RESEARCH ARTICLE

Estimation of Completeness of Cancer Registration for Patients Referred to Shiraz Selected Centers through a Two Source Capture Re-capture Method, 2009 Data

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Abstract

<u>Background</u>: Cancer has important social consequences with cancer registration as the basis of moving towards prevention. The present study aimed to estimate the completeness of registration of the ten most common cancers in patients referred to selected hospitals in Shiraz, Iran by using capture-recapture method. <u>Materials and Methods</u>: This cross-sectional analytical study was performed in 2014 based on the data of 2009, on a total of 4,388 registered cancer patients. After cleaning data from two sources, using capture-recapture common findings were identified. Then, the percentage of the completeness of cancer registration was estimated using Chapman and Chao methods. Finally, the effects of demographic and treatment variables on the completeness of cancer registration were investigated. <u>Results</u>: The results showed that the percentages of completeness of cancer registration in the selected hospitals of Shiraz were 58.6% and 58.4%, and influenced by different variables. The age group between 40-49 years old was the highest represented and for the age group under 20 years old was the lowest for cancer registration. Breast cancer had the highest registration level and after that, thyroid and lung cancers, while colorectal cancer had the lowest registration level. <u>Conclusions</u>: According to the results, the number of cancers registered was very few and it seems that factors like inadequate knowledge of some doctors, imprecise diagnosis about the types of cancer, incorrectly filled out medical documents, and lack of sufficient accuracy in recording data on the computer cause errors and defects in cancer registration. This suggests a necessity to educate and teach doctors and other medical workers about the methods of documenting information related to cancer and also conduct additional measures to improve the cancer registration system.

Keywords: Completeness estimation - cancer registry - cancer documentation - capture-recapture method - cancer records

Introduction

CCancer, as a chronic disease, is the main health problem in most countries and has important social consequences. It is the second cause of death in developed countries and the third cause of death in less developed countries (Achagani et al., 2008; Paula et al., 2009). Entering, collecting, storing, analyzing and interpreting data related to cancer patients in called cancer registration (Abdelhak et al., 2003; Jensen et al., 1991). In cancer registration, information about the type and the stage of the cancer, patient's age at the time of diagnosis, patient's gender, his or her address, histological type, first treatment period, previous surgeries, radiotherapy and chemotherapy were collected and stored (Bickell NA and Chassin MR, 2000). Cancer registration system is the basis of cancer

controlling program (Achagani et al., 2008; Dortag et al., 2011). Existence of the reports of cancer registration can help health and treatment policy makers and is an important reference in cancer research (Dortag et al., 2011). In the national program for cancer registration, sources of the registration information are mainly public and private hospitals, pathology centers, health insurances, labs, general physicians and also mortality data (Zendehdel et al., 2010; Zendehdel et al., 2010). As the registry age, gain experience and produce reports, the prospect of a collective and integrated cancer control program in the public health arena is moe achievable (Mohagheghi et al., 2010).

For increasing the quality of data we need data quality control. Data quality control in cancer registration is a procedure that includes investigations about the validity

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and reliability of data and identifying defect areas of them (Ferlay et al., 2005). More structured medical records, stronger cancer registry systems, desirable data agreement, more agreement regarding the cancer stage data elements as well as the type of the received treatment is required in order to assess the process of cancer care quality (Keshtkaran et al., 2013). Complete coverage of the population in cancer registration means to register all the cancer cases in the population of a restricted area such as a province in cancer registration centers (Jensen et al., 1991; Parkin et al., 1994). The ideal percentage of cancer registration should be near 100% (Esteban et al., 1995). There are different methods to measuring the completeness of cancer registration that "capture-recapture method" is one of them. Capture-recapture is a popular method for estimating the completeness of registration in different diseases (Brenner et al., 1995). This method and eventually the virtual three source model should be established as the standard indicator to monitor the quality of case ascertainment of cancer registries. These simple tools can be used to evaluate the level of completeness for case under ascertainment in cancer registries (Suwanrungruang et al., 2011). In two-source capture-recapture method, data are identified and codified for the first source based on some specifications, and then the same procedure will be used for the second source. By estimating the cases

Table 1. Estimation of Completeness of Cancer Registration in Patients Referring to Selected Hospitals and their Related Pathology Centers of Shiraz, 2009 using Capture-recapture Method, Regarding the Types of Cancer

