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Care and Costs for Advanced Cervical Cancer

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The types, amounts and costs of hospital and home care in patients who died from cervical cancer are investigated, using both national data sources and hospital files. Our goal has been assessment of the savings on treatment and care of advanced cervical cancer resulting from cervical cancer screening. Hospital costs account for 70% of the total cost per patient of Dfl 29 200. The amount of hospital care decreases significantly with increasing age. The average number of days of hospitalisation per patient with advanced disease decreases from 62 days below age 50 to less than 10 days at age 70 and older. In-hospital medical procedures, home care and nursing home care account for 24, 22 and 8% of the costs, respectively. Mass screening programmes for cervical cancer will result in a reduction in both advanced disease and mortality. The potential savings compensate approximately 10% of the costs of screening.
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INTRODUCTION

KNOWLEDGE OF the total amount of care and related medical costs in patients with advanced cancer is significant both in itself and for studies on the cost-effectiveness of cancer prevention. Our goal has been assessment of the savings on treatment and care of advanced cervical cancer resulting from cervical cancer screening. In an earlier study on the costs and savings of cervical cancer screening [1, 2], we roughly estimated the costs of treating advanced disease. This topic now has been dealt with in a more detailed way, accounting for hospitalisation days, diagnostic and (palliative) treatment procedures and home care.

MATERIALS AND METHODS

The relevant episode of care starts at the first diagnosis of recurrence or metastasis after primary therapy and always ends with death. If women receive no primary curative treatment, because of poor prognosis at the time of primary diagnosis, the episode studied starts with primary diagnosis. From here on, we will use the term 'advanced cervical cancer' for all cases.

In-hospital care

We analysed national data on the number of admissions and length of stay in Dutch hospitals for patients with advanced cervical cancer during the years 1987–1988 [3] (see Table 1 for details).

For additional information, especially on number and type of medical procedures, a file study was performed in the Dr Daniel den Hoed Clinic in Rotterdam, which is one of the two cancer centres in The Netherlands with an associated radiotherapy centre. From the medical registration, the files of 40 women who died from cervical carcinoma during the period 1 June 1987 to 31 December 1988 were collected. This registration also includes outpatients never admitted. 5 cases have been excluded from further analysis because of incomplete information on stays in other hospitals. In the remaining 35 cases, primary therapy had been radical hysterectomy (8 women) or radiotherapy (22 women), or no primary curative therapy had been applied because of advanced disease with poor prognosis (5 women).

For the major cost categories, we used estimates of the actual resource costs. This is the case for nursing costs per hospital day (excluding costs of medical procedures) [4], and for radiotherapy. The costs of radiotherapy are based on a special study on the costs of radiotherapy in breast cancer [5], but taking differences between breast cancer and cervical cancer treatment into account. The costs of the other medical procedures were approximated by the tariffs charged.

Nursing home care

The average length of stay in nursing homes has been estimated from national data concerning nursing homes admissions [6], covering 80% of all Dutch nursing homes (1986–1988). The data studied concerned a selection of women dying in a nursing home and having neoplasm of the female urogenital tract (NFUGT) and metastasis registered as first two diagnoses (in any order).

Home care

Patients who stay at home can receive informal and professional care. Informal care is defined as care provided by relatives, neighbours, friends and volunteers. Professional care in The Netherlands is mainly provided by district nurses, home helps, general practitioners and private nurses.

The available data enabled us to discern two successive phases to assess the total amount of home care provided: a low-care phase and a terminal phase in which the level of care increases rapidly. To estimate the total amount and cost of care in the two phases, information is required concerning the length of the phase, the proportion of patients receiving different types of home care, the intensity of care, and the costs per unit of care.

