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Trends in incidence of and mortality from cancer in The Netherlands in the period 1989–1998

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Abstract

This paper summarises the population-based major trends in cancer incidence and mortality in the period 1989–1998 in The Netherlands. Trends of the European age-adjusted incidence and mortality rates were estimated by the Estimated Annual Percentage Change (EAPC) method. Increases in incidence were found for cancer of the breast and lung for females. For males, an increase was observed for cancer of the prostate, colon, rectum and testis. In both groups, oesophageal and pharyngeal cancer increased, but that of stomach and gallbladder cancer decreased. The main increases in mortality were found for pharyngeal cancer in males, lung in females and oesophageal cancer in both sexes. Decreases were shown for stomach cancer for both sexes and lung cancer for males. Trends in incidence may be a result of changes in behaviour, smoking habits in preceding decades are related to the increase in lung cancer for females, and early detection, screening programmes increased the incidence for breast and prostate cancers. Decreases in mortality may be related to more successful treatment of leukaemia, Hodgkin's lymphoma, colorectal and testicular cancers. Primary prevention of cancer remains important.

Keywords: Cancer; Trend; Incidence; Mortality; Cancer registry

1. Introduction

Cancer registries provide background information on the site-, gender-, and age-specific incidence of cancer in a defined population. Incidence data may form a basis for setting priorities for cancer control activities. Monitoring changes in cancer occurrence and mortality can also provide essential information on changes in detection and treatment.

In The Netherlands, there are nine regional cancer registries. These registries are maintained by the Comprehensive Cancer Centres, which were established during the late 1970s and early 1980s, their primary task being improving care for cancer patients. The regional registries submit their data to the nationwide Netherlands Cancer Registry (NCR), which has been complete since 1989 and has now become the second largest cancer registry in Europe. In the years 1989 and 1990, the most common cancer sites among males were the lung, prostate and colon [1]. For females, the most common site was the breast followed by the colon and lung. Compared with other countries in Northwestern Europe and North America, high incidence rates in The Netherlands were reported for the lung and stomach among males, breast cancer among females and colorectal cancer for both sexes. In 1989 and 1990, mortality was highest for cancer of the lung, prostate, colorectal and stomach cancers in males and for breast, colon, lung and ovary cancers in females [2].

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In this paper, trends in cancer incidence and mortality during the period 1989–1998 are described. Tumour sites are only reported if a clear trend is observed. Melanoma skin cancer is described extensively in another paper [3].

2. Patients and methods

The NCR includes all invasive and *in situ* malignancies diagnosed from 1989 onwards in The Netherlands. Carcinoma *in situ* of the cervix and basal cell carcinomas of the skin have not been included, the latter being registered by the Eindhoven cancer registry. Notification is obtained from the pathology and haematology departments in their regions. All pathology laboratories in The Netherlands have a combined automated archive (PALGA) for the pathological diagnoses. Other sources are the radiotherapy departments of the hospitals, as well as the National Registry of Hospital Discharge Diagnosis, which accounts for up to 8% [4] of new cases. Death certificates are not available in an identifiable form to the cancer registry because of privacy regulations.

The minimum dataset, collected by all regional registries, includes identifying information (e.g. first letters of the name, date of birth, gender, postal code), tumour characteristics (e.g. date of incidence, topography, morphology, stage) and follow-up data. All data are collected from patient files in the hospital and are coded according to a national manual. This manual describes inclusion and exclusion criteria, as well as definitions and coding of items. Topography and morphology are coded according to the International Classification of Diseases for Oncology (ICD-O) [5]. The TNM classification is used for the staging of the tumours [6]. For the current analyses, the International Association of Cancer Registries (IACR) criteria for multiple primaries were applied [5].

The quality of the data is high [7] due to thorough training of the registrars and computerised consistency checks, at both the regional and national level. Completeness is estimated to be at least 95%, although for some cancer types it may be lower (e.g. pancreatic and gallbladder cancers) [1,8]. In the 1998 data, 1–2% of the cancers may be missing because some cancers may have been registered several years after diagnosis. Population data and cancer mortality data (cause of death) were obtained from Statistics Netherlands.

2.1. Statistical methods

For the period 1989–1998, the trends in incidence and mortality were been investigated according to age, gender, topography and/or morphology, histological subtype, region and/or grade of urbanisation. All rates have been age-adjusted to the European population (European Standardised Rates (ESR)) and calculated per 10^6 person-years. All rates in this paper are presented as 3-year moving averages.

