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Melanoma epidemiology in Sweden

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INTRODUCTION

The incidence of cutaneous melanoma in most populations of European origin has increased for several decades (1). The upward incidence trend has been accompanied by an increase in mortality, which indicates that there is a true increase in the underlying onset rate of the disease. In Sweden, cutaneous melanoma was a relatively uncommon disease in the 1960s but the incidence has been rising rapidly during the last decades. The increasing incidence has been attributed to changes in lifestyles such as increased outdoor recreational activities and fashion trends. It seems clear that the risk of malignant melanoma is related to sun exposure but this relationship is not straightforward. There is no clear correlation with chronic exposure - except possibly for head-neck melanoma - but rather with intermittent exposure and a history of sunburns at young age. Melanoma can also arise in skin areas typically not exposed to sunlight such as the mucous membranes.

Melanoma may show familial aggregation, which indicates a genetic susceptibility in certain individuals. In some cases such a constitutionally determined increased risk has been linked to a specific syndrome characterized by multiple, atypical nevi among family members and a substantially increased lifetime risk of the disease. However, melanomas occurring among such families have been estimated to account for less than ten percent of all incident cases. The increased melanoma incidence has been accompanied by corresponding but less dramatic increase in melanoma mortality (2). This discrepancy indicates that melanoma survival has improved (3).

In order to decrease melanoma incidence and mortality, strategies for both primary and secondary prevention targeting the general population in Sweden were developed and implemented during the 1980s and 1990s. This included a wide variety of actions ranging from community based education programs targeting children and adolescents, to nationwide screening campaigns. Similarly, preventive measures, including education and regular surveillance, targeting individuals at high risk for cutaneous melanoma, were initiated.

In general, the risks associated with excessive sun exposure have gained much more media attention in recent decades in Sweden. Preventive measures such as the use of sunscreens and protective clothing have become more widely accepted by the general public whose awareness of the risks associated with sun exposure appears to have improved over the years.

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The use of sunbeds in Sweden increased dramatically during the 1970s and 1980s. The use of such beds has typically been described as "safe" by the manufacturers as they entail exposure mainly to UV-A-radiation and relatively little exposure to UV-B. However, although the increased risk of squamous cell and basal cell cancer related to chronic sun exposure may be primarily explained by UV-B, the same may not hold true for melanoma. Several case-control studies have done concerning the putative role of sunbeds in melanoma etiology, but such an association remains controversial.

MATERIALS AND METHODS

In the registries described below, a personal identification number identifies each case, which is unique to all persons living in Sweden. Computerized linkage between the different registries is possible due to this personal ID number.

The Swedish Cancer Registry: Since 1958, patients diagnosed with cancer must be reported to the Swedish Cancer Registry. The majority of cases are reported twice, since all responsible clinicians as well as the involved pathologist/cytologist in hospitals and other establishments for medical treatment under public or private administration must do a separate report to the Registry. Approximately 99 % of the cancer cases are morphologically verified and of the melanoma, cases approximately 100 % are verified by the pathology report (4). The registration deficit of diagnosed melanoma cases in the Cancer Registry has been estimated at less than 1% (5).

The Swedish Cause of Death Registry: The Swedish Cause of Death Registry annually collects information on date and cause of death on all Swedish citizens. Statistics on causes of death have been collected in Sweden since 1749. The National Central Bureau of Statistics is responsible for the compilation of statistics and since 1994 The National Board of Health and Welfare is responsible for the yearly publication on causes of death. The cause of death is registered according to International Classification of Diseases, Injuries, and Causes of Death (ICD). All deaths must be certified by a clinician. Concerning malignant melanoma as a cause of death, all types of melanoma are included (cutaneous and non-cutaneous).

The Oncology centers and the Regional Melanoma Registries: In 1974, recommendations for the planning and organization of cancer care in Sweden were issued by the National Board of Health and Welfare. Guidelines for six Oncology centers were developed based on the concept that optimal care should be available to all cancer patients. The assignment was to co-ordinate cancer care, to run regional cancer registries, to initiate cancer care programs, to give advice in screening activities and be involved in public information. The care programs are not only aimed at co-coordinating and optimizing cancer care but also serve as tools for quality assurance and evaluation of outcome. The Oncology center in the Stockholm-Gotland health region was established in 1976. During 1978 to 1991, Oncology centers were founded in the remaining five health regions. All primary cancer registration in Sweden is done at these centers, which each year supply processed and computerized data to the National Cancer Registry, which compiles the national incidence statistics. In 1976, the Swedish Melanoma Study Group issued treatment practice guidelines for patients with cutaneous malignant melanoma. The same year, a regional melanoma group with representatives from dermatology, plastic, and general surgery, oncology, and pathology was established in the Stockholm-Gotland region. A regional care program was initiated including agreed recommendations on referral, diagnosis, classification, treatment, and follow-up. As a part of the care program from 1976 and on, all patients with cutaneous melanoma residing in Stockholm-Gotland at the time of diagnosis were to be recorded in a database kept at the Oncology center. The database comprises extensive information about the clinical characteristics of each case, the surgical treatment, histopathologic classification of the tumor as well as follow-up information. All pathology slides are routinely reviewed by a few experienced pathologists. All types of recurrences and date of death are prospectively reported to the database. Regularly, information on cause of death is

