is presented in table 1.

The majority of MAs reported a dedicated medical department (60%, 99/165) and/or medical committee (70%, 116/165). In contrast, less than half reported a designated consulting cardiologist (49%, 81/165) and/or sports cardiologist (19%, 32/165). When comparing MAs with access vs those without access to a designated sports cardiologist, a higher screening rate (97% vs 75%) and a more comprehensive cardiac screening protocol inclusive of echocardiography (male adult players 81% vs 56%, female adult players 72% vs 37%, male youth players 47% vs 25%, female youth players 46% vs 26%) and exercise stress

Table 1 Overview of the medical infrastructure and different degrees of cardiac screening regulation among participating FIFA Member Associations (MAs) grouped according to the six FIFA Confederations

	All FIFA MAs (n=165)	AFC (n=29)	CAF (n=46)	CONCACAF (n=25)	CONMEBOL (n=10)	OFC (n=9)	UEFA (n=46)
Medical infrastructure							
Medical department, n (%)	99 (60)	16 (55)	31 (67)	14 (56)	9 (90)	1 (11)	28 (61)
Medical committee, n (%)	116 (70)	20 (69)	38 (83)	13 (52)	7 (70)	2 (22)	36 (78)
Consultant cardiologist, n (%)	81 (49)	10 (34)	27 (59)	10 (40)	7 (70)	4 (44)	23 (50)
Sports cardiologist, n (%)	32 (19)	2 (7)	8 (17)	3 (12)	3 (30)	2 (22)	14 (30)
Cardiac screening recommended or mandated							
Yes, n (%)	134 (81)	21 (72)	37 (80)	19 (76)	10 (100)	3 (33)	44 (96)
No, n (%)	28 (17)	7 (24)	8 (17)	6 (24)	0 (0)	5 (56)	2 (4)
Unclear, n (%)	3 (2)	1 (3)	1 (2)	0 (0)	0 (0)	1 (11)	0 (0)
Cardiac screening regulated by MA for male adult players							
Mandatory requirement from MA/league, n (%)	49 (30)	8 (28)	8 (17)	2 (8)	4 (40)	1 (11)	26 (56)
Mandatory prior to international tournaments, n (%)	21 (13)	3 (10)	6 (13)	9 (36)	1 (10)	1 (11)	1 (2)
Mandatory requirement from MA/league and prior to tournaments, n (%)	37 (22)	5 (17)	17 (37)	4 (16)	2 (20)	0 (0)	9 (20)
No screening regulation by MA or screening is recommended, but left at the discretion of players, n (%)	58 (35)	13 (45)	15 (33)	10 (40)	3 (30)	7 (78)	10 (22)
Cardiac screening regulated by MA for female adult players							
Mandatory requirement from MA/league, n (%)	44 (27)	6 (21)	7 (15)	4 (16)	3 (30)	1 (11)	23 (50)
Mandatory prior to international tournaments, n (%)	30 (18)	6 (21)	10 (22)	8 (32)	2 (20)	1 (11)	3 (7)
Mandatory requirement from MA/league and prior to tournaments, n (%)	28 (17)	2 (7)	15 (33)	3 (12)	1 (10)	0 (0)	7 (15)
No screening regulation by MA or screening is recommended, but left at the discretion of players, n (%)	63 (38)	15 (52)	14 (30)	10 (40)	4 (40)	7 (78)	13 (28)
Cardiac screening regulated by MA for male youth players							
Mandatory requirement from MA/league, n (%)	35 (21)	6 (21)	8 (17)	3 (12)	2 (20)	0 (0)	16 (35)
Mandatory prior to international tournaments, n (%)	28 (17)	3 (10)	11 (24)	7 (28)	3 (30)	1 (11)	3 (7)
Mandatory requirement from MA/league and prior to tournaments, n (%)	22 (13)	4 (14)	9 (20)	2 (8)	1 (10)	0 (0)	6 (13)
No screening regulation by MA or screening is recommended, but left at the discretion of players, n (%)	80 (49)	16 (55)	18 (39)	13 (52)	4 (40)	8 (89)	21 (45)
Cardiac screening regulated by MA for female youth players							
Mandatory requirement from MA/league, n (%)	32 (19)	5 (17)	7 (15)	3 (30)	1 (10)	0 (0)	16 (35)
Mandatory prior to international tournaments, n (%)	29 (18)	5 (17)	11 (24)	7 (28)	2 (20)	1 (11)	3 (7)
Mandatory requirement from MA/league and prior to tournaments, n (%)	19 (12)	2 (7)	9 (20)	2 (8)	1 (10)	0 (0)	5 (11)
No screening regulation by MA or screening is recommended, but left at the discretion of players, n (%)	85 (51)	17 (59)	19 (41)	13 (24)	6 (60)	8 (89)	22 (47)
Screening mandatory by law (all players)*	11 (7)	2 (7)	1 (2)	0 (0)	0 (0)	0 (0)	8 (17)