	Estimation of the completeness (Chao)					
Cancer type	Completeness of identifie cases %	2nd list %	1st list %	Confidence interval (upper limit)	Confidence interval (lower limit)	total cases
	(L1+L2-d)/N	L2/N	L1/N	95% CI U	95% CI L	N
Stomach	56.9	29.0	39.7	601.6	431.4	516.5
Lung	59.9	22.8	50.6	428.2	299.3	363.7
Colorectal	26.5	22.1	6.5	1579.3	772.7	1176.0
Breast	81.7	53.7	60.7	961.4	872.6	917.0
Skin	41.6	36.8	10.4	1169.1	773.2	971.1
hemato	31.0	20.0	13.9	1758.4	1038.3	1398.3
Thyroid	66.0	43.7	39.8	327.8	235.8	281.8
Prostate	35.3	23.6	15.5	768.7	381.9	575.3
Bladder	64.3	33.6	46.9	643.4	504.1	573.8
Brain	46.6	17.0	36.8	412.8	222.9	317.8
Total	58.4	37.4	33.5	5950.2	5412.7	5681.5
	Estimation of the completeness (Chapman)					
Cancer type	Completeness of identifie cases %	2nd list %	1st list %	Confidence interval (upper limit)	Confidence interval (lower limit)	total cases N
	(L1+L2-d)/N	L2/N	L1/N	95% CI U	95% CI L	N
Stomach	58.7	30.0	40.9	580.2	421.2	500.7
Lung	70.4	26.8	59.4	356.2	263.4	309.8
Colorectal	38.9	32.4	9.5	1044.3	561.4	802.9
Breast	82.0	53.9	61.0	956.6	869.3	912.9
Skin	60.9	53.9	15.2	771.5	554.3	662.9
hemato	32.5	21.0	14.6	1661.4	1000.0	1330.7
Thyroid	66.6	44.0	40.1	323.6	234.9	279.2
Prostate	37.9	25.4	16.6	703.9	366.3	535.1
Bladder	66.3	34.7	48.4	621.2	491.3	556.2
Brain	54.9	20.0	43.4	340.4	198.4	269.4
Total	58.6	37.6	33.6	5927.5	5394.1	5660.8
	Calculating total numbers				
	No. tot. of known cases(%)	No. tot. of known cases	Matched records (both)	2nd source (pathology)	1st source (hospital)
	d/(L1+L2-d)	L1+L2-d	d	L2	L1
Stomach	20.7	294	61	150	205
Lung	22.5	218	49	83	184
Colorectal	7.7	312	24	260	76
Breast	40.1	749	300	492	557
Skin	13.4	404	54	357	101
hemato	9.2	433	40	279	194
Thyroid	26.3	186	49	123	112
Prostate	10.8	203	22	136	89
Bladder	25.2	369	93	193	269
Brain	15.5	148	23	54	117
Total	21.6	3316	715	2127	1904

that are unique in both sources and the cases that are captured in them, it is possible to estimate the cases that are not mentioned and estimate the actual population by means of various statistical procedures (Poorolajal et al., 2010). In this study, Chapman and Chao methods were used to estimate the completeness of cancer registration in ten most common types of cancer in Iran and around the world in selected health centers of Shiraz, Iran that covers patients of the south of Iran..

Materials and Methods

This study is a cross-sectional analytical study that was performed during the first half of 2014 (based on the data of 2009). The study has covered the available data about cancer in different centers of Shiraz that service high percentage of the patients in southwest of Iran (including the central station of cancer registration, Nemazi Hospital, Dena Hospital, Shafa Hospital, Khalili Hospital, Shahid Faghihi Hospital, MRI Hospital, Kowsar Heart Hospital, Shahid Beheshti Hospital, Ali Asghar Hospital, Amir

Oncology Hospital and related pathology centers). Because the data were not codified and registered in the computer and there was not any possibility to restore the data in Shafa and MRI Hospitals, these hospitals were removed from our study.

This study was conducted to estimate the completeness of cancer registration in ten most common cancers around the world (stomach, lung, rectum and colon, breast, skin, Blood & Reticuloendotelial, thyroid, prostate, bladder, and brain and central nervous system) (Bahador A 2008) in selected centers of Shiraz, and also identifying the effect of some variables such as demographic information on the completeness of cancer registration.

