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ORIGINAL ARTICLE

Masters age football and cardiovascular risk

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Key words
cardiac risk factor, myocardial infarction, football, defibrillator, Masters sport.

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Abstract

Background: Football (soccer) is popular among those of Masters age (≥35 years). Although regular exercise improves health, strenuous exercise causes a transient increase in cardiac risk.
Aim: To gain insight into cardiac risk factors, symptoms, and knowledge, attitudes and beliefs about myocardial infarction (MI), and support for prevention.
Methods: A web-based survey using REDCap was completed by 153 amateur Masters footballers from A grade competition ($n = 24$), B or lower grade ($n = 95$) or social games ($n = 34$) in Sydney, Australia.
Results: Participants were aged 49.3 ± 7.5 years and primarily male (92.2%), Caucasian (88.9%) and university educated (75.2%). Risk factors included hypercholesterolaemia (37.3%), hypertension (19.6%), smoker (7.8%), overweight (40.5%) or obese (13.1%). One-fifth (21.6%) reported ≥1 potential cardiac symptom during activity in the prior year, for which one-quarter (24.2%) sought medical attention. Knowledge of typical MI symptoms was high (>80%) but lower (<40%) for less typical symptoms. Half (49.6%) were not confident to recognise MI in themselves. Half (49.0%) would remain on the field for 5–10 min with chest pain. Only 39.9% were aware that warning signs might precede MI by days. They overestimated survival from cardiac arrest (43%). Participants supported training in automatic external defibrillators (AED) and cardiopulmonary resuscitation (84%), AED at games (85%) and cardiac education (>70%).
Conclusions: Cardiac risk factors are common In Masters footballers, with one in five experiencing possible cardiac symptoms in the prior year. While gaps exist in knowledge and optimal responses, strong support exists for preventive measures.

Introduction

Football (soccer) is Australia's most popular team sport.[1] Although sudden cardiac death (SCD) during the sport is rare, these deaths are widely publicised and are of concern given the recognised health benefits of exercise.[2,3] While regular physical activity is associated with physical and mental health benefits, it is a paradox that strenuous physical exercise can cause a transient increase in cardiac events, including myocardial infarction (MI) and sudden cardiac arrest (SCA).[3–5] The increased risk is greater in older adults and those who exercise infrequently,[6] with the majority of sports-related SCD occurring in people aged over 35 years.[4] In Masters age athletes, the most likely cause of SCD is atherosclerotic coronary artery disease,[7,8] while genetic and other non-atherosclerotic causes are more common in younger athletes.[7,8]

Despite the popularity of Masters football, the prevalence of cardiac risk factors and potential cardiac symptoms in these players is not well described. Similarly, player knowledge and confidence in recognising potential cardiac symptoms and responding appropriately has not been well studied. Early recognition of symptoms and intervention is vital with low survival rates for out-of-hospital SCA, decreasing by 7–10% for every minute without cardiopulmonary resuscitation (CPR) or defibrillation.[9,10] In approximately half the cases, warning symptoms are experienced in the 4 weeks preceding

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SCA, but frequently the symptoms are not recognised or acted on.[11,12]

The aim of this study was to determine the cardiac risk factors and potential prodromal symptoms in Masters amateur footballers, their knowledge, attitudes and beliefs about symptoms and the appropriate response, and their support for preventive strategies.

Methods

Study design

The web-based Masters Football and Cardiovascular Risk (MAFACARI) survey was informed by a literature review and case study, and based on existing cardiac health instruments and sports health screening frameworks. The survey collected self-reported data via a questionnaire on REDCap, a web-based survey application. Approval was obtained from the local Institutional Human Ethics Committee and conformed to the principles outlined in the Declaration of Helsinki.

Questionnaire

The questionnaire contained four sections: (i) demographic information and medical history to determine the prevalence of cardiac risk factors and symptoms; (ii) knowledge of cardiac symptoms; (iii) behaviour, attitudes and beliefs that might influence cardiac risk; and (iv) support for preventative strategies. Instruments used to help formulate the questionnaire included the acute coronary syndrome (ACS) response index,[14] Pre-Exercise Screening Tool[15] and the American Heart Association/American College of Sports Medicine's Pre-Participation Screening Questionnaire.[16] The ACS Response Index[14] includes knowledge, attitudes and beliefs subscales. The knowledge subscale has 21 items assessing knowledge of symptoms and is measured using a binary scoring system with a maximum of 21 points. The attitudes subscale has five items measuring symptom recognition and help-seeking. Patients respond on a 4-point Likert scale from 1 (not at all) to 4 (very sure), with scores ranging from 5 to 20. Higher scores indicate greater confidence in recognising and responding to symptoms. The beliefs subscale has seven items measuring what participants would do if they experienced a heart attack. Items on the beliefs subscale are evaluated on a 4-point Likert scale from 1 (strongly agree) to 4 (strongly disagree). Scores range from 7 to 28. A 4-point Likert scale was also used to assess participant support for risk mitigation strategies.

Participant recruitment and data collection

Participants were Masters age (≥35 years) amateur football players from Sydney competing at three levels: Masters competition A grade, Masters competition B grade or lower and social football groups. Players were invited to participate through researcher attendance at team sessions, or telephone and email communication with team and area coordinators who distributed study information. Potential participants received an information sheet and link to the REDCap questionnaire. The questionnaire was accessed by 180 individuals, of whom 175 consented and 153 completed questionnaires. The questionnaire took 15–20 min to complete using personal digital devices at a time convenient to them. Participation was voluntary and anonymous, with no financial incentive. Only completed and submitted questionnaires were analysed. Participation required English literacy and access to a digital device.

