Pre-race medical clearance in 60609 distance running race entrants: which entrants sought clearance, what physicians did, and what was the outcome? SAFER XXXVII

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ABSTRACT

Background: Medical clearance is often recommended for athletes prior to endurance exercise. The primary aim was to determine the percentage (%) of race entrants that sought medical clearance prior to participation in endurance running events, describe the diagnostic modalities used by doctors to assess entrants seeking medical clearance, and the clearance advice given. Secondary aims were to investigate the factors associated with seeking and outcome of clearance.

Methods: All consenting race entrants who completed an online screening questionnaire during registration to participate in the 21.1km or 56km Two Oceans marathon races from 2013-2015 (n=60609). Runners were stratified into four risk categories "low risk" (LR), "intermediate risk" (IR), "high risk" (HR) and "very high risk" (VHR). Runners were asked if they consulted with a medical doctor to obtain medical clearance. Follow-up questions enquired about what the doctor did when they sought medical clearance and what advice the doctor gave as an outcome of the medical clearance consultation. Prevalence (%; 95%CIs) and Prevalence Ratios (PRs) are reported.

Results: Over the 3-year period, 14.8% of entrants sought medical clearance. For clearance, doctors used history only (9.9%), history and physical examination (36.7%) and history, physical examination, and special investigations (53.0%). Most entrants seeking medical clearance were fully cleared to race (87.7% in 21.1km and 85.9% in 56km) ($p=0.0156$). Factors associated with seeking medical clearance include longer race distance, older age and a higher risk category ($p<0.0001$).

Conclusions: The methods doctors use when conducting medical clearance consultations vary greatly. Further research is suggested to develop a protocol that doctors can use for medical consultations.

KEYWORDS: Pre-race medical clearance, running, screening

INTRODUCTION

There has been an increase in the popularity of organised community-based mass-participation distance running events over the past few years. This is most likely due to an increased awareness of the numerous benefits of regular physical exercise.(1-3) However, there is also a well-recognised risk of adverse medical events in participants at endurance running events.(1, 4-6) These events attract entrants with a wide variety of running experience, as well as varying risk for adverse medical events.(1, 4) Therefore, strategies to promote safe participation in endurance running events is crucial. Sudden cardiac arrest (SCA) or sudden cardiac death (SCD) are often the first indications that a runner has underlying cardiovascular disease.(7, 8) In runners >35 years, coronary artery disease is the most common cause of SCA and SCD, in runners <35 years, congenital abnormalities of heart muscle, coronary artery disorders and conduction system disorders account for the most common causes of sudden cardiac death.(1, 7) Several national and international sporting bodies agree that screening for predisposing factors of sudden cardiac death in competitive athletes should be done.(9-11)

Several pre-participation medical screening tools have been proposed by international organisations with the aim to identify individuals who may have a higher risk of medical encounters (MEs) during high-intensity exercise, specifically the risk for SCA or SCD. These include various pre-participation medical screening tools such as the Physical Activity Readiness Questionnaire (PAR-Q), as well as guidelines by the American Heart Association (AHA), American College of Sport Medicine (ACSM), European Society of Cardiology (ESC) and the European Association of Cardiovascular Prevention and Rehabilitation (EACPR).(9-11) These tools involve self-screening, and based on responses, advice is given to seek clearance from a medical doctor before participating in moderate- to high-intensity exercise.

However, there is a large variation in the % of participants completing the five most common international screening tools that are advised to seek medical clearance.(12)

In the context of community-based mass-participation distance running events, implementing a pre-race medical self-screening tool that risk stratifies endurance race entrants may be valuable in identifying categories of entrants at higher risk of adverse medical events. Entrants in higher risk categories can then be advised to seek pre-race medical clearance (PreRMc) from a medical doctor prior to participation.(13, 14) In one study, a marked decline in adverse medical events occurred following the introduction of the SAFER (Strategies to reduce Adverse medical events For the ExerciseR) pre-race medical screening, risk stratification and educational intervention tool, which was adapted from the EACPR pre-exercise screening tool.(15) In this study, the online pre-race screening questionnaire medical screening and runner-targeted educational intervention resulted in a reduction in the incidence of any MEs by 29%, and of serious / life-threatening MEs by 64% (MEs known to be life-threatening and requiring immediate emergency medical treatment).(15) However, this tool, and other tools, currently do not offer guidelines or official recommendations on how doctors should conduct PreRMc.(16)