obtained through linkage to the National Cause of Death Registry. Extensive quality control is carried out in collaboration with the Regional cancer registry. Similarly, regional melanoma groups have successively been established and care programs implemented in all six health care regions in Sweden. Data are prospectively registered at each Oncology center. Recently, a national melanoma database was initiated, where data from the six regional melanoma groups are collected.

INCIDENCE

The incidence of cutaneous malignant melanoma rose rapidly in Sweden during the last decades (Figure 1) (6).

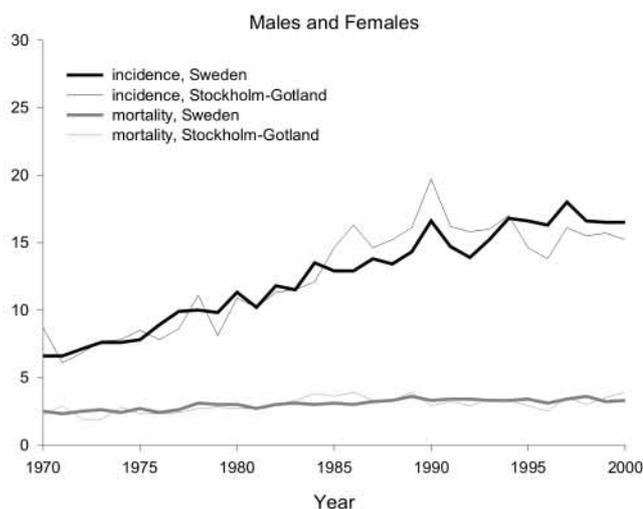


Figure 1. Age-standardised incidence of invasive cutaneous malignant melanoma and mortality from malignant melanoma in Sweden during 1970 to 2000

The average annual increase during 1960 through 1982 was 5.4 % for women and 5.8 % for men (3). During 1973 to 1992, an increase was also observed in children and adolescents (7). The last 20 years, an average annual increase of 2.1 per cent was observed in men, and 1.7 per cent in women (4). In 2003, 1,889 new cases of cutaneous malignant melanoma were reported in Sweden and the age-standardized incidence was 22.9 among males and 19.5 per 100,000 among females (Swedish standard population 2000). Cutaneous melanoma constituted 3.9 % of all cancers in Sweden, which made it the seventh most common malignant tumor among males and the sixth among females. The cumulative lifetime probability to develop the disease was 2.2 males and 1.8 females out of one hundred individuals respectively.

In Stockholm, public campaigns aiming at primary and secondary prevention were started in the mid 1980s (8). In order to assess putative effects of the intervention activities the incidence trends in Stockholm during 1976 to 1994 were analyzed in detail (9). An upward trend was observed in all age groups among both males and females. An increase was observed both for cases with invasive and in situ tumors although the estimated mean annual increase was about twice as large for the in situ tumor cases (9-10%) as for the invasive tumor cases (4-5%). The educational and screening activities initiated during the late 1970s and 1980s appeared to have resulted in earlier diagnosis, since the increase in incidence during the 1980s and 1990s mainly consisted of situ or thin, invasive tumors (< 0.8 mm) whereas the incidence of thick tumors (>2.0 mm) remained stable. The median thickness decreased from 1.3 mm during 1976-1979 to 0.9 mm during 1990-1994 among males. Among females, the corresponding decrease was from 1.2 mm to 0.7 mm. However, no clear effect of the primary prevention efforts was observed during the study period with the possible exception of the male population in the Stockholm area in which age-standardized incidence appear to have leveled

off during the 1990s. The leveling incidence for males during the 1990s mostly concerned thin tumors. No such trend shift was observed neither among females, nor among males or females residing outside Stockholm (Figure 2,3) (6). Recently, data from the Swedish Cancer Registry indicates that the incidence increased continuously during 2000-2003 in both sexes (4).