The study consists of five steps

Step 1: Information about cancer patients were collected from the central station of cancer registration of Shiraz, then information about all cancer cases under the study were compiled from pathology centers related to each hospital based on their hospital documents and demographic data.

Table 2. Estimation of Completeness of Cancer Registration in Patients Referring to Selected Hospitals and their Related Pathology Centers of Shiraz, 2009, using Capture-recapture Method, Regarding the Hospitals

Hospital name	Completeness of identifie cases %	2nd list %	1st list %	Confidence interval (upper limit)	Confidence interval (lower limit)	total cases
	Estimation of the completeness (Chao)					
	(L1+L2-d)/N	L2/N	L1/N	95% CI U	95% CI L	N
Nemazi	40.4	21.1	24.5	2662.4	2021.0	2341.7
Shahid Faghihi	66.8	44.8	40.0	2051.6	1817.5	1934.5
Dena	40.6	29.1	16.7	1136.4	732.8	934.6
Khalili	79.1	52.3	56.3	169.2	129.0	149.1
Shahid Beheshti	53.1	34.4	28.7	330.7	192.9	261.8
Kowsar	88.9	65.4	67.9	174.5	149.5	162.0
Ali Asghar	28.4	21.0	9.8	536.2	139.8	338.0
Amir oncology	19.8	13.7	7.2	1660.6	543.6	1102.1

Cancer type	Completeness of identifie cases %	2nd list %	1st list %	Confidence interval (upper limit)	Confidence interval (lower limit)	total cases N
	Estimation of the completeness (Chapman)					
	(L1+L2-d)/N	L2/N	L1/N	95% CI U	95% CI L	N
Nemazi	40.9	21.4	24.8	2631.5	2003.9	2317.7
Shahid Faghihi	67.1	45.0	40.2	2042.3	1810.7	1926.5
Dena	44.3	31.8	18.2	1031.8	680.7	856.2
Khalili	79.6	52.6	56.7	167.6	128.8	148.2
Shahid Beheshti	54.5	35.3	29.4	319.0	191.3	255.1
Kowsar	89.1	65.6	68.0	173.9	149.5	161.7
Ali Asghar	35.4	26.2	12.2	406.2	135.8	271.0
Amir oncology	23.3	16.2	8.5	1363.2	505.6	934.4

	No. tot. of known cases(%)	No. tot. of known cases	Matched records (both)	2nd source (pathology)	1st source (hospital)
	Calculating total numbers				
	d/(L1+L2-d)	L1+L2-d	d	L2	L1
Nemazi	12.9	947	122	495	574
Shahid Faghihi	26.9	1293	348	867	774
Dena	12.9	379	49	272	156
Khalili	37.3	118	44	78	84
Shahid Beheshti	18.7	139	26	90	75
Kowsar	50.0	144	72	106	110
Ali Asghar	8.3	96	8	71	33
Amir oncology	5.5	218	12	151	79

Step 2: All the information about the patients of each hospital and pathologic center were entered in Excel software and repeated cases were removed and the exact number of the cases from each source were identified.

Step 3: In this stage, the two sources (eight files related to the hospital and eight files related to their pathologic centers) were combined by using Excel software to identify the number of the cases mentioned in each source and the number of them mentioned in both sources. Required data for creating data link are: fist and last name of the patient, father's name, date of birth, and age that all of them were controlled.

Step 4: In this stage, designing form, Chapman and Chao methods, a confidence interval of 95%, and the statistical formulas were described through Excel. Numerical data from each source and also common data were entered into the software and the percentages of the completeness of cancer registration related to each hospital and each cancer type were specifically estimated and the completeness of all cancer types in all centers was analyzed.

Step 5: The effect of demographic variables on the completeness of the cancer registration was investigated.

In this research, two-source capture-recapture method was used. This method has been documented earlier (Seddon and Williams., 1997; Crocetti et al., 2001; McClish, Penberthy, 2004; Siva et al., 2009 ; Peragallo et al., 2011; Kroll et al., 2011; Aghaei et al., 2013; Ghojazadeh et al., 2013; Zemestani et al., 2013),. For analyzing and estimating the completeness of cancer registration they mostly used Chapman and Chao by a confidence interval of 95%. Interpreting data was done considering previous studies which explain desirable level of cancer registration about 90% to 100% (Esteban et al., 1995; Kroll et al., 2011).

