Age-specific differences in the diagnostics and treatment of cancer patients aged 50 years and older in the province of Limburg, The Netherlands.

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Original article

Age-specific differences in the diagnostics and treatment of cancer patients aged 50 years and older in the province of Limburg, the Netherlands

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Summary

Background: In the Netherlands, 45% of all cancer cases occur in men and women aged 70 years and older. Since the population is ageing and cancer incidence rises with age, the number of new malignancies in the elderly is increasing. It has become apparent that there is a relationship between age at diagnosis and the treatment received. Therefore, age-specific variations in patterns of care for six common forms of cancer in the elderly, are examined.

Patients and methods: Patients aged 50 years and older, diagnosed in the period 1988–1992 in Middle and South Limburg with breast, colorectal, lung, ovarian, head and neck cancer and non-Hodgkin lymphoma were included (n = 6911). Data were obtained from the population-based Regional Cancer Registry of the Comprehensive Cancer Centre Limburg. Age-specific differences in diagnostics and treatment were analysed using chi-square analysis (age categories: 50–59, 60–69, 70+). Logistic regression analyses were used to examine the extent to which age increased the chance of not being treated or of receiving less intensive treatment, while controlling for the stage of the disease and the sex of the patient.

Results: For all malignancies the stage was unknown in a larger proportion of the patients aged 70 years and older than in the younger patient groups. Compared to their younger counterparts, the diagnosis of elderly breast, colorectal and lung cancer patients was more often based solely on clinical grounds. In the total study population, 16% were not treated. Per age category 50–59 years, 60–69 years and 70+ these percentages were 7%, 12% and 22%, respectively, (P-trend = 0.001). For all malignancies the chance of not receiving treatment increased with increasing age. However, the size and nature of the differences varied with the localisation of the tumour. The proportion of untreated patients was particularly high in the patients with lung cancer and metastatic colorectal and ovarian cancer, and there was an increase with increasing age (P-trend = 0.001). The vast majority of patients with NHL, breast, head and neck and non-metastatic colorectal cancer received treatment, 90%, 94%, 91%, and 99%, respectively. However, elderly patients less often received a combination of treatment modalities.

Conclusions: The diagnostics and choice of treatment for several common types of cancer were dependent on age. This study could not take into account the major problem of comorbidity which can be a reason to choose for lesser therapy in the elderly. More research is necessary to determine which factors determine the diagnostics and choice of treatment and whether these factors differ between young and elderly patients.

Key words: cancer, elderly, patterns of care

Introduction

Steady increases in the survival length of cancer patients and of life expectancy as such in the Netherlands are expected to lead to an increase in the prevalence of cancer. At present, over 45% of incident cancer patients in the Netherlands are older than 70 years at diagnosis [1]. Very little knowledge is available on the course of disease in the elderly, or more importantly, on specific treatment policies for elderly cancer patients. Knowledge about treatment methods is mainly based on experience with patients younger than 70 years. Clinical trials often apply the same age limit [2, 3]. In the few studies that included elderly patients, they were selected on the grounds of not having any comorbid conditions.

Existing literature gives the impression that a greater proportion of elderly patients are not treated or receive less intensive treatment (e.g., in terms of monotherapy *versus* combination therapy) than younger patients [4–11]. In addition, there is hesitance about administering chemotherapy to elderly patients and, not infrequently, a potentially curative operation is not performed because the risk is assumed to be too high [12–15]. It is not the elderly patients themselves who choose less intensive treatment, although for them toxicity and quality of life do weigh more heavily [16]. A survey by telephone revealed that treating physicians were less in-

clined to offer alternative treatment modalities to elderly patients [17].

We performed a study on the differences in diagnostics and treatment between young and elderly cancer patients in the Middle and Southern part of the province of Limburg. The study group comprised patients with several common forms of cancer: breast, colorectal, lung, ovarian, head and neck cancer and non-Hodgkin lymphoma. Besides the high incidence of these common tumours, variation in treatment modalities was a basis for selection.

Patients and methods

Data collection

Data on incident cancer cases and data on diagnostic procedures and treatment were obtained from the Regional Cancer Registry Limburg, a department of the Comprehensive Cancer Centre Limburg (IKL). This population-based Cancer Registry covers the regions of Middle and South Limburg with about 850,000 inhabitants and 8 hospitals (for a description of the region and registration procedures see [18]).

