Heartbeat: sex-based discrepancies in survival from sudden cardiac death

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Sudden cardiac death (SCD) is a major cause of death worldwide, with a higher prevalence in men compared with women. To further understand sex differences in SCD presentation and outcomes, Skjelbred and colleagues[1] looked at data on deaths in Denmark in 2010 and found that SCD accounted for 12.7% of all deaths with a male predominant (56% men, 44% women). The average age at SCD was higher in women (79 years) compared with men (71 years), with the greatest sex difference in SCD incidence rates in the age group from 35 to 50 years (incidence rate ratio 3.7, 95% CI 2.8 to 4.8) (figure 1). Women, compared with men, more often died at home (80.5% vs 69.7%, p<0.01) rather than in the hospital (16.8% vs 22.2%, p<0.01). The cause of SCD was coronary artery disease in about 40% of cases. Other causes (each <5%) included cardiac arrhythmias, heart failure, aortic dissection, valve disease and cardiomyopathy.

In the accompanying editorial, Tan and Remme[2] suggest that SCD risk relates not only to biological sex differences but also to societal and environmental factors. In men, the cause of SCD usually is coronary artery disease and the initial rhythm typically is ventricular fibrillation. In contrast, the cause of SCD in women more often is ventricular hypertrophy, aortic dissection or myocarditis and the initial rhythm is likely to be pulseless electrical activity or asystole. Women also are more likely to have an unwitnessed event at home, thus, not receiving prompt resuscitation. Even when witnessed, women are less likely to be resuscitated by bystanders; the combination of a longer delay to resuscitation plus the low frequency of a shockable rhythm results in lower survival rates. The authors urge increased research and action to reduce the risk of SCD in both women and men. 'Clearly, to reduce the societal burden of SCD, we must focus our efforts on earlier recognition of SCA risk. Given the complex underlying causes of SCA and in view of the observation that our ability at early recognition has been stagnant over the last decades, we must adopt a more comprehensive strategy and reap the benefit of relatively new methods which have so far been poorly used in SCA research, for example, artificial intelligence-based analysis of large data sets, genetic analysis and metabolomic analysis. We must also recognise that we should direct our view to the group in society that has so far received insufficient attention in SCA research, that is, individuals who are in the care of their general practitioner and have not (yet) been referred to a cardiologist.' (figure 2).

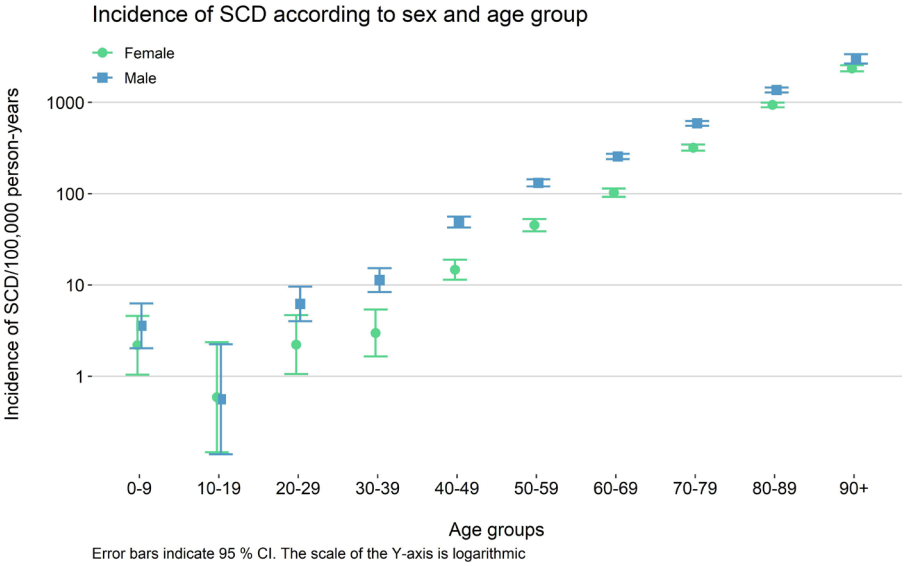

Figure 1 Incidence rates according to sex and age group. SCD, sudden cardiac death.

