Canadian Journal of Cardiology 35 (2019) 935–939

## Training/Practice
## Health Policy and Promotion

# Translation of the Canadian Cardiovascular Society/ Canadian Heart Rhythm Society Cardiovascular Screening and Care of Athletes Program Into Practice

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**ABSTRACT**

**In the absence of systematic cardiovascular preparticipation screening (PPS) practices in Canada, the Canadian Cardiovascular Society and Canadian Heart Rhythm Society published a joint position statement outlining PPS recommendations for competitive athletes in an effort to standardize screening. The Queen's University Cardiovascular Screening and Care of Athletes Program aimed to translate these recommendations into practice. Screening packages were administered to athletes in 2017 and 2018. Each package required completion of a medical/history questionnaire, a physician's examination, and 12-lead electrocardiogram performed by the athlete's primary care physician. A tiered approach to screening, as recommended by the position statement, was implemented. A multidisciplinary team flagged at-risk athletes and determined the need for follow-up testing and participation eligibility. Over a 2-year period, 517 varsity athletes were**

**RÉSUMÉ**

**Constatant l'absence au Canada de pratiques établies en matière de dépistage des troubles cardiovasculaires préalable à la participation à des compétitions sportives, la Société canadienne de cardiologie et la Société canadienne de rythmologie ont publié un énoncé de position conjoint dans lequel elles formulent des recommandations visant à uniformiser les exigences en la matière applicables aux athlètes de compétition. Le programme de dépistage et de soins des troubles cardiovasculaires chez les athlètes de l'Université Queen's visait à mettre en pratique ces recommandations. Des athlètes ont passé une série de tests de dépistage en 2017 et en 2018. Cette série de tests comprenait le remplissage d'un questionnaire sur l'état de santé et les antécédents médicaux des athlètes, un examen médical et un électrocardiogramme à 12 dérivations administré par leur médecin traitant. Une approche du dépistage par paliers, comme**

Sudden cardiac death is the leading medical cause of death among young competitive athletes,[1] and though rare, is a tragic occurrence, affecting entire communities. Preparticipation screening (PPS) is successful in the identification of cardiac conditions known to predispose athletes to sudden cardiac death, however, with the exception of the initial Italian experience,[2] evidence supporting a reduction in mortality attributable to screening is lacking. Nonetheless, cardiovascular (CV) PPS to identify at-risk athletes is recommended by the American Heart Association and European Society of Cardiology, although their recommendations vary regarding the utility of an electrocardiogram (ECG), in addition to a standardized history and physical examination.[3]

With no widespread systematic screening practices mandated for Canadian athletes, substantial inter- and

Received for publication February 12, 2019. Accepted March 31, 2019.

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See page 939 for disclosure information.

https://doi.org/10.1016/j.cjca.2019.03.026

**screened, with 438 (84.7%) completing all recommended screening components. Analysis of completed packages resulted in 114 (26.0%) athletes flagged for initial review. After subsequent review by an emergency care physician, only 12 (2.7%) athletes required further referral to cardiology for assessment or further testing. All athletes referred for cardiology assessment were cleared for participation, except for one, who was eventually cleared after a shared decision-making process and cardiovascular intervention. The Queen's University Cardiovascular Screening and Care of Athletes Program shows the successful implementation of a cardiovascular PPS program that used shared decision-making and a multidisciplinary approach to screening, allowing for efficiency and effective resource utilization.**

**recommandée par l'énoncé de position, a été mise en œuvre. Une équipe multidisciplinaire a repéré les athlètes exposés à un risque et a déterminé s'il y avait lieu de leur faire subir des examens de suivi et s'ils étaient aptes à participer. Sur une période de 2 ans, ce dépistage a été effectué auprès de 517 athlètes universitaires, dont 438 (84,7 %) se sont prêtés à tous les volets de la série de tests. Après analyse des séries de tests dont tous les volets avaient été administrés, il a été déterminé que 114 athlètes (26,0 %) devaient passer un examen initial. Après un examen subséquent effectué par un médecin urgentologue, seuls 12 athlètes (2,7 %) nécessitaient une évaluation ou des tests plus poussés dans un service de cardiologie. Tous les athlètes orientés vers une évaluation en cardiologie ont été déclarés aptes à participer à l'exception d'une personne, qui a finalement obtenu le feu vert après un processus de prise de décision partagée et une intervention en cardiologie. Le programme de dépistage et de soins des troubles cardiovasculaires chez les athlètes de l'Université Queen's prouve la faisabilité de la mise en œuvre d'un programme de dépistage des troubles cardiovasculaires préalable à la participation à des compétitions sportives qui privilégie la prise de décision partagée et une approche multidisciplinaire du dépistage, permettant ainsi une utilisation des ressources efficiente et efficace.**