Study population

Patients aged 50 years and older who were diagnosed between 1 January 1988 and 31 December 1992 with breast cancer (n = 1637), colorectal cancer (n = 1935), lung cancer (n = 2341), ovarian cancer (n = 255), head and neck cancer (n = 412) or a non-Hodgkin lymphoma (n = 331) were included in the study (total n = 6911). We excluded patients who had had an earlier malignancy and those in whom the diagnosis had not been made until autopsy.

Definitions and operationalisation

Age

The patients were divided into three age categories: 50–59 years, 60–69 years and 70 years and older.

Tumour stage

In the IKL-registry tumour stage is registered according to the TNM classification system, the Ann Arbor staging system for lymphomas and the FIGO classification system for gynaecological tumours [19]. Tumour stage referred to the extent of the disease at the time of making the definitive decision about the treatment policy. For the current study, the simplified staging system was used: stage 1, 2, 3, or 4 and stage unknown. For the analysis of treatment by age, various stages were grouped together on the basis of similarities in general treatment modalities (see Table 1).

Grade of malignancy

Owing to the fact that in non-Hodgkin lymphoma more than in any other malignancy, classification according to malignancy grade plays a major role in determining the choice of treatment and the prognosis [20], this factor was also included in the analysis.

Diagnostics

The extent of the diagnostic work-up was derived from the basis for diagnosis and from the degree of certainty about the TNM classification (certainty factor). The basis for making the diagnosis was clinical (anamnesis and physical examination), cytological or histological; the latter was considered to be the most valid. The certainty factor is a measure of the extent and reliability of the examination procedures used for staging [19]. If there were insufficient data on the tumour (T), regional lymph nodes (N) or distant metastases (M) in the medical file, that part of the TNM was coded C0. The certainty factor was recorded as C1 when data were available from standard examination procedures (anamnesis, X-ray photographs), C2 when data were available from more advanced examination procedures and C3 if surgical exploration had taken place. Per type of cancer (except for non-Hodgkin lymphomas because no C factor was recorded for them) we determined the proportion of patients per age category in whom the stage could be determined but for whom one or more parts of the TNM had a certainty factor of 0 (C0).

Treatment

Treatment concerned the primary treatment received by the patient in the first three months after diagnosis, in terms of: surgery, radiotherapy, chemotherapy, endocrine treatment, other therapy, all possible combinations of these, and no treatment. Treatment policies for patients with lung cancer were analysed separately for small-cell lung cancer and non-small-cell lung cancer patients. Because the distinction between small-cell and non-small-cell lung cancer is based on the microscopically-confirmed morphology of the tumour, the basis for diagnosis was not analysed separately in order to avoid the risk of selection bias.

An overview of regular treatment policies for the various malignancies in the IKL-region was made by two clinical consultants from the Comprehensive Cancer Centre Limburg (HS, JJ), an internist-oncologist and a radiotherapist-oncologist (see Table 1).

Table 1. General treatment per malignancy and stage in Middle and South Limburg.

Malignancy	Stage	Treatment
Colorectal	1, 2, 3	Surgery whether or not in combination with radiotherapy or chemotherapy
	4[a]	Chemotherapy or no treatment
Lung, non-small-cell	1, 2, 3	Surgery or radiotherapy or a combination of the two
	4[a]	No treatment
Lung, small-cell	Limited	Chemotherapy whether or not in combination with surgery or radiotherapy
	Extensive	Chemotherapy
Breast	1, 2, 3	Surgery whether or not in combination with radiotherapy or chemotherapy or endocrine therapy
	4[a]	Chemotherapy or endocrine therapy
Ovary	1, 2, 3	Surgery in combination with chemotherapy
	4[a]	Chemotherapy
Head–neck	1, 2, 3	Surgery or radiotherapy or a combination of the two
	4[a]	Chemotherapy or no treatment
NHL-low grade	1	Radiotherapy
	2, 3, 4	Chemotherapy whether or not in combination with radiotherapy
NHL-intermediate/high-grade	all	Chemotherapy whether or not in combination with radiotherapy

[a] Distant metastases.

