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Survival of cancer patients in urban and rural areas of Germany—A comparison

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ABSTRACT

Background: Cancer care services including cancer prevention activities are predominantly localised in central cities, potentially causing a heterogeneous geographic access to cancer care. The question of an association between residence in either urban or rural areas and cancer survival has been analysed in other parts of the world with inconsistent results. This study aims at a comparison of age-standardised 5-year survival of cancer patients resident in German urban and rural regions using data from 11 population-based cancer registries covering a population of 33 million people.
Material and methods: Patients diagnosed with cancers of the most frequent and of some rare sites in 1997–2006 were included in the analyses. Places of residence were assigned to rural and urban areas according to administrative district types of settlement structure. Period analysis and district type specific population life tables were used to calculate overall age-standardised 5-year relative survival estimates for the period 2002–2006. Poisson regression models for excess mortality (relative survival) were used to test for statistical significance.
Results: The 5-year relative survival estimates varied little among district types for most of the common sites with no consistent trend. Significant differences were found for female breast cancer patients and male malignant melanoma patients resident in city core regions with slightly better survival compared to all other district types, particularly for patients aged 65 years and older.
Conclusion: With regard to residence in urban or rural areas, the results of our study indicate that there are no severe differences concerning quality and accessibility of oncological care in Germany among different district types of settlement.

Members of the GEKID cancer survival working group are listed at end of the manuscript

1. Introduction

Cancer care services including specialised diagnostic and therapeutic facilities are predominantly localised in central cities, potentially causing a heterogeneous geographic access [1–3]. In general, cancer patients living in rural areas have to overcome more time, distance and inconvenience to reach oncologic care than city residents and thus might be disadvantaged regarding outcome [4]. The question of an association between residence in either urban or rural areas and cancer survival has been analysed in other parts of the world with inconsistent results [5–10]. The partially contradictory findings might reflect the impreciseness

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and variety of the terms 'urban' and 'rural'. Areas can be classified on the basis of population counts of administrative units such as towns, cities or counties, on the basis of economic relations, or a gradient of urbanisation may be established using some measure of population density [11]. Sizes and definitions of spatial units vary among regions and nations due to geographic and historic specifics, and rural populations may exist within the boundaries of a metropolitan area as well as urban areas may overlap borders of units classified as "rural".

In Germany population-based analyses of cancer survival have been published for several regions and states during the last decade [12]. However, regional comparisons of these cancer survival data within the federal territory would have been difficult to interpret due to considerable variations in the cancer registries' data quality and in their methods of survival analysis [12,13]. In 2009 a collaborative project funded by the German Cancer Aid was initiated in order to provide a comprehensive overview of cancer survival in Germany based on a pooled national dataset [14]. Data from population-based German cancer registries covering 11 out of 16 states in whole or in part were included, equivalent to 40% of the German population. The pooled dataset permits the allocation of cancer patients to similar types of settlement structure across the state boundaries, thus presumably levelling out insufficient data comparability among the registries.

The aim of this study is a population-based comparison of cancer survival in consistently defined urban and rural areas in Germany. If residence in rural areas impairs the outcome of oncological care at all, special attention is given to older age-groups as they are assumed to be more affected by differences in accessibility of health care services.

2. Materials and methods

2.1. Study population

The study is based on a pooled national dataset comprising survival data from German population-based cancer registries in 11 federal states covering a population of 33 million people. This dataset includes 1.1 million patients diagnosed with cancer in 1997–2006 at an age of 15 years or above and followed up until 31st December 2006. The completeness of case ascertainment exceeded 90% in most registries, but was at least 80% during 2004–2006. Of the cases 16% had been notified by death certificate only (DCO), the proportion varying considerably among the registries. Those contributing data had to meet the following criteria: less than 20% DCO cases throughout the study period or decrease by at least two percentage points per year to levels below 20% by the end. A more detailed description of the dataset listing states, case numbers, etc. was presented previously [14].

For this analysis patients diagnosed with cancer of one of the most common sites were selected: stomach, colorectum, pancreas, lung and trachea, melanoma of the skin, female breast, prostate, kidney, urinary bladder and Non-Hodgkin lymphoma. In addition several rare cancer sites were chosen: small intestine, heart, bone, mesothelioma, male breast and renal pelvis. DCO cases and 0.08% cases without information on residence were excluded from the analysis.

2.2. Urban and rural areas

In the pooled national dataset information on the patients' place of residence at time of diagnosis was available on the level of administrative districts. The classification into urban and rural areas follows the district types of settlement structure defined by the Federal Institute for Research on Building, Urban Affairs and Spatial Development for 2006, based on both population density and the characteristics of the supraordinate regions [15]. In city core districts the population exceeds 100,000 and the density is higher than 300 inhabitants per square kilometre (inh/km^2). A densely populated outer conurbation is defined by more than 150 inh/km^2, while districts with less than 150 inh/km^2 but referring to regional centres are categorised as rural outer conurbation. A population of less than 100 inh/km^2 or the lack of a regional centre in areas with 100–150 inh/km^2 categorises a district as rural. From a total of 439 districts in Germany 201 were covered by the pooled national dataset (Table 1, Fig. 1).

2.3. Statistical methods

For the common cancers age-standardised five-year relative survival (RS) was calculated by site, sex, district type, and in case of notably different results by age-group, applying period analysis based on the life-table method for the time period 2002–2006 [16]. Relative survival is the ratio of the observed and the expected probability of the patients' survival, the latter referring to the assumption of normal background mortality [17]. Expected survival was estimated according to the Ederer II method [18,19]. Population life tables stratified by age, sex, calendar year and district type were derived by means of data on population and deaths on district level, available from the German Federal Statistical Office by five-year age groups up to age 64, age groups 65–74 and 75+ [20]. Via data pooling according to district types abridged life tables were constructed first [21]. Referring to Baili et al. [22] in the context of the EUROCARE-3 study two methods to derive complete life tables for single-year age groups up to age 100 were then combined taking the differing age-group intervals of the available population data into account: we applied the Kostaki method up to age 74 and the Elandt–Johnson method for ages 75 and over [22–24]. To control for possible differences in the age structure of the district types directly age-standardised survival was calculated using the International Cancer Survival Standards [25]. For the rare cancers age-standardisation was omitted for lack of reliable five-year RS estimates concerning several age groups. Period analysis was applied, as it provides rather accurate predictions of survival expectations of newly diagnosed patients [26]. Ninety-five percent confidence intervals (95%CI) refer to the

Table 1
Number and distribution of districts and population in the present analysis and in Germany across district types of settlement.

District type	Districts Number (%)		Underlying population in 2006 Number in million (%)	
	Included in analysis	Germany	Included in analysis	Germany
City core	27 (13.4)	72 (16.4)	8.7 (26.3)	24.0 (29.2)
Densely populated outer conurbation	61 (30.2)	174 (39.6)	11.2 (33.6)	36.5 (44.3)
Rural outer conurbation	47 (23.4)	91 (20.7)	6.1 (18.5)	11.3 (13.7)
Rural	66 (32.8)	102 (23.2)	7.2 (21.6)	10.5 (12.8)
Total	201 (100)	439 (100)	33.2 (100)	82.3 (100)