



A novel approach to estimate the German-wide incidence of testicular cancer

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ABSTRACT

Background: Currently, only 7 out of 16 Federal States of Germany provide testicular cancer incidence rates with an estimated completeness of at least 90% which complicates the regional comparison of incidence rates. The aim of this study was to provide a novel approach to estimate the testicular cancer incidence in Germany by using nationwide hospitalization data. **Methods:** We used the nationwide hospitalization data (DRG statistics) of the years 2005–2006 including 16.6 million hospitalizations among men. We identified incident testicular cancer cases by the combination of a diagnosis of testicular cancer and an orchiectomy during the same hospitalization and estimated the age-specific and age-standardized (World Standard Population) incidence of testicular cancer across Federal States. We also analyzed available cancer registry data from 2005 to 2006. **Results:** A total of 8544 hospitalizations indicated incident testicular cancer cases in 2005–2006. The nationwide crude incidence rate of testicular cancer was 10.6 per 100,000 person-years. The ratio of the number of registered cases (cancer registry) to the estimated number of cases based on the hospitalization statistics ranged between 79% and 100%. There was only little variation of the age-standardized DRG-based incidence estimates across Federal States (range: 8.2–10.6 per 100,000 person-years). **Discussion:** We provided testicular cancer incidence estimates for each of the 16 Federal States of Germany based on hospitalization data for the first time. The low within-population incidence variability in Germany and high between-population incidence variability in Europe may indicate that ecologic factors play a causal role in the European variation of testicular cancer.

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1. Introduction

Germany includes a population of 82 million people and cancer registration is only organized by regional cancer registries usually at Federal State level. The Federal States of Baden-Württemberg and Hesse are currently building up their registries and do not provide incidence estimates. German-wide cancer incidence estimates are based on mathematical models that are provided by the Robert Koch-Institute on a regular basis [1].

Recent regional time trend analyses revealed that the incidence of testicular cancer annually increased by 4.9% from 1961 through 1989 in East Germany and by 3.0% from 1970 through 2004 in Saarland respectively. Increases were most pronounced among

adolescents and young men aged 15–49 years. The current age-specific incidence pattern shows three age peaks: one peak in the first year of life (mainly yolk sac tumors), another peak at 30–39 years (seminoma and nonseminoma), and a late peak at ages 75–84 years [2].

The etiology of testicular cancer is poorly understood to date [3]. The study of the regional variation of testicular cancer incidence rates may give clues to the etiology of testicular cancers. However, a valid regional comparison of testicular cancer incidence rates in Germany requires a comparable registration completeness and data quality by regional population-based cancer registries. The completeness of cancer registration can be estimated by use of the age-specific ratios of testicular cancer incidence to testicular cancer mortality and some regression modelling [4]. According to this approach, only seven out of 16 Federal States provide estimates of the testicular cancer incidence with an estimated completeness of at least 90% for the years 2003–

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2004 [5]. Therefore, the regional comparison of testicular cancer incidence rates in Germany is complicated and cannot be easily used for the study of the regional distribution of testicular cancer in Germany.

In 2004, Germany introduced the DRG system for reimbursement of inpatient hospital services. The goal of that system is to define payment to the hospital by a DRG-number (DRG: diagnosis related group) that is specified by diagnosis and treatment of the patient. All individual hospitalizations with individual diagnostic and therapeutic codes contribute to the German-wide DRG statistics that may provide a data source for the estimation of testicular cancer of a male population of 40.4 million men.

As a rule radical orchiectomy is performed before any further treatment among patients with testicular cancer. Organ-preserving surgery might be an alternative to orchiectomy in small primary, especially benign tumors. However, the European Germ Cell Cancer Consensus group (EGCCCG) considers this approach as “highly experimental” and therefore recommends that organ-preserving surgery should be limited to clinical trials only [6]. According to EGCCCG, organ-preserving surgery of the testicular tumor may be considered among patients with synchronous bilateral testicular tumors, among patients with metachronous contralateral (second) testicular tumor (that is among patients with a remaining solitary testicle as a result of a previous orchiectomy), or among patients with a solitary testicle and sufficient endocrine function. However, the EGCCCG group warns that organ-preserving surgery should only be performed in experienced centers [6]. According to an analysis of the clinical cancer registries of the Federal State of Brandenburg of the years 2003 through 2007, overall at least 97% of all patients with newly diagnosed testicular cancer underwent an orchiectomy within the first 6 months after diagnosis. For the remaining 3% of patients, information on primary treatment was either missing or unclear [7].

