

RESEARCH ARTICLE

Direct Costs of Cervical Cancer Management in Morocco

Mohamed Berraho^{1*}, Adil Najdi¹, Simone Mathoulin-Pelissier², Roger Salamon², Chakib Nejjari¹

Abstract

Background: For cervical cancer the epidemiological profile is poorly known in Morocco and no data is available concerning the direct medical costs. The purpose of this work is to estimate the direct cost of medical management of invasive cervical cancer during the first year after diagnosis in Morocco. **Methods:** The estimation of direct costs of medical management of invasive cervical cancer during the first year after diagnosis in Morocco is based on the estimation of individual cost in each stage which covers diagnosis, treatment and follow-up during first year. The cost was estimated per patient and whole cycle-set using the costs for each drug and procedure as indicated by the Moroccan National Agency for Health Insurance. Extrapolation of the results to the whole country was used to calculate the total annual cost of cervical cancer treatments in Morocco. **Results:** Overall approximately 1,978 new cases of cervical cancer occur each year in Morocco. The majority (82.96%) of these cases were diagnosed at a late stage (stage II or more). The cost of one case of cervical cancer depends on stage of diagnosis, the lowest cost is \$382 for stage I followed by the cost of stage IA1 for young women (< 40 years) which is \$2,952. The highest cost is for stage IV, which is \$7,827. The total cost of cervical cancer care for one year after diagnosis is estimated at \$13,589,360. The share allocated to treatment is the most important part of the global care budget with an annual sum of \$13,027,609 whereas other cost components are represented as follows: \$435,694 for annual follow-up activity and \$126,057 for diagnosis and preclinical staging. **Conclusion:** This study provides health decision-makers with a first estimate of costs and the opportunity to achieve the optimal use of available data to estimate the needs of health facilities in Morocco.

Keywords: Neoplasms - health costs - morocco - cervical cancer - prevention - mediterranean area

Asian Pacific J Cancer Prev, 13, 3159-3163

Introduction

Cervical cancer is the second most common cancer among women worldwide (Parkin et al., 2005). It accounted for 529 409 incident cases and 274 883 deaths in the world in 2008 (Ferlay et al., 2010), constituting approximately 8% of the global burden of cancer among women (Ferlay et al., 2010). Although cervical cancer is preventable, it still represents a burden on health resources in developing countries where women are often diagnosed at advanced stages and with incurable disease, and has poor prognosis overall (IARC, 2008). In Morocco, cervical cancer represents the second most common cancer for women after breast cancer (Gueddari, 2001). According to the 2008 GLOBOCAN report (Ferlay et al., 2010), the age-standardized incidence of cervical cancer among women in Morocco was 14.1 new cases/100 000 women / year (1978 new cases/year). The death rate from this cancer was 8.4 per 100 000 (1152 deaths).

The diagnosis of cancer, in Morocco, in general, and particularly in cervical cancer is made at the late stages. According to the FIGO classification, only 17.2% of patients in Morocco were diagnosed in the early stages of

cervical cancer (stage 0-0.5% and I - 16.7%), and 82.8% were presented from intermediate to advanced stages: stage II in 43.7%, stage III in 31.8%, and stage IV only in 6.3% (Lalla Salma Association against Cancer, National Cancer Plan, 2009).

Financing cancer treatment is a major challenge for both developed and developing countries. The occurrence of the disease has a significant negative impact as the treatments are very expensive, quality of life is degraded and the disease leads too often to death. These deaths account for a significant number of potential years of life lost. Cancer also causes a loss of economic income available to the community. This consists of two elements: the cost of care, and production losses due to the impact of illness on employment (National Cancer Institute - France, 2007).