The Estimated Annual Percentage Change (EAPC) [9] was used as an estimate of the trend. Using calendar year as a regression variable, a regression line is fitted to the natural logarithm of the rates, i.e. $y = mx + b$, where $y = \ln(\text{rate})$ and $x = \text{calendar year}$. Then $\text{EAPC} = 100*(e^m - 1)$. Testing the hypothesis that the EAPC is equal to zero is equivalent to testing the hypothesis that the slope of the regression line is zero, using the t-distribution of m/SE_m. The number of degrees of freedom equals the number of calendar years minus 2. The standard error of m, i.e. SE_m, is obtained from the fit of the regression line. This calculation assumes that the rates increased/decreased at a constant rate over the entire period.

3. Results

The total number of patients with primary cancers in The Netherlands increased from 56 368 in 1989 to 65 771 in 1998 (17%). When adjusted to the European standard population, the rate for both sexes increased slightly from 381 per 10^6 person-years in 1989 to 390 in 1998. For males, the rates decreased from 449 to 442 per 10^6 person-years (EAPC 0.2%, $P = 0.53$), for females an increase was observed from 313 to 337 per 10^6 person-years (EAPC 0.9%, $P = 0.001$).

The results according to site are presented according to the ICD-O. Incidence and mortality data are shown separately and grouped according to the magnitude of the ESR to enable visual inspection of the trends in Figs. 1–3.

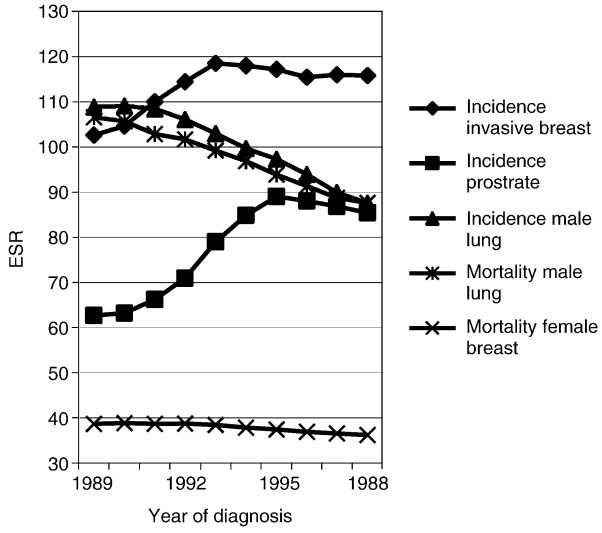

Fig. 1. Trends in incidence and mortality of invasive cancers with high frequency (>35 per 10^6 person-years) for males and females.

3.1. Head and neck

In general, the incidence of head and neck cancer increased for females (oral cavity: EAPC 3.6%, $P=0.001$, larynx: EAPC 2.6%, $P=0.10$, pharynx: EAPC 3.2%, $P=0.01$, Fig. 2e) and decreased for males (lip: EAPC −3.6%, $P=0.04$, Fig. 2c, larynx: EAPC −2.2%, $P=0.01$, Fig. 2b), with the exception of pharyngeal cancer (EAPC 2.0%, $P=0.01$, Fig. 2c). Mortality patterns for head and neck cancer were roughly equal to the incidence patterns. An increase in mortality was observed for females (oral cavity: EAPC 4.7%, $P=0.001$, Fig. 3f) and a decrease for males (tongue: EAPC −2.7%, $P=0.03$, Fig. 3c), but mortality due to pharyngeal cancer increased (EAPC 3.0%, $P=0.001$, Fig. 3b).

3.2. Gastrointestinal tract

Diverging trends were exhibited for cancer of the gastrointestinal tract.

For both sexes, the incidence of oesophageal cancer increased (for males from 7.4 to 9.7 per 10^6 person-years, EAPC 3.1%, $P=0.001$, Fig. 2b; for females from 2.7 to 3.2 per 10^6 person-years, EAPC 2.0%, $P=0.01$, Fig. 2e, respectively). The incidence of adenocarcinoma, which occurred predominantly in the lower third of the oesophagus, increased the most. Mortality increased for males and females from 7.9 to 9.3 and from 2.6 to 3.0 per 10^6 person-years, respectively (EAPC = 2.4%, $P=0.001$, Fig. 3a and b).

The incidence of stomach cancer decreased in both groups (for males from 23.8 to 18.5 per 10^6 person-years, EAPC −3.3%, $P=0.00$, Fig. 2a; for females from 9.4 to 7.1 per 10^6 person-years, EAPC −3.5%, $P=0.001$, Fig. 2d). The largest increase was found for the middle and distal parts. In addition, mortality due to stomach cancer decreased for both sexes (for males from 19.9 to 13.9 per 10^6 person-years, EAPC −4.1%, $P=0.001$, Fig. 3a; for females from 7.9 to 5.6 per 10^6 person-years, EAPC −3.8%, $P=0.001$, Fig. 3e).