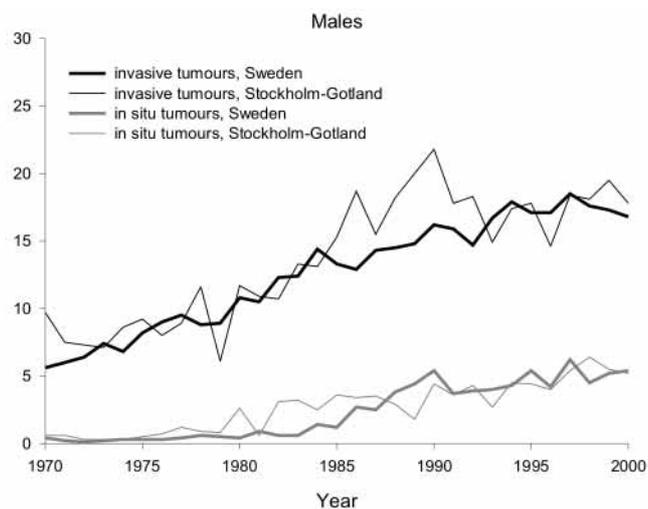


Figure 2. Age-standardised incidence of cutaneous malignant melanoma in males in Sweden during 1970 to 2000

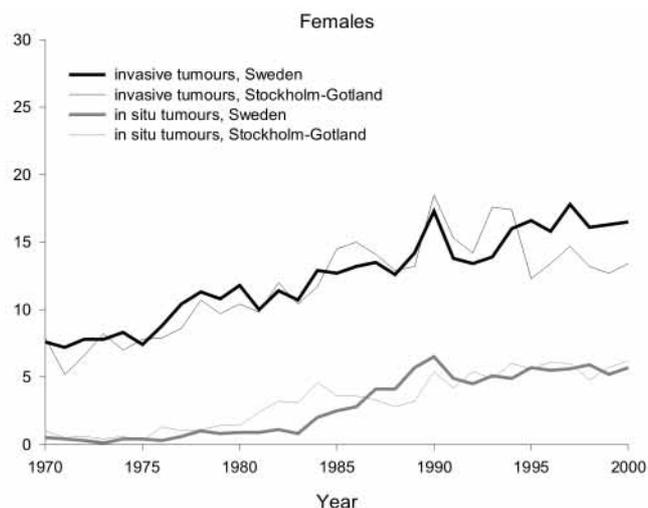


Figure 2. Age-standardised incidence of cutaneous malignant melanoma in females in Sweden during 1970 to 2000

Trends in incidence in non-cutaneous malignant melanoma in Sweden have also been studied. The age-standardized incidence of melanoma of the vulva in Swedish women decreased during 1960 to 1984 by 3 % annually (10). Similarly, the age-standardized incidence in Sweden of uveal melanoma declined significantly among males from 1960 to 1998 (11). Among females, a trend, however non-significant, towards reduced incidence was observed.

MORTALITY

During several decades, melanoma mortality in Sweden increased continuously (2). Since the mid-1980s, the melanoma mortality in Sweden leveled off with no further increase during the last 10-15 years (12). In females, a significant decrease of mortality from cutaneous melanoma was observed for the period of 1987-1996, with an estimated annual change of -2.3 %. This trend appeared to be more pronounced in the Stockholm-Gotland region. The mortality among females leveled off or decreased among all age groups from the mid-1980s in the Stockholm-Gotland region, which was in contrast to the rest



of Sweden, where mortality was stable, or increased throughout the studied period.

Age-standardized mortality in Sweden up to the year 2000 was recently analyzed (6). The age-standardized mortality appeared to be fairly stable both among males and females (Figure 1). The observed trends coincided with increased preventive activities.

SURVIVAL

Survival trends have changed considerably during the last decades in Sweden. The five-year relative survival rate in males increased from 54.5 % in 1960 to 73.1 % in 1982 (2). In females, the corresponding figures were 65.8% and 84.9 %. When analyzing survival trends up to 1999, Lindholm et al (13) reported a further increase in survival with a relative survival rate of 88% in men and 94 % in women. The improved survival could be related to favorable trends in prognostic factors in the population.

CONCLUSION

The incidence of cutaneous malignant melanoma has been rising in Sweden during several decades. However, the trends appear to have shifted during the 1990s: the increase during the last 10-15 years has been less pronounced than previously. This might be interpreted as a result of the different programs and activities aimed at primary prevention initiated during the 1980s. The increase in incidence has been followed by an increase in mortality, however, since the mid 1980s stabilization and even a decline in mortality has been observed. The 5-year melanoma-specific survival rate has successively improved and is now approximately 92 %.

It is tempting to interpret the improved survival and the shift in the mortality trend because of improved results of secondary preventive measures ranging from an increased public awareness of the disease to improved clinical diagnostics of pigmented skin lesions. The public campaigns in Sweden aimed at both primary and secondary prevention were not conducted as controlled experiments. This implies that it is difficult in retrospect to assess to what extent their overarching aims were achieved. However, there is undoubtedly a greater awareness in the general Swedish public today than it was two to three decades ago about the risks associated with excessive sun exposure and the potential significance of pigmented skin lesions. It may yet be too early to forecast the effect this increased awareness, but the trends during the 1990s are to some extent encouraging.

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