Statistical analysis

Analysis was undertaken for the overall group, as well as separately for the three subgroups based on playing levels. Data were analysed using IBM SPSS Statistics 26.0 (IBM Corp, Armonk, NY, USA) for Windows, with descriptive statistical analysis applied for non-open-ended variables. Discrete data were represented using proportions and frequencies. Continuous variables were represented with mean and standard deviation for those well modelled by a normal distribution. Statistical differences between group mean scores were tested using one-way analysis of variance (ANOVA).

Results

Participant characteristics

Of the 153 Masters football players, 24 (15.7%) currently played at A grade level, 95 (62.1%) at B grade or lower competition and 34 (22.2%) played non-competition social football (Table 1). Participants were aged 49.3 ± 7.5 years and primarily male (92.2%), Caucasian (88.9%) and university educated (75.2%). Demographics were similar across the three playing levels.

The most common risk factors were hypercholesterolaemia (37.3%), hypertension (19.6%), current smoking (7.8%), overweight (body mass index (BMI) 25–30 kg/m^2) (40.5%), obesity (BMI >30 kg/m^2) (13.1%) and family history of heart disease (22.9%). Participants exercised or played sport an average of 3.6 days per week, with a weekly average of 2.6 h of

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Table 1 Study participant characteristics

Characteristic	All ($n = 153$)	A grade ($n = 24$)	B grade ($n = 95$)	Social ($n = 34$)
Age, mean (±SD) (years)	49.3 (7.5)	50.0 (5.7)	48.7 (7.3)	50.5 (9.2)
Male, *n* (%)	141 (92.2)	22 (91.7)	87 (91.6)	32 (94.1)
Female, *n* (%)	12 (7.8)	2 (8.3)	8 (8.4)	2 (5.9)
Caucasian, *n* (%)	136 (88.9)	23 (95.8)	84 (88.4)	29 (85.3)
Highest academic qualification, *n* (%)				
HSC or lower	15 (9.8)	3 (12.5)	9 (9.5)	3 (8.8)
TAFE qualification	23 (15.0)	3 (12.5)	17 (17.9)	3 (8.8)
University degree	115 (75.2)	18 (75.0)	69 (72.6)	28 (82.4)
Risk factors				
Hypertension, *n* (%)	30 (19.6)	2 (8.3)	18 (18.9)	10 (29.4)
Hypercholesterolaemia, *n* (%)	57 (37.3)	9 (37.5)	37 (38.9)	11 (32.4)
Diabetes, *n* (%)	1 (0.7)	0 (0)	1 (1.1)	0 (0)
Heart condition†, *n* (%)	12 (7.8)	2 (8.3)	6 (6.3)	4 (11.8)
BMI, mean (±SD)	26.0 (3.6)	25.8 (3.5)	26.3 (3.5)	25.5 (3.9)
Overweight, *n* (%)	62 (40.5)	9 (37.5)	42 (44.2)	11 (32.4)
Obese, *n* (%)	20 (13.1)	3 (12.5)	13 (13.7)	4 (11.8)
Family history, *n* (%)	35 (22.9)	4 (16.7)	23 (24.2)	8 (23.5)
Current smoker, *n* (%)	12 (7.8)	2 (8.3)	8 (8.4)	2 (5.9)
At least occasional high stress over past 3 months, *n* (%)	101 (66.0)	14 (58.3)	67 (70.5)	20 (58.8)
Regular exercise, mean (±SD)				
Exercise or sport (days/week)	3.6 (1.7)	3.4 (1.8)	3.6 (1.6)	3.5 (1.8)
Moderate intensity physical activity (min/week)	156 (124)	154 (109)	159 (125)	146 (133)
Vigorous intensity physical activity (min/week)	141 (90)	154 (83)	144 (76)	125 (124)
Muscle strengthening (days/week)	1.3 (1.4)	1.3 (1.6)	1.3 (1.5)	1.0 (1.2)
Activity level of employment, *n* (%)				
Sedentary	114 (74.5)	17 (70.8)	72 (75.8)	25 (73.5)
Physically active	38 (24.8)	7 (29.2)	22 (23.2)	9 (26.5)
Unemployed	1 (0.7)	0 (0)	1 (1.1)	0 (0)
Health checks				
Time since last BP check, *n* (%)				
<1 year	117 (76.5)	21 (87.5)	68 (71.6)	28 (82.4)
2–5 years	31 (20.3)	2 (8.3)	24 (25.3)	5 (14.7)
>6 years	5 (3.3)	1 (4.2)	3 (3.2)	1 (2.9)
BP never taken	0 (0)	0 (0)	0 (0)	0 (0)
Time since cholesterol check, *n* (%)				
<1 year	97 (63.4)	19 (79.2)	57 (60.0)	21 (61.8)
2–5 years	33 (21.6)	4 (16.7)	22 (23.2)	7 (20.6)
>6 years	10 (6.5)	1 (4.2)	7 (7.4)	2 (5.9)
Cholesterol never tested	13 (8.5)	0 (0)	9 (9.5)	4 (11.8)
Previous exercise stress test, *n* (%)	64 (41.8)	11 (45.8)	38 (40.0)	15 (44.1)
Medication usage, *n* (%)				
Regular medications doctor prescribed	47 (30.7)	6 (25.0)	28 (29.5)	13 (38.2)
Medications before playing	22 (14.4)	6 (25.0)	12 (12.6)	4 (11.8)
Over counter or complementary	43 (28.1)	10 (41.7)	25 (26.3)	8 (23.5)
Potential cardiac symptoms during physical activity in prior 12 months, *n* (%)				
One or more of above symptoms in prior 12 months	33 (21.6)	5 (20.8)	22 (23.2)	6 (17.6)
Unexplained pain or tightness in chest, arms or neck	6 (4.0)	2 (8.3)	3 (3.2)	1 (2.9)
Felt faint or dizzy	23 (15.0)	4 (16.7)	15 (15.8)	4 (11.8)
Breathless above what would normally be expected	17 (11.1)	3 (12.5)	10 (10.5)	4 (11.8)
Sought medical attention at the time a symptom was experienced‡	8 (24.2)	1 (20.0)	7 (31.8)	0 (0)
First aid course completed, *n* (%)				
Current (past 3 years)	37 (24.2)	4 (16.7)	22 (23.2)	11 (32.4)
Out of date	51 (33.3)	11 (45.8)	33 (34.7)	7 (20.6)
Never	65 (42.5)	9 (37.5)	40 (42.1)	16 (47.1)
Able to provide CPR, *n* (%)	103 (67.3)	18 (75.0)	60 (63.2)	25 (73.5)