Low-care phase. Information about the amount of care during the low-care phase has been based on data collected in 1986, 1987 and 1988 by the National District Nursing Association [7]. The data are based on a 4% sample of the Dutch population, which is representative with respect to age and sex composition. From this registry, we selected data on patients with cancer of the female genital tract as main diagnosis. To estimate only the

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Table 1. Hospital days for invasive cervical cancer

Year	Hospital days: Invasive cervical cancer (a)*	Hospital days: Advanced cervical cancer (b)=(a)–(i)	Advanced cervical cancer, per death (c)=(b)/(d)	Deaths from cervical cancer (absolute no.) (d)
1987	17654	7392	24.6	301
1988	19531	8496	25.4	334

Year	Hospital days: Primary diagnosis and surgical treatment (e)†	Primary (brachy-) radiotherapy (f)‡	Complications of primary treatment (g)§	Treatment in survivors of recurrent cervical cancer (h)‖	Total (i)=(e)+(f)+(g)+(h)
1987	6615	3217	245	185	10262
1988	8033	2560	242	201	11035

*The total no. of hospital days from admissions with a main diagnosis of invasive cervical cancer (ICD-9 code 180) or metastasis (ICD-9 codes 160 to 179) and invasive cervical cancer as second diagnosis [3].

†The no. of hospital days for primary diagnosis and surgical treatment of cervical cancer, assessed by summing the hospital days from admissions with invasive cervical carcinoma (ICD-9 code 180) as the main diagnosis and one of the possible surgical diagnostic or primary treatment procedures (including cervical or uteral biopsies, curettages, exconisations and hysterectomies) as one of the operations coded [3].

‡The no. of hospital days (*BrDays*) for primary (brachy)radiotherapy (megavolt radiotherapy is given in an outpatient setting) is calculated using the formula: $BrDays = (700\text{-}Hys) \times 1.6 \times 5$, in which 700 is the estimated yearly frequency of invasive cancer, *Hys* is the yearly number of hysterectomies performed for invasive cervical cancer [3], 1.6 is the average no. of brachytherapy sessions for a woman who is receiving primary radiotherapy, 5 is the estimated no. of hospital days per session of brachytherapy [3].

§The no. of hospital days for complications after primary therapy, $(Hys \times 0.03 \times 10) + [(700\text{-}Hys)(0.04 \times 9)]$, in which 700 is the estimated yearly incidence of invasive cancer, *Hys* is the yearly no. of hysterectomies performed for invasive cervical cancer [3], 0.03 and 10 are the risk of a complication and the no. of hospital days for a complication requiring a supplementary hospital admission after radical hysterectomy [20], 0.04 and 9 days are the risk of a complication and no. of hospital days for a complication requiring a supplementary hospital admission after primary radiotherapy [20].

‖The no. of hospital days for treatment of recurrent invasive cervical cancer in women that survive is: *deaths* × 5% × 12 days, in which *deaths* = no. of deaths from cervical cancer, 5% is the estimated cure rate in women with advanced disease [20], 12 is the estimated no. of hospital days per admission for curative treatment of recurrence [20].

care for patients in the low-care phase, we excluded the patients recorded as terminal patients by district nurses.

National data about home help only provides information about the average level of care by age group [8]. Diagnosis-specific information on home help was available from one organisation [9].

Costs per hour of care were calculated using average wages per type of health care worker, derived from financial reports of the Intensive Homecare Project (IHP) [10] and from the national associations of district nursing, home help and general practitioners [7, 8, 11, 12]. These financial reports also provided the material costs.

Terminal phase. The IHP, whose services have been called 'intensive home care', in operation in an experimental setting since 1987 in three regions in The Netherlands, provided data concerning intensive home care [13, 14]. This project concerns mainly cancer patients who die within a relatively short period and who would need hospital or nursing home care in the absence of this project. This type of care is available for 24 h per day. The amount of care, delivered by district nurses, home helps, general practitioners, private nurses, and informal help was registered daily. We used data from 1988 about care for all 32 patients with cancer of the female genital organs (cervical cancer was not classified separately).

