

## RESEARCH ARTICLE

# Characteristic Trend Analysis of Cancer Patients Hospitalized in Shanxi Tumor Hospital for the First Time during 2001 and 2010

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### Abstract

To observe and analyze the characteristic trend of cancer patients hospitalized for the first time in Shanxi Tumor Hospital from 2001 to 2010, clinical data including case number, age, gender, and frequency of different tumor occurrences were collected and statistically analyzed. **Results:** (i) From 2001 to 2010, the number of cancer patients hospitalized for the first time increased by 1.3-fold; (ii) The patient overall average age also increased from 51.8 to 54.4, for males from 55.5 to 58.7 and females from 48.4 to 51.1, respectively. (iii) Male patients accounted for 43-48% and females accounted for 52-57% of the total. The percentage of female patients was higher than that of male patients in every year and showed an upward trend over the years, while that of the males showed a downward trend ( $\chi^2 = 7.031, p = 0.008$ ); (iv) Among the top 6 most common cancers, lung, cervical, esophageal, colorectal and breast cancers tended to increase over the years ( $p < 0.05$ ), but not gastric cancer ( $p = 0.423$ ). **Conclusions:** (i) The number of cancer patients hospitalized for the first time during the past 10 years increased year by year, and was higher for female than male; (ii) the average age of patients increased year after year and was greater for male than female; (iii) the number of patients with lung cancer, cervical cancer, esophageal cancer, colorectal cancer and breast cancer increased over years.

**Keywords:** Cancer inpatients - trend analysis - age - gender - Shanxi, China

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### Introduction

Hospital registries collect, manage, analyze, and report information on cancer patients who are newly diagnosed and/or treated, and provide useful data to evaluate patient care within the hospital. This type of data may be focused on the care of cancer patients. The data can be used in studies that compare patterns of care among providers, population subsets, or geographic regions.

Shanxi Tumor Hospital is a large and nationally well-known comprehensive cancer center specialized in clinical management and applied research serving cancer patients from Shanxi Province and its surrounding Northern China provinces. In this paper, we analyzed the trend of the number, age, gender and different cancer occurrences of cancer patients hospitalized in our hospital for the first time between 2001 and 2010.

### Materials and Methods

This study was approved by the Ethics Committee of Shanxi Tumor Hospital. No written consent form was obtained since we used the registry data. No written consent was given by the patients for their information to

be stored in the database and used for research.

The clinical data such as case number, age, gender, and trend of different tumor occurrence of cancer patients who was hospitalized for the first time in this Hospital for the past 10 years were collected and statistically analyzed. The cancer incidence rates from 2001 to 2010 were calculated with reference to the new cancer cases identified in Shanxi Tumor Hospital. Linear regression analysis was utilized to depict the relationship between the first visiting year and the average age of the patients. The Chi-square test was used to depict yearly-based trending. All statistical tests were 2 sided and considered statistically significant for  $p \leq 0.05$ .

### Results

*Number of cancer patients hospitalized in Shanxi Tumor Hospital for the first time during January 2001 and December 2010*

Among the total of 156,433 cancer patients hospitalized from 2001 to 2010, 117,738 were hospitalized for the first time. Their number was slowly increased from 2001 to 2007, and thereafter rapidly increased, by 1.3-fold during 10 years. The results are shown in Figure 1.

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*Age of cancer patients hospitalized in Shanxi Tumor Hospital for the first time during January 2001 and December 2010*

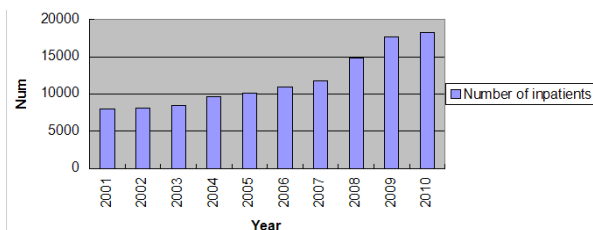
Trend analysis of the age of the patients hospitalized for the time from 2001 to 2010 showed that: *i)* their average age at hospitalization was increased year after year for both male and female; *ii)* compared with the overall average ages from 51.82 to 54.39, the average age of male patients was 3.5-4.5 years higher, and that of female patients was 3-3.5 years lower; *iii)* the average age of the male patients was 6-7 years higher than that of the female patients; *iv)* The regression analysis of the scatter plot of the average age versus the year of first hospitalization showed a linear relationship with a regression equation of  $Y=0.281X-510.611$  ( $p<0.05$ ), meaning that for every additional year, patients' average age increased by 0.281 years old as shown in Table 1.