Data analysis

For each malignancy we analysed the relationship between age and the extent of the diagnostic work-up, and between age and treatment by using the Pearson Chi-square test and the Mantel–Haenszel chi-square test for trend. As the treatment for cancer depends on the extent of the tumour, for each malignancy we also analysed the relationship between tumour stage and the age category of the patient. With the aid of models based on logistic regression (SAS, procedure LOGIST) we evaluated the extent to which the age at diagnosis of each malignancy influenced the chance of not receiving treatment. These analyses were corrected for the effects of stage and sex.

Results

General

The total study population comprised 6911 patients (3515 men and 3396 women). The percentages of men in the lung cancer group, the head and neck tumour group, the non-Hodgkin lymphoma group and the colorectal tumour group were 91%, 79%, 48% and 49%, respectively.

Diagnosis

The diagnosis was confirmed histologically in 88% of the total patient population. Per age category 50–59 years, 60–69 years and 70+ these percentages were 93%, 90% and 83%, respectively. In the patients with breast, lung and colorectal cancer there was a significant increase in the proportion of patients without histological or cytological confirmation with increasing age, but proportions were very small. For ovarian cancer, 14% of the diagnosis of elderly patients was based on cytological grounds, while this was only 2% in the younger age categories. Also for lung cancer, cytological confirmation of the diagnosis played a fairly major role. In 20% of these patients the diagnosis was confirmed cytologically (see Table 3). In the three age categories 50–59 years, 60–69 years and 70+ years, the diagnosis was confirmed cytologically in 16%, 17% and 24%, respectively (P-trend = 0.001).

Stage

Classification of tumour stage per age category is shown in Tables 2, 3 and 4. For all malignancies, the stage was unknown in a larger proportion of the elderly patients than the younger patients. The difference was statistically significant in all the malignancy groups, except for non-Hodgkin lymphoma and ovarian cancer (the two smallest groups). In the colorectal and lung tumour groups, this was associated with a lower proportion of elderly patients with more advanced stage disease, whereas in the breast and ovarian cancer groups, the proportion of women with stage 4 disease increased with increasing age. Furthermore, a relatively large number of young patients with advanced stage head and neck cancer was found: 41% in the 50–59 year olds *versus* 26% and 24% in the two other age categories. This was also true for colorectal cancer, 25%, 19% and 17%, respectively. When the proportion of unknown stages was added, this difference tended to disappear for the colorectal group but only partially disappeared for the head and neck cancer group.

Sometimes the stage of the disease was based on less extensive staging examinations (certainty factor = 0 for T, N or M). This phenomenon was associated with increasing age, although this was not statistically significant (see Tables 2 and 3).

Malignancy grade

In the elderly patients with non-Hodgkin lymphomas, malignancy grade was unknown in a larger proportion than in the younger patients: 26% in the 70+ age category *versus* 15% and 22% in the younger age categories ($P = 0.014$). Moreover, more of the elderly patients had a high or intermediate malignancy grade than the younger patients (Table 4).

Treatment

In the total study population, 16% were not treated ($n = 1081$). Per age category 50–59 years, 60–69 years and 70+ these percentages were 7%, 12% and 22%, respectively (P-trend = 0.001).

In 12% of the complete study population, the stage of the tumour was unknown; 51% of these patients were not treated. Per age category 50–59 years, 60–69 years and 70+, these percentages were 23%, 45% and 58%, respectively (P-trend = 0.001). A higher age was significantly associated with an unknown stage and no treatment. Although this applied to all malignancies, the percentages differed to some extent per site and varied from 9%, 9% and 16% per age category in the breast cancer group to 38%, 58% and 74% in the patients with non-small-cell lung cancer (see Tables 2, 3 and 4).

In the patients with stage 1, 2 or 3 at diagnosis ($n = 4519$, excluding the non-Hodgkin lymphomas), overall 5% were not treated. Per age category 50–59 years, 60–69 years and 70+, this was 2%, 4% and 8%, respectively (P-trend = 0.001). For stage 1–3 patients there was wide variation in the proportions of untreated patients per malignancy (see Tables 2 and 3). The proportion was particularly high in the patients with lung cancer and there was an increase with increasing age (P-trend = 0.001). Treatment patterns showed that a single treatment modality was applied more often to the elderly patients than to the younger ones; for colorectal cancer this was surgery, for ovarian cancer this was surgery or only chemotherapy, for non-small-cell lung cancer this was radiotherapy and for breast cancer this was surgery or endocrine therapy. In contrast, more of the younger patients received combination therapy, which depended on the localisation. Particularly in the breast cancer group, there were many more different treat-

Table 2. Distribution according to age, stage, diagnostics and treatment for patients of 50 years and older with head and neck, breast, colorectal and ovarian cancer; IKL 1988–1992.