*Subgroup of 'mandatory requirement from MA/league'.
AFC, Asian Football Federation; CAF, Confédération Africaine de Football; CONCACAF, Confederation of North, Central America and Caribbean Association Football; CONMEBOL, Confederación Sudamericana de Fútbol; OFC, Oceania Football Confederation.

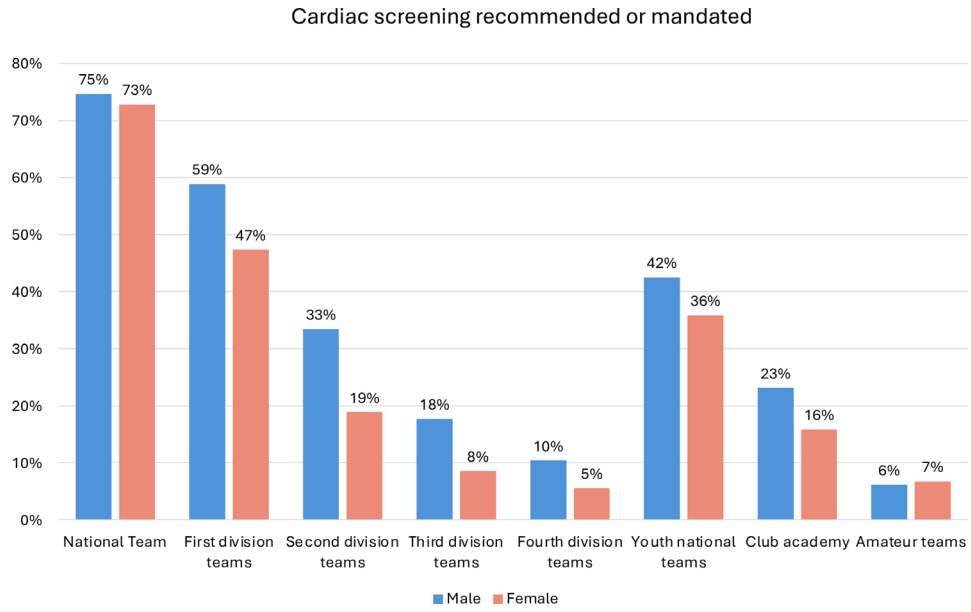

Figure 1 Proportion of cardiac screening recommended or mandated by FIFA Member Associations according to level of play for male and female players.

testing (male adult players 40% vs 31%, female adult players 28% vs 17%, male youth players 19% vs 13%, female youth players 16% vs 12%) was observed among MAs that reported a designated sports cardiologist. Similar differences, but of a smaller magnitude, were found when comparing access to any cardiologist versus having no cardiologist. A total of 34/165 (21%) MAs reported the existence of a national registry for sports-related SCA/D, 105/165 MAs (63%) reported that no registry was in place and 26/165 MAs (16%) were unsure.

