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Research Letter

# Incidence and autopsy rates for sudden cardiac death in Northern Finland

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Sudden cardiac death (SCD) has an estimated annual incidence of 1 per 1000 person-years on the basis of epidemiological studies from death certificates. However, up to 40% of sudden deaths have been determined to be due to extracardiac causes in autopsy studies.[1,2] We aimed to determine the autopsy rate for out-of-hospital sudden unexpected death and estimate the SCD incidence in Northern Finland (~740,000 inhabitants) in 2016.

The cause-of-death investigation and death certificates are systemically done in Finland. Forensic pathologists review every death certificate before filing. A medicolegal autopsy is mandatory, by law, for all subjects with sudden unexpected death without a known disease, if the deceased was not treated by a physician during his or her last illness and/or if the death was otherwise unexpected, and in all non-natural deaths. This law has not changed in recent decades, and sufficient information can be achieved from data of a single year.

Death certificates and permission for the study were obtained from Statistics Finland. Homicides, suicides, and deaths that occurred in health care or hospice units were excluded. Cause of death was classified according to the *International Classification of Diseases, Tenth Revision* codes. Death was determined to be sudden if it occurred within 1 hour of the occurrence of symptoms or if the individual was found dead.

A total of 7527 deaths occurred, of which 1412 (18.8%) occurred out of the hospital, and the death was classified as sudden in 1067 (75.6%) (Figure 1). The mean age was 70.1 ± 16.5 years; 714 (66.9%) were male; and 282 (26.4%) were witnessed. The autopsy rate for sudden death subjects was 73.9% (male 76%; female 68.1%; $P = .013$), 90.8% in subjects younger than 70 years (male 91.8%; female 89.3%; $P = .59$), and 96.6% in subjects younger than 50 years (male 98.9%; female 89.3%; $P = .04$). The mean age was 63.2 ± 15.3 years for autopsied sudden deaths and 78.6 ± 11.2 years for nonautopsied sudden deaths ($P < .001$). In 789 autopsied sudden deaths, the cause of death was cardiac disease in 421 subjects (53.4%), of which ischemic heart disease was the cause in 310 subjects (total 73.6%; male 76.1%; female 64.9%), hypertensive heart disease in 48 (total 11.4%; male 11.3%; female 11.7%), cardiomyopathy in 52 (total 12.4%; male 9.8%; female 19.2%), and other cardiac cause in 11 subjects (total 2.6%; male 2.8%; female 4.3%) ($P = .058$). The proportion of autopsied sudden deaths with negative autopsy and toxicology results (the *International Classification of Diseases, Tenth Revision* code R99) was 0.25% (2 of 789). In autopsied sudden deaths, external causes of mortality and morbidity (including alcohol poisonings and accidents) were much more common in subjects younger than 50 years (47.0%) than in subjects older than 50 years (16.5%). SCD was more common in subjects older than 50 years (59.3%) than in subjects younger than 50 years (18.3%) ($P < .001$). There were 278 subjects with sudden death without autopsy; and in 233 of 278, the cause of death was adjudicated to be cardiovascular, of which 185 were due to ischemic coronary disease and 35 due to cardiomyopathies.

Our results demonstrate that the autopsy rate for out-of-hospital sudden death is high in Finland and that the