		Head–Neck				Breast				Colorectal				Ovary			
Age		50–59	60–69	70+	Tot.	50–59	60–69	70+	Tot.	50–59	60–69	70+	Tot.	50–59	60–69	70+	Tot.
N		111	163	138	412	488	552	597	1637	293	600	1042	1935	54	90	111	255
Stage																	
1		25%	32%	36%	31%	36%	35%	19%	29%	22%	25%	23%	23%	24%	24%	18%	22%
2		12%	15%	9%	12%	47%	48%	49%	48%	25%	28%	28%	28%	17%	12%	9%	12%
3		9%	16%	10%	12%	10%	9%	14%	11%	25%	23%	22%	22%	46%	39%	40%	41%
4		41%	26%	24%	30%	6%	6%	9%	7%	25%	19%	17%	19%	11%	20%	21%	18%
Unknown		12%	10%	22%	15%	2%	2%	9%	5%	3%	5%	11%	8%	2%	4%	9%	5%
Basis for diagnosis																	
Histology		100%	99%	99%	99%	98%	98%	87%	94%	99%	97%	96%	97%	96%	97%	82%	90%
Cytology		–	1%	1%	1%	1%	1%	10%	5%	–	1%	1%	1%	2%	2%	14%	7%
Staging diagnostics[a]																	
Insufficient		6%	4%	10%	6%	3%	3%	4%	4%	4%	5%	6%	5%	6%	16%	18%	14%
Treatment stage 1–3	N	51	103	75	229	450	507	491	1448	209	454	754	1417	47	68	74	189
No treatment		2%	3%	7%	4%	–	–	1%	0%	2%	1%	1%	1%	2%	7%	13%	8%
Surgery (S)		29%	22%	21%	24%	17%	20%	30%	23%	81%	86%	90%	87%	19%	22%	24%	22%
Radiotherapy (RT)		49%	55%	52%	53%	–	0%	0%	0%	0%	1%	1%	1%	–	–	–	–
Chemotherapy (CT)		–	–	–	–	0%	0%	–	0%	1%	–	–	0%	11%	13%	19%	15%
Endocrine th. (ET)		–	–	–	–	1%	1%	14%	5%	–	–	–	–	–	–	–	–
S + RT		16%	15%	17%	16%	37%	38%	16%	31%	6%	4%	4%	4%	2%	1%	–	1%
S + CT		–	–	–	–	7%	3%	2%	4%	8%	6%	2%	4%	66%	54%	42%	52%
S+ET		–	–	–	–	12%	12%	27%	17%	–	–	0%	0%	–	–	–	–
Other		4%	4%	3%	3%	25%	25%	10%	20%	2%	2%	2%	3%	–	3%	2%	2%
Treatment stage 4	N	46	43	33	122	27	34	51	112	74	115	178	367	6	18	23	47
No treatment		6%	9%	12%	9%	–	3%	12%	6%	8%	17%	30%	22%	–	40%	26%	28%
Surgery (S)		9%	7%	9%	8%	–	–	–	–	40%	48%	54%	50%	17%	6%	9%	8%
Chemotherapy (CT)		4%	–	3%	2%	18%	15%	4%	11%	11%	10%	4%	8%	33%	16%	52%	36%
Radiotherapy (RT)		33%	26%	33%	30%	–	–	2%	1%	1%	–	2%	1%	–	–	–	–
Endocrine th. (ET)		–	–	–	–	26%	35%	59%	44%	–	–	–	–	–	–	–	–
S + RT/ET/CT[b]		39%	51%	36%	43%	33%	23%	12%	20%	35%	20%	6%	16%	50%	38%	13%	28%
Other		9%	7%	7%	8%	23%	27%	11%	18%	5%	5%	4%	3%	–	–	–	–
Treatment stage Unknown	N	14	17	30	61	11	11	55	77	10	31	110	151	1	4	14	19
No treatment		7%	–	13%	8%	9%	9%	16%	14%	30%	42%	61%	55%	100%	25%	50%	47%
Treatment		64%	77%	77%	74%	91%	82%	68%	73%	50%	45%	17%	32%	–	75%	36%	43%
Treatment ?		29%	23%	10%	18%	–	9%	16%	13%	20%	13%	12%	13%	–	–	14%	10%