Chapman method
$$N = \frac{(L_1 + 1)(L_2 + 1)}{d + 1} - 1$$

L1= number of the cases in the first source
L2= number of the cases in the second source
d= number of the cases in both sources
N was also calculated another time with a confidence interval of 95%:

Table 3. Estimation of Completeness of Cancer Registration in Patients Referring to Selected Hospitals and their Related Pathology Centers of Shiraz, 2009 using Capture-recapture Method, Regarding the Age Groups

Cancer type	Estimation of the completeness (Chao)					
	Completeness of identifie cases %	2nd list %	1st list %	Confidence interval (upper limit)	Confidence interval (lower limit)	total cases
	(L1+L2-d)/N	L2/N	L1/N	95% CI U	95% CI L	N
<20	38.4	22.0	21.0	1193.2	748.1	970.7
20-29	51.9	30.0	31.2	399.6	240.6	320.1
30-39	67.4	40.9	45.0	447.7	344.1	395.9
40-49	71.1	47.0	45.4	762.4	641.6	702.0
50-59	62.3	39.6	37.5	1050.0	857.4	953.7
60-69	53.4	34.4	29.1	1198.7	924.1	1061.4
69<	51.1	33.3	26.8	1916.2	1537.2	1726.7

Cancer type	Estimation of the completeness (Chapman)					
	Completeness of identifie cases %	2nd list %	1st list %	Confidence interval (upper limit)	Confidence interval (lower limit)	total cases N
	(L1+L2-d)/N	L2/N	L1/N	95% CI U	95% CI L	N
<20	39.0	22.4	21.3	1171.0	743.3	957.2
20-29	52.7	30.5	31.7	390.2	239.8	315.0
30-39	67.9	41.2	45.3	443.8	342.8	393.3
40-49	71.2	47.1	45.5	760.2	640.7	700.5
50-59	62.5	39.8	37.7	1045.6	855.4	950.5
60-69	54.0	34.8	29.4	1183.2	915.9	1049.6
69<	51.8	33.8	27.2	1885.5	1517.2	1701.3

	Calculating total numbers				
	No. tot. of known cases(%)	No. tot. of known cases	Matched records (both)	2nd source (pathology)	1st source (hospital)
	d/(L1+L2-d)	L1+L2-d	d	L2	L1
<20	12.1	373	45	214	204
20-29	18.1	166	30	96	100
30-39	27.3	267	73	162	178
40-49	30.1	499	150	330	319
50-59	23.9	594	142	378	358
60-69	18.9	567	107	365	309
69<	17.7	882	156	575	463

$$95\% \; CI = N \pm 1.96 \sqrt{\frac{(L_1 + 1)(L_2 + 1)\;(L_1 - d)(L_2 - d)}{(d + 1)^2\,(d + 2)}}$$

Chao method

$$N = f_1 + f_2 + \frac{f_1^2}{4f_2}$$

F1= [L1+L2-2d] and f2=d in Chapman method

N was also calculated another time with a confidence interval of 95%:

$$95\% \; CI = N \pm 1.96 \sqrt{\frac{f_1^2}{4f_2}\left(\frac{f_1}{2f_2} + 1\right)^2}$$

Results

Totally 4388 cases of cancer in ten cancer types, from eight selected hospitals and eight pathology centers related to them were studied based on the data of 2009. After eliminating repeated cases, the total number of registered cancer reduced to 4031 that 1904 of them were registered in hospitals and 2127 of them in pathology centers and 715 of them were common (Table 1).

Estimating the percentages of the completeness of cancer registration for breast, lung, thyroid, and bladder cancers in the selected centers by Chapman methods were 82%, 70.4%, 66.6% and 66.3%, respectively and by Chao method were 81.7%, 59.9%, 66% and 64.3% respectively, that they showed the highest percentages of the registration. The percentages of the completeness of the cancer registration in blood, prostate, and colorectal cancers by Chapman method were 32%, 37.9% and 38.9% and by Chao method were 31%, 35.3% and 26.5% that they were the lowest. Registration percentages of skin, stomach, and brain cancers by Chapman method were 60.9%, 58.7% and 54.9% and by Chao method were 41.6%, 56.9% and 46.6%.

The results showed that the overall estimation of the completeness of cancer registration in all the selected hospitals of Shiraz by Chapman method was 58.6% and by Chao method was 58.4% (Table 1).