†Eight (5%) participants had a past history of cardiac catheterisation, percutaneous transluminal coronary angioplasty or cardiac surgery.
‡Percentage based on the 33 participants who experienced a symptom.
BMI, body mass index; BP, blood pressure; CPR, cardiopulmonary resuscitation; HSC, High School Certificate; SD, standard deviation; TAFE, Technical and Further Education.

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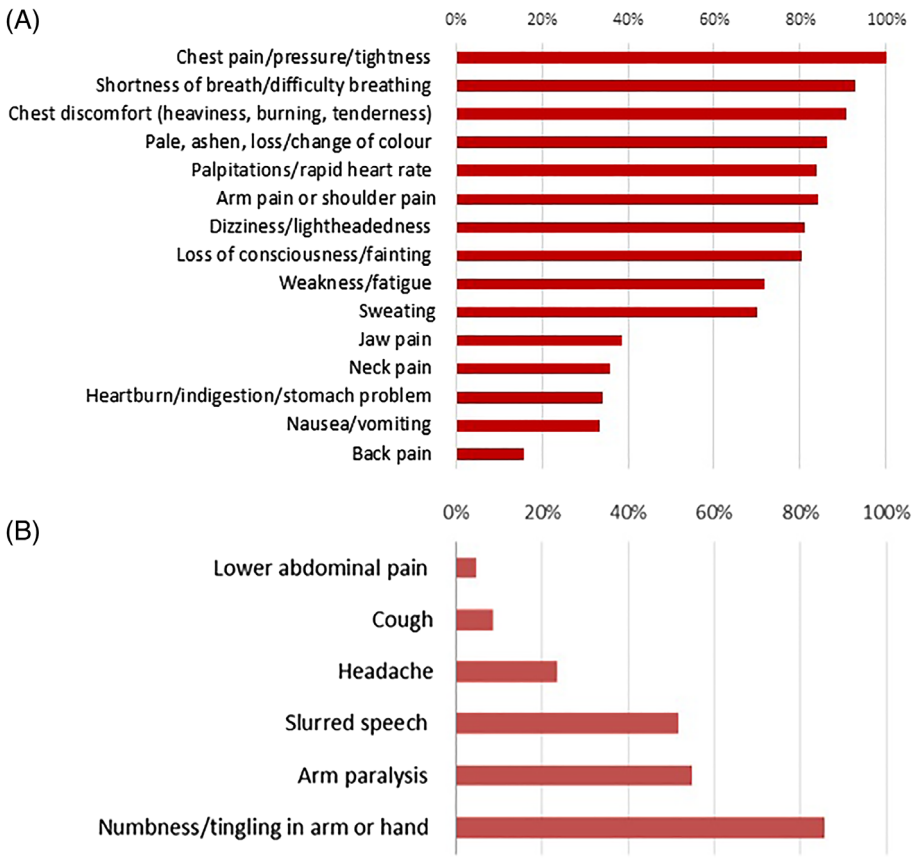

Figure 1 (A) Proportion of symptoms correctly identified as being associated with a heart attack, and (B) proportion of symptoms incorrectly identified as being typical of a heart attack.

moderate activity and 2.4 h of vigorous activity. Almost on-third (30.7%) took regular prescription medication, with a trend to a higher use among social players. Medications were taken before a game by 14.4%, and over-the-counter or complementary medication were taken by 28.1%, with a trend to higher use among A grade players. Most participants reported having measured their blood pressure (76.5%) and cholesterol (63.4%) within the prior year. Two-fifths (41.8%) had previously completed an exercise stress test, of which most were reportedly normal (95.3%). Over half (57.5%) had completed a first aid course, one-quarter (24.2%) within the prior 3 years. Two-thirds (67.3%) reported that they knew how to provide CPR.

Potential cardiac symptoms

One-fifth (21.6%) of participants reported experiencing one or more potential cardiac symptoms during physical activity in the preceding 12 months (Table 1). Only one-quarter (24.2%) of those with symptoms sought medical advice.

Knowledge of cardiac symptoms

Knowledge of typical MI symptoms was high (>80%) but lower (<40%) for less typical symptoms (Fig. 1). Symptom knowledge using the knowledge subscale of the ACS Response Index,[14] was 13.7 ± 2.3 compared with a maximum scale score of 21. There were no between-group differences (A grade, 13.8 ± 2.1; B grade, 13.9 ± 2.5; social, 13.0 ± 1.7; $P = 0.138$). Most participants were familiar with the terms 'heart attack' (98.7%) and 'cardiac arrest' (92.2%), but less so with 'angina' (68.6%). Only 39.9% of participants considered that warning signs could be experienced 'days to months before' a heart attack, with 60.1% responding that symptoms would be experienced 'minutes to hours before'. The chance of surviving an out-of-hospital cardiac arrest was estimated as 43% (±25).