Only 11/165 MAs (7%) reported that local legislation dictated cardiac screening practices. However, the majority of MAs (81%, 134/165) reported that cardiac screening was recommended or mandated for their players, while the remaining MAs either indicated no provision of cardiac screening (17%, 28/165) or were unsure (2%, 3/165). Cardiac screening practices varied geographically across confederations, ranging from 100% (10/10 MAs within CONMEBOL) to 33% (3/9 MAs within OFC). Among the 134 MAs that reported that cardiac screening was recommended or mandated for their players, 59% of MAs (n=79/134) reported direct regulation of screening. Direct MA regulation of cardiac screening was similar among male and female adult players (65% vs 62%) and male and female youth players (51% vs 49%).

MAs reported variable levels at which football was considered professional and the regulation of cardiac screening decreased in parallel with decreasing levels of competition (figure 1). Among male players, national team, first division and second division teams were considered to represent a professional level of play by 85%, 68% and 38% of MAs, respectively. Among female players, national team, first division and second division teams were considered to represent a professional level of play by 74%, 44% and 4% of MAs, respectively. Men's third and fourth division teams were considered professional by 13% and 5% MAs, while these lower levels of play were universally considered non-professional for women.

Cardiac screening protocols

The specific components included in cardiac screening protocols, stratified by sex and player age category (ie, adult vs youth players), are shown in figure 2. Cardiac screening confined to medical history and physical examination was infrequent but was significantly more common among youth than adult players. In contrast, the vast majority of MAs reported the use of a cardiac screening protocol inclusive of a 12-lead ECG, ranging from 92% (123/134) for adult male players to 81% (108/134) for youth female players. The inclusion of a transthoracic echocardiogram was common but similarly variable by player age and sex (range=68% (91/134) for adult male players to 44% (59/134) for youth female players). The inclusion of additional testing, inclusive of exercise stress testing, bloodwork and urine analysis, was also common (figure 2). A small number of MAs reported the use of chest radiography for adult male players (n=9), adult female players (n=4) and all youth players (n=2). Results broken down by FIFA Confederation are provided in online supplemental material S4.

Repeat cardiac screening interval and age of first screening

Reported prespecified screening intervals varied, but with the majority reporting annual screening for both adult and youth male and female players (table 2).

Among the 96 MAs that indicated a specific age for initial cardiac screening among youth players, this occurred at a median age of 14 years (25th percentile 12 years, 75th percentile 15.5 years, IQR 3.5 years, range 6–17 years, figure 3).

DISCUSSION

In this study, we examined cardiac screening practices in football globally. Key findings were first that approximately 80% of FIFA MAs reported that some form of cardiac screening was recommended or mandated. Second, there was substantial geographic variability in the application of cardiac screening across FIFA Confederations. Third, the majority of MAs reported the use of a cardiac screening protocol inclusive of medical history, physical examination and 12-lead ECG. However, the addition of transthoracic echocardiography to routine cardiac screening was common, particularly among adult players. Fourth, there were no relevant sex differences in cardiac screening protocols for both