Another study in this issue of *Heart* addresses sex (biological) and gender (sociocultural) differences in cardiovascular disease (CVD) risk factors. Based

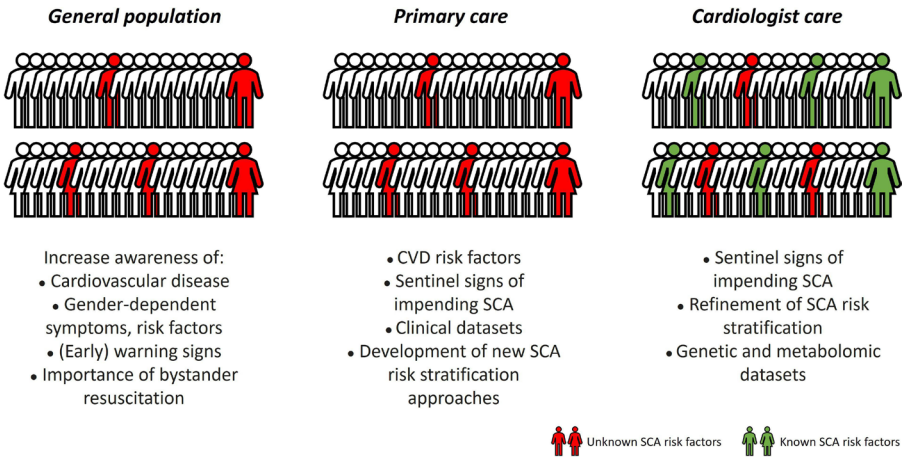

Figure 2 Potential approaches on the level of the general population, primary care and cardiologist care to improve (early) identification of individuals at risk of SCA with the aim of reducing the societal burden of sudden cardiac death. CVD, cardiovascular disease; SCA, sudden cardiac arrest.

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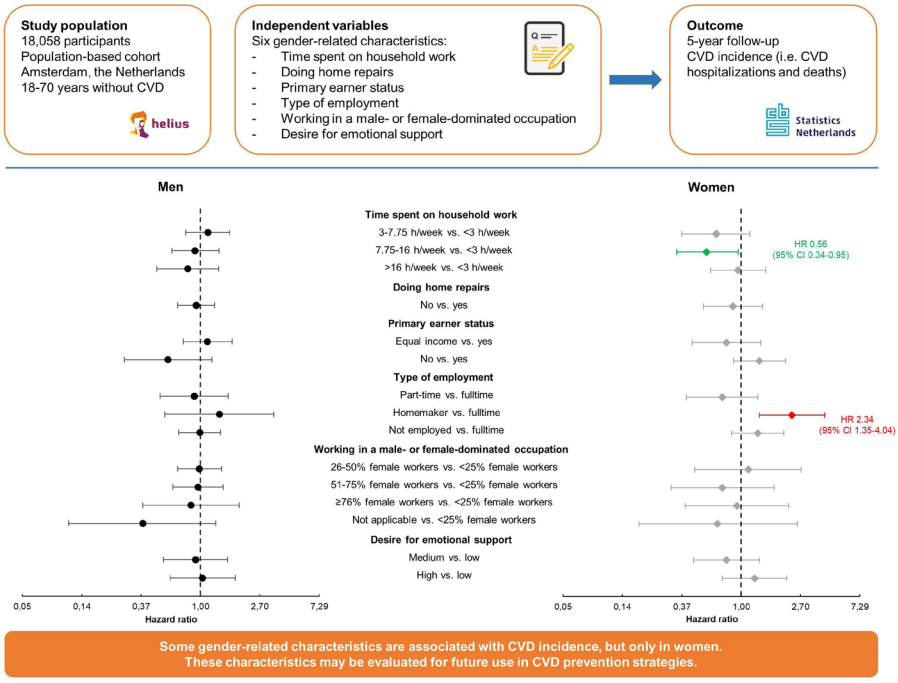

Figure 3 Summary figure of the design and main findings of this study with Forest plots of adjusted associations between gender-related characteristics and cardiovascular disease incidence for men (left) and women (right). CVD, cardiovascular disease.

on data from the HELIUS (HEalthy LIfe in an Urban Setting) population-based study of 18 058 adults without known CVD, Bolijn and colleagues[3] found no association between gender characteristics and CVD risk in men. However, women who did not work outside the home were at higher risk of CVD than working women (HR 2.34, 95% CI 1.35 to 4.04). In those working only at home, more time spent on housework was associated with lower CVD risk (HR 0.56, 95% CI 0.34 to 0.95 for moderate vs little time) (figure 3).