Attitudes and beliefs about MI symptoms and appropriate response

The mean score for the attitudes subscale was 11.9 ± 2.7 (maximum score of 20), with no difference between A

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grade (11.5 ± 2.7), B grade (11.9 ± 2.7) or social players (12.2 ± 2.8) (P = 0.569; Table 2). Only one-third (32.7%) were pretty/very sure they could recognise heart attack symptoms in someone else, while almost half (49.6%) had little or no confidence in recognising heart attack symptoms in themselves.

The mean score in the beliefs subscale was 22.1 ± 3.2 (maximum 28), with no difference between A grade (22.0 ± 3.4), B grade (22.1 ± 3.2) or social players (22.1 ± 3.4) ($P = 0.980$).

Player experience and behaviour

Almost three-quarters (73.3%) had played football for at least 5 years since age 35 years (Table 3). The most popular reasons for playing were social interaction and enjoyment (93.5%), health and exercise (89.5%) and love of football (79.7%). Competitive drive was a more common motivator in A grade (66.7%) and B grade (43.2%) players than social (20.6%), with a corresponding gradient in moderate or intense emotions while playing (83.3%), (65.3%) and (44.1%).

In response to a hypothetical episode of unusual chest pain while playing football, almost half (46.6%) would leave the field immediately; however, half (49.0%) would stay on the field for 5–10 min to see if the pain eased. Several A grade (16.6%) and B grade (2.2%) players would play until their performance became unsatisfactory or until the end of the game. The main reason for those remaining on the field was being physically able to play through the pain or discomfort (86.6%). Additional reasons to continue playing, particularly among competition players, were 'personal drive' (31.8%), 'not wanting to let the team down' (28%) and 'expectations of club or teammates to keep playing' (8.5%). While most (81.7%) would see a doctor within 1 week of experiencing a health problem such as chest pain, 18.3% would wait longer or not go. Three-quarters (76.5%) would use the internet for information about their symptoms before seeing a doctor.

Support for risk mitigation strategies

The most strongly supported strategies were automated external defibrillator (AED) availability at games,

Table 2 Study participant attitude and belief scale responses

ACS attitudes subscale, *n* (%)	Not at all (1)	Little sure (2)	Pretty sure (3)	Very sure (4)
How sure are you that you could				
Recognise the signs and symptoms of a heart attack in someone else	16 (10.5)	87 (56.9)	47 (30.7)	3 (2.0)
Recognise the signs and symptoms of a heart attack in yourself	10 (6.5)	66 (43.1)	72 (47.1)	5 (3.3)
Differentiate between the signs and symptoms of a heart attack and other medical problems	27 (17.6)	91 (59.5)	35 (22.9)	0 (0)
Get help for someone you believed to be having a heart attack	13 (8.5)	40 (26.1)	72 (47.1)	28 (18.3)
Get help for yourself if you believed you were having a heart attack	20 (13.1)	67 (43.8)	55 (35.9)	11 (7.2)
ACS beliefs subscale, *n* (%)	**Strongly agree (1)**	**Agree (2)**	**Disagree (3)**	**Strongly disagree (4)**
If I have chest pain that does not stop after 15 min, I should get to hospital as soon as possible (reverse scored)	86 (56.2)	56 (36.6)	10 (6.5)	1 (0.7)
I would be embarrassed to go to hospital if I thought I was having a heart attack but wasn't (reverse scored)	7 (4.6)	49 (32.0)	54 (35.3)	43 (28.1)
If I thought I was having a heart attack, I would wait until very sure before going to hospital	3 (2.0)	44 (28.8)	69 (45.1)	37 (24.2)
If I thought I was having a heart attack, I would rather someone drive me to hospital than have an ambulance come to my home	18 (11.8)	51 (33.3)	52 (34.0)	32 (20.9)
Because of the cost of medical care, I would want to be absolutely sure I was having a heart attack before going to hospital	3 (2.0)	9 (5.9)	63 (41.2)	78 (51.0)
If I'm having chest pain and I'm not very sure if it's a heart attack, I should go to hospital (reverse scored)	41 (26.8)	88 (57.5)	24 (15.7)	0 (0)
If I thought I was having a heart attack, I would go to the hospital right away (reverse scored)	103 (67.3)	45 (29.4)	5 (3.3)	0 (0)

ACS, acute coronary syndrome.

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training in their use and information about cardiac health and warning symptoms (Fig. 2). Players indicated willingness to contribute \$71 ± \$57 dollars per season to cover costs of preventative strategies.

Discussion

Despite football's popularity among Masters players (≥35 years), they have rarely been scientifically investigated.[17] To our knowledge, this is the first study to assess cardiac knowledge, attitudes and beliefs in this group.

The main findings were: (i) cardiac risk factors were common in the Masters footballers; (ii) competition and social players had overall similar characteristics and responses, although competition players expressed a stronger competitive drive; (iii) one in five participants experienced a possible cardiac symptom in the prior 12 months, but only one-quarter of those with symptoms sought medical advice at the time; (iv) participants had a good knowledge of typical heart attack symptoms but were uncertain about less typical symptoms, or the duration of prodromal warning symptoms; (v) beliefs and responses regarding heart attack symptoms were largely appropriate, although some participants reported high-risk responses such as someone driving them to hospital for a suspected heart attack rather than calling an ambulance; and (vi) strong support for risk mitigation strategies, such as providing AED at games, training in basic life support and AED, and cardiac education.