For colon cancer, an increase in incidence from 29.3 to 32.8 per 10^6 person-years (EAPC 1.2%, $P=0.001$, Fig. 2a) and a small decrease in mortality from 16.6 to 15.2 per 10^6 person-years (EAPC −1.0%, $P=0.001$, Fig. 3a) was observed for males. For females, the incidence remained stable at a level of about 26 per 10^6 person-years, while a small increase in mortality was observed (from 20.6 to 21.7 per 10^6 person-years, EAPC 0.5%, $P=0.001$, Fig. 3d).

For rectal cancer, a small increase in incidence from 20.8 to 22.9 per 10^6 person-years was observed among males (EAPC 1.1%, $P=0.001$, Fig. 2a) whereas mortality decreased in both groups (for males from 7.3 to 6.8 per 10^6 person-years, EAPC −1.1%, $P=0.001$, Fig. 3a; for females from 4.2 to 3.7 per 10^6 person-years, EAPC −0.9%, $P=0.001$, Fig. 3e).

Incidence of cancer of the liver seemed to increase slightly, although the trend was not statistically significant due to the small numbers. For both sexes, the mortality increased (for males from 2.9 to 3.3 per 10^6 person-years, EAPC 2.8%, $P=0.001$, Fig. 3b; for females from 1.1 to 1.7 per 10^6 person-years, EAPC 5.0%, $P=0.001$ Fig. 3f).

The incidence of cancer of the pancreas among males decreased from 10.5 to 8.7 per 10^6 person-years (EAPC −2.5%, $P=0.001$, Fig. 2b) towards a level almost equal to that for females (mean incidence rate: 7.2 per 10^6 person-years). The same trend was observed for mortality (for males from 12.5 to 10.6 per 10^6 person-years, EAPC −2.0%, $P=0.001$, Fig. 3a; for females from 8.9 to 8.2 per 10^6 person-years).

Cancer of the gallbladder exibited the most rapidly decreasing incidence. For males, incidence rates decreased by 5.7% per year from 1.0 to 0.6 per 10^6 person-years ($P=0.001$, Fig. 2c) and for females by 6.0% per year from 2.5 to 1.4 per 10^6 person-years, ($P=0.001$, Fig. 2e). Mortality due to this cancer decreased to the same extent (for males from 0.8 to 0.6 per 10^6 person-years, EAPC −5.3%, $P=0.001$, Fig. 3c; for females from 2.0 to 1.1 per 10^6 person-years, EAPC −6.7%, $P=0.001$ Fig. 3f).

Incidence of cancer of the other and unspecified parts of the biliary tract (extrahepatic bile duct and ampulla of Vater) remained unchanged. However, mortality decreased sharply in 1996 for both sexes (for males from 1.6 to 0.9 per 10^6 person-years, EAPC −6.4%, $P=0.02$, Fig. 3b; for females from 1.7 to 0.9 per 10^6 person-years, EAPC −5.6%, $P=0.001$, Fig. 3f).

3.3. Lung

The trends in incidence and mortality of lung cancer were striking. Overall, the incidence decreased among males from 109.0 to 89.3 per 10^6 person-years (EAPC −2.7%, $P=0.001$, Fig. 1), whereas for females the incidence increased from 16.9 to 25.0 per 10^6 person-years, particularly in urban regions (EAPC 4.7%, $P=0.001$, Fig. 2d). The male to female ratio nearly halved from 6.4 in 1989 to 3.6 in 1998. The decrease in incidence for males was mainly caused by squamous cell carcinoma (EAPC −5.1%, $P=0.001$), the most common lung cancer type, as well as small cell carcinoma (EAPC −4.4%, $P=0.001$). For men under 60 years if age, a decrease in adenocarcinoma was seen, but for elderly males, adenocarcinoma and large cell undifferentiated cancers increased. For females, the most rapid increase was exhibited by adenocarcinoma (EAPC 5.8%, $P=0.001$) and large cell undifferentiated carcinoma (EAPC 8.7%, $P=0.001$). The incidence of squamous cell carcinoma and small cell carcinoma did not increase among females younger than 60 years old.