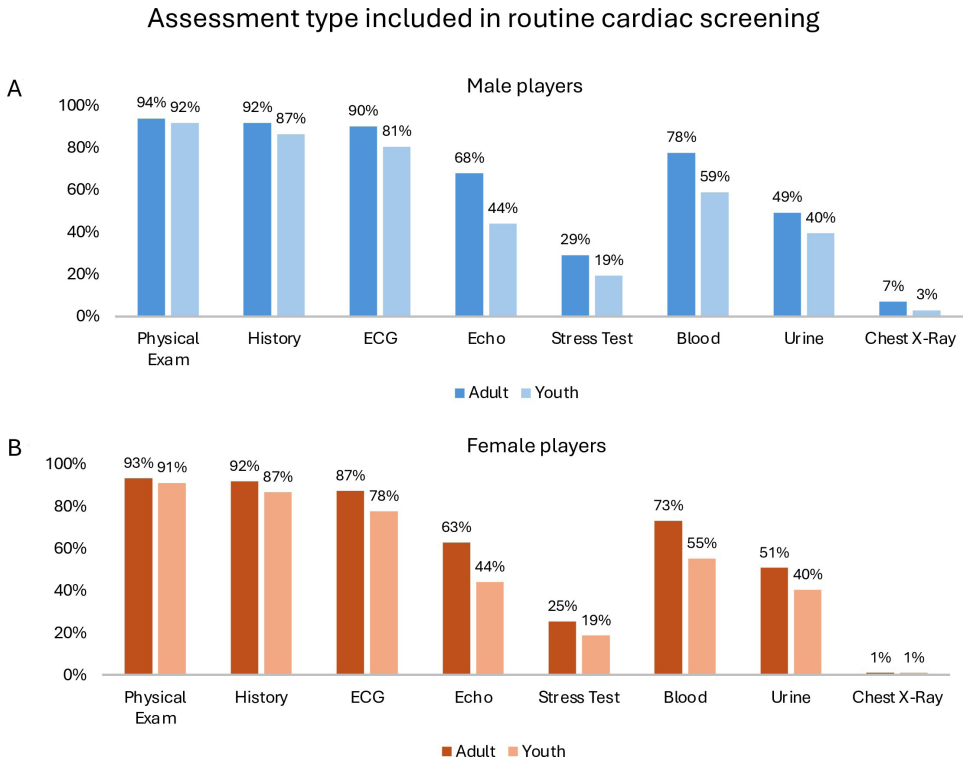

Figure 2 Proportion of assessment type included in routine cardiac screening in (A) male adult/youth and (B) female adult/youth players from 134 FIFA Member Associations in which cardiac screening was recommended or mandated.

adult and youth players. Finally, youth player cardiac screening practices were highly variable. Specifically, MAs less commonly recommend or mandate youth player screening, thereby leaving it to the discretion of individual players and clubs. In aggregate, these findings demonstrate considerable global variability in cardiac screening practices in football.

Concordance with current cardiac screening recommendations

Cardiac screening with medical history and physical examination is recommended by all major medical organisations. Data from this study provide real-world information about the implementation of these recommendations. The majority of MAs (~80%) reported that cardiac screening was available for their adult and youth players, which in all cases was inclusive of medical history and/or physical examination. While this indicates a globally high level of compliance with the universal recommendation to perform a medical history and physical examination, players in ~20% of associations may still not have access to any routine cardiac screening. Until recently, the European Society of Cardiology (ESC) recommended the inclusion of resting ECG in routine cardiac screening,[6] while the American College of Cardiology/American Heart Association (ACC/AHA) recommended routine cardiac screening confined to medical history and physical examination.[15] Among elite football players globally, a screening approach aligning with the ESC approach represents the more common clinical practice. The recently updated ACC/AHA recommendations now endorse ECG-inclusive screening in settings with adequate financial resources and clinical expertise.[16] The degree to which this historic change will result in more uniform global application of ECG-inclusive cardiac screening deserves future study. In 2025, FIFA published a consensus statement on recommendations for cardiac screening in youth football which also recognises ECG-inclusive screening as best practice when clinician expertise and resources allow.[17] The extent to which these new recommendations influence cardiac screening practices in youth football globally and the application of international standards for ECG interpretation in youth athletes will be important areas of future research.