The footballers in this cohort were regularly active, exercising an average of 3.6 days per week, with the social players exercising to a similar frequency as the competition players. It is uncertain whether there is a higher cardiac risk from exertion among 'weekend warriors' versus regular exercisers. Recent data suggest that both gain health benefit; however, there is a higher relative risk of MI triggered by heavy exertion among more sedentary individuals.[5]

Cardiac risk factors were common in participants. Compared with Australian national averages for a similar group (males aged 45–54 years),[18] participants reported a higher prevalence of hypercholesterolaemia (37.3% vs 7.0%) and hypertension (19.6% vs 13.4%), less current smoking (7.8% vs 20.5%), similar overweight (40.5% vs 43.0%) but less obesity (13.1% vs 40.6%). Two-thirds of participants reported at least occasional high emotional stress over the prior 3 months. There were no significant differences in risk factors across the three playing levels apart from hypertension tending to be more prevalent among social and B grade players than A grade. The study results reinforce the importance of addressing modifiable risk factors[19,20] in this population.

Enjoyment and love of football, health and exercise, were strong motivators across all three levels consistent with the known physical and psychological benefits of exercise.[21] Not surprisingly, competitive drive was a greater motivator in A grade than B grade or social players, as was the intensity of their emotions when playing. Future analysis could explore any correlation between competitiveness and continuing to play despite symptoms.

One-fifth of participants reported potential cardiac symptoms, such as unexplained pain or tightness in the chest, arms or neck, feeling faint or dizzy, and breathless, above normally expected during physical activity in the preceding year. However, only one-quarter of those who experienced symptoms sought medical advice. A good knowledge of ACS symptoms has been associated with reduced decision delay during an acute cardiac event in some but not all studies.[22–25] While participants in the present study demonstrated good knowledge of common heart attack symptoms such as chest and arm pain and shortness of breath, they had limited knowledge of less typical symptoms such as nausea and neck, back and jaw pain. They also had difficulty differentiating between some signs and symptoms of a heart attack and other conditions, with over half incorrectly considered slurred speech and arm numbness or paralysis to be signs of a heart attack rather than stroke. Participants were also uncertain if angina was the same as a heart attack, and whether a heart attack differed from a cardiac arrest, with many considering the latter two to be the same. The moderate score in ACS attitudes reflected lack of confidence in recognising heart attack symptoms. Over half inaccurately considered that the earliest that warning signs could be experienced before a heart attack was only minutes to hours. Confusion regarding possible MI symptoms and failure to recognise prodromal symptoms could cause delay in seeking help.[26,27] Since prodromal symptoms are frequently experienced during the month preceding a cardiac event,[11] improved recognition of warning symptoms might lead to more timely medical assessment and prevention. Participants overestimated the chance of surviving an out-of-hospital SCA as 43% in contrast with the reality of 8–11%.[9,28,29] Our findings may represent a best-case scenario since the cohort had a high education level with 75% university educated. Sociodemographic disparities have been reported in MI symptom awareness and knowledge of appropriate responses.[30]

Participants scored more highly in the beliefs than attitudes subscales suggesting that they held safer beliefs about need to seek treatment for a heart attack than confidence in recognising one. Education would help close

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Table 3 Player experience and behaviour responses

Characteristic	All ($n = 153$)	A grade ($n = 24$)	B grade ($n = 95$)	Social ($n = 34$)	*P*-value
Years played since age 35 years, *n* (%)					
1–4 years	41 (26.8)	3 (12.5)	30 (31.6)	8 (23.5)	
5–9 years	42 (27.5)	6 (25.0)	24 (25.3)	12 (35.3)	
10 years or more	70 (45.8)	15 (62.5)	41 (43.2)	14 (41.2)	
Motivation for playing					
Social interaction and enjoyment	143 (93.5)	22 (91.7)	90 (94.7)	31 (91.2)	
Health and exercise	137 (89.5)	21 (87.5)	82 (86.3)	32 (100.0)	
To be part of a team	105 (68.6)	17 (70.8)	73 (76.8)	15 (44.1)*	0.002
Love of the sport	122 (79.7)	21 (87.5)	73 (76.8)	28 (82.4)	
Competitive drive/desire to win	64 (41.8)	16 (66.7)	41 (43.2)	7 (20.6)	0.002
Other	3 (2.0)	1 (4.2)	1 (1.1)	1 (2.9)	
Competitiveness playing at current level					0.014*
Very	39 (25.5)	10 (41.7)	23 (24.2)	6 (17.6)	
Moderately	83 (54.2)	11 (45.8)	58 (61.1)	14 (41.2)	
Slightly	26 (17.0)	3 (12.5)	12 (12.6)	11 (32.4)*	
Not at all	5 (3.3)	0 (0)	2 (2.1)	3 (8.8)	
Intensity of emotions when playing					
Very	19 (12.4)	3 (12.5)	13 (13.7)	3 (8.8)	
Moderately	78 (51.0)	17 (70.8)	49 (51.6)	12 (35.3)	
Slightly	50 (32.7)	4 (16.7)	29 (30.5)	17 (50.0)	
Not at all	6 (3.9)	0 (0)	4 (4.2)	2 (5.9)	
Response to hypothetical episode of chest pain					
1. Time taken to leave the field if unusual chest pain or discomfort, *n* (%)					0.049*
Immediately	71 (46.4)	9 (37.5)	49 (51.6)	13 (38.2)	
I would stay for 5–10 min to see if pain eased	75 (49.0)	11 (45.8)	43 (45.3)	21 (61.8)	
I would stay until performance was unsatisfactory	3 (2.0)	2 (8.3)*	1 (1.1)	0 (0)	
I would seek first aid and then resume playing	1 (0.7)	0 (0)	1 (1.1)	0 (0)	
I would keep playing until the end of the game	3 (2.0)	2 (8.3)*	1 (1.1)	0 (0)	
2. Main reasons for staying on the field if pain or discomfort ($n = 82$), *n* (%)					
Physically able to continue playing through the pain or discomfort	71 (86.6)	15 (100.0)	39 (84.8)	17 (81.0)	
Personal drive – not want to give in	26 (31.8)	6 (40.0)	14 (30.4)	6 (28.6)	
Do not want to let the team down	23 (28.0)	5 (33.3)	16 (34.8)	2 (9.5)	
Expectations of club or teammates to keep playing	7 (8.5)	2 (13.3)	5 (10.9)	0 (0)	
Concern about appearing weak if you left the field	4 (4.9)	1 (6.7)	2 (4.3)	1 (4.8)	
Other	6 (7.3)	0 (0)	4 (8.7)	2 (9.5)	
Length of time experiencing a health problem (such as chest pain) before seeing a doctor, *n* (%)					0.023*
Less than 7 days	125 (81.7)	19 (79.2)	77 (81.1)	29 (85.3)	
1–2 weeks	19 (12.4)	2 (8.3)	13 (13.7)	4 (11.8)	
3–4 weeks	5 (3.3)	0 (0)	5 (5.3)	0 (0)	
More than 4 weeks	2 (1.3)	1 (4.2)	0 (0)	1 (2.9)	
I would not go to the doctor	2 (1.3)	2 (8.3)*	0 (0)	0 (0)	
Would use Internet to search for information about symptoms prior to seeing a doctor, *n* (%)	117 (76.5)	17 (70.8)	72 (75.8)	28 (82.4)	