As orchiectomy for testicular cancer is performed in general anaesthesia, it is performed among hospitalized patients in Germany. Orchiectomy is typically performed in one of the 516 urology clinics all over Germany [8]. Depending on the histological features, lymph node status and other factors, radiation therapy or chemotherapy may be used as additional therapy [6] during the same hospitalization, during a later hospitalization or within an out-patient setting. Thus, it is reasonable to assume that hospitalizations including a diagnosis of testicular cancer and a treatment by orchiectomy indicate incident testicular cancer cases.

The aim of this study was to provide a new approach to estimate the testicular cancer incidence in Germany by using the scientific use file of the German-wide hospitalization data (DRG statistics) of the years 2005–2006. We wanted to study regional differences of the incidence of testicular cancer in Germany. Furthermore, we aimed to compare these incidence estimates with available incidence estimates of population-based cancer registries in Germany and Europe.

2. Materials and methods

Based on an amendment of the hospital financing system in Germany in 1999 (Statutory Health Insurance Reform Act), the DRG reimbursement system became compulsory for hospitals in 2004. According to Section 21 of the hospital financing law (Krankenhausentgeltgesetz, KHEntG), all hospitals that are recompensated by the DRG-system annually transfer their individual hospitalization data to a DRG data center (Institute for the Hospital Renumeration System (InEK)). Psychiatric and psychotherapeutic departments are not recompensated by the DRG system and are not included in the nationwide data file. Hospital stays that are reimbursed by the statutory accidents

insurance and hospital patient care in the ambulatory setting are not included as well. All hospitals that are recompensated by the DRG system have a strong incentive to report their complete hospitalization data. The German DRG statistics is virtually a complete collection of all hospitalizations all over Germany with a few exceptions.

The DRG data center undertakes a plausibility check of the data and generates a plausibility protocol that is sent back to the corresponding hospital. Hospitals can re-submit their corrected data files. Thereafter, the DRG data center forwards anonymised data to the Federal Bureau of Statistics. Based on confidentiality regulations (Bundesstatistikgesetz, BStatG), individual hospitalization data are available for research purposes. Hospitalizations are anonymised which means that subjects that are hospitalized more than once during the study period cannot be re-identified. We were able to use the hospitalization years 2005 and 2006 including overall 36.3 million hospitalizations.

For each hospitalization, one main diagnosis and up to 99 secondary or ancillary diagnoses coded by ICD-10 can be documented. In 2005, diagnoses were coded according to the ICD-10-GM version of 2005 [9]. In 2006, the ICD-10-GM version 2006 was used [10]. The diagnosis that led to the hospitalization assessed at the end of the hospitalization is defined as the main diagnosis. Up to 100 medical procedures can be coded according to German classification of operations and procedures (OPS), a classification that represents a German version of the International Classification of Procedures in Medicine (ICPM) and that is updated annually by the German Institute of Medical Documentation and Information (DIMDI). In 2005 and 2006, the OPS versions of the years 2005 and 2006 respectively were used [11,12]. We defined the combination of a main or secondary diagnosis of testicular cancer (ICD-10: C62) and the procedure of orchiectomy (OPS: 5-622) as a marker of an incident testicular cancer case. In a sensitivity analysis, we only considered hospitalizations as markers of incident testicular cancers, if the main diagnosis (as opposed to any) was testicular cancer and the treatment was orchiectomy. Hospitalizations with a diagnosis of testicular cancer but without an orchiectomy were disregarded. The scientific use file of the DRG statistics also provides data including region of residence, age at hospital admission, and gender among others. With the exception of the upcoming cancer registries of Hesse and Baden-Württemberg, all population-based cancer registries including the registries from Bavaria (BY), Bremen (HB), Hamburg (HH), Lower Saxony (NS), North Rhine-Westphalia, administrative district of Münster (NW), Rhineland-Palatinate (RP), Schleswig-Holstein (SH), Saarland (SL), the Common Cancer Registry of the New Federal States including the Federal States of Mecklenburg-West Pomerania (MV), Brandenburg (BB), Berlin (BE), Saxony (SN), Saxony-Anhalt (ST) and Thuringia (TH), and the German Childhood Cancer Registry (GCCR) provided individual testicular cancer data. The cancer registry of Rhineland-Palatinate was only able to provide data from 2005.

As soldiers of the German Armed Forces are usually treated in military hospitals that are not compensated by the DRG system, soldiers with testicular cancer do not contribute to the DRG statistics. We therefore asked the Statistical Office of the Federal Armed Forces (WehrMedStatInstBw, Abt. III Wehrmedizin-statistik, Andernach) to provide individual data of testicular cancer related hospitalizations of soldiers of the Federal Armed Forces for the years 2005 and 2006. Among these testicular cancer related hospitalizations, we were not able to identify hospitalizations with orchiectomies. However, we kept only the first hospitalization with a diagnosis of testicular cancer within the data set of each year leaving 73 out of 214 (2005) and 83 out of 224 (2006) hospitalizations in the Armed Forces data set.

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