[a] Thoroughness of staging diagnostics, derived from the certainty factor. These percentages are only valid for the patients with a known stage.

[b] S +RT for head and neck cancer; S + ET for breast cancer; S + CT for ovary and colorectal cancer.

Table 3. Distribution according to age, stage, diagnostics and treatment for patients of 50 years and older with lung cancer; IKL 1988–1992.

		Lung cancer (all)							
Age		50–59	60–69	70+	Total				
N		428	891	1022	2341				
Basis for diagnosis									
Histology		80%	78%	64%	72%				
Cytology		16%	17%	24%	20%				
Staging diagnostics[a]									
Insufficient		6%	8%	9%	8%				
		Non-small-cell lung cancer				Small-cell lung cancer			
Age		50–59	60–69	70+	Total	50–59	60–69	70+	Total
N		302	688	859	1849	126	203	163	492
Stage									
1[b]		22%	21%	18%	20%	37%	41%	35%	38%
2		6%	4%	3%	4%				
3		31%	32%	27%	29%				
4[b]		26%	24%	19%	22%	50%	43%	42%	45%
Occult[c]		4%	1%	1%	2%				
Unknown		11%	18%	32%	23%	13%	16%	23%	17%
Treatment stage 1–3[b]	N	189	395	425	1009	56	98	73	227
No treatment		6%	10%	24%	15%	4%	11%	19%	12%
Surgery (S)		48%	41%	24%	35%	2%	2%	1%	2%
Radiotherapy (RT)		27%	36%	44%	38%	2%	–	1%	1%
Chemotherapy (CT)		4%	1%	0%	1%	80%	74%	73%	75%
S + RT		13%	9%	6%	9%	–	–	–	–
RT + CT		–	1%	1%	0%	7%	10%	5%	8%
Other		2%	1%	2%	1%	7%	3%	1%	2%
Treatment stage 4[b]	N	79	168	162	409	63	87	69	219
No treatment		57%	55%	70%	62%	10%	16%	35%	20%
Chemotherapy (CT)		15%	11%	2%	8%	82%	77%	60%	73%
Radiotherapy (RT)		16%	28%	20%	23%	2%	2%	4%	3%
Other		12%	6%	8%	7%	6%	5%	1%	4%
Treatment stage unknown	N	34	125	272	431	7	18	21	46
No treatment		38%	58%	74%	67%	14%	22%	52%	35%
RT/CT[d]		35%	26%	16%	21%	86%	57%	29%	48%
Other		27%	16%	10%	12%	–	11%	19%	17%

[a] Thoroughness of staging diagnostics, derived from the certainty factor. These percentages are only valid for the patients with a known stage.

[b] The stage of small-cell lung carcinoma is coded according to 'extend of disease'. Limited disease = stage 1, extensive disease = stage 4.

[c] Occult stage: the primary tumour could not be evaluated, or the presence of a tumour was detected through malignant cells in sputum or bronchial rinsing, but was not visible on a chest X-ray or at bronchoscopy (TX, N0, M0). For analysis these patients were classified under stage 1.

[d] Radiotherapy for non-small-cell lung cancer; chemotherapy for small-cell lung cancer.

ment combinations in the younger patients than in the 70+ age category.