the gap between a player's desire to respond appropriately to cardiac events and the knowledge and confidence of how best to do so. The study identified several higher risk behaviours. The finding that only one-quarter of participants who experienced potential cardiac symptoms sought medical advice at the time accords with a known tendency to ignore prodromal symptoms. For instance, only 19% of individuals in one study called emergency services for symptoms before SCA.[11] This reluctance was demonstrated in participant responses to a hypothetical scenario of chest pain while playing, with almost half stating they would stay on the field for 5–10 min and a small percentage continuing to play until their performance was unsatisfactory or until the end of the game. One-third

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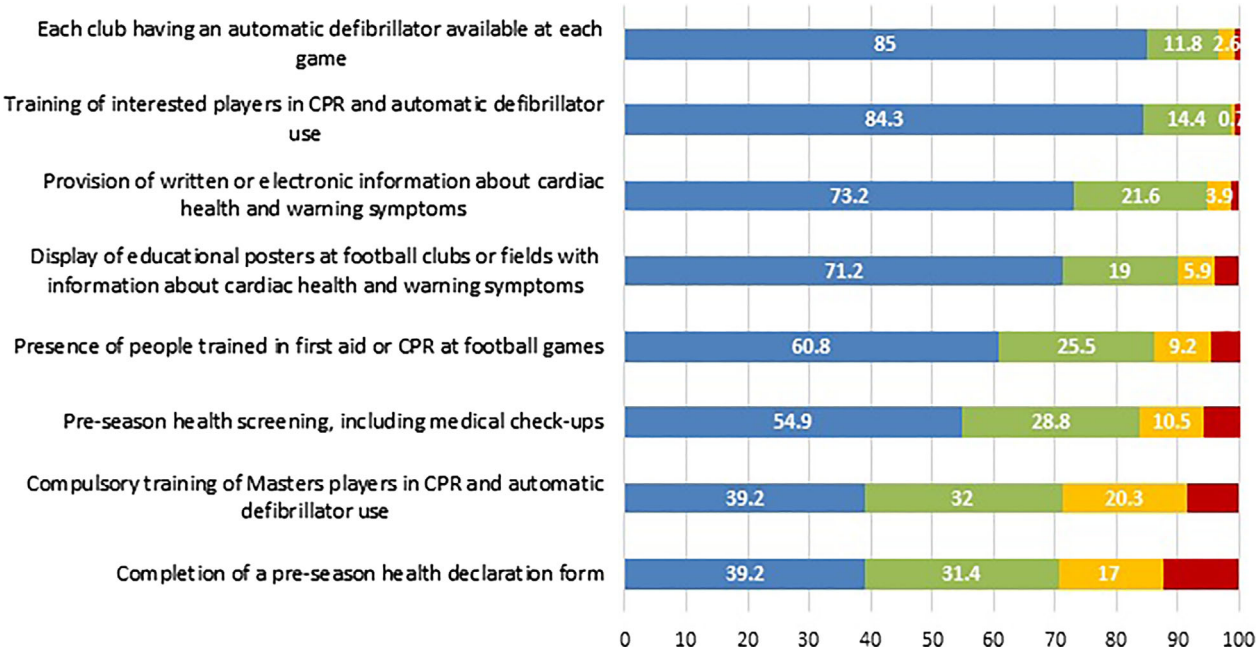

Figure 2 Participant support for risk mitigation strategies (%). (■), Very much; (■), moderately; (■), slightly; (■), not at all. CPR, cardiopulmonary resuscitation.

would be embarrassed to go to hospital if they thought they were having a heart attack but were incorrect, while nearly half would prefer that someone drive them to the hospital rather than an ambulance come to their home. Three-quarters would search the internet prior to seeing a doctor if experiencing chest pain, supporting the importance of reliable information sources.

Support across all playing levels was strong for actions to prevent or mitigate cardiac events. The most strongly supported strategy was AED availability at games. Prompt use of onsite AED doubles neurologically intact survival[31] with community studies demonstrating the effectiveness of public access defibrillation programmes.[32] Support for AEDs aligns with recent Australian grant initiatives to assist sporting clubs to have their own AED, although this has not been extended to social games. Football clubs could supplement such programmes through player contributions with participants indicating a willingness to pay towards preventative strategies. Training of interested players in CPR and AED use was strongly supported and is critical to increase survival after SCA.[33] Compulsory training gained less support suggesting player involvement in programmes may best be voluntary. The presence of people trained in first aid or CPR at games was also supported. While two thirds stated they knew how to provide CPR, only one-quarter had completed a first aid course within the prior 3 years.