*Gender of cancer patients hospitalized in Shanxi Tumor Hospital for the first time during January 2001 and December 2010*

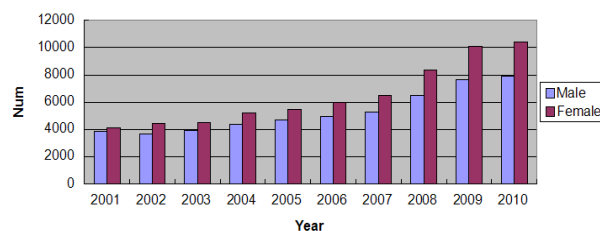
Trend analysis of the gender of the patients hospitalized for the first time in the 10 years from 2001 to 2010 showed that: *i)* the percentage of female patients hospitalized for the first time was higher than that of male patients during the 10 years; *ii)* the percentage of male patients hospitalized for the first time was 43%-48%, while that of female patients was 52%-57%; *iii)*  $\chi^2$  trend analysis indicated that the percentage of male patients hospitalized for the first time showed a downward trend over the years, while that of the females showed an upward trend ( $\chi^2=7.031, p=0.008$ ). The results are shown in Figures 3 and 4.

*Analysis of common cancers in patients hospitalized in Shanxi Tumor Hospital for the first time during January 2001 and December 2010*

Trend analysis of common cancers among patients hospitalized for the time from 2001 to 2010 showed that *i)* patients with lung, cervical and esophageal cancers ranked the first, second and third place, and their numbers increased by almost 2-, 3-, and 2-fold from 2001 to 2010, respectively; *ii)* during the 10 years, patients with breast, gastric and colorectal cancers increased nearly 3-fold and ranked the fourth, fifth and sixth place, respectively; *iii)* during the 10 years, although only a few patients with prostate and endometrial cancers were hospitalized, their number increased dramatically by 9- and 7-fold,



**Figure 1. Number of Cancer Patients Hospitalized for the First Time during Jan. 2001 and Dec 2010**



**Figure 2. Gender of Cancer Patients Hospitalized for the First Time during Jan. 2001 and Dec 2010**

**Table 1. Age for the First Time Hospitalized Patients During 2001 and 2010**

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Average(yr)	51.82	51.84	52.48	52.75	52.79	52.91	53.22	53.63	54.12	54.39
Male	55.54	55.42	56.49	56.87	57.42	57.42	57.43	57.9	58.39	58.74
Female	48.38	48.88	49.29	49.29	49.14	49.14	49.8	50.32	50.88	51.09

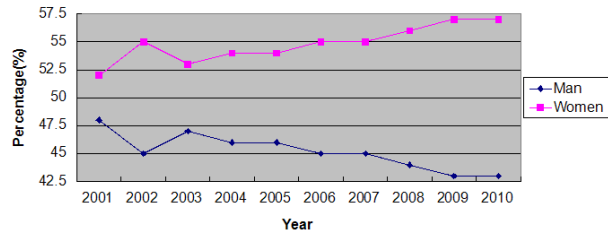
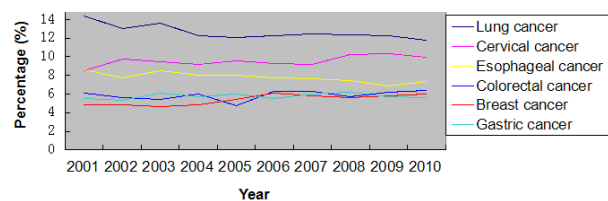
**Table 2. The Number of Common Cancer Patients among the First Time Hospitalized Cancer Patients during Jan 2001 and Dec 2010**