In the total group of patients with metastatic cancer (n = 1126 excluding the non-Hodgkin lymphomas), 36% were not treated. Per age category 50–59 years, 60–69 years and 70+, this was 20%, 30% and 40%, respectively (P-trend = 0.001). About 38% of the patients with a metastatic non-small cell lung tumour were treated, mainly with radiotherapy (23%). This differed substantially from the percentage with a small cell tumour: 80% received treatment, mainly chemotherapy (73%). For the patients with stage 4 ovarian cancer it was found that a remarkable high proportion of patients received chemotherapy (64%), from which 28% in combination with surgery. The younger patients were given more often a combination of surgery and chemotherapy than the elderly (see Table 2). The vast majority (94%) of patients with metastatic breast cancer received treatment, which usually comprised endocrine therapy (44%) or a combination of surgery and endocrine therapy (20%); however, more of the elderly women only received endocrine therapy than the younger ones. Nearly all of the patients with metastatic head and neck cancer were treated (91%). They received surgery and radiotherapy (43%) or only radiotherapy (30%); this also applied to the elderly patients. Furthermore, it was found that in the patients with a metastatic colorectal tumour, more of the women aged

Table 4. Distribution according to age, stage, diagnostics and treatment for patients of 50 years and older with a non-Hodgkin lymphoma. IKL, 1988–1992.

		Non-Hodgkin lymphoma			
Age		50–59	60–69	70+	Total
N		74	105	152	331
Basis for diagnosis					
Histology		97%	94%	94%	95%
Cytology		3%	6%	6%	5%
Stage (Ann Arbor)					
1		28%	36%	26%	30%
2		24%	17%	17%	18%
3		11%	15%	18%	16%
4		24%	25%	22%	24%
Unknown		12%	7%	16%	12%
Malignancy grade					
Low		27%	15%	10%	15%
Intermediate		57%	60%	59%	59%
High		1%	3%	5%	4%
Not classified		15%	22%	26%	22%
Treatment stage 1	N	21	38	40	99
No treatment		–	–	13%	5%
Surgery (S)		14%	24%	22%	21%
Radiotherapy (RT)		5%	13%	35%	20%
Chemotherapy (CT)		19%	29%	12%	20%
S + RT		9%	16%	2%	9%
S + CT		14%	8%	7%	9%
RT + CT		24%	8%	5%	10%
Other		15%	2%	4%	6%
Treatment stage 2–4	N	44	60	87	191
No treatment		4%	7%	16%	10%
Chemotherapy (CT)		77%	75%	57%	67%
CT + RT		4%	5%	8%	6%
Other		15%	13%	19%	17%
Treatment stage unknown	N	9	7	25	41
No treatment		–	14%	28%	19%
Treatment		22%	29%	36%	32%
Treatment ?		78%	57%	36%	49%

70+ years did not receive treatment than the men within this age category, 40% and 21%, respectively. Otherwise no sex differences were found.

The elderly patients with a non-Hodgkin lymphoma stage I received radiotherapy (35%), surgery (22%) or chemotherapy (12%), while the younger patients received more often a combination of these treatments (see Table 4).

The majority of patients with a non-Hodgkin lymphoma stage 2, 3 or 4 received chemotherapy, but the percentage decreased with increasing age. In the three age categories 50–59 years, 60–69 years and 70+, the percentages were 77%, 75% and 57%, respectively ($P = 0.023$). When the malignancy grade was also included in the analysis (data not shown), we found that only 10% of the patients with low grade disease, stage 1 ($n = 11$), received radiotherapy alone, whereas this percentage was 45% in the patients with intermediate or high grade disease. In the patients with low grade disease, stage 2, 3 or 4, 50% received chemotherapy and 18% were not treated, whereas 74% of the patients with intermediate or high grade disease, stage 2, 3 or 4 received chemotherapy and 7% were not treated. The majority of patients who were not treated were 70 years of age or older.

The logistic regression analyses showed that, corrected for stage and sex, the chance of not receiving treatment increased with increasing age (see Table 5). In the colorectal cancer group, the effect of higher age depended on the tumour stage and the sex of the patient (see Table 6). The effect of age on the chance of not being treated was greater for women of 70 years and older than for men. Owing to the fact that nearly all of the breast cancer patients were treated, we investigated the effect of age on the chance of receiving one

Table 5. Odds ratios and 95% confidence intervals for no treatment according to age, adjusted for stage and sex. Various sites, age: 50 years and older. IKL, 1988–1992.