Peters and Woodward[4] put this data in context and comment: 'Persistent barriers to the understanding of the impact of sex and gender on health are the under-representation of women as study participants and the inappropriate or complete lack of sex-based and gender-based analyses and reporting. For example, while women account for nearly 50% of all patients with coronary heart disease (CHD), they only account for about 25% of all participants in CHD trials. Even when a sufficient number of women have been included, many studies still fail to report sex-specific findings, often without justification. This kind of research is not about women, it is about getting the science right for the benefit of all.'

In heart failure patients with a continuous-flow left ventricular assist device (LVAD), one of the factors limiting exercise capacity is an insufficient increase in cardiac output with exertion. In a focused study of 22 patients with an LVAD, Stapor and colleagues[5] showed that transthoracic echocardiographic visualisation of aortic valve opening during a cardiopulmonary exercise test can be used to adjust the LVAD speed to optimise peak oxygen consumption and improve exercise tolerance. The investigators' long-term goal is to use the concept of dynamic LVAD speed adjustments to provide more physiological pump control protocols. In an editorial, Keenan and Pal[6] discuss the patient and LVAD factors that affect systemic cardiac output and they point out that 'The development of closed-loop LVAD systems that can dynamically adjust pump speed will require reliable, continuous and instantaneous assessment of loading conditions and responsiveness to changing cardiac output needs.'

The *Education in Heart* article[7] in this issue concisely presents the clinical presentation and diagnostic evaluation of patients with anomalous coronary arteries, approaches to risk stratification and appropriate management strategies (figure 4).

Be sure to look at the *Image Challenge* question in this issue with interesting multimodality imaging in an elderly patient with fever and left ventricular systolic dysfunction.[8]

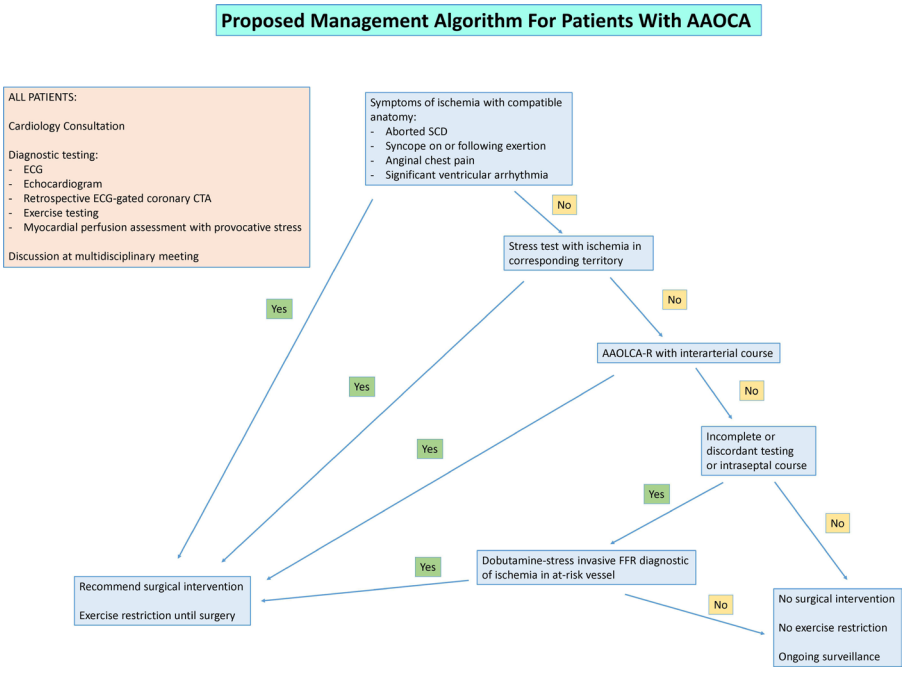

Figure 4 Proposed management algorithm. AAOCA, anomalous aortic origin of a coronary artery; AAOLCA, anomalous aortic origin of a left coronary artery; CTA, CT angiography; FFR, fractional flow reserve; SCD, sudden cardiac death.

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