Education strategies were strongly supported. These should focus on clear instructions to assist symptom recognition and build confidence in responding appropriately.[23,34] Education to allow prompt recognition and management of cardiac arrest is vital, with reduced survival when intervention is delayed greater than 10 min.[32] The provision of written or electronic information to players and posters at club grounds was strongly supported. There was only moderate support for pre-season health screening, including medical check-ups, or compulsory completion of pre-season health declaration forms. Given the debate about the feasibility and cost-effectiveness of pre-participation health screening,[35,36] greater success in amateur players may be achieved by encouraging voluntary rather than mandatory pre-season health screening. Education initiatives should encourage players to obtain regular medical evaluations, although it was encouraging that the majority of participants had blood pressure and cholesterol checks within the prior year.

Study limitations

Generalisability is limited by the selection of participating teams based on convenience and the lack of a control group. The number of university-educated participants was higher than the Australian average.[37] Since educational level has been associated with a greater awareness of cardiac warning signs[38] gaps in knowledge and behavioural responses are likely to be greater in other Masters

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footballers with less education. As participation was voluntary, a pre-existing interest in cardiac health may have influenced participation. Nevertheless, the study provides insight into factors contributing to the cardiac risk among amateur football players and strategies to mitigate that risk.

Conclusion

Masters age (≥35 years) football is increasingly popular. Modifiable cardiac risk factors were common in this group and one-fifth of survey participants reported a potential cardiac symptom in the prior year, for which only one-quarter sought medical attention. Gaps were identified in knowledge of cardiac symptoms and appropriate responses, but were accompanied by strong player support for cardiac health education. Research into the most effective delivery of this information would be worthwhile. The availability of AED at games and training in their use, was strongly supported by the players, and should be further promoted. While the many benefits of physical activity far outweigh the risk, our data provide insights to further increase the benefit–risk ratio for Masters football and other sport.

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References

1 Australian Sports Commission. *AusPlay: Participation Data for the Sport Sector*. Australian Government; 2016.

2 Dvorak J, Kramer EB, Schmied CM, Drezner JA, Zideman D, Patricios J *et al*. The FIFA medical emergency bag and FIFA 11 steps to prevent sudden cardiac death: setting a global standard and promoting consistent football field emergency care. *Br J Sports Med* 2013; **47**: 1199–202.

3 Singh R, Pattisapu A, Emery MS. US physical activity guidelines: current state, impact and future directions. *Trends Cardiovasc Med* 2020; **30**: 407–12.

4 Chugh SS, Weiss JB. Sudden cardiac death in the older athlete. *J Am Coll Cardiol* 2015; **65**: 493–502.

5 Mittleman MA, Maclure M, Tofler GH, Sherwood JB, Goldberg RJ, Muller JE. Determinants of myocardial infarction onset study investigators: triggering of acute myocardial infarction by heavy physical exertion: protection against triggering by regular exertion. *N Engl J Med* 1993; **329**: 1677–83.

6 Thompson PD, Franklin BA, Balady GJ, Blair SN, Corrado D, Estes NM *et al*. Exercise and acute cardiovascular events placing the risks into perspective: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism and the Council on Clinical Cardiology. *Circulation* 2007; **115**: 2358–68.

7 Maron BJ, Pelliccia A. The heart of trained athletes: cardiac remodelling and the risks of sports, including sudden death. *Circulation* 2006; **114**: 1633–44.

8 Tabib A, Miras A, Taniere P, Loire R. Undetected cardiac lesions cause unexpected sudden cardiac death during occasional sport activity. *Eur Heart J* 1999; **20**: 900–3.

9 Benjamin EJ, Virani SS, Callaway CW, Chamberlain AM, Chang AR, Cheng S *et al*. Heart disease and stroke statistics-2018 update: a report from the American Heart Association. *Circulation* 2018; **137**: e67–e492.

10 Link MS, Atkins DL, Passman RS, Halperin HR, Samson RA, White RD *et al*. Part 6: electrical therapies: automated external defibrillation, cardioversion, and pacing: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2010; **122**: S706–19.

11 Marijon E, Uy-Evanado A, Dumas F, Karam N, Reinier K, Teodorescu C *et al*. Warning symptoms are associated with survival from sudden cardiac arrest. *Ann Intern Med* 2016; **164**: 23–9.

12 Nishiyama C, Iwami T, Kawamura T, Kitamura T, Tanigawa K, Sakai T *et al*. Prodromal symptoms of out-of-hospital cardiac arrests: a report from a large-scale population-based cohort study. *Resuscitation* 2013; **84**: 558–63.

13 Harris PA, Taylor R, Minor BL, et al.. The REDCap consortium: Building an international community of software partners, *J Biomed Inform*. 2019; **95**: 103208.

14 Riegel B, McKinley S, Moser DK, Meischke H, Doering L, Dracup K. Psychometric evaluation of the acute coronary syndrome (ACS) response index. *Res Nurs Health* 2007; **30**: 584–94.

15 Exercise and Sports Science Australia, Fitness Australia, Sports Medicine Australia Adult Pre-Exercise Screening Tool. 2011. [cited 2021 June 30]. Available from URL: https://bp-fitnessaustralia-production.s3.amazonaws.com/uploads/uploaded_file/file/201/Australian-Adult-Pre-Exercise-Screening-Tool.pdf

16 Balady GJ, Chaitman B, Driscoll D, Foster C, Froelicher E, Gordon N *et al*. Recommendations for cardiovascular screening, staffing, and emergency policies at health/fitness facilities. *Circulation* 1998; **97**: 2283–93.