In reality, there are two different approaches to the fight against cancer: firstly, reducing forms of rationing, which limit access to higher quality of care, and secondly, strengthening policies of prevention, screening and research on cancer. This second approach raises questions of resource allocation that should be clarified through economic analysis in studies examining cost of care and

¹Laboratory of Epidemiology, Clinical Research and Community Health, Faculty of Medicine, Fez, Morocco, ²Inserm CIC-EC7, axe cancer. Institut de Santé publique Epidémiologie et Développement (ISPED) *For correspondence: maberraho@yahoo.fr

Table 1. Standards Treatment Methods of Cervical Cancer According to Hassan II University Hospital Practices

| FIGO Stage | Surgery | Chemotherapy (number of courses) | Radiotherapy (Grays) | Brachytherapy |
|------------|------------|-------------------------------------|-------------------------|---------------|
| Cis | Conization | No | No | No |
| IA1 | | | | |
| <40 years | Conization | No | Yes (46) | No |
| >40 years | TH* + PL\$ | No | Yes (46) | HDR£ |
| IA2 | TH* + PL\$ | No | Yes (46) | HDR£ |
| IB1 | TH* + PL\$ | No | Yes (46) | HDR£ |
| IB2 | TH* + PL\$ | Cisplatin (5) | Yes (46) | HDR£ |
| IIA | TH* + PL\$ | Cisplatin (5) | Yes (46) | HDR£ |
| IIB | TCH¥+ PL\$ | Cisplatin (5) | Yes (46) | HDR£ |
| IIIA | No | Cisplatin (5) | Yes (46) | HDR£ |
| IIIB | No | Cisplatin (5) | Yes (46) | HDR£ |
| IV | No | Paclitaxel+Cisplatin (3 to 6) | Yes (30) | HDR£ |

*TH, Total hysterectomy; \$PL, pelvic lymphadenectomy; ¥TCH, Total colpohysterectomy; £HDR, High Dose Rate

cost-effectiveness (National Cancer Institute - France, 2007).

In Morocco, the epidemiological profile of cervical cancer is poorly known due to the absence of a national cancer registry, the rarity of epidemiological studies, as well as the absence of a screening program. To our knowledge, no data is available concerning direct medical costs of cervical cancer in Morocco. The purpose of this work is to estimate the direct cost of medical management of invasive cervical cancer during the first year after diagnosis in Morocco.

Materials and Methods

In order to estimate the cost of medical management of invasive cervical cancer during the first year after diagnosis we need the following data: the number of new cases of cervical cancer per year, the examinations and the complementary procedures indicated for the diagnosis, therapeutic indications by stage of diagnosis, examinations used in monitoring, the stages of diagnosis and the cost per step management (diagnosis, treatment and follow-up).

Estimation of cervical cancer incidence

According to the 2008 GLOBOCAN (IARC, 2008), the world age-standardized incidence of cervical cancer among women in Morocco was 14.1 new cases/100 000 inhabitants/year (1978 new cases/year).

Data on the stages of diagnosis

To estimate the stages of diagnosis, we used data from a recent study conducted as part of preparations for the implementation of the Cancer Plan in Morocco (Lalla Salma Association against Cancer, National Cancer Plan, 2009). This is a retrospective study on the basis of data from hospital records with 900 cases randomly selected, by systematic sampling (Lalla Salma Association against Cancer, National Cancer Plan, 2009). This study has been conducted to provide descriptive epidemiological and pathological characteristics of cervical cancer among patients attending the largest cancer care centres in Morocco (three public and one private).

Actions and therapeutic indications

We divided the management of cervical cancer into three parts: diagnosis, supportive care treatment and follow-up at 1 year after diagnosis. To determine the practices and current therapeutic indications for cervical cancer by stage of diagnosis, we conducted a study in the University Hospital of Fez (Table 1).

Regarding the necessary examinations for diagnosis and 1 year of follow-up after diagnosis we used clinical recommendations of AROME (Association of Radiotherapy and Oncology of the Mediterranean Area) (AROME, 2011). This classification takes into account availability of means and cultural aspects; they were developed for the most common cancer sites in countries around the Mediterranean area.

Cost estimation

The estimation of direct costs of medical management of invasive cervical cancer during the first year after diagnosis in Morocco is based on the estimation of individual cost in each stage which covers diagnosis, treatment and follow-up during first year. The cost was estimated per patient and whole cycle-set using the costs for each drug and procedure as indicated by the Moroccan National Agency for Health Insurance (Agence Nationale de l' Assurance Maladie - Morocco), and is reported in US dollars (\$).