Site	Age	Treatment		Odds ratio 95% CI[b]
		No	Yes	
Head-neck	50–59	5	106	1[b]
	60–69	7	156	1.0 (0.3–3.4)
	70+	13	125	2.7 (0.9–7.9)
Lung, small cell	50–59	9	117	1[b]
	60–69	29	174	2.2 (0.9–4.8)
	70+	49	114	5.5 (2.6–11.9)
Lung, non-small cell	50–59	70	232	1[b]
	60–69	206	482	1.4 (1.0–2.0)
	70+	418	441	3.2 (2.2–4.5)
Ovary	50–59	2	52	1[b]
	60–69	13	77	3.7 (0.8–17.5)
	70+	23	88	4.7 (1.1–21.4)
Non-Hodgkin lymphoma	50–59	2	72	1[b]
	60–69	5	100	1.8 (0.3–9.5)
	70+	26	126	7.4 (1.7–32.2)

[a] 95% confidence interval.
[b] Reference category.

Table 6. Odds ratios and 95% confidence intervals for no treatment according to age; patients with colorectal cancer aged 50 years and older. IKL 1988–1992.

	Colorectal			
	Sex	Treatment		Odds ratio 95% CI[b]
		No	Yes	
Age				
50–59		13	280	1[c]
60–69[a]		39	561	1.6 (0.8–3.3)
Age + stage[d]				
70+ stage 1–3	Men	2	346	0.8 (0.3–2.5)
	Women	7	399	1.4 (0.5–4.1)
70+ stage 4	Men	19	71	2.8 (1.2–6.3)
	Women	35	53	4.8 (1.7–10.7)
70+ stage unknown	Men	30	23	2.7 (1.0–7.0)
	Women	37	20	4.6 (1.7–12.6)

[a] Adjusted for stage and sex.
[b] 95% confidence interval.
[c] Reference category.
[d] The effect of age 70+ was different for men and women and depended on stage. Therefore, the odds ratios are presented separately.

treatment modality *versus* a combination of two or more modalities. The results showed that a higher age at diagnosis increased the chance of only receiving one type of treatment (see Table 7).

Table 7. Odds ratios and 95% confidence intervals for one treatment modality *versus* two or more treatment modalities according to age; breast cancer, age 50 years and older. IKL 1988–1992.

Site	Age	Treatment		Odds ratio 95% CI[a]
		One	>One	
Breast	50–59	101	387	1[b]
	60–69	133	419	1.3 (0.9–1.6)
	70+	277	320	3.4 (2.6–4.5)

[a] 95% confidence interval.
[b] Reference category.

Discussion

Age-specific differences in the diagnostics and treatment of patients with various forms of cancer, diagnosed in the period 1988–1992, were investigated. Data on incident cancer cases and data on diagnostic procedures and treatment were obtained from the population-based Regional Cancer Registry Limburg. Several findings indicated that elderly patients had undergone a less extensive diagnostic work-up: a larger proportion of unknown tumour stage among the elderly, a higher proportion of patients without a histologically or cytologically confirmed diagnosis, and a higher proportion of patients in whom the stage was based on less accurate diagnostic procedures (certainty factor). Furthermore, it could be concluded that a higher age increased the chance of not being treated or of receiving less intensive treatment.

The extent of the diagnostic work-up was derived from the basis for diagnosis and from the degree of certainty about the TNM classification (certainty factor). Our classification according to the certainty factor was rather rigorous and may have caused some misclassification. For example, a lung tumour which had a C0 for M, but C2 for T and C2 for N, which can be enough information to make the decision not to operate, was valued in this study as being insufficient diagnostic work-up. Also a rather high proportion of the certainty factor was missing for one or more parts of the TNM. Nevertheless, an association was found between the diagnostic work-up according to the certainty factor and age, suggesting a less extensive work-up at higher age.

The degree to which diagnostics and treatments differed and the nature of these differences depended on the localisation of the tumour. For head and neck cancer, for example, there were hardly any age-specific differences in the treatment modalities applied. It is possible that the heterogeneity within this group of tumours obscured any differences.

Lung cancer on the contrary, revealed large age-specific differences in the diagnostic work-up and treatment methods. This was probably related with the fact that lung cancer still has a very poor prognosis. For example with non-metastatic non-small-cell lung cancer, older age decreased the likelihood of receiving surgery: 61% of the patients in the age category 50–59 years were operated on, while this was 50% in the 60–69 year olds and only 30% in those of 70+ years. A reluctancy to operate on elderly patients was described earlier by Smith et al. [21] for locoregional NSCLC. They studied differences in treatment patterns of lung cancer with data from incident cases from the Virginia Cancer Registry, 1985–1989. In their study comorbidity did not appear to have influence. However, over the past few years, various authors have argued in favour of considering tumour resection in elderly patients with a non-small cell lung carcinoma [15, 22].