Testing beyond current cardiac screening recommendations

Recommendations from the ESC,[6] the ACC/AHA[16] and North American and European imaging societies[18 19] do not encourage the use of transthoracic echocardiography during routine cardiac screening. Nonetheless, our data indicate that approximately 65% of elite adult and 45% of elite

Table 2 Prespecified cardiac screening intervals for adult male, adult female, youth male and youth female football players among FIFA Member Associations (n=134)

Frequency of serial cardiac screening							
Player age and sex	**<1 year**	**Annually**	**Every 2 years**	**Only prior to tournaments**	**Once at a specific age**	**Non-existent**	**Unclear**
Adult male, n(%)	8 (6)	85 (63)	7 (5)	20 (15)	3 (2)	3 (2)	8 (6)
Adult female, n (%)	8 (6)	79 (59)	9 (7)	25 (19)	5 (4)	1 (1)	7 (5)
Youth male, n (%)	8 (6)	67 (50)	8 (6)	23 (17)	3 (2)	4 (3)	21 (15)
Youth female, n (%)	8 (6)	63 (47)	7 (5)	23 (17)	6 (5)	4 (3)	23 (17)

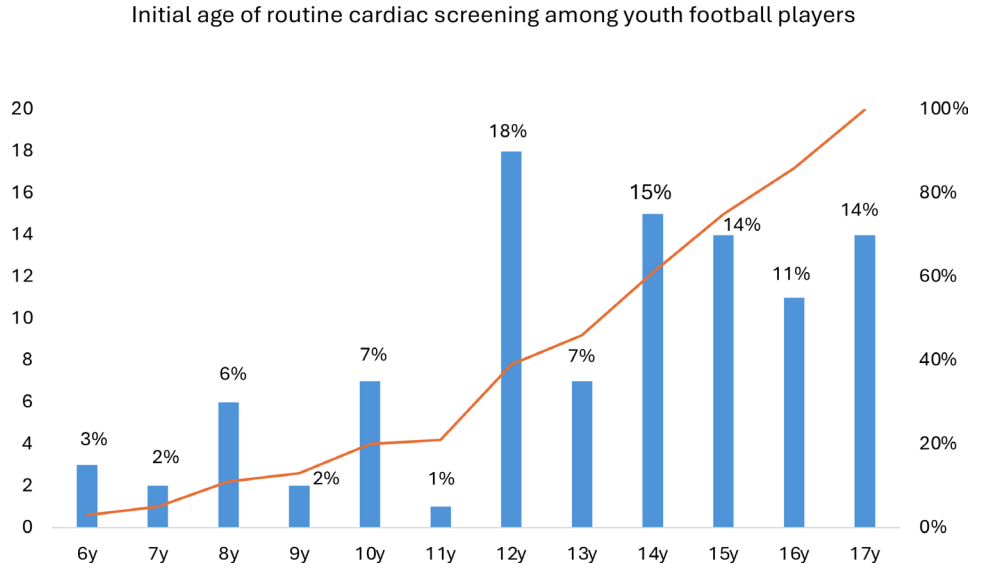

Figure 3 Proportional distribution of the initial age (years=y) of routine cardiac screening among youth players reported by 96 FIFA Member Associations highlighted by a cumulative percent graph.

youth players currently undergo echocardiography during routine screening. This finding may in part be explained by the fact that FIFA has required echocardiography for adult players prior to international tournament participation for the last two decades.[8 9] Additionally, we found that cardiac screening protocols inclusive of echocardiography and exercise stress testing were more common among FIFA MAs with access to a designated sports cardiologist. Performance and diagnostic interpretation of these screening modalities, coupled with the secondary evaluation and management of screening abnormalities, may be most effective under the guidance of a sports cardiologist. Accordingly, policy makers are encouraged to consider the importance of suggesting this resource in the development and guidance related to what constitutes high-quality screening strategies. Our data also indicate that a significant number of MAs include additional testing to routine cardiac screening including exercise stress testing, laboratory blood analysis and chest radiography. Scientific data supporting the inclusion of these items is sparse, perhaps with the exception of exercise stress testing, where limited experience suggests a potential value for the detection of sub-clinical arrhythmias.[20] Justification for the inclusion of chest radiography to cardiac screening is not supported by any published data and thus represents an unnecessary source of radiation exposure. Therefore, resources currently devoted to chest radiography might be more effectively directed to support ECG-inclusive screening. At present, the diagnostic yield, false positive/false negative rates and financial implications of cardiac screening, inclusive of cardiac diagnostic testing beyond ECG, are incompletely known and future work aimed at generating more data to reconcile these areas of uncertainty is warranted.