Group N(%)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Lung cancer	1144(14.37)	1056(13.02)	1142(13.58)	1178(12.3)	1228(12.11)	1338(12.27)	1468(12.45)	1838(12.37)	2167(12.24)	2153(11.78)
Cervical cancer	674(8.47)	792(9.76)	798(9.49)	880(9.19)	966(9.53)	1011(9.27)	1079(9.15)	1523(10.25)	1832(10.35)	1817(9.94)
Esophageal cancer	682(8.57)	625(7.71)	712(8.46)	764(7.98)	817(8.06)	839(7.69)	904(7.67)	1110(7.47)	1213(6.85)	1336(7.31)
Colorectal cancer	484(6.08)	455(5.61)	457(5.43)	574(5.99)	668(4.72)	685(6.28)	740(6.28)	847(5.7)	1092(6.17)	1161(6.35)
Breast cancer	386(4.85)	397(4.89)	395(4.7)	460(4.8)	550(5.42)	665(6.1)	682(5.78)	837(5.64)	1022(5.77)	1089(5.96)
Gastric cancer	442(5.55)	434(5.35)	510(6.06)	543(5.67)	609(6.01)	603(5.53)	708(6.01)	915(6.16)	1006(5.68)	1027(5.62)
Malignant lymphoma	238(2.99)	189(2.33)	190(2.26)	247(2.58)	248(2.45)	227(2.08)	241(2.04)	297(2)	323(1.82)	364(1.99)
Hepatic carcinoma	173(2.17)	182(2.24)	182(2.16)	171(1.79)	186(1.83)	193(1.77)	201(1.7)	253(1.7)	328(1.85)	334(1.83)
Thyroid	123(1.55)	151(1.86)	124(1.47)	191(1.99)	191(1.88)	172(1.58)	182(1.54)	212(1.43)	274(1.55)	317(1.73)
Ovarian cancer	114(1.43)	109(1.34)	119(1.41)	146(1.52)	153(1.51)	167(1.53)	176(1.49)	214(1.44)	253(1.43)	268(1.47)
Endometrial cancer	38(0.48)	26(0.32)	69(0.82)	78(0.81)	107(1.06)	131(1.2)	127(1.08)	150(1.01)	181(1.02)	217(1.19)
Kidney cancer	49(0.62)	56(0.69)	57(0.68)	74(0.77)	89(0.88)	113(1.04)	99(0.84)	128(0.86)	156(0.88)	176(0.96)
Bone cancer	144(1.81)	56(0.69)	71(0.84)	60(0.63)	60(0.59)	45(0.41)	32(0.27)	31(0.21)	50(0.28)	103(0.56)
Gallbladder	45(0.57)	33(0.41)	37(0.44)	43(0.45)	43(0.42)	42(0.39)	56(0.47)	79(0.53)	115(0.65)	98(0.54)
Pancreatic cancer	28(0.35)	23(0.28)	21(0.25)	30(0.31)	27(0.27)	44(0.4)	39(0.33)	51(0.34)	74(0.42)	76(0.42)
Brain tumor	42(0.53)	32(0.39)	48(0.57)	51(0.53)	36(0.35)	55(0.5)	47(0.4)	74(0.5)	76(0.43)	73(0.4)
Leukemia	30(0.38)	28(0.35)	18(0.21)	35(0.37)	34(0.34)	28(0.26)	23(0.2)	29(0.2)	90(0.51)	61(0.33)
Prostate cancer	6(0.08)	10(0.12)	15(0.18)	13(0.14)	10(0.1)	13(0.12)	16(0.14)	36(0.24)	69(0.39)	58(0.32)
Endometrial adenocarcinoma	13(0.16)	7(0.09)	21(0.25)	20(0.21)	21(0.21)	2(0.02)	4(0.03)	13(0.09)	6(0.03)	7(0.04)

\*Note: The order was based on the data of 2010

**Table 3. Trend Analysis of the Common Cancers in the First Time Hospitalized Cancer Patients during January 2001 and December 2010**

Group	Lung cancer	Cervical cancer	Esophageal cancer	Colorectal cancer	Breast cancer	Gastric cancer
$\chi^2$	5.738	4.113	6.303	5.114	6.392	0.641
$p$	0.017	0.043	0.012	0.024	0.001	0.423

**Figure 3. The Percentage of Common Cancer Patients among Cancer Patients Hospitalized for the First Time during Jan 2001 and Dec 2010****Figure 4. Analysis of the First Six Common Cancers in Cancer Patients Hospitalized for the First Time during Jan. 2001 and Dec 2010**

respectively; in addition, the number of patients with liver, thyroid, ovarian, gallbladder, pancreatic and bladder cancers increased more than 2-fold while the number of patients with endometrial cancer, bone cancer, brain tumors, blood disease and liver cancer showed a downward trend.  $\chi^2$  analysis of patients with the first six common cancers hospitalized for the first time during January 2001 and December 2010 showed that the number of patients with lung, cervical, esophageal, colorectal and breast cancers increased over the 10 years, ( $p < 0.05$ ), while that of patients with gastric cancer was not changed ( $p = 0.423$ ). The results are shown in Tables 2 and 3 and in Figure 5.