Next to this a significant part of the terminal patients receive 'regular home care', which is restricted to a maximum of 2.5 h of district nursing and 8 h of home help per day. Data on this group of patients were obtained from 2 sources: a study of district nursing care in Amsterdam and data about the level of care for patients in the last week before entering the IHP [10].

RESULTS

In-hospital care

National data on the number of days of hospitalisation for the years 1987–1988 are presented in Table 1. The average number of days of hospitalisation for advanced cervical cancer estimated for the years 1987 and 1988 is 25 [see column (c)]. Average age at death for the 35 women in the file study was 53 years. This is lower than the average age at death from cervical cancer on a national level: 65.3 years in 1987 and 66.1 years in 1988 [15]. Of the 35 patients, 15 (43%) died at home, which is not significantly different from the percentage (50%) reported from Dutch national data on cervical cancer deaths [16]. The average duration of the episode of advanced disease was 11 months.

The hospital data from the 35 cases in the file study are

*Table 2. Medical record study of advanced cervical cancer**

Procedure	Mean no. per women	Costs per procedure (Dfl)	Costs per patient (Dfl)	% of total costs
Outpatient visits	13.1	17	225	2.2
Radiotherapy†	0.5	5100	2625	26.1
Surgery‡	0.7	2080	1486	14.8
Chemotherapy cures	1.8	1075	1935	19.2
Computed tomography	1.9	435	821	8.2
X-rays (IVP exluded)§	4.8	57	272	2.2
IVP	0.7	110	66	0.7
Echoscopies	1.2	141	165	1.6
ECG	0.9	45	41	0.4
Other diagnostics	0.9	325	279	2.8
Intercollegial consultations	1.3	66	83	0.8
Diagnostic punctions	1.3	199	251	2.5
Biopsies	1.2	95	117	1.2
Exam under narcosis	0.7	380	250	2.5
Laboratory	53.0	27	1456	14.5
Total			10070	100.0
Hospital days	43.4			
Of which in intensive care	0.5			

*Outpatient visits, diagnostic and treatment procedures, and hospital days in 35 women who died from cervical cancer (Daniel den Hoed Clinic).

†Referring to a whole course of treatment; 18 out of the 35 women had radiotherapy.

‡Including the urinary tract (13), the digestive tract (7), laparotomies (2), radical hysterectomy (1), brain surgery (1) and cordotomy (1).

§65% of the thorax, 18% of the abdomen, pelvis and lumbar spinal column.

presented in Table 2. The average number of hospital admissions per patient was 4.2 and the average length of stay was 10.3 days. Chemotherapy cycles required relatively short admissions of 2–5 days. On average, the length of stay in hospital was 43 days per woman. This number decreases markedly with increasing age (Fig. 1). Below age 50, the average number of days is 62, but the 7 women older than 70 years had a mean total duration of stay of only 8 days. This age trend should be kept in mind in comparing the hospital data to national data, since the women in the file study were relatively young. Standardisation of the mean duration of stay on the age distribution of cervical cancer deaths in The Netherlands results in a much lower estimate of 29 days for the average duration of stay in hospital (and an extra 0.3 days in intensive care), which is in reasonable agreement with the study on national admission data, although it is slightly higher (29 vs. 25 days).

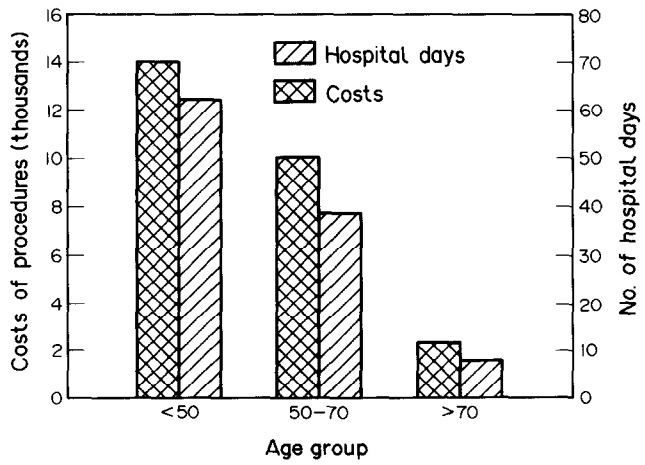

Fig. 1. Average no. of hospital days and average costs (Dfl) of in-hospital medical procedures per patient in different age groups.