Regional differences in cardiac screening

We observed significant variability of cardiac screening practices across global regions and individual countries. Explanations for this variability remain incompletely understood but likely include differences in the costs of screening, financial resources and access to trained medical professionals. However, our data suggest that local healthcare standards do not necessarily translate into a lack of cardiac screening availability for elite football players. For example, despite well-documented inequities in the South American healthcare system,[21] all CONMEBOL MAs reported that cardiac screening is recommended or mandated for their players. This suggests that other MAs representing nations with relatively limited healthcare resources, perhaps of particular importance in regions with disproportionate rates of SCA/D,[22] can strive to achieve high levels of cardiac screening availability. This is supported by the observation that additional cardiac screening consisting of echocardiography and exercise stress testing is similarly implemented in CAF (African nations) and UEFA (mainly European countries with more robust healthcare systems and resources, online supplemental file S4).

Screening of youth players

Until 2025, no consensus recommendation from medical organisations and international sporting federations pertaining to youth athlete screening was available. Therefore, it is not surprising that we observed considerable heterogeneity in youth cardiac screening practices across FIFA MAs. Specifically, the median age of first screening for youth players in this study was 14 years, with a range spanning 6–17 years. This heterogeneity is noteworthy given recent data which document an increased prevalence of at-risk conditions and incidence in SCA/D among 12-year-old children compared with those in the 8- to 11-year age range.[23–25] We also observed considerable variability in the cardiac screening intervals for youth athletes among FIFA MAs. While approximately one half of MAs reported a youth player cardiac screening interval of at least 2 years, the other half reported screening less frequently or did not report a standardised screening interval. Recognition of the need for the standardisation of youth cardiac screening prompted FIFA to convene a working group to address this important issue with best practice recommendations published recently.[17] Accordingly, cardiac screening for youth players should begin at the age of 12, be repeated

every 2–4 years and include a combination of personal medical history, family medical history, physical examination and a 12-lead ECG.

Study limitations

Several limitations of this study are acknowledged. First, there was incomplete data capture of all FIFA MAs. Nonetheless, a high response rate, inclusive of a broad representation of MAs from all FIFA Confederations, was achieved, suggesting reasonable generalisability of our results. Second, we received survey data from people performing different roles within their respective MAs and therefore cannot exclude the possibility that some respondents had incomplete knowledge about the cardiac screening services provided by their MAs. However, survey data collection was largely performed at an international meeting comprised of official medical delegates of all FIFA MAs, thereby minimising the risk of any potential influence. Finally, we are unable to comment on the clinical impact of cardiac screening as it relates to incident SCA/D. This represents an area of important ongoing work.

CONCLUSION

The majority of FIFA MAs recommend or mandate routine cardiac screening for both male and female players. However, cardiac screening practices vary between countries, and screening protocols within and across geographic regions are variable. Compared with adult players, cardiac screening is less prevalent among youth football players, and both the age of initial screening and the interval of serial screening are highly variable. Our findings suggest the potential value of establishing global recommendations for cardiac screening in both adult and youth football.

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Competing interests ALB serves as the clinical sports cardiologist for the United States Soccer Federation (USSF). TM is chairman of the Medical Committee of the German FA and UEFA and chairman of the working group 'Medicine in Professional Football' of the German League Organisation (DFL). AS, KG and AM all declare full-time employment by FIFA. All authors declare that they have no competing interests regarding the aims of the study.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants but Swiss Association of Research Ethics Committees (Req-2024-00126) exempted this study. Participants gave informed consent to participate in the study before taking part.

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