intraorganization practice variability exists.[4] In an effort to standardize CV PPS of competitive athletes, the Canadian Cardiovascular Society and Canadian Heart Rhythm Society developed a joint position statement outlining consensus-based recommendations toward screening and the development of a Cardiovascular Screening and Care of Athletes Program (CSCAP).[5] The position statement calls for a systematic approach to screening, one that implores appropriate screening assessment, investigations, and interpretation, in addition to management, counselling, and follow-up. It outlines how institutions should use a stepwise approach to athletic CV care, in which a foundation of high-quality emergency protocols, access to sports cardiology expertise, and a shared decision-making (SDM) approach are required, before the additional use of 3 screening tiers, including a history questionnaire, physical examination, and ECG. In this article, we describe the Queen's University (QU) experience in implementation of a CSCAP. We summarize the execution of the tiered approach and highlight a cardiac diagnosis in an athlete, illustrating the use of the SDM process.

## Program Development

The experience of QU in fulfilling the CSCAP requirements and becoming a recognized Center of Excellence under this program is illustrated in Figure 1. Setting the stage for the CV safety of athletes, well established safety protocols and procedures formed the foundational pillar of the CSCAP. The strategic placement of 15 automated electronic defibrillators (AEDs) served as a benchmark safety initiative. Currently, QU has 6 AEDs located on its main campus, 1 AED on its satellite campus, and 8 AEDs at local, affiliated educational facilities. The locations of these AEDs are described in the *AED Placement and Locations* section of the Supplemental Material and shown in Supplemental Figure S1, which illustrates the PulsePoint AED mobile device application (https://www.pulsepoint.org/pulsepoint-aed/). Reaching the enhanced pillar, internal cooperation between the Cardiovascular Imaging Network at Queen's, Queen's Therapy Zone, Athlete Services, and Queen's Strength and Conditioning served to form a collaborative sport cardiology network centred on athlete safety and support. As part of the excellence pillar, the QU CSCAP used a stepwise approach to screening through mobilization of a multidisciplinary screening team consisting of an administrative assistant, 2 athletic therapists, 2 affiliated emergency medicine physicians (EMPs), and an attending cardiologist with cardiac point-of-care ultrasound imaging expertise and experience in the care of amateur, varsity, and professional athletes. The screening review procedures are summarized in detail in the *Methods* section of the Supplementary Material and outlined in Supplemental Figure S2. In this model, the initial assessment for CV (or non-CV) abnormalities was completed by the primary care provider (PCP), reducing the burden of mass screening on our institution. In addition, an SDM approach involving the athlete, parents/guardians, medical professionals, and sport-specific institutional employees was used to discuss choice awareness pertaining to screening, options for testing and treatment, and sports restriction decisions when required.

## Program Implementation and Analysis

The CSCAP at QU was implemented before the commencement of the academic year in 2017 and 2018. This program was designed as a prerequisite to participate in any events/activities related to varsity athletics, which included selection camps, practices, preseason workouts, and other varsity team-related activities. Thus, an institutional decision was made attesting to screening before participation. All athletes (incoming or current) intending to participate in varsity sport were screened. However, only first-year athletes within a varsity team were required to complete all screening components. Inclusion criteria included incoming recruits, transfer athletes, walk-on athletes, practice players not on the team roster, and athletes who have played on a varsity team previously but did not have an eligibility certificate the previous season. Returning athletes were only required to complete a medical/history questionnaire.