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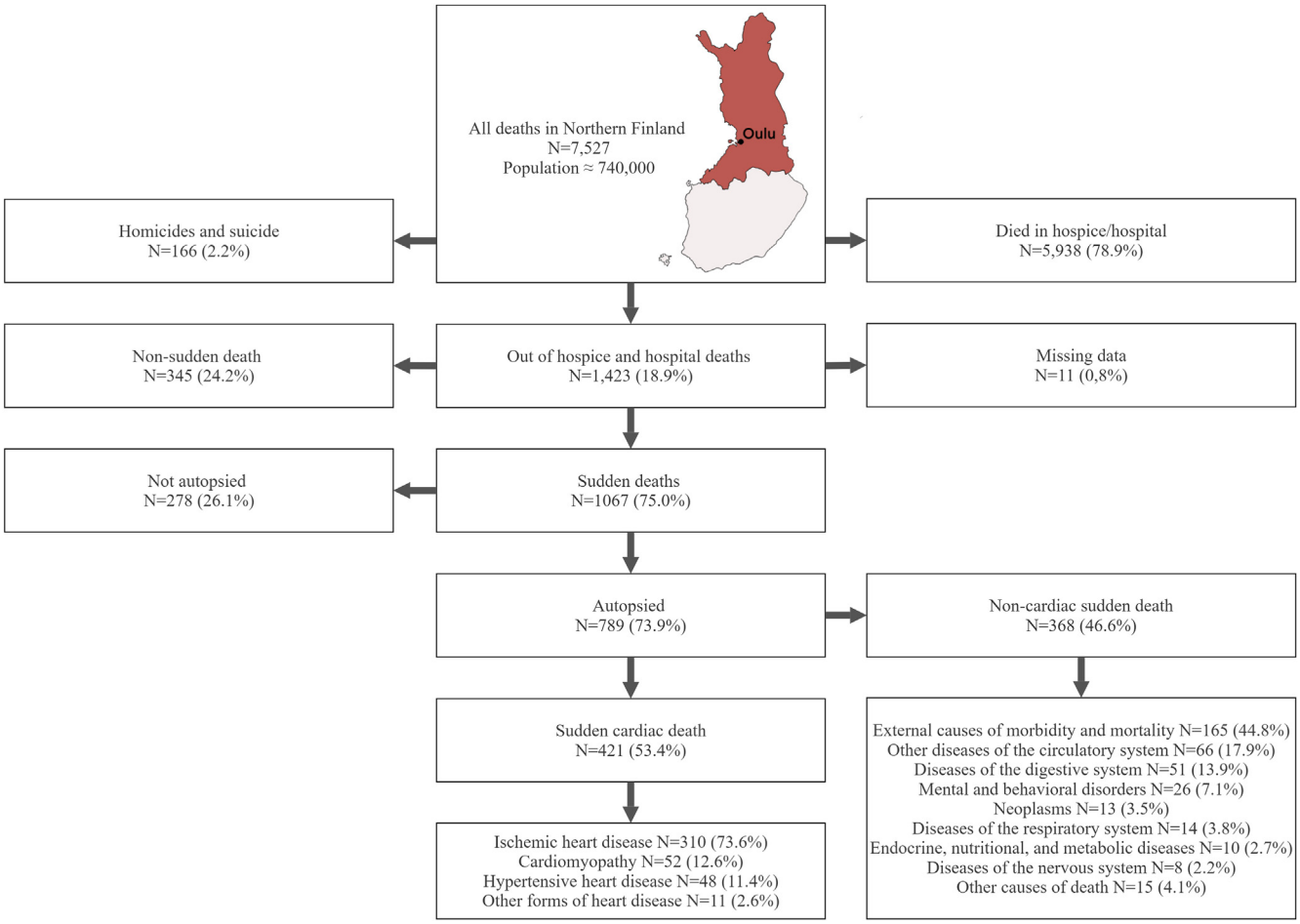


**Figure 1**
Flowchart of the study. The external causes of morbidity and mortality included accidents and alcohol intoxication–related deaths, which were determined in autopsy.

estimated incidence of SCD was 77 per 100,000 person-years, which is close to previously published estimates of 1 per 1000 person-years. A previous review article reported that 59 countries (30.3%) had publicly available data on autopsy rates and only 14 (7.2%) reported autopsy rates in a setting of sudden deaths.[3] This review also reported autopsy rates in a setting of young sudden death, ranging between 5% and 100%. We observed an autopsy rate higher than that reported in a prior Danish study, in which the autopsy rate for sudden death in those younger than 50 years was 60.1%.[4] All sudden deaths were not autopsied because according to the Finnish legislation, sudden deaths are not mandated to undergo medicolegal autopsy if the death is not considered as unexpected. As seen in our study, this scenario is more likely in older individuals with high comorbidity burden. Causes of SCD were in the same range as in the study done in the United Kingdom.[5] These results highlight the accurate epidemiological premises for SCD research in Finland.

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