The cost of medical management of invasive cervical cancer during the first year after diagnosis in Morocco will be estimated as follows: in the first steps, we calculated the unit cost of care by stage of diagnosis per year, then we estimated the total cost of care by stage of diagnosis per year and finally we estimate the total cost of care of cervical cancer per year.

1. Estimation of per patient cost of care by stage of diagnosis per year

In this step we calculated the unit cost of care for one patient with cervical cancer in stage (x) for one year.

For example, for one patient with cervical cancer in stage I, the cost will be estimated as follows:

Unit cost of care for stage (I) per year = Unit cost of diagnosis for stage (I) + Unit cost of treatment for stage (I) + Unit cost of 1 year follow-up for stage (I) With: Unit cost of diagnosis for stage (I) = Diagnosis Procedures i * Cost i + ...+ diagnosis procedure j * Cost j Unit cost of treatment for stage (I) = Treatment i * Cost i + ...+ treatment j * Cost j Unit cost of 1 year follow-up for stage (I) = Procedure follow-up i * Cost i + ... + Procedure follow-up j * Cost j The estimation of cost for the other stages is done with the same methodology.

2. Estimation of total cost of care by stage of diagnosis per year

In this step we calculated the total cost of care for patients with of cervical cancer in stage (x) for one year. Total cost of care for stage (x) of diagnosis per year = TCC stage (x) = [Unit cost of diagnosis for stage (x) + Unit cost of treatment for stage (x) + Unit cost of 1 year follow-up for stage (x)] * number of new cases of stage (x) per year

3. Estimation of total cost of care of cervical cancer per year

In this step we calculated the total cost of care of

Table 2. Estimation of Distribution of New Cases of Cervical Cancer by Stage of Diagnosis in Morocco.

Estimation based on the GLOBOCAN data (IARC, 2008) and the results of the study conducted as part of preparations for the implementation of the Cancer Plan in Morocco (Association Lalla Salma de Lutte contre le Cancer; Plan national du cancer, 2009)

| FIGO Stage at diagnosis | New cases per year | Percentage (%) |
|-------------------------|--------------------|----------------|
| Cis | 9 | 0.46 |
| IA1 (≤40years) | 6 | 0.30 |
| IA1 (>40years) | 5 | 0.25 |
| IA2 | 25 | 1.26 |
| IB1 | 201 | 10.16 |
| IB2 | 91 | 4.60 |
| IIA | 194 | 9.81 |
| IIB | 671 | 33.92 |
| IIIA | 91 | 4.60 |
| IIIB | 541 | 27.35 |
| IV | 144 | 7.28 |

Table 3. Cost of 1 Cancer Case by Stage of Diagnosis and Type of Treatment (USD\$)

| Stage of diagnosis | Cost by type of treatment (USD\$) | | | | Total |
|--------------------|-----------------------------------|--------------|--------------|---------|-------|
| | Brachytherapy | Radiotherapy | Chemotherapy | Surgery | |
| Cis | – | – | 98 | 98 | |
| IA1 (≤40years) | – | 2570 | – | 98 | 2,668 |
| IA1 (>40years) | 2813 | 2570 | – | 975 | 6,358 |
| IA2 | 2813 | 2570 | – | 975 | 6,358 |
| IB1 | 2813 | 2570 | – | 975 | 6,358 |
| IB2 | 2813 | 2570 | 242 | 975 | 6,600 |
| IIA | 2813 | 2570 | 242 | 975 | 6,600 |
| IIB | 2813 | 2570 | 242 | 975 | 6,600 |
| IIIA | 3750 | 2570 | 242 | – | 6,562 |
| IIIB | 3750 | 2570 | 242 | – | 6,562 |
| IV | 3750 | 2083 | 1710 | – | 7,543 |

cervical cancer for one year

Total cost of care of cervical cancer per year = TCC stage (cis) + TCC stage (I) + TCC stage (II) + TCC stage (III) + TCC stage (IV)

Results

Estimation of incidence and stage of diagnosis of cervical cancer in Morocco

In table 2, we present the estimated distribution of new cases by stage of diagnosis (IARC, 2008; Lalla Salma Association against Cancer, National Cancer Plan, 2009). The majority (83.0%) of cases are diagnosed at a late stage (stage II or more).