17 Wegmann M, Steffen A, Pütz K, Würtz N, Such U, Faude O *et al*. Cardiovascular risk and fitness in veteran football players. *J Sports Sci* 2016; **34**: 576–83.

18 Australian Bureau of Statistics National Health Survey: First Results. 2018. Table 3.7 Long-term health conditions (a), Proportion of persons—Males; Table 8.3 Body Mass Index, waist circumference, height and weight(a)(b), Proportion of persons; Table 9.3 Smoking, Proportion of persons. [cited 2021 Jun]. Available from URL: https://www.abs.gov.au/statistics/health/health-conditions-and-risks/national-health-survey-first-results/latest-release#data-download

19 Berry JD, Dyer A, Cai X, Garside DB, Ning H, Thomas A *et al*. Lifetime risks of cardiovascular disease. *N Engl J Med* 2012; **66**: 321–9.

20 Wannamethee SG, Shaper AG, Walker M, Ebrahim S. Lifestyle and 15-year survival free of heart attack, stroke, and diabetes in middle-aged

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British men. *Arch Intern Med* 1998; **158**: 2433–40.
21 Penedo FJ, Dahn JR. Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Curr Opin Psychiatry* 2005; **18**: 189–93.
22 Garrido D, Petrova D, Catena A, Ramírez-Hernández JA, Garcia-Retamero R. Recognizing a heart attack: patients' knowledge of cardiovascular risk factors and its relation to prehospital decision delay in acute coronary syndrome. *Front Psychol* 2020; **11**: 2056.
23 Hoschar S, Albarqouni L, Ladwig KH. A systematic review of educational interventions aiming to reduce prehospital delay in patients with acute coronary syndrome. *Open Heart* 2020; **7**: e001175.
24 Luepker RV, Raczynski JM, Osganian S, Goldberg RJ, Finnegan JR Jr, Hedges JR *et al*. Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) trial. *JAMA* 2000; **284**: 60–7.
25 Mooney M, McKee G, Fealy G, O'Brien F, O'Donnell S, Moser D. A randomized controlled trial to reduce prehospital delay time in patients with acute coronary syndrome (ACS). *J Emerg Med* 2014; **46**: 495–506.
26 De Luca G, van't Hof AW, de Boer MJ, Ottervanger JP, Hoorntje JC, Gosselink AT *et al*. Time-to-treatment significantly affects the extent of ST-segment resolution and myocardial blush in patients with acute myocardial infarction treated by primary angioplasty. *Eur Heart J* 2004; **25**: 1009–13.
27 Horne R, James D, Petrie K, Weinman J, Vincent R. Patients' interpretation of symptoms as a cause of delay in reaching hospital during acute myocardial infarction. *Heart* 2000; **83**: 388–93.
28 Sasson C, Rogers MA, Dahl J, Kellermann AL. Predictors of survival from out-of-hospital cardiac arrest. *Circ Cardiovasc Qual Outcomes* 2010; **3**: 63–81.
29 Nehme Z, Andrew E, Bernard S, Patsamanis H, Cameron P, Bray JE *et al*. Impact of a public awareness campaign on out-of-hospital cardiac arrest incidence and mortality rates. *Eur Heart J* 2017; **38**: 1666–73.
30 Mahajan S, Valero-Elizondo J, Khera R, Desai NR, Blankstein R, Blaha MJ *et al*. Variation and disparities in awareness of myocardial infarction symptoms among adults in the United States. *JAMA Netw Open* 2019; **2**: e1917885.
31 Berdowski J, Blom MT, Bardai A, Tan HL, Tijssen JGP, Koster RW. Impact of onsite or dispatched automated external defibrillator use on survival after out-of-hospital cardiac arrest. *Circulation* 2011; **124**: 2225–32.
32 Lawless CE, Asplund C, Asif IM, Courson R, Emery MS, Fuisz A *et al*. Protecting the heart of the American athlete: proceedings of the American College of Cardiology Sports and Exercise Cardiology Think Tank October 18, 2012, Washington, DC. *J Am Coll Cardiol* 2014; **64**: 2146–71.
33 Adabag AS, Luepker RV, Roger VL, Gersh BJ. Sudden cardiac death: epidemiology and risk factors. *Nat Rev Cardiol* 2010; **7**: 216–25.
34 Buckley T, McKinley S, Gallagher R, Dracup K, Moser DK, Aitken LM. The effect of education and counselling on knowledge, attitudes and beliefs about responses to acute myocardial infarction symptoms. *Eur J Cardiovasc Nurs* 2007; **6**: 105–11.
35 Corrado D, Schmied C, Basso C, Borjesson M, Schiavon M, Pelliccia A *et al*. Risk of sports: do we need pre-participation screening for competitive and leisure athletes? *Eur Heart J* 2011; **32**: 934–44.
36 Maron BJ, Thompson PD, Ackerman MJ, Balady G, Berger S, Cohen D. Recommendations and considerations related to preparticipation screening for cardiovascular abnormalities in competitive athletes: 2007 update. *Circulation* 2007; **115**: 1643–55.
37 Australian Bureau of Statistics (ABS) 2016 Census QuickStats. Canberra: ABS; 2018 [cited 2018 Nov 30]. Available from URL: http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/036?opendocument
38 Gallagher R, Roach K, Belshaw J, Kirkness A, Sadler L, Warrington D. A pre-test post-test study of a brief educational intervention demonstrates improved knowledge of potential acute myocardial infarction symptoms and appropriate responses in cardiac rehabilitation patients. *Aust Crit Care* 2013; **26**: 49–54.

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