## Discussion

This study indicated that cancer patients hospitalized for the first time in Shanxi Tumor Hospital increased by 1.3-fold during the 10 years from 2001-2010. The number of patients increased slowly until 2007 and then rapidly increased. The following factors could attribute the phenomena: *i*) The hospital has been expanded since early May of 2008 on. A new surgical building with more than 700 beds was placed in use, which increased the hospital's capacity for cancer patient admissions; *ii*) Central Government implemented new health insurance policies, which covers the provincial health insurance, municipal health insurance, residents health insurance, railway company health insurance, especially the new rural cooperative medical insurance policy, which promoted patients' willingness to visit a hospital. In addition, this new policy allowed patients to be freely admitted by

a hospital at their will; *iii*) Shanxi Tumor Hospital is a prestigious specialized hospital for cancer patients in Shanxi Province and the only hospital which could treat patients using comprehensive measures including surgery, radiotherapy, chemotherapy, interventional therapy, targeted therapy, biological therapy, traditional Chinese medicine and hospice. In addition, the hospital is a multi-functional modern cancer hospital with state-of-the-art facilities, as well as skilled health care professionals, and could provide consecutive service of pre-, within and post hospitalization. All the above attracts patients to come for clinical management of their diseases.

The survey indicated that the average ages of patients hospitalized for the first time showed an increased trend year by year. This is mainly due to the improved living standards, enhanced prevention and health awareness, regular medical examination, early care and early prevention, all of which postpone the age at tumor occurrence. The survey also showed that male patients accounted for 43%-48% of the total hospitalized patients, and female accounted for 52%-57%, significantly higher than that of the male. This is possibly due to the following reasons: *i*) The morbidity and mortality of cervical cancer in women in Shanxi ranks the first in China (Zhao et al., 2004; Zen et al., 2004), even though the fact that the morbidity and mortality of cervical cancer has decreased slightly for the recent years because the provincial government has carried out a large scale census for cervical cancer and developed early detection and treatment measures (Rong et al., 2002). *ii*) Over the past decade, lifestyle has been increasingly westernized, incidence increase of breast cancer in females is accelerated, especially in middle-aged women, forming a new incidence peak (Ji et al., 2011). But Chen et al. reported that cancer incidence rates for males were higher than those for females (Chen et al., 2014).

This study showed that patients with lung cancer had been in the first place for the 10 years. Lung cancer is one of the typical diseases closely related to environmental factors and lifestyles. In addition to smoking, the most recognized causative factor, Shanxi is the most important chemical and energy industry base in China, coal and coke industry have caused serious environmental pollution. In addition, the increased heating systems and automobiles may also be an important factor leading to the rise of lung cancer (Chen et al., 2010; Chen et al., 2011; Jiang et al., 2012). Numbers of patients with cervical and esophageal cancers also increased during the 10 years. Shanxi Province is located in the Taihang Mountain area, which is one with high incidence of esophageal and cervical cancers. The incidence of cervical cancer is related to many factors. Among them, HPV infection is an important one (Sheng et al., 2003; Guan et al., 2006; Qiao et al., 2007; Li et al., 2013). Esophageal cancer is a

common malignant tumors, the morbidity and mortality of it in China are one of the highest worldwide and possibly associated with external environmental factors, unhealthy lifestyles, genetics and gene polymorphisms (Chen et al., 2003; Wang et al., 2011). The number of patients hospitalized for the first time due to breast and colon cancers showed a gradual upward trend during the 10 years. These cancers are caused by many factors and complex mechanisms. Owing to the westernization of life behavior and diet structure for the recent years, the incidence of breast and colorectal cancers showed an upward trend (Kuriyama et al., 2005; Pei et al., 2008). Therefore, enhancing the awareness of the risk factors for malignant tumors, improving the recognition of colorectal and breast cancers, and reasonable diet and nutrition education are important measures to prevent the occurrence of colon and breast cancers.

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