The trend in mortality equalled the trend in incidence, a decrease for males from 109.7 to 86.4 per 10^6 person-

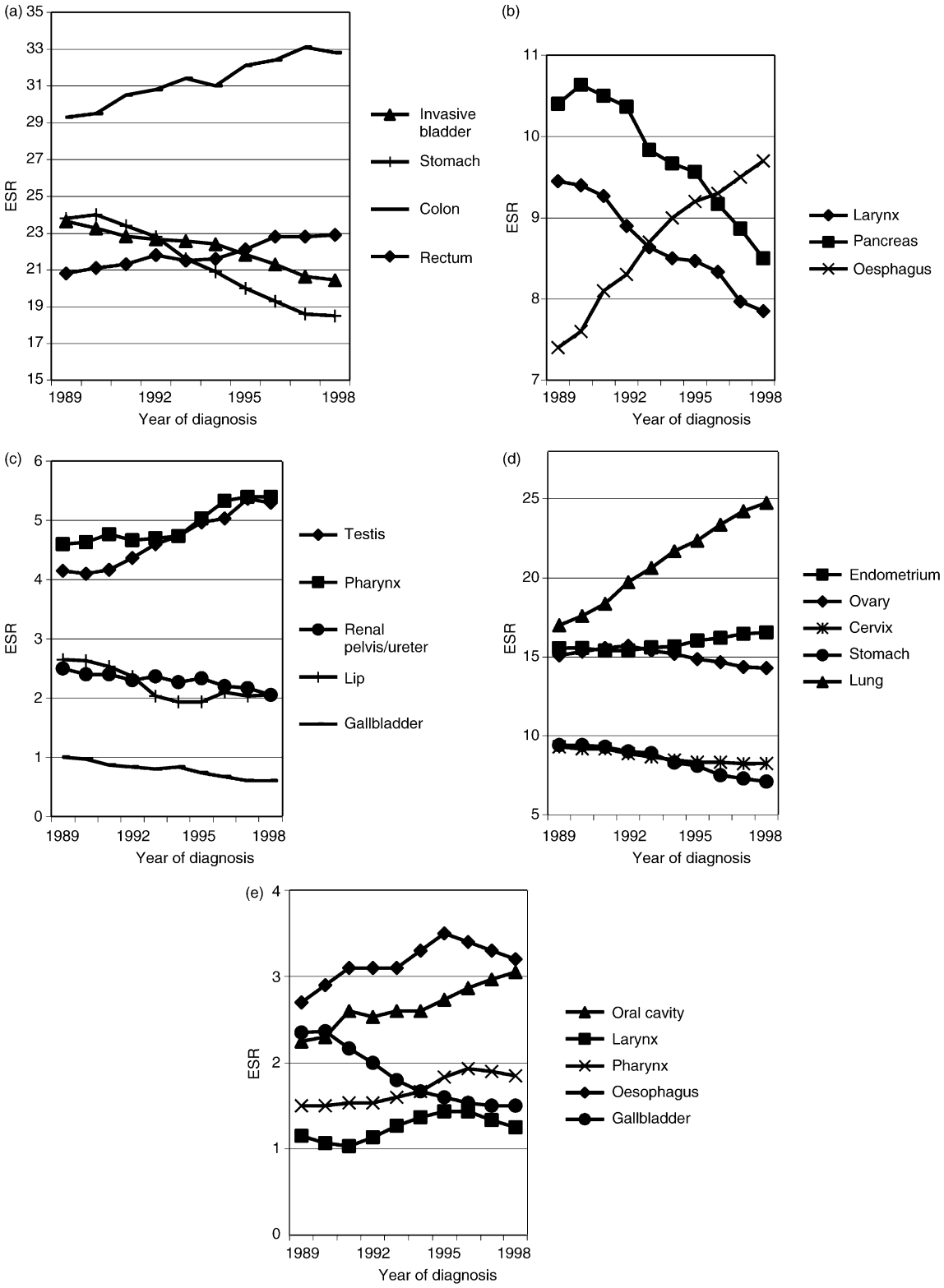

Fig. 2. (a) Trends in incidence of invasive cancers with a moderate frequency (15–35 per 10^6 person-years) for males; (b) trends in incidence of invasive cancers with a moderate/low frequency (7–12 per 10^6 person-years) for males; (c) trends in incidence of invasive cancers with a low frequency (<6 per 10^6 person-years) for males; (d) trends in incidence of invasive cancers with a moderate frequency (5–25 per 10^6 person-years) for females; (e) trends in incidence of invasive cancers with a low frequency (<5 per 10^6 person-years) for females.

