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Original Research

# Trends in incidence of thick, thin and *in situ* melanoma in Europe

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*Abbreviations:* APC, annual percent change; AAPC, average annual percent change; ASR(W), age standardised rate on World population; CI, confidence interval; CMM, cutaneous malignant melanoma; CRs, cancer registries; DCO, death certificate only; HN, head and neck; LM, lentigo maligna melanoma; MV, microscopic verification; NM, nodular melanoma; SSM, superficial spreading melanoma; SEER, Surveillance, Epidemiology, and End Results Program; WHO, World Health Organization.

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**KEYWORDS**
Melanoma incidence trends;
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Breslow;
Thickness;
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**Abstract** ***Background:*** We analysed trends in incidence for *in situ* and invasive melanoma in some European countries during the period 1995–2012, stratifying for lesion thickness.
***Material and methods:*** Individual anonymised data from population-based European cancer registries (CRs) were collected and combined in a common database, including information on age, sex, year of diagnosis, histological type, tumour location, behaviour (invasive, *in situ*) and lesion thickness. Mortality data were retrieved from the publicly available World Health Organization database.
***Results:*** Our database covered a population of over 117 million inhabitants and included about 415,000 skin lesions, recorded by 18 European CRs (7 of them with national coverage). During the 1995–2012 period, we observed a statistically significant increase in incidence for both invasive (average annual percent change (AAPC) 4.0% men; 3.0% women) and *in situ* (AAPC 7.7% men; 6.2% women) cases.
***Discussion:*** The increase in invasive lesions seemed mainly driven by thin melanomas (AAPC 10% men; 8.3% women). The incidence of thick melanomas also increased, although more slowly in recent years. Correction for lesions of unknown thickness enhanced the differences between thin and thick cases and flattened the trends. Incidence trends varied considerably across registries, but only Netherlands presented a marked increase above the boundaries of a funnel plot that weighted estimates by their precision. Mortality from invasive melanoma has continued to increase in Norway, Iceland (but only for elder people), the Netherlands and Slovenia.


## 1. Introduction

The incidence of cutaneous malignant melanoma has increased steeply since the Second World War [1–7] although recent observations show a stabilisation of rates in North America and Australia [2]. In these countries, prevention campaigns and interventions aimed at early diagnosis have been implemented, with the aims of limiting solar exposure (especially at younger ages) and of detecting suspicious lesions as early as possible. However, a clear decrease in melanoma mortality in all age groups [8–11] has not yet been observed.

Some countries have recently noted evidence of decrease in the incidence of invasive melanoma. However the reasons for the decline are not clear from the data and may be due to sun prevention campaigns or earlier diagnosis or both. An important element in understanding the trends is the concurrent behaviour of *in situ*, thin and thick lesions. Some studies have shown that the incidence of *in situ* and thin melanomas has been increasing faster than that of thick melanomas [9,12–19].

At present, information on the incidence of *in situ*, thin and thick lesions is collected by many cancer registries in Europe, but statistics on thickness are not available on a routine basis from most of the public access sites. In addition, published studies often focus on the national burden of the disease, lacking a broader European perspective.

This article investigated melanoma incidence and mortality in 13 European countries during the period 1995–2012. To better understand trends, analyses were performed by country, age, sex and Breslow thickness.

## 2. Materials and methods

Individual anonymised incidence data (with corresponding population files) were collected from population-based European cancer registries (CRs) through an *ad hoc* call. CRs directors and researchers received the study protocol by e-mail by the end of year 2015. CRs were selected on the basis of a long history of high-quality data (as proven by inclusion in the last two editions of Cancer Incidence in Five Continents, low percentages of DCO and high proportions of MV for melanoma); at least ten years of complete registration; a sufficiently large population to avoid large year-to-year variation; and availability of information on thickness. Registries in Cluj, Geneva, Iceland, and Ragusa were also included to ensure representation of a wide range of geographical areas.

To minimise the workload of CRs, data were accepted in any format available and for any period which CRs could provide. This helped ensure a broader perspective and reflected the heterogeneity of European cancer registration activity. However, after data cleaning and the pre-processing of all CRs data files, the analysis focused on cases diagnosed between 1995 and 2012.

A common anonymised database was created containing the following variables for each case: age at diagnosis, sex, year of diagnosis, histological type, tumour location, behaviour (invasive, *in situ*), Breslow

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