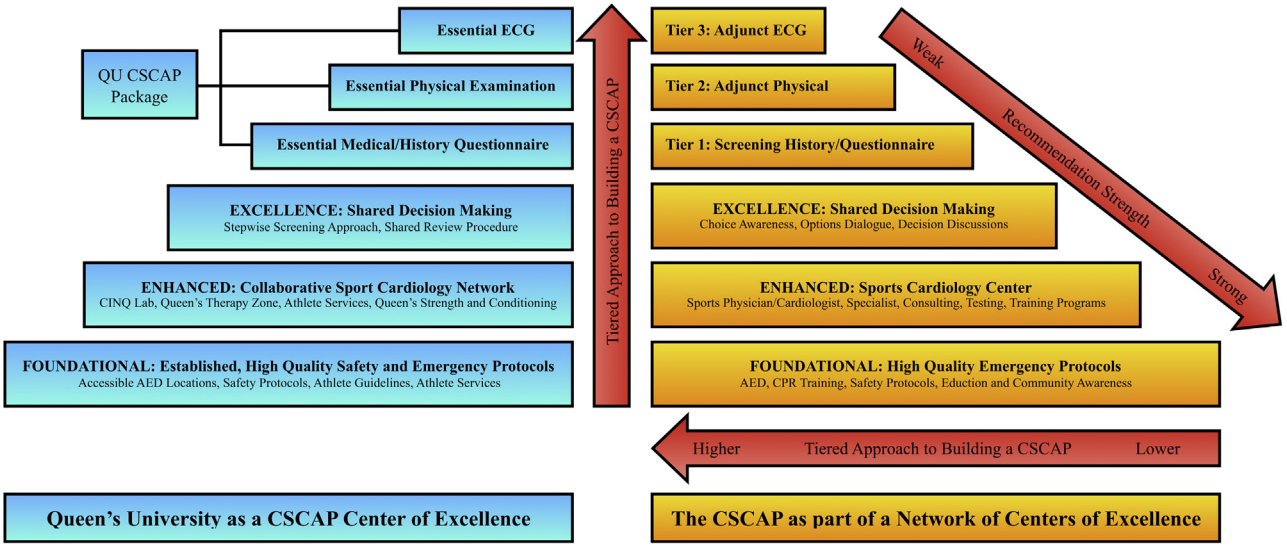


**Figure 1.** The QU CSCAP Centre of Excellence. QU met all the suggested recommendations by the CCS/CHRS position statement to develop an institutional CSCAP. The stepwise foundational, enhanced, and excellence tiers are fulfilled, and the screening package, composing of an essential medical/history questionnaire, physical examination, and ECG was used. AED, automatic electronic defibrillator; CCS, Canadian Cardiovascular Society; CHRS, Canadian Heart Rhythm Society; CINQ, Cardiovascular Imaging Network at Queen's; CPR, cardiopulmonary resuscitation, CSCAP, Cardiovascular Screening and Care of Athletes Program; ECG, electrocardiogram; QU, Queen's University.

In our model, screening packages were sent to athletes in the summer before participation. These packages consisted of a consent form, medical/history questionnaire (the cardiovascular questionnaire is shown in Supplemental Table S1), a physical examination form, and ECG request, with the latter 2 completed by the athlete's PCP. If the athlete's PCP was unable or unwilling to fill this request, or if the athlete did not have access to a PCP, the physical examination and ECG were performed by a sports physician at QU. These components are described in more detail in the *Methods* section of the Supplementary Material. This model presented a unique workflow approach, avoiding the need for routine mass ECG screening by the institution, through retrieval of the most recent ECG conducted by the primary care well-check visit. All screening packages were completed by the athlete and PCP, and then mailed or faxed into our athletic office by a set deadline. Failure to send completed PPS packages by the specified deadline risked the delay of participation in all team activities.

A retrospective analysis of all athlete screening packages from the 2017 and 2018 QU CSCAP program was conducted by 2 independent reviewers (N.G. and N.K.) to evaluate the internal workflow, feasibility, and outcomes of this PPS program. All athletes signed a consent form for their screening packages to be used for research purposes. This study was approved by the QU Health Sciences and Affiliated Teaching Hospital Research Ethics Board. The number of athletes at each screening stage were tabulated for the 2017 and 2018 cohorts. Descriptive statistics were used for all analyses.