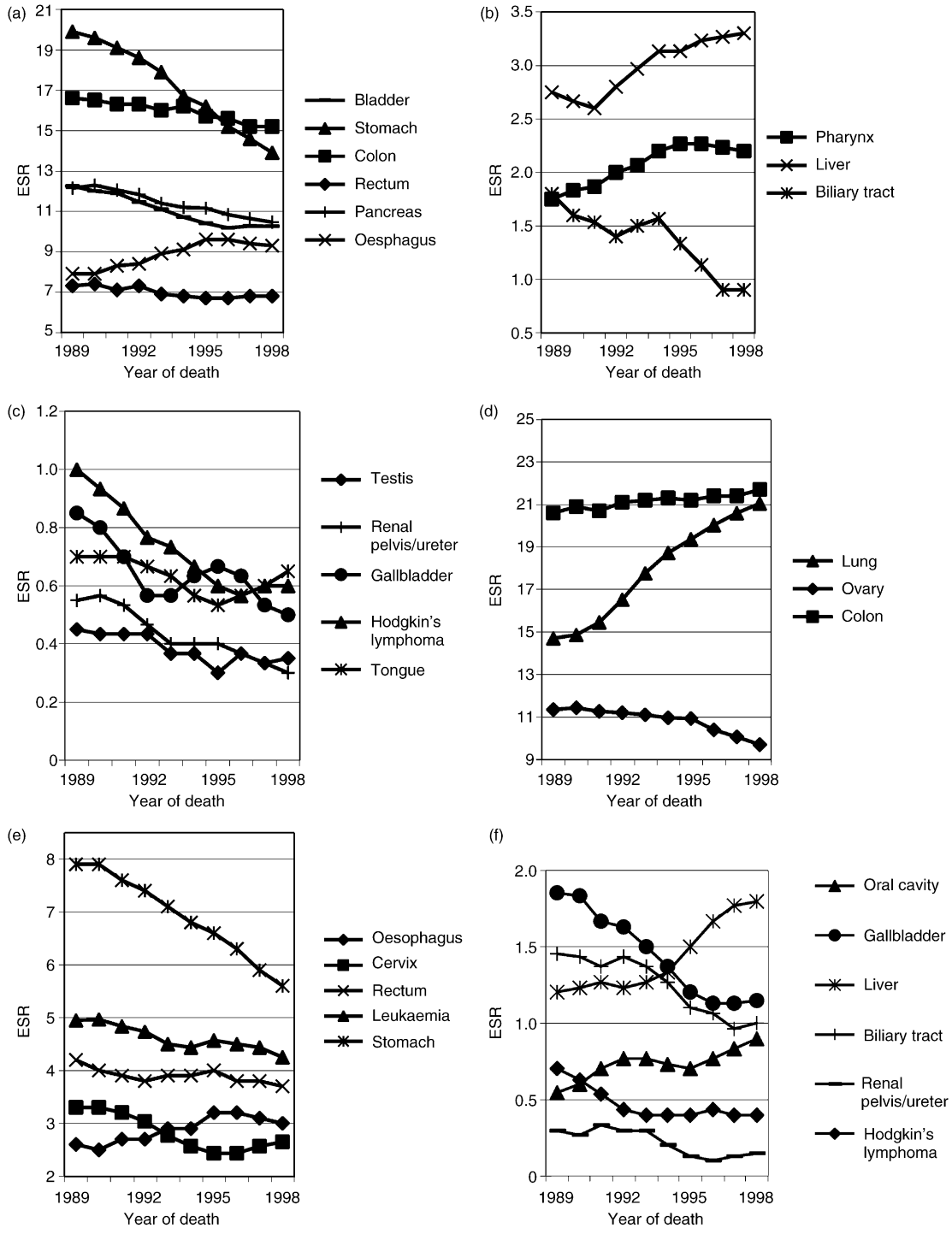

Fig. 3. (a) Trends in mortality from invasive cancers with a moderate mortality (5–20 per 10^6 person-years) for males; (b) trends in mortality from invasive cancers with a moderate/low mortality (0.5–3.5 per 10^6 person-years) for males; (c) trends in mortality from invasive cancers with a low mortality (<1.2 per 10^6 person-years) for males; (d) trends in mortality from invasive cancers with a moderate mortality (9–25 per 10^6 person-years) for females; (e) trends in mortality from invasive cancers with a low mortality (2–8 per 10^6 person-years) for females; (f) trends in mortality from invasive cancers with a low mortality (<2 per 10^6 person-years) for females.

years (EAPC −2.5%, $P=0.001$, Fig. 1) and an increase for females from 14.8 to 21.2 per 10^6 person-years (EAPC 4.7%, $P=0.001$, Fig. 3d).

3.4. Breast

The incidence of invasive breast cancer increased until 1994 and stabilised at approximately 116 new cases per 10^6 person-years (total period EAPC 1.4%, $P=0.02$, Fig. 1). The increase was mainly observed among females aged 50–69 years and for stage I cancers. Stage II cancers showed an increase until 1994 and a decrease thereafter, whereas incidence rates for stage III and IV cancers decreased over the entire period. The incidence of carcinoma *in situ* of the breast increased from 4.8 to 12.4 per 10^6 in 1998 (EAPC 11.3%, $P=0.001$). Mortality due to breast cancer has slowly, but steadily, decreased over the past 10 years from 39.0 to 35.6 per 10^6 person-years (EAPC −0.9%, $P=0.001$, Fig. 1). This decrease was found for females aged under 50 years (EAPC −1.1%, $P=0.06$) and females aged 50–69 years (EAPC −1.2%, $P=0.001$), but not in females aged 70 years and older (EAPC −0.3%, $P=0.37$).