The primary aims of the study were to: 1) determine the percentage (%) of race entrants that sought PreRMc prior to participation in endurance running events, 2) describe the diagnostic modalities used by doctors when making the decision on PreRMc, and 3) describe the advice given after PreRMc. Secondary aims were to determine if factors (race distance, sex, age group, and risk category) were associated with 1) the decision of entrants to seek PreRMc, 2) the outcome of the PreRMc (fully cleared vs. not fully cleared), and 3) the diagnostic modalities used by the doctor to make the decision on PreRMc.

METHODS

Study Design

A descriptive cross-sectional study.

Setting

The 21.1km and 56km Two Oceans Marathon races from 2013 to 2015.

Participants

This study forms part of the SAFER (**S**trategies to reduce **A**dverse medical events **F**or the **E**xercise**R**) studies.(13) All the runners who registered online to participate in the 21.1km and 56km Two Oceans marathon races from 2013 to 2015 were considered possible study participants. The mandatory registration process required all participants to provide demographics (age, sex, race distance) and complete an online pre-race medical screening questionnaire adapted from the EACPR tool described in previous SAFER studies.(17) (15, 18) Only runners who gave informed consent for their data to be used were in the study population. The Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria (REC number 442/2021 and 433/2015) and University of Cape Town (REC 009/2011 and 030/2013) approved this study.

Data collection and outcome variables

General online pre-race medical screening questionnaire and risk stratification:

All participants completed an online pre-race medical screening questionnaire containing information on demographics, running and training history, as well as a history of the following: history of cardiovascular disease (CVD), risk factors for CVD, symptoms of CVD, other chronic medical conditions (respiratory disease, metabolic or hormonal disease,

gastrointestinal disease, nervous system disease, renal or bladder disease, haematological or immune system disease, cancer), history of collapse, medication use, allergies, and running injuries.

Runners were stratified into the following four risk categories: "low risk" (LR), "intermediate risk" (IR), "high risk" (HR) and "very high risk" (VHR), based on the following criteria:

- VHR: Existing CVD or symptoms suggestive of existing CVD.
- HR: Two or more risk factors for CVD.
- IR: Existing chronic disease in other organ systems, use of prescription medication, use of anti-inflammatory drugs immediately before and/or during a race or history of collapse during exercise.
- LR: None of the criteria for the very high, high or intermediate risk categories.(18)

Entrants in the VHR and HR groups were prompted via e-mail to seek PreRMc from a medical doctor prior to participating in their running events. Importantly, this e-mail notification was sent after entrants answered the question regarding seeking PreRMc or not was asked (see below). This is part of the interventional steps taken in the quest to reduce adverse medical events on race day. The motivation for doing this is that it has been previously demonstrated that outcomes after completing pre-race medical screening and risk stratification predict adverse events, i.e. higher risk (in the VHR and HR groups) carries a greater risk of an adverse medical event occurring on race day.(10) Pre-race medical screening, risk stratification, and educational intervention prior to participation in 21.1km and 56km road races reduce the incidence of adverse medical events on race day.(15)

Specific question/s on pre-race medical clearance (PreRMc) within the questionnaire:

There were two specific questions on PreRMc. The first question was, "*Have you consulted with a medical doctor in the last 12 months to obtain medical clearance that you can safely participate in endurance running?*" Entrants who answered "yes" were asked what the doctor did when they sought PreRMc. Entrants could choose any of the following: *"a) doctor spoke to you only, b) doctor spoke to you and examined you physically, c) doctor performed an exercise test but no electrocardiogram [ECG], d) doctor performed an exercise test with an ECG, e) doctor performed an echocardiogram, f) doctor performed blood tests for cholesterol, g) doctor performed other blood tests, h) doctor performed other tests"*. The second question asked about the advice given by the doctor in one of the following three categories: "*a) doctor did not give clearance to run, b) doctor did give clearance to run but with some restrictions and guidelines on safe participation, or c) doctor did give clearance to run with no restrictions*". Specific "restrictions" were not defined but would typically be that the doctor provided specific advice in runners that reported any underlying medical conditions. Advice from the medical practitioner could have included: a) the importance of symptoms that may develop during exercise, b) what action to take, and c) appropriate duration and intensity of exercise for a specific medical condition.