For breast and ovarian cancer, the total of stage 4 and stage unknown is much higher in elderly patients, which may indicate patient delay. A high percentage of elderly patients with advanced stage disease is in agreement with some studies [6, 23, 24] but not with other [25, 26]. Especially for breast cancer the literature on the age–stage relationship is inconsistent [27].

Since the end of the 1980s, it was recommended not to treat elderly breast cancer patients with endocrine therapy alone (usually Tamoxifen) [6, 28–30]. This policy was also recommended in our region and we found that a considerable proportion of the elderly patients received a combination of surgery and endocrine therapy: 27% for stage 1–3 patients and 12% for stage 4 patients. However, 14% of the elderly patients with breast cancer stage 1–3 and 59% of the elderly patients with advanced stage disease received endocrine therapy alone.

In the elderly patients with a metastatic colorectal tumour ($n = 178$), more elderly women than elderly men did not receive treatment, 40% and 21%, respectively, which is in agreement of earlier findings [8]. However, within this wide age category the average age of the women was higher than that of the men. Probably there was also more comorbid disease among the elderly women.

One of the factors that is of great importance for the prognosis of a patient with a non-Hodgkin lymphoma is the malignancy grade. In this study we found that 22% of the NHL patients could not be classified. Partly this was due to the fact that the diagnosis was based upon cytology only. Also, there is no classification according to the Working Formulation for a group of lymphomas which comprise 5% of the total of lymphomas (e.g., T-cell lymphoma). However, these two phenomena do not completely explain the high proportion of unclassified lymphomas, which may be partially due to a registration artefact. Furthermore, we had to be cautious with our analyses on this patient group, because stratifying the patients according to stage, malignancy grade and age sometimes produced very

small numbers and consequently, dubious conclusions.

One of the advantages of using population-based data from a cancer registry is that bias on the basis of referral policies is excluded. If for example, patients are recruited for a study via a hospital registry, there is a risk that this will be a selected group. However, a cancer registry does not have at its disposal data on, e.g., the dose of cytotoxic drugs administered, the number of treatment cycles, possible complications during treatment and whether the treatment was stopped prematurely. These are all factors that may be subject to age-specific differences that were not addressed in this study.

Also we did not have any information about comorbidity in our population of cancer patients, or about their functional and cognitive status, social circumstances and education level. These factors may have helped to explain why a patient had a less intensive diagnostic work-up or a less intensive treatment. Advanced stage disease with the associated series of diagnostic tests may be considered to be too much of a burden by a patient with poor physical or mental health, or by the family or the treating physician. In addition, if the treating physician feels defeatism or has misgivings about the efficacy of the treatment, this may lead to a less intensive policy. In the literature available on this subject, there is no consensus about the role that these factors play in the choice of treatment. In some studies, the age effect on the choice of treatment remained intact after correction for comorbidity [4, 8], while in others the effect disappeared [14]. Within the group of elderly patients in the USA, associations have been found between no treatment and civil status, socio-economic status, transport facilities and the distance between home and the treatment centre [8, 30].

In this study we confirmed the existence of age-specific differences in the diagnostics and treatment of cancer patients. However, we are just as much in the dark about the decision-making process about diagnostics and therapy in the elderly, as we are about the consequences of the age-specific differences observed, e.g., consequences for the patient in terms of survival and quality of life. In a group of breast cancer patients, Bergman et al. [6] found a difference in treatment between the younger and elderly patients, but not in survival. Gloeckler Ries [7] on the contrary concluded that for ovarian cancer, there were differences between treatment and survival: the younger patients had relatively higher survival chances than the older patients.

If the decision not to treat a patient is based on disease progression and on misgivings about treatment efficacy [14], then why is it that so many younger patients with more advanced stage cancer do receive treatment, while the older ones do not? Maybe we are under-treating the older patients, or over-treating the younger ones? More research is necessary to provide answers to these questions.

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