## Program Outcomes

Over a 2-year period, 517 screening packages were received in total. Four hundred thirty-eight (84.7%) packages were complete and 79 (15.3%) were incomplete. Only completed packages were used for analysis. One hundred fourteen (26.0%) packages were flagged at initial assessment by an athletic therapist, for further assessment by an EMP. Flags arose because of abnormalities in the athlete's medical/history questionnaire (27.2%), physical exam (1.8%), ECG (59.6%), 2 or more components (10.5%), or other medical concerns (0.9%). Most of these cases were flagged for CV-specific concerns alone (91.2%), whereas cases of CV and non-CV concerns (0.9%), as well as non-CV concerns alone (7.9%), were also flagged. One hundred thirteen flagged packages were then reviewed in full by an EMP, because 1 athlete decided to remove themselves from athletic involvement, terminating their involvement in the screening program. After EMP review, 101 packages were cleared, whereas the remaining 12 were identified as having cardiac-related risks/abnormalities requiring further review, follow-up, and/or testing by a cardiologist. These 12 athlete cases are outlined in Supplemental Table S2. Upon review by the cardiologist, all but 1 required further investigation and management. This athlete was suspected of having a diagnosis of Wolff-Parkinson-White syndrome. Appropriately, this finding was evaluated by the EMP and referred to the program-associated cardiologist, who confirmed the diagnosis, on the basis of classical ECG findings. Using an SDM approach to manage this abnormal case, the athlete was referred for further assessment by an electrophysiologist, and an electrophysiology study confirmed a high-risk bidirectional accessory pathway. Catheter ablation was performed with no complications, leading to eventual sports clearance for the athlete, because of the small risk of pathway reoccurrence.

All athletes, except for 1 (because of recent injury), enrolled in the QU CSCAP, with complete packages, were eventually cleared for participation. Of the 79 incomplete packages, 8 were flagged because of abnormalities/concerns in the athlete's medical/history questionnaire (n = 3), ECG (n = 1), or other medical concerns (n = 4). Five of these flags were of specific