For each patient in the file study, the total costs of all in-hospital medical procedures (excluding the costs of hospitalisation) have been calculated (Table 2). The average costs are Dfl 10070 per patient. The main constituents are costs of radiotherapy (26%), chemotherapy (19%), surgery (15%) and laboratory costs (15%).

In the costs of hospital procedures, again, a marked age trend was found, very similar to the trend in number of days of hospitalisation (Fig. 1). For women who died before age 50, the average costs amount to Dfl 14000, but for women over age 70 the costs are only Dfl 2300. Standardisation for the age distribution of all cervical cancer deaths in The Netherlands results in an estimated average of Dfl 7100. After primary treatment, 4 out of the 35 women received only radiotherapy, 4 only surgery, 1 only chemotherapy, 4 radiotherapy and chemotherapy, 6 radiotherapy and surgery, 2 chemotherapy, 4 all three treatment modalities and 10 none of them. For the group of 25 women who had radiotherapy, surgery and/or chemotherapy, the average costs of in-hospital procedures were Dfl 13700 and the average number of hospital days is 39. Radiotherapy, surgery and chemotherapy then account for 27, 15 and 20% of these costs, respectively.

The total in-hospital cost for advanced cervical cancer is based on the sum of the age-standardised costs of procedures (Dfl 7100) and the costs of hospitalisation. Assuming 27 hospital days (an intermediate between the 2 described estimates), a cost per hospital day of Dfl 470 for normal care (medical procedures excluded) and Dfl 1880 for intensive care [4], the costs for hospitalisation amount to Dfl 13250 per patient (Table 3).

Nursing home care

The average length of stay in a nursing home for the 95 women who died from advanced cancer of the urogenital tract

Table 3. Estimated costs of diagnosis and treatment of advanced cervical cancer

	Costs per patient (Dfl)	% of total costs
In-hospital care	20350	70
Hospital days	12690	43
Intensive care	560	2
In-hospital procedures	7100	24
Nursing home care	2400	8
Home care	6440	22
Total care	29200	100

during the period 1986–1989 was 230 days. 61% of these women came from hospitals. From the data on hospital admissions, it appears that each year between 4 and 16 women with advanced cervical cancer enter a nursing home after leaving the hospital. On the basis of these figures we assumed that 5% of the approximately 300 women who die from cervical cancer in a year in The Netherlands are admitted to a nursing home because of advanced disease for an average 230 days per patient.

Accounting for the costs per nursing home day (Dfl 200), these estimates mount up to the average costs of nursing home care of Dfl 2400 per patient with advanced cervical cancer. This is 8% of the total costs of care for these patients (Table 3).

Home care

The estimates concerning the four relevant variables (phase length, participation in different types of home care, intensity of care, and costs per hour) are presented in Table 4.

Phase length. The 32 women with metastases of the female genital tract in the IHP received on average 3 weeks of intensive home care, which we accepted as the length of the terminal phase. The average duration of the low-care phase should therefore be 10 months: the total period of advanced disease according to the hospital patient files (11 months), minus the terminal 3 weeks.

Participation. In the data from the regions covered by the IHP, we found that 27% of the terminal patients received intensive home care. We extrapolated this percentage to all women dying from cervical cancer, as nationwide coverage of intensive home care is to be implemented in the near future. The percentage of women dying at home with regular care (23%) follows as the remainder from the total number of deceased minus the number of patients dying in hospitals and nursing homes (approximately 50%) [16], and at home with intensive terminal care (27%).