Estimation of cost

Estimation of individual cost by stage of diagnosis and type of treatment: The cost of treatment of cervical cancer depends on stage of diagnosis. Indeed, the lowest cost is \$98 for stage Cis followed by \$2 668 for stage IA1 for young women. The highest cost is that of stage IV, which is \$7 543. From stage IA1 for older women to stage III the cost does not change much. It ranges between \$6 358 and \$6 562 (Table 3).

Depending on the type of treatment, brachytherapy, followed by radiotherapy, represented the largest share of the cost of treatment for cervical cancer (Table 3).

Table 4. Estimation of Annual Management Cost of Cervical Cancer by Stage of Diagnosis in Morocco (in USD\$)

| FIGO Stage | New patients per year | Cost (USD\$) | |
|----------------|-----------------------|--------------|--------------|
| | | One patient | All patients |
| Cis | 9 | 382 | 3,438 |
| IA1 (≤40years) | 6 | 2,952 | 17,712 |
| IA1 (>40years) | 5 | 6,642 | 33,210 |
| IA2 | 25 | 6,642 | 166,050 |
| IB1 | 201 | 6,642 | 1,335,042 |
| IB2 | 91 | 6,883 | 626,353 |
| IIA | 194 | 6,883 | 1,335,302 |
| IIB | 671 | 6,883 | 4,618,493 |
| IIIA | 91 | 6,846 | 622,986 |
| IIIB | 541 | 6,846 | 3,703,686 |
| IV | 144 | 7,827 | 1,127,088 |
| Total | 1978 | – | 13 589 360 |

Estimation of individual management cost of one cancer patient by stage of diagnosis during the first year after diagnosis:

The management cost of one case of cervical cancer depends on the stage of diagnosis. In fact, the lowest cost is \$382 for stage Cis, followed by \$2952 for stage IA1 for young women. The highest cost is that of stage IV, which is \$7 827. For stage IA1 for older women to stage III the cost does not change considerably. It ranges between \$6 642 and \$6 846 (Table 4).

Estimation of annual cost by stage of diagnosis: In table 5, we present the estimation of the annual cost of cervical cancer in Morocco by stage of diagnosis. The annual cost of cervical cancer depends on the stage of diagnosis. The lowest annual cost is \$3438 for stage Cis, followed by \$17 712 for stage IA1 young women. The highest annual cost is that of stage IIB which is \$4 618 493, followed by \$3 703 686 for stage IIIB (Table 5).

Estimation of annual cost of care for cervical cancer per year in Morocco: The total cost of cervical cancer care for one year after diagnosis (direct cost only) in Morocco is estimated at \$13 589 360. The share allocated to treatment is the most important part of the global care budget with an annual sum of \$13 027 609 (95.87%). Other cost components are represented as follows: \$435 694 for annual follow-up activity and \$126 057 for diagnosis and preclinical staging.

Discussion

This is the first study to estimate the annual direct costs of invasive cervical cancer in Morocco. Its results were used to estimate the individual direct costs by FIGO stage and the total direct cost according to the incidence and distribution of cancers by stage of disease.

In the literature, the majority of studies on the cost of cervical cancer only consider screening (Zappa et al., 1998; Holmes et al., 2005). The costs of care for cervical cancer are often approached with overall estimates of the utilized resources (Schaffer et al., 1994) or models based on treatment protocols that may be different from clinical practices (Fahs et al., 1992; Rocconi et al., 2005). Until now, no study to our knowledge has estimated the

cost of care for cervical cancer according to the stage of diagnosis in Morocco.

Our study shows that the direct costs of cervical cancer care for one year in Morocco is estimated at \$13.6 million USD. This is very important in the Moroccan context especially when compared to budgets of the Ministry of Health. For example, in the region of Casablanca with 3 823 000 inhabitants (representing 13% of the Moroccan population), the budget allocated to health care is \$11 026 756 (Ministry of health – Morocco, Santé en chiffre, 2011).