Outcome variables

The main outcome variables for the primary aim were the choice of race entrants to seek PreRMc (n, %), the outcome of PreRMc, and the diagnostic modalities used by the doctor during the PreRMc consultation. The outcome variables for the secondary aims were selected factors (race distance, sex, age and risk category) associated with 1) the decision by entrants to seek PreRMc, 2) the outcome of the PreRMc (fully cleared vs. not fully cleared), and 3) the

diagnostic modalities (use or no use of special tests) used by the doctor to make the decision on PreRMc.

Statistical analysis

For descriptive statistics, the number (%) of consenting race entrants (n=60609) who sought PreRMc, the number (%) in each of the PreRMc outcome categories, and the number (%) of each of the diagnostic modalities and special tests performed (Table 1).

Table 1. The outcome of the pre-race medical clearance (PreRMc) (n; %) and the diagnostic modalities (history, physical examination, special tests) used by doctors to decide on PreRMc (n; %) in race entrants (n=60609)

	Race Entrants reporting PreRMc	
Outcome of PreRMc [$] for all consenting entrants (n=60609)	n	%
Fully cleared to race	7725	12.8
Not cleared to race (cleared with restrictions or not cleared) [$]	*1178*	*1.9*
Cleared with restrictions	773	1.3
Not cleared to race	405	0.7
Diagnostic modalities for consenting entrants who sought PreRMc (n=8942)	n	%
No special tests group	4140	
History only	879	9.9[#]
History, physical examination	3261	36.7[#]
Special tests group (with history and physical examination)	4802	53.0[#]
Special tests performed (special tests group) (n=4802)	n	%
Exercise test (no ECG)	629	13.1
Exercise test and ECG	2207	46.0
Echocardiogram	795	16.6
Blood tests for cholesterol	3506	73.0
Other blood tests	2690	56.0
Other tests	457	9.5

[$]39 were missing a response
[$]combination of the "cleared with restrictions" and "not cleared to race"
ECG: electrocardiogram
Multi-select question %'s can add up to more than 100%
[#]modelled %
The last 6 rows are a subset of the 4802 who underwent special tests "history, physical examination and special tests"

The PreRMc outcome was reported as a binary response variable (yes n=8942/no n=51 667), and generalized linear modeling adjusted for the clustering of repeated runners was done to estimate the probability of seeking PreRMc. The independent variables race distance (21.1km, 56km), sex (Male, Female), age groups (≤40;>40), and risk categories (LR, IR, HR, VHR) were included in the model. (Table 2).

Table 2: Factors associated with entrants seeking pre-race medical clearance (PreRMc) (race distance, sex, age group, and risk category) (n=60609)

	Consenting Race entrants (n=60609)	Participants who sought PreRMc (n=8942)	Prevalence (%; 95% CI)	PR (95% CI)	p-value
Overall	60609	8942	14.8 (14.5-15.2)		
Race distance					
21.1km	36160	4594	12.8 (12.5-13.2)		
56km	24449	4348	17.9 (17.4-18.4)	1.4 (1.3-1.5)	<0.0001
Sex					
Male	34971	5383	15.5 (15.1-15.9)	1.1 (1.1-1.2)	<0.0001
Female	25638	3559	14.0 (13.5-14.5)		
Age Group					
≤40 years	35146	4387	12.7 (12.3-13.1)		
>40 years	25463	4555	17.9 (17.4-18.5)	1.4 (1.4-1.5)	<0.0001
Risk Category					
Very High	1783	889	49.7 (47.3-52.2)	5.1 (4.8-5.4)	<0.0001
High	6291	1412	22.0 (21.0-23.1)	2.3 (2.1-2.4)	<0.0001
Intermediate	26815	4188	15.9 (15.4-16.4)	1.6 (1.6-1.7)	<0.0001
Low	25720	2453	9.7 (9.4-10.1)		

PR: prevalence ratio

For the outcome of PreRMc, categories were combined to result in a binary response variable (either fully cleared (n=7725) or not fully cleared (n=1178)). Generalized linear models adjusted for the clustering of repeated runners were conducted and the independent variables race distance (21.1km, 56km), sex (Male, Female), age groups (≤40;>40), risk categories (LR/IR, HR, VHR) were included in the model.