The findings showed that the percentages of the completeness of cancer registration in all the selected hospitals of Shiraz in ages between 40 to 49, 30 to 39, and 50 to 59 by Chapman method were 71.2%, 67.9% and 62.5% respectively and by using Chao method were 71.1%, 67.4% and 62.3% respectively which had the highest percentages in cancer registration there. The lowest percentage was related to the ages under 20 which was 39% by Chapman method and 38.4% by Chao method. The percentages of completeness of cancer registration in ages between 60 to 69, 20 to 29 and above 69 years old were 54%, 52.7% and 51.8% respectively by Chapman method and 53.4%, 51.9% and 51.1% respectively by Chao method (Table 3).

Total percentages of the completeness of cancer registration in the selected hospital of Shiraz for males and females were respectively 41.4% and 67.6% by using Chapman method and 40.9% and 67.5% by using Chao method which shows that the registration of females were higher than males.

Discussion

The results totally showed that between different cancer types under the study, the estimation of the completeness of breast cancer registration in all the selected centers of Shiraz was the highest one and this is similar to some researches like Dortag (2011), Bailly (2008), and Brenner (1994). One reason for this similarity may be the spread of the breast cancer in female group all around the world. Other reasons may be the difference between the survivals of various types of cancer, the special concentration on females' healthcare programs, supporting screening, self-care, and diagnosing and treatment of the disease in early stages, long survival due to adjuvant treatments in compare of other cancer types and older background of developed countries in using data registration and appropriate management in information systems. As the ideal percentage for cancer registration is about 90% to 100% (Esteban et al., 1995; Kroll et al., 2011), the results of the present research show that the registration for breast cancer is not satisfactory. The registration of the breast cancer in this research is higher than the other types of the cancer, but is still needs to be improved.

The results of some studies such as Schmidtmann (Schmidtmann, 2008) and Croccetti (Crocetti et al., 2001) also indicate that the registration in those researches were higher than our research. The reasons may vary from differences between societies and structural and management differences in health and treatment systems of these countries to differences between the attitudes of the health system managers about the importance of the information for making policies and planning for the future to control the disease, prevention and treatment in early stages, and improving the quantity and the quality of the patients' lives.

In contrast, Seddon's (1997) research in England, as a developed country, showed that the completeness of breast cancer registration was 47.5% (Seddon and Williams, 1997) that was lower than our research. This difference may be because of the time of that research (two decades ago), so this comparison seems to be not logical.

Estimations of the completeness of stomach cancer registration in selected centers were 58.7% and 56.9% that put it in the sixth place among the ten cancer types under the study. The results are not similar Dortag's (2011) study. In Jeong-Soo IM's (2000) study in South Korea, the lowest registration rate was for stomach cancer (Jeong-Soo Im et al., 2000) that is similar to the present. Generally the study in South Korea showed registration rates which are very similar to the present study, especially for stomach cancer. Also both studies emphasize on the improvement of cancer registration indices.

The percentages of the completeness of lung cancer registration in all selected centers were 70.4% and 59.9% that put this cancer in the second place. This may be because of the spread of the disease and also the ability to diagnose the disease based on its different risk factors. As already mentioned, the percentage of lung cancer registration in the target population is in an appropriate condition in compare to other cancer types, but it still needs to be improved. Croccetti (2001) carried out a

research in Tuscany, Italy which the results of that research were more satisfactory (Seddon DJ and Williams EMI, 1997).

Finally it seems that according to the acceptable results in the registration of breast and lung cancers in the selected centers of Shiraz University of Medical Sciences, it is necessary to perform complementary studies for finding the reason of these differences comparing with other cancer types.

The percentages of the completeness of skin cancer registration in the selected centers were 60.9% and 41.6% that put it in the sixth place which is not acceptable. Therefore, it needs to be improved in data registration. It is suggested to compare the results of this study to some countries like Australia that has the highest regional spread of the disease to have a better comparison.

Estimating the completeness of the colorectal cancer in the selected centers were 38.9% and 26.5% which put it in the lowest place and it is similar to Dortag's research (Dortag et al., 2011). Bailly's (2008) research showed that colorectal cancer had higher registration percentage than the present research, but it had lower registration percentage in compare to other cancer types (Brenner et al., 1997) that is similar to the present research. One reason for this may be the different spread of colorectal cancer in developed countries and developing countries like Iran due to the differences in life styles, diets, eating fast foods and drinking alcoholic drinks in that countries.