Intensity. No data were available with respect to private nursing during the terminal period in patients who did not participate in the IHP. The amount of informal care in these patients has been estimated at 43 h per week, similar to patients receiving intensive home care. In view of the much lower amount of professional care, this may well be an underestimation.

Total costs of home care. Combining the estimates presented in Table 4 results in average costs per patient, shown in Table 5. The average total cost of home care per patient with advanced cervical cancer is Dfl 6440. More than 60% of these costs are incurred by the intensive terminal home care.

Total costs of advanced disease

The total costs of (professional) care for a patient with advanced cervical cancer are Dfl 29000 (Table 3). From the hospital costs, the hospital days account for 45% of the total costs, and in-hospital procedures for 24%, which amounts to Dfl 20350, over two-thirds of the total costs. Professional home care accounts for Dfl 6440 per patient, or 22% of the total costs.

Table 4. Average values for episode length, participation in different types of home care, intensity of care, and costs per hour, for cervical cancer patients with advanced disease

	Low-care episode	Terminal episode	
		Intensive care	Regular care
Episode length	10 months	3 weeks	
Participation			
District nursing	22% each month	27%	23%
Home help	22% each month		
Private nursing	NA		
GP	NA		
Informal care	NA		
Care intensity (h/week)			
District nursing	0.6	29	8
Home help	5	20	10
Private nursing	NA	19	NA
GP	NA	1.5	1
Informal care	NA	43	43
Costs per hour (Dfl)			
District nursing	75	81	86
Home help	36	47	42
Private nursing	61	73	69
GP	110	110	110

NA = No data available.
GP = General practitioner.

*Table 5. Average costs for home care per patient with advanced cervical cancer**

Type of care	Low-care episode	Terminal episode		Total period	Total costs
		Intensive	Regular		
District nursing	500	1910	480	—	2890
Home help	770	760	290	—	1820
GP	NA	130	80	—	210
Private nursing	NA	1120	NA	—	1120
Material costs				400	400
Total	1270	3920	850	400	6440
Informal care (h)	NA	35	30		65

*Costs per type of care and episode in Dutch guilders.
NA = No data available.
GP = General practitioner.

Savings by cervical cancer screening

As stated before, our concern has been to study the costs and effects of cervical cancer screening, which demands an assessment of the savings resulting from deaths avoided. We calculated the impact of these savings on the total costs of screening using our model for cervical cancer [1, 2]. In these calculations we used detailed cost estimates on screening and primary diagnosis and treatment described elsewhere [1, 2], and the cost estimates of care for advanced disease presented in this article. The results are presented in Table 6. In The Netherlands, a hypothetical screening policy in which women are invited seven times between ages 37 and 73, assuming a participation rate of 65%, will cost 325 million guilders in the period 1988–2015. The effectiveness of screening is reflected in a decrease of the costs for care of advanced disease from Dfl 164 (128 + 36) million to 127 (99 + 28) million. The saving of Dfl 37 million represents 10% of the costs of screening plus the incremental costs of diagnostic and treatment procedures for primary disease. The costs per life-year gained are Dfl 21 700.

Sensitivity analyses

The main uncertainty in our analysis of national hospital data on the number of hospital days is the number of admission days per brachytherapy session in primary therapy (see Table 1). Assuming an average stay of 3 days, which is a minimum per session, this would increase the number of hospital days per woman dying from cervical cancer from 25 to 27 days, which would even be closer to the number found in the file study (29 days).

We accepted the (age-corrected) outcomes for the costs of treatment procedures of the cancer clinic as representative for the current and future practice on a national level. However, the role of chemotherapy in advanced cervical cancer is still the subject of randomised trials. We calculated the results in case chemotherapy could be abandoned, accounting for the resulting savings on admission days. The total costs of treatment and care of advanced cervical cancer would then decrease from Dfl 29 200 to Dfl 25 100 (−14%).