The methodology adopted in our study was used to estimate only the direct use of care. Indeed, some treatments and examinations performed on an outpatient basis and other hospitalizations were not included in our estimation. In addition, this study only collected information regarding care in the first year after diagnosis, which underestimates the cost of overall management of this disease. It is not uncommon that a patient is followed for several years after diagnosis of her cancer. The costs observed after the first year of treatment were estimated in the United Kingdom at 20% of the total cost of care (Arveux et al., 2007), representing an additional cost to that of the first year which was estimated at 25%. The cost rates in the public sector are significantly lower than those in the private sector, which is a growing area in Morocco. Finally, indirect costs were not taken into consideration and consequently the results presented in this study probably underestimate the actual costs of cervical cancer in Morocco.

Our study showed that the average direct cost increases with the severity of the disease. Indeed, the cost ranges from \$382 for stage Cis to \$7 827 for stage IV. This result is consistent with results previously published in Britain and France (El M'rini et al., 1997; Wolstenholme et al., 1998; Arveux et al., 2007).

A British study reported that the average cost for treating pre-invasive tumours was \$672, the cost of invasive cancer in stage I was \$11 780, and that the costs of these two stages were lower than those of stages II to IV (respectively \$19 407, \$18 818 and \$19 629) (Wolstenholme et al., 1998). Similar patterns were observed in a recent study done by a French team which showed that the average cost of care of cervical cancer in the first year after diagnosis increased according to the stage of disease: \$9 234 for stage I, \$22 878 for stage II, \$32 456 for stage III and \$38 446 for stage IV (Arveux P, et al. 2007). In the French district Doubs, in 1995, the cost of management of invasive cervical cancer with limited extension was half as much (\$13 573) as that of invasive cancers with diffuse extension (\$32 052) (El M'rini et al., 1997).

There are certain limitations to our methodology for estimating the cost of cervical cancer. To estimate the distribution of cases of cervical cancer by stage of diagnosis, we used data from a national study conducted in 2008. This study was conducted in four hospitals specializing in cancer care (three public and one private). The three public centres were: the National Institute of Oncology in Rabat, the Oncology Centre of Ibn-Rochd University Hospital in Casablanca and the Sheikh Zaid Hospital in Rabat. Up until 2007, these three centres were

considered to be the only public centres for cancer care in Morocco. The private hospital was "Clinic Alkawtar" in Rabat and until 2007, only three private clinics existed: two in Casablanca and one in Rabat. They treated a very small proportion of cancer cases in Morocco. However, as the study was conducted in the period between 2003 and 2007, we believe that the population of the study can be considered as representative of cases of cervical cancer that access the health system in Morocco.

Data on the treatment of cervical cancer by stage of diagnosis was obtained from a survey conducted at the Fez University Hospital from gynaecologists, oncologists and radiotherapists. We believe that the data from this study represents the in-field management of cervical cancer in Morocco for two main reasons. Firstly, this study was conducted in October 2011 and therefore it is very recent and reflects current practices in the management of cervical cancer at the Fez University Hospital. Secondly, physicians at the University Hospital of Fez were trained in Rabat or Casablanca hospitals and both cities remain to this date the only training centres for oncology and radiotherapy.

The results of our study lead us to recommend the implementation of primary prevention and early diagnosis measures to reduce the economic impact of cervical cancer in Morocco. Two vaccines against different types of human papillomavirus (HPV), types 16 and 18 for the first vaccine, in addition to types 6 and 11 for the second vaccine, showed 100% efficacy in preventing precancerous lesions (CIN2 and 3), carcinoma in situ (CIS), and external genital lesions (Villa et al., 2005; Lehtinen et al., 2012). These vaccines could be included in a primary prevention strategy against cervical cancer in Morocco. The high cost and the late stages of cervical cancer diagnosis in Morocco show that an effective prevention strategy could significantly reduce the socioeconomic burden of invasive cervical cancer in Morocco. To prepare the implementation of this new strategy, a thorough analysis of epidemiological data, medical data and economic assessment will be required for potential clinical benefits of this new preventive strategy.