3.5. Female genital organs

The incidence of and mortality from cervical cancer decreased (EAPC −1.6%, $P=0.001$ Fig. 2d; EAPC −3.6%, $P=0.001$, Fig. 3e, respectively). This decrease was most prominent among females older than 59 years (incidence from 18.3 to 14.5 per 10^6 person-years, EAPC −3.3%, $P=0.001$; mortality from 12.2 to 9.4 per 10^6 person-years EAPC −4.7%, $P=0.001$). The incidence for squamous cell carcinoma (SCC) of the cervix decreased (from 7.1 to 6.1 per 10^6 person-years, EAPC −1.6%, $P=0.001$). The incidence of endometrial cancer increased slightly (from 15.9 to 16.4 per 10^6 person-years, EAPC 0.7%, $P=0.03$, Fig. 2d), but for females older than 50 years, it clearly increased (EAPC 1.1%, $P=0.01$), while a decrease was observed for females younger than 50 years (EAPC −2.9%, $P=0.03$). Mortality remained unchanged.

Incidence (from 15.1 to 14.3 per 10^6 person-years, EAPC −0.9%, $P=0.02$, Fig. 2d) and mortality (from 11.6 to 9.7 per 10^6 person-years, EAPC −1.8%, $P=0.001$, Fig. 3d) for all invasive ovarian cancers decreased in all age groups, except for females born before 1920. 90% of all invasive ovarian tumours were of epithelial origin and occurred mainly in females 60 years and older. This was also true for sarcomas and mixed tumours.

3.6. Male genital organs

The incidence of prostate cancer increased to a level of 89.2 per 10^6 person-years in 1995 and then decreased slightly to 85.0 in 1998 (EAPC 4.6%, $P=0.001$, Fig. 1). The trend varied according to age. For males over 74 years old, the incidence increased from 750 to 960 per 10^6 person-years in 1994, followed by a decrease to 760 in 1998. For males aged 60–75 and 45–60 years, the incidence increased (from 240 to 380 and from 20 to 40 per 10^6 person-years, respectively). Mortality remained constant (average mortality rate: 33 per 10^6 person-years).

The incidence of testicular cancer increased (from 4.1 to 5.6 per 10^6 person-years in 1998, EAPC 3.5%, $P=0.001$, Fig. 2c) for both seminoma (EAPC 2.8%, $P=0.01$) and non-seminoma (EAPC 4.1%, $P=0.001$). The mortality decreased by 5.7% per year to a level of 0.3 per 10^6 person-years in 1998 ($P=0.09$, Fig. 3c).

3.7. Urinary tract

For males, the incidence of invasive bladder cancer, as well as that of cancer of the renal pelvis and ureter, decreased (from 24.1 to 20.3 per 10^6 person-years, EAPC −1.7%, $P=0.001$, Fig. 2a; from 2.5 to 2.1 per 10^6 person-years, EAPC −1.8%, $P=0.03$, Fig. 2c, respectively). Mortality due to both bladder cancers and renal pelvis and ureter cancer decreased in both groups. For males, mortality due to bladder cancer decreased from 12.0 to 10.8 per 10^6 person-years (EAPC −2.2%, $P=0.001$, Fig. 3a) and for females from 2.7 to 2.4 per 10^6 person-years (EAPC −5.4%, $P=0.001$, Fig. 3e). For males, mortality from cancer of the renal pelvis and ureter decreased from 0.5 to 0.3 (EAPC −5.5%, $P=0.001$ Fig. 3c) and for females from 0.2 to 0.1 (EAPC −7.1%, $P=0.06$, Fig. 3f).

3.8. Haematological malignancies

The overall incidence of haematological malignancies remained rather stable during the period of 1989–1998. Increases were found for leukaemia in adolescent males aged 15–30 years (EAPC 3.9%, $P=0.09$) and females aged 30–45 years (EAPC 4.7%, $P=0.001$), whereas a decrease in the incidence of chronic lymphocytic leukaemia (CLL) was observed in females (EAPC −2.7%, $P=0.04$).