The proportion of women receiving district nursing and home help in the low-care phase is very uncertain. Halving the proportion of district nursing results in Dfl 6120 costs of home care, a decline of only 5%. Our estimate of the proportion of women receiving home help was quite conservative. Doubling this proportion, a quite dramatic change, gives the total costs for home care in advanced cervical cancer of Dfl 7060 and only a 2% rise in the total costs.

Appraisal of the informal care would probably have more impact. It is possible by use of shadow prices [17]. However, we think that the bulk of informal care is given in the low-care phase, for which no data are available.

Table 6. Cost-effectiveness of an efficient policy of cervical cancer screening, assuming total costs of advanced disease per woman of Dfl 29 200. 5% discount rate

Costs (million DFL)	Screening policy*	No early detection	Difference in costs
Screening, and diagnostic and treatment procedures for primary disease	556	230	326
Care of advanced disease			
In-hospital care	99	128	−29
Home care	28	36	−8
Total costs	682	393	289
Life-years gained	13 321		
Costs (Dfl) per life-year gained	21 713		

*Screening women 7 times between 37 and 73 (every 6 years) during the period 1988–2015 in The Netherlands, attendance rate 65%.

DISCUSSION

For estimating the amount of in-hospital care one should collect empirical data from different settings: cancer treatment centres, universities and other major hospitals, and smaller local hospitals. This was not possible because only cancer treatment centres systematically follow the vital status and cause of death of all patients. Without such a complete follow-up, selecting patients who died would retrieve mainly patients who died in hospitals. Next to this, in most hospitals outpatients are not recorded in the medical registration. Patients without any hospital admissions would be missed when analysing data from these hospitals.

For the total length of stay in hospitals, by far the most important cost component, we analysed two independent sets of data, one on a national basis, one from a specialised centre. The difference between the results was small (25 vs. 29 hospital days), suggesting that average medical practice in respect to treatment of advanced cervical cancer differs little from the practice in specialised cancer treatment centres. We found a clear association between age and number of hospital days, and also between age and treatment costs. Treatment costs are probably lower at higher age because of the risks and adverse effects of treatment that will often not be counterbalanced by the low chance of remission.

Riley *et al.* [18] compared medical costs in different age groups of elderly patients in the last year of life with cause of death. For all sites they report lower costs for patients with cancer in age group 85+ than in age group 65–74. For patients with cancer of the genital organs the decrease was 40%, from US$ 9126 to US$ 5440. Our data show that this trend starts in younger age groups.

We had to assess the costs of home care for advanced cervical cancer by data on patients with neoplasma of the female genital tract. However, the difference in the amount of intensive home care between different cancer sites is very small [13], therefore this is not a major shortcoming.

We only found one study in which the costs of advanced cervical cancer are assessed from empirical data: an analysis of the Medicare file in the USA [19]. The different cost components are not presented in this study. The total costs of care for the period following primary therapy until death are US$ 17 700, which is higher than in our study (US$ 1 is approximately Dfl 2). The US tariff per hospital-day, however, is approximately twice the Dutch tariff, which could already level off the difference. We could not find any study in which the amount of care in advanced cervical cancer patients is presented explicitly.

In the present study, only the medical costs have been assessed. Advanced cancer, leading to death, also causes a psychological burden and social costs (loss of productivity and costs of informal care). Effective mass screening programmes for cervical cancer will reduce both. On the other hand, cervical cancer screening also affects a larger number of women in a negative way because of false-positive test results and detection of regressive intraepithelial neoplasias.

The costs of hospital and home care in advanced cervical cancer are substantial. Nevertheless, in cervical cancer screening the savings on the treatment of advanced cervical cancer cannot compensate the costs of screening. To answer the question whether cervical cancer screening is expensive, the cost-effectiveness should be compared with that of other medical interventions. Such a comparison shows that the costs per life-year gained are intermediate between breast cancer screening, which is cheaper per life-year gained, and hypertension treatment in men and heart transplantation, which is more expensive [21].

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