For the diagnostic modalities of "what the doctor did" as an outcome variable, the history only and history plus examination were combined into one category (No special tests) (n=4140) and

the probability of the category for history, exam and special investigations (Special tests) (n=4802) was modelled, and the independent variables: race distance (21.1km, 56km), sex (Male, Female) , age groups (≤40;>40), risk categories (low/intermediate, and high/very high) were included in the model (Table 3).

Table 3: Factors associated with the outcome of pre-race medical clearance (PreRMc) (fully cleared vs. not fully cleared) (race distance, sex, age group, and risk category) (n=8942, only participants who reported PreRMc)

	Fully Cleared	Not fully cleared *		PR (95%CI)	p-value
	n	n	% (95%CIs)		
Overall	7725	1178	13.3 (12.6-14.0)		
Race distance					
21.1km	3921	646	14.2 (13.2-15.3)	Ref	
56km	3804	532	12.3 (11.3-13.3)	0.9 (0.8-1.0)	0.0082
Sex					
Male	4687	675	12.7 (11.8-13.6)	0.9 (0.8-1.0)	
Female	3038	503	14.2 (13.0-15.4)	Ref	0.0455
Age Group					
≤40	3792	568	13.4 (12.4-14.5)	Ref	
>40	3933	610	13.1 (12.1-14.2)	1.0 (0.9-1.1)	0.6604
Risk Category					
Very High	372	515	59.4 (56.0-62.9)	7.5 (6.8-8.4)	<0.0001
High	1263	145	10.4 (8.9-12.1)	1.3 (1.1-1.6)	<0.0001
Intermediate and Low	6090	518	7.9 (7.2-8.5)	Ref	

39 of the 8942 were missing for PreRMc outcome
* Not cleared or cleared with restrictions
PR: Prevalence ratio
Risk categories: Intermediate and low were combined as they were the groups who were not prompted for PreRMc

For all the above models the prevalence (%) in the categories and the prevalence ratio (PR; 95%CI; p value) with relevant reference categories were reported. All analyses were done using the SAS (v9.4) statistical analyses system and a p value of ≤0.05 was significant.

RESULTS

During the 3-year study period, there were a total of 66103 entrants for the Two Oceans Marathon races. Of these, 60609 (91.7%) consented and had useable data.

Percentage (%) race entrants that sought pre-race medical clearance (PreRMc)

In the 3-year period, 14.8% (95%CI:14.5-15.2) entrants (n=8942) sought PreRMc by consulting a doctor, and 85.3% (95%CI: 85.0-85.6) (n=51667) did not seek PreRMc. The % of entrants who sought PreRMc was lower in 2013 (13.7; 95%CI:13.2-14.2) compared to 2014 (15.7; 95%CI: 15.2-16.2) and 2015 (15.0; 95%CI:14.6-15.5) ($p<0.0001$).

Outcome of the PreRMc, and the diagnostic modalities (use of special tests) used by doctors to make the decision on PreRMc

The outcome of the PreRMc (n; %) and the diagnostic modalities and special tests used by doctors to make the decision on PreRMc (n; %) in race entrants (n=60609) are shown in Table 1. The two most common categories of modalities used by the doctor for PreRMc were 1) *physical examination and special tests* (n=4802; 53.0%), and 2) *history and physical examination* (n=3261; 36.7%). In only 9.9% cases (n=879) the doctor used *history only* for making the PreRMc decision.

Factors associated with the decision by entrants to seek PreRMc

Factors associated with the decision by entrants to seek PreRMc are shown in Table 2. The factors significantly associated with increased likelihood by entrants to seek PreRMc included entering for the longer 56km race (PR=1.4 vs. 21.1km), older age (PR=1.4; >40yrs vs. <40yrs), all higher risk categories compared with the low risk (LR) category (IR: PR=1.6, HR: PR=2.3, VHR: PR=5.1).