Mortality due to leukaemia (for females from 5.2 to 4.4 per 10^6 person-years, EAPC −1.7%, $P=0.03$, Fig. 3e) and Hodgkin's lymphoma (for males from 0.9 to 0.6 per 10^6 person-years, EAPC −6.1%, $P=0.00$, Fig. 3c; for females from 0.7 to 0.3 per 10^6 person-years, EAPC −5.8%, $P=0.02$, Fig. 3f, respectively) decreased.

4. Discussion

An impressive number of changes in incidence and mortality occurred during the 1990s, partly due to

tobacco and alcohol habits and partly due to early detection and screening. They are summarised in Tables 1 and 2. It is unlikely that changes in completeness of the cancer registry influenced our rates, since registration activities in the nine regions started several years before 1989.

The opposite trends in lung cancer for males and females were caused by the difference in smoking habits between males and females [10,11]. Since the 1960s, more males have given up smoking and fewer males have started smoking. Only a few females smoked in the 1950s and 1960s. However, in the 1970s and 1980s, the proportion of smokers among females increased sharply. This lead to an increase of lung cancer deaths among females of 84%, the greatest increase in the European Union (EU). The risk of death from lung cancer in females ranged up to 95% in the Netherlands, compared to 29% overall in the EU [12]. Rapid increases in lung cancer mortality among females have also been observed in Denmark, Hungary, Ireland and the United Kingdom (UK) [13–15].

The increased percentage of smokers among females may also partly explain the increase in the incidence of tumours of the oral cavity, pharynx and larynx. Another factor may have been an increased intake of alcohol. Smoking-related cancers have been described extensively in literature [16]. Borras and colleagues pointed out the relationship between exposure to tobacco, alcohol and occupational carcinogens and the high cancer rates for the larynx, bladder and upper digestive tract in Spanish men [17].

Trends in incidence of cancer of the gastrointestinal tract may have been influenced by changes in risk factors such as smoking habits, alcohol consumption, diet pattern and physical activity [18]. The decrease in incidence of stomach cancer could be due to a protective effect of a higher intake of fruit (vitamin C) and vegetables and fewer infections with *Helicobacter pylori*. Easy access to endoscopy may also have played a role.

In England and Wales, increases in the incidence of colorectal cancer were found for males and to a lesser extent for females [19]. The age-adjusted mortality fell by 24% for males and by 37% for females in a 23-year period. Advances in the management of colorectal cancer have resulted in an improved prognosis for this disease [20]. In contrast, in our study, an increase in mortality among females was observed for colon cancer.

In France, in the Dijon area, the incidence of gallbladder carcinoma was stable [21] and that of primary liver cancer in men increased [22]. This observation contrasts with the observed trend in The Netherlands: gallbladder incidence in The Netherlands decreased for both sexes whereas the incidence of cancer of the liver remained stable.

The sudden decrease in mortality from other and unspecified cancer of the biliary tract in 1996 in both groups was probably related to the introduction of ICD-10 in mortality statistics in 1996.

The rising trend of bladder cancer mortality in The Netherlands from 1955 to 1988 has been described as a cohort effect, implying an increased risk of dying from bladder cancer for the 1875 birth cohort to the 1910 birth cohort, and a decreased risk for more recent birth cohorts [23]. The authors pointed out that this decrease in risk for generations born after 1910 would probably result in a decreasing trend for mortality in the near future, when more of these 'youngsters' reach the age of 70 years and over. This phenomenon was confirmed by our study.

Table 1
Changes in cancer incidence of primary tumours in The Netherlands, 1989–1998

	Increase	Decrease
Males	Prostate[a]	
	Lip	
	Colon	Larynx
	Rectum	Pancreas
	Testis	Lung
		Bladder
		Renal pelvis and ureter
Females	Breast[a]	Cervix[a]
	Oral cavity	Ovary
	Larynx	
	Lung	
	Endometrium	
Both sexes	Pharynx	Stomach
	Oesophagus	Gallbladder

[a] Possible screening effect.

Table 2
Changes in cancer mortality in The Netherlands, 1989–1998

	Increase	Decrease
Males	Pharynx	Tongue
		Colon[a]
		Pancreas
		Lung
		Testis[a]
Females	Oral cavity (excluding base of the tongue)	Breast[a]
		Cervix[a]
	Colon	Ovary[a]
	Lung	Leukaemia[a]
Both sexes	Oesophagus	Stomach
	Liver	Rectum[a]
		Gallbladder
		Biliary tract
		Bladder
		Renal pelvis and ureter
		Hodgkin's lymphoma*

[a] Possible treatment effect.