There is evidence that survival amongst patients with cervical cancer could be significantly improved through screening. Numerous clinical studies have clearly demonstrated an improvement of survival in relation with screening (Mandelblatt et al., 2002; Sanders et al., 2003; Goldie et al., 2006). The 5-year survival of detected and treated cervical cancer is close to 100% for carcinoma in situ while it is 80% for stage I and less than 10% for stage IV cancers (Schaffer et al., 1994; Panorama de la santé, 2007). Since March 2010, the National Plan for the Prevention and Control of Cancer (PNPCC) has been in place in Morocco. Screening and treatment of cervical cancer in Morocco represent the most important priorities for the PNPCC. A screening program for cervical cancer is being introduced as well as other measures aiming for the improvement of opportunities for access to early diagnosis by reducing geographical obstacles, multiplying the number of centres for confirmation of diagnosis, diminishing economic barriers and providing facilities and resources.

In conclusion, the estimated cost of treating cervical cancer during the first year after diagnosis in Morocco shows that the average cost is currently very high at approximately \$13.6 million. There is a need for other medico-economic studies to estimate the benefits of screening for cervical cancer and HPV vaccination in Morocco, taking into account both the number of potential cases of cancer prevented by screening, and the number of patients with improved survival. The evaluation of indirect costs would also be useful.

Acknowledgements

The authors are grateful to McKelvie-Sebileau Pippa for English medical editorial assistance.

References

- AROME (2011). Guidelines, minimal requirements and standard of cancer care around the Mediterranean Area: Report from the Collaborative AROME (Association of Radiotherapy and Oncology of the Mediterranean Area). *Crit Rev Oncol Hematol*, **78**, 1-16.
- Arveux P, Bénard S, Bouée S, et al (2007). Coût de la prise en charge du cancer invasif du col de l'utérus en France. *Bull Cancer*, **94**, 219-24.
- El M'rini T, Arveux P, Gay C, et al (1997). Estimation du coût du traitement du cancer du col. *Rev Épidémiol Santé Publique*, **45**, 508-15.
- Fahs MC, Mandelblatt J, Schechter C, Muller C (1992). Cost effectiveness of cervical cancer screening for the elderly. *Ann Intern Med*, **117**, 520-7.
- Ferlay J, Shin H, Bray F, et al (2010). Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*, **127**, 2893-917.
- Goldie SJ, Kim JJ, Myers E (2006). Chapter 19: Cost-effectiveness of cervical cancer screening. *Vaccine*, **24**, 164-70.
- Gueddari M (2001). Diagnostic précoce des cancers du sein et du col utérin. Ministère de la Santé, direction de l'épidémiologie et de lutte contre les maladies, Rabat 2001.
- Holmes J, Hemmett L, Garfield S (2005). The cost-effectiveness of human papillomavirus screening for cervical cancer. A review of recent modelling studies. *Eur J Health Econ*, **6**, 30-7.
- International Agency for Research on Cancer (IARC) (2008). *World cancer report*.
- Lalla Salma Association against Cancer, (2009). National Cancer Plan, Volume 3: Etude des stades de diagnostic et des résultats de traitement des cancers au Maroc.
- Lehtinen M, Paavonen J, Wheeler CM, et al (2012). Overall efficacy of HPV-16/18 AS04-adjuvanted vaccine against grade 3 or greater cervical intraepithelial neoplasia: 4-year end-of-study analysis of the randomised, double-blind PATRICIA trial. *Lancet Oncol*, **13**, 89-99.
- Mandelblatt JS, Lawrence WF, Gaffikin L, et al (2002). Costs and benefits of different strategies to screen for cervical cancer in less-developed countries. *J Natl Cancer Inst*, **94**, 1469-83.
- Ministry of health – Morocco (2011). Santé en chiffre 2011.
- National Cancer Institute - France (2007). Etude et Expertises : Analyse économique des coûts du cancer en France : Impact sur la qualité de vie, prévention, dépistage, soins, recherche. Panorama de la santé 2007 : Les indicateurs de l'OCDE. Qualité des soins. *Cancer*. Paris, Editions de l'OCDE, 2007, 195 p.
- Parkin DM, Bray F, Ferlay J, Pisani P (2005). Global cancer