Factors associated with the outcome of the PreRMc (fully cleared vs. not fully cleared)

Factors associated with the outcome of PreRMc (fully cleared vs. not fully cleared) are shown in Table 3. The following factors were associated with an increased likelihood of entrants not

being fully cleared to race: entering for the shorter race distance (21.1km), and a higher risk category (VHR: PR=7.5 vs. IR/LR; HR=1.3 vs. IR/LR). 59.4% of VHR entrants were not fully cleared to race.

Table 4: Factors associated with the diagnostic modalities (no special tests vs. special tests) used by the doctor to decide on PreRMc (race distance, sex, age group, and risk category) (n=8942)

	No special tests (history only or history and examination)	**Special tests (combined with history, and examination)**		**PR (95%CI)**	**p-value**
	n	**n**	**% (95%CIs)**		
Overall	4140	4802	53.0 (51.9-54.1)		
Race distance					
21.1km	2275	2319	49.7 (48.2-51.2)	Ref	
56km	1865	2483	56.5 (55.0-58.1)	1.1 (1.1-1.2)	<0.0001
Sex					
Male	2202	3181	58.3 (57.0-59.7)	1.3 (1.2-1.4)	
Female	1938	1621	45.1 (43.5-46.9)	Ref	<0.0001
Age Group					
≤40	2501	1886	42.7 (41.3-44.3)	Ref	
>40	1639	2916	63.4 (62.0-64.9)	1.5 (1.4-1.5)	<0.0001
Risk Category					
Very High and High	787	1514	64.3 (62.3-66.4)	1.3 (1.3-1.4)	<0.0001
Intermediate and Low	3353	3288	49.3 (48.1-50.6)	Ref	

39 of the 8942 were missing for PreRMc outcome
PR: Prevalence ratio
Risk categories were divided into the groups who were prompted to seek PreRMc (VHR and HR) and the groups who were not (IR and LR)
"History only" or "history and examination" were combined (No special tests) due to small numbers, and the larger differences lying between "history, examination and special tests" (Special tests) compared to the other two.

Factors associated with the diagnostic modalities used by the doctor to make the decision on PreRMc

The diagnostic modalities used by the doctor to make the decision on PreRMc were divided into two categories: 1) No use of special tests (only history and / or examination) and 2) Use of special tests (with history and examination). Factors associated with the two categories of diagnostic modalities are shown in Table 4. Doctors were more likely to use special tests in PreRMc decision making for entrants in the 56km (vs. 21.1km) (PR=1.1), male (vs. female)

(PR=1.3), older age (>40yrs) (PR=1.5) and those in the two highest risk categories (VHR, HR) (PR=1.3).

DISCUSSION

The study aimed to determine the prevalence (%) of race entrants who self-reported that they consulted a medical doctor to obtain PreRMc, to describe the diagnostic modalities used by doctors to assess entrants seeking PreRMc and the clearance advice given by doctors prior to participation in the 21.1km and 56km Two Oceans Marathon races over three years (2013-2015). The three main findings from the study included: 1) that 14.8% of the consenting entrants sought PreRMc, and that entrants were more likely to seek PreRMc if they entered for a longer race distance, were males and >40years, or were risk stratified in a higher risk category, 2) 86.4% of the entrants seeking PreRMc were fully cleared to race, and entrants were more likely to not being fully cleared if they entered for the shorter race distance, were female, and were risk stratified in a higher risk category, 3) methods used by doctors to perform PreRMc varied, but doctors were more likely to use special tests as part of their PreRMc for entrants in the longer race distance, were males and older, and entrants that were risk stratified in a higher risk category.

Entrants seeking PreRMc and factors associated with seeking PreRMc

Our first main finding was that most entrants (about 85%) reported not seeking PreRMc in the 12 months before a race. We are not aware of other studies reporting on PreRMc in running race entrants. Therefore this finding cannot be compared to previously published work. We are also not aware of data describing intrinsic and extrinsic factors related to race entrants who choose to seek PreRMc compared to entrants who don't. In our study, we show that entrants for the longer race distance, males and older entrants, as well as entrants that were risk stratified in a higher risk category, were more likely to seek PreRMc. This is encouraging because some

of these factors have been associated with a higher risk of MEs in distance races in previous SAFER studies (19-24), perhaps indicating that long-distance race entrants are aware of these risk factors for MEs, and therefore seek PreRMc. Despite this encouraging observation, we note that 50.3% of the VHR group and 78.0% of the HR group still did not seek PreRMc. These groups are at higher risk of MEs and present an opportunity for prevention strategies through PreRMc.

Ideally, runners at higher risk of MEs during exercise should seek PreRMc. Factors associated with higher risk of MEs at distance running races include not being screened, recent systemic illness, female sex, older age, less experience, and longer race distance studies.(19-24) In recent literature, the risk of SCD in runners is associated with older age and the male sex.(9, 25) Although we did not investigate this, possible barriers to seeking PreRMc might include ignorance regarding their risk for adverse exercise-related medical events or other factors such as the perceived effort of getting PreRMc, the financial cost of PreRMc, or the perception that they might be disqualified from participating following the PreRMc. Further studies are needed to identify barriers to seeking PreRMc among these sub-groups of entrants that may be at higher risk of MEs, particularly in cohorts of mass community-based endurance athletes.

<u>Outcomes of PreRMc and factors associated with not being fully cleared to race</u>

Most of the entrants (86.4%) who sought PreRMc from a medical doctor were fully cleared to race. This is encouraging for race entrants who do seek PreRMc and indicates that it is highly likely that they will be cleared to race. We are not aware of any similar data in the published literature to compare our results. Our finding is interesting that sub-groups of race entrants are more likely <u>to not be fully cleared</u> were entrants for the shorter race distance, female entrants, and those that were risk stratified in a higher risk category. There weren't any significant

differences in the medical clearance outcomes between entrants from different age categories. However, as there were only two age categories due to the small numbers, this may have limited the generalisability of age as a factor. Our study did not determine the precise reason/s for not clearing entrants after the PreRMc assessment. Reasons for a higher likelihood of not clearing these sub-groups entrants are therefore speculative, but in the case of entrants for shorter race distances, this may be related to the following possible reasons: a known higher risk of SCA or SCD in shorter race distances,(26) no pre-race entry qualifying times, possible poor or inadequate race preparation, and less experienced runners. In the second sub-group of female entrants, the reason for a higher rate of not clearing is unknown. This is an interesting observation that requires further investigation. In the final sub-group of runners that were stratified in a higher risk category, we expect a higher likelihood of not being cleared. This is probably related to a history of underlying chronic disease and is therefore expected but needs to be confirmed in future studies.

Methods used by doctors to perform PreRMc and factors associated with the use of special tests in the PreRMc decision

Of the participants in the VHR and HR groups proceeding to seek pre-race medical clearance, 66% of the consultations included a combination of history, physical examination, and special investigations. Less than 28% comprised of history and physical examination, while <8% incorporated history only. Furthermore, entrants in higher risk categories (VHR and HR) were both more likely to undergo a more extensive medical clearance consultation (including history, physical examination, as well as special investigations) compared to the lower risk categories (IR and LR). As the risk category decreased, the use of history, physical examination, and special investigations decreased slightly. Entrants who were male, older age, and intending to participate in a longer race distance also underwent more extensive medical

clearance consultations. In general, these findings are encouraging and indicate that medical doctors are aware of sub-groups of runners at higher risk of MEs during a running race. However, we also shown that the different modalities used by doctors conducting PreRMc varied and probably indicates that doctors rely on clinical discretion in each consultation because there are no clear guidelines for conducting PreRMc, specifically which special investigations to use. Regarding special investigations, tests to screen for cardiovascular disease were often used. Identifying risk factors associated with cardiovascular disease, such as identifying risk factors for CVD (e.g. test for hypocholesterolaemia), was most frequently requested by the attending doctor (other blood tests were also common). An exercise test and an ECG were used in about half of these consultations. We suggest that more comprehensive consultations would be ideal for all VHR and HR participants and that medical doctors conducting the PreRMc could benefit from more specific guidance in choosing the most relevant screening methods for participants.