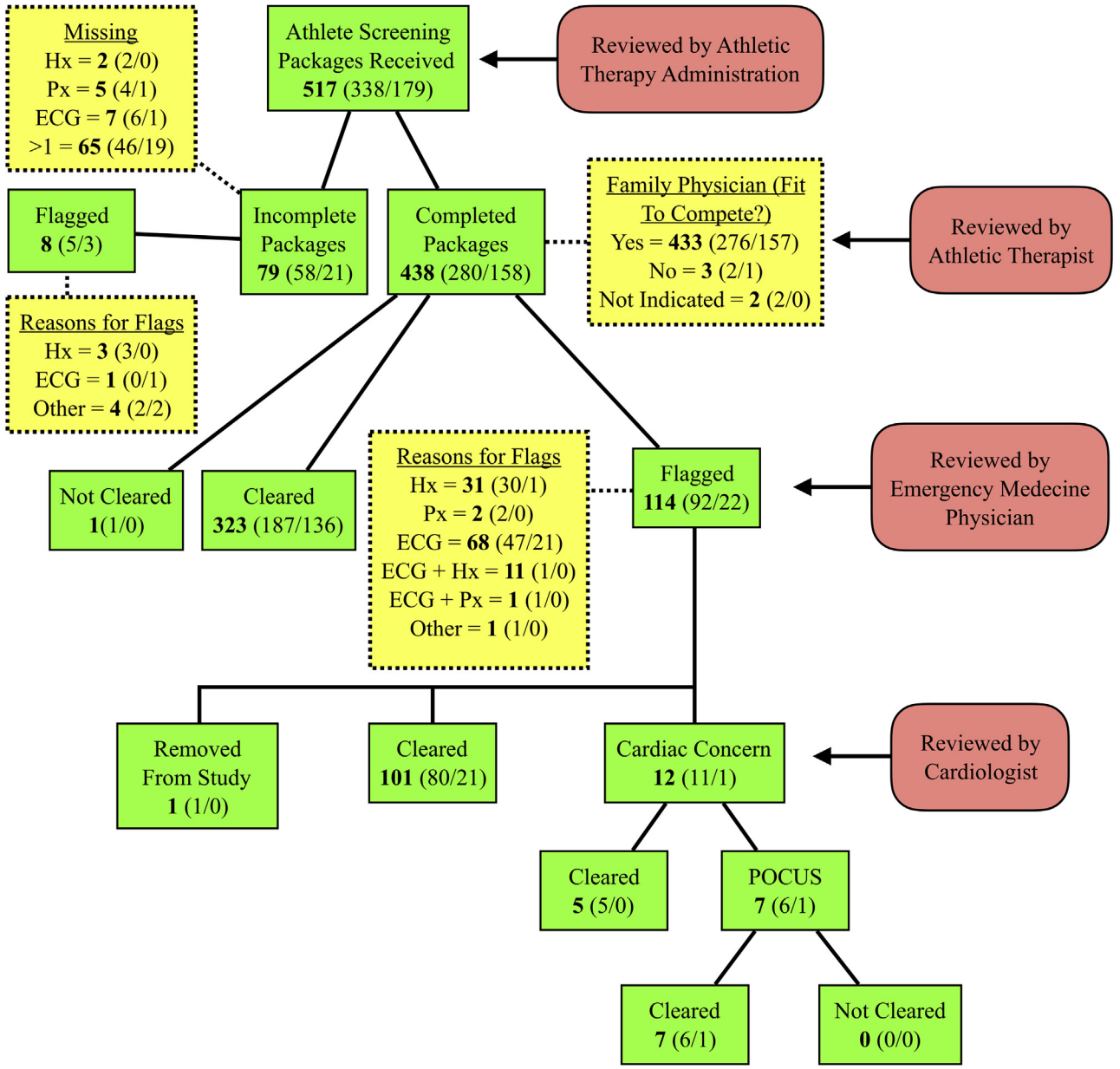


**Figure 2.** QU CSCAP results: the breakdown of athletes throughout the screening process. Screening packages were received as either complete or incomplete (athletes who submitted incomplete packages were contacted). Flagging of packages and subsequent referral to cardiology occurred. Athletes were cleared for participation at various stages of the screening process. Bolded numbers indicate all athletes from 2017 and 2018 cohorts at each screening point; 2017 and 2018 cohort-specific numbers are indicated as (n/n). CSCAP, Cardiovascular Screening and Care of Athletes Program; ECG, electrocardiogram; Hx, medical history; POCUS, point-of-care ultrasound; Px, physical examination; QU, Queen's University.

CV concern, whereas 3 were not CV-related. It was unclear what percentage of athletes with incomplete packages, unflagged and flagged, went on to participate in sport. This limitation suggests the importance of established infrastructure to track athlete clearance status within any PPS program, an area our institution is developing. The results and outcomes of this primary sample program are shown in Figure 2.

## Conclusions

The QU CSCAP shows successful translation of the Canadian Cardiovascular Society/Canadian Heart Rhythm Society athlete screening recommendations. The QU CSCAP serves as a preliminary blueprint for other Canadian institutions intending to implement a formal PPS program by using a stepwise approach to screening beginning with emergency protocols, sports cardiology expertise, and an SDM approach, before providing PPS with consideration of the 3 main components, consisting of a medical/history questionnaire, physical examination, and ECG. With a goal for national uptake of the CSCAP model, future directions are aimed at the development of a nationwide network to track athlete CV health outcomes. To achieve this goal, we propose the development of an online Canadian-specific CV screening questionnaire for athletes,

continued development and use of point-of-care-ultrasound to enhance the physical examination, as well as further validation of our ECG workflow approach, involving collaboration with our national primary care partners.

## Acknowledgements

The authors thank Heidi Bonnell and James Sawchuk for their contributions.

## Disclosures

The authors have no conflicts of interest to disclose.

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## Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Cardiology* at www.onlinecjc.ca and at https://doi.org/10.1016/j.cjca.2019.03.026.