Both incidence and mortality of ovarian cancer have decreased, which in literature has been ascribed to the use of oral contraceptives. They were taken by a large proportion of the Dutch female population born after 1935 [24]. The age pattern (no decrease for women over 75 years of age) possibly reflects the fact that oral contraceptives were not used by women born before 1930, because they were already in menopause when oral contraceptives were introduced in The Netherlands. In the last decade, a substantial decrease in mortality has been seen for most European countries [25].

In contrast to several other European Cancer Registries, including the Eindhoven Cancer Registry in South Netherlands, no upward trend in incidence and mortality of non-Hodgkin's lymphoma was observed. Perhaps the increase took place in the 1970s and 1980s and leveled off in the 1990s [2,26,27].

Mortality from Hodgkin's disease decreased for both males and females, which in the absence of a decline in incidence may be attributed to improved treatment [28]. In the countries of the European Union (EU), mortality rates for Hodgkin's disease decreased steadily by approximately 75% between the late 1960s and the late 1990s [29].

An increase in age-adjusted incidence rates may be caused by the introduction and wider application of methods for early detection, for example a screening programme. Early detection may aim at detection and treatment of precancerous lesions and thereby prevent the occurrence of invasive cancers (e.g. cervical cancer). However, more often the aim is increased detection and treatment of earlier (or preclinical) stages and, in the long run, a decrease in mortality (e.g. breast cancer). In The Netherlands, national screening programmes only exist for breast cancer (since 1990) and cervical cancer (restarted in 1996).

The increase in breast cancer incidence was predominantly among females aged 50–69 years (the age group invited for screening). It is likely that the increase can be attributed to expanding screening activities in 1990–1996 [30]. Due to the screening programme, a shift in incidence of the different stages of tumours was established. Stage I tumours doubled, stage II tumours increased but had returned to original levels in 1995, whereas stage III and IV tumours had decreased by more than 24% [31]. However, the small reduction of breast cancer mortality in females younger than 70 years may also be related to the introduction of the breast cancer screening programme in the beginning of the 1990s and the wider use of adjuvant treatments. Mortality due to breast cancer also declined in other countries of the EU [32]. In England and Wales, an increase in the incidence of breast cancer was detected [33]. Blanks and colleagues [34] concluded in their study that by 1998 both screening and other factors, including improvements in treatment, had resulted in substantial reductions in mortality due to breast cancer. Screening also had an indirect influence by raising an awareness of changes in detection and treatment.

A screening programme for cervical cancer was introduced in the mid-1970s and extended to the national level in the mid-1990s (nationwide since 1996). The programme is meant to detect precancerous lesions and therefore aims at a decrease in the incidence of invasive cancer. The incidence of and mortality from cervical cancer have been decreasing since 1960 and this has become more rapid since about 1975 [35]. Organised screening, which began in 1976, could be responsible for the acceleration in the decrease. Since the decrease was already evident before screening was started, other factors, such as an impressive amount of opportunistic screening [36] before the start of the national programme, must play a role. As in our study, a decrease in the incidence of cervical cancer around 1960, almost 10 years before the organised population screening programme, was revealed in Sweden [37]. It was suggested that this was probably due to introduced opportunistic Papanicolaou (Pap) testing.

In Sweden, the incidence of squamous cell carcinoma (SCC) decreased and that of adenocarcinoma increased, suggesting that the increase in the incidence of adenocarcinoma is related to an increased prevalence of human papilloma virus (HPV) infection related to the large-scale use of oral contraceptives. No increase was seen in SCC, which is attributed to effective screening [38].

Between 1960 and 1998, mortality decreased for uterine cancer (usually originating from the cervix) among women aged 24–44 years in all Western European countries, except Ireland. The decrease was larger and earlier in some Nordic countries [39].

Although a national screening programme does not exist for prostate cancer, the increase in incidence was caused to a large extent by early detection, especially due to Prostate Specific Antigen (PSA) assessment [40]. The data revealed an increase in all age groups, especially for stage II prostate carcinoma and to a lesser extent also for stage I. A similar increase was also found in the UK [41] and Southern Europe [42]. Post and colleagues described increasing mortality from prostate cancer, mainly in successive birth cohorts of men born until 1930 [43]. After 1989, the mortality rates stabilised, as we also found in our study. This was in contrast to decreasing trends in the EU of −3% since 1995 [32].

Trends in incidence and mortality indicate the changes in demand and effectiveness of patient care. Monitoring of trends in cancer incidence and mortality are necessary to support the planning of health care facilities and to evaluate the effectiveness of care. Not only trends in incidence and mortality of cancer, but also changes in the population structure, e.g. the increasing

aging of The Netherlands population, are an important factor in predicting the demands for cancer care. In addition, the primary prevention of cancer remains important.

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Appendix

The current data have also been published in a report [44] and on the internet (http://www.ikc.nl, then click on English and Publications).

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