It is a reality that no screening or medical clearance program will be able to prevent all medical encounters, but the burden can be reduced if these programs are implemented correctly.(27) Some studies have suggested using a risk-based approach when it comes to medical clearance and ultimately individualising the practice of medical clearance rather than following a pragmatic approach.(28, 29) Therefore, future research should be directed toward developing guidelines that doctors can follow when conducting medical clearance consultations without undue burden.

Strengths and Limitations

The limitations include that these data are almost ten years old and were self-reported and is prone to recall bias. Furthermore, due to low numbers, this study did not investigate the effects

of medical clearance on the incidence of medical encounters. The study is limited by the number of runners who sought medical clearance, as the outcomes of the clearance (fully cleared, cleared with restrictions and not cleared) reflect a small sample size. We also did not determine the reasons for the medical doctors' decision to give clearance or not.

CONCLUSION

Only 14.8% of distance running race entrants sought PreRMc before participating in the 21.1km and 56km Two Oceans Marathon races from 2013 to 2015, with older male race entrants and those within a higher risk category and participating in the longer running distance were more likely to seek PreRMc. The modalities doctors used when conducting PreRMc consultations varied greatly, and factors associated with not being cleared to race included a shorter race distance, females, and a higher risk category. Pre-race medical screening is a potential intervention to reduce the risk of medical encounters during mass participation in distance running events, fostering safer participation for athletes in endurance sports. It is encouraging that our results show that entrants in sub-groups at higher risk for MEs (such as longer races, older male entrants, and entrants at higher risk based on medical history) are more likely to seek medical PreRMc, and that medical doctors doing PreRMc are more likely to use special investigations for these higher risk entrants. However, there are several knowledge gaps, including the following: at least 50% of race entrants at higher risk still did not seek PreRMc, there are no data linking PreRMc outcomes to the risk of medical encounters, and there are currently no specific guidelines that medical doctors can follow for PreRMc. Further research is needed to address these gaps.

What are the new findings?

- 15% of distance running race entrants seek pre-medical clearance (PreRMc) prior to participation in two endurance events (21.1km and 56km race).
- Entrants were more likely to seek PreRMc if they entered for the longer race distance, were males and older, or were risk stratified in a higher risk category.
- Most (86.4%) of the entrants seeking PreRMc were fully cleared to race, and entrants were more likely not to be fully cleared if they entered for the shorter race distance, were female, and were risk stratified in a higher risk category.
- Methods used by doctors to perform PreRMc in distance running race entrants varied, but doctors were more likely to use special tests as part of their PreRMc for entrants in the longer race distance, were males and older, and entrants that were risk stratified in a higher risk category.

Practical Implications

- Race medical directors and race organisers should note that most race entrants for distance running events do not seek pre-race medical clearance (PreRMc).
- A pre-race medical screening and educational intervention tool can identify sub-groups of running race entrants at higher risk of medical encounters who would benefit from PreRMc.
- Although we show that methods used by doctors to perform PreRMc in distance running race entrants vary, we suggest that doctors consider the risk category of race entrants and are encouraged to use special tests in the PreRMc decision-making of these higher risk entrants.

Author responsibility information:

All authors read and approved the final version of the manuscript.

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Data sharing statement:

No additional data are available.

Acknowledgements:

We want to express gratitude to all the dedicated Two Ocean Marathon entrants who completed the online screening questionnaires, the Two Ocean Marathon race organisers and medical directors.

Funding:

The study was partially funded by a research grant from the International Olympic Committee (IOC) Research Centre (South Africa) at the University of Pretoria.

The South African Medical Research Council (SAMRC) provided partial funding for the statistical analysis. This work is based on the research supported in part by the National Research Foundation of South Africa (Ref Number: TTK2204051971).

Ethical Approval:

Research ethics approval was granted by the Faculty of Health Sciences of the University of Pretoria (REC number 442/2021 and 433/2015) and University of Cape Town (REC 009/2011 and 030/2013).

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Word Count:

Abstract: 248; Text body: 4018