The estimations of the completeness of Blood & Reticuloendotelial cancer registration in the selected centers were 32.5% and 31% that put it in the ninth place, which is not acceptable. The reasons for this may be the low survival, high fatality, and the short time for diagnosing this disease due to metastatic and end stage.

For thyroid cancer, the percentages of the completeness of the cancer were 66.6% and 66% which put this cancer in the second place. The result for thyroid cancer is similar to Jeong-Soo Im's (Jeong-Soo et al., 2000) research, but the percentage of the present research is lower. According to the registration, this cancer also doesn't have a good condition in the present research. As the diagnosis of thyroid cancer can be based on concise pathologic examinations and also low spread of this disease in Iran (eighth in females and fifteenth in males), it seems that Shiraz University of Medical Sciences can be used as the reference for other provinces.

About prostate cancer, the registration percentages were 37.9% and 35.3% which is in the ninth place and is not acceptable. The results are not similar to Dortag's (Dortag et al., 2011) and McClish's (McClish and Penberthy, 2004) researches. It is important to know that prostate cancer is in the fourth place (in males) in Iran, therefore, it shows the importance of the registration for the future and planning for prevention programs. The estimations of bladder cancer registration were 66.3% and 64.3% which put it in the fourth place among the cancer types under the study, but it is not satisfactory. The estimations of the completeness of bladder cancer in all the selected centers were 66.3% and 64.3% that put it in the fourth place, which is not again acceptable. The

importance of this cancer is more obvious when we notice that it is common in Iranian males (third place among all the cancers) and it is essential to do further studies to find the reason of the incompleteness of the registration related to this cancer to organize and complete the it in future.

For brain and central nervous system the estimations of the completeness were 54.9% and 46.6% that put this cancer in the seventh place, which is low and unacceptable. Considering the spread of this cancer (thirteenth place in men and eleventh place in women) this result is justifiable.

Totally, the estimations of all the cancer types in all the selected centers after combining were 54.9% and 46.6% which are not generally acceptable and they need to be improved through scientific and also practical plans to reach an appropriate place in data registration. The results of the present study were compared to some studies like Kroll (2011), Larsen (2009), Bailly (2008), Schmidtmann (2008), Croccetti (2001), McClish (2005), Song (2012), Razum (2000), Ballivet (2000), Brenner (1994), Seddon (1997), Gholamzadeh (2013), (Suwanrungruang, 2011), and Zemestani (2013) and the results of these comparisons showed that the percentages of the completeness of cancer registration in this study are lower than the other studies, But they are identical to Drog's (2011) study and higher than Azevedo-Silva's (Azevedo-Siva et al., 2009) research. Also the results show that in all the selected centers of Shiraz, the age group between 40-49 years old has the highest percentage for cancer registration and the age group less than 20 years old has the lowest one. Considering the consequences of the cancer in young patients, the importance of paying attention to this age group is obvious. Ghojazadeh's (Ghojazadeh et al., 2013) research showed that there were fewer registrations in the age group under 20 year old that is similar to the present research, while in the age group upper than 45 years old the results were not similar to the present study. Maybe the reason is various target populations of these two studies. Zemestani's (2013) reseach in Guilan showed that the highest percentage of the completeness of cancer registration was related the age group between 5 to 14 years old (Zemestani et al., 2013) that is not similar to the present study, but the lowest percentage was related to the age group under 4 years old that is similar to the present study.

Peragallo's (Peragallo et al., 2011), Leong-Soo Im's (Jeong-Soo et al., 2000), Bailly's (Bailly et al., 2011) studies were almost identical to the present study, while Kroll's (Kroll ME et al., 2011) results were not similar to this study. Totally, the comparison between the previous studies and the present study shows that in previous studies in some age groups like young or children patients the percentages of cancer registration were higher than the other age groups which is maybe because of the special concern about the cancer in early ages in developed countries. The existence of specific centers for children's cancer registration in developed countries is the evidence of the special attention to these age groups. The results also show that in all the selected centers, females had higher cancer registrations than males. Regarding this difference, the results of the present study is similar to Bailly's (Bailly

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et al., 2011) study in France and McClish's (McClish and Penberthy, 2004) , while it is in contrast with Zemestani's (Zemestani et al., 2013) study, Ghojazadeh's (Ghojazadeh et al., 2013) investigation, Aagahi's (Aghaei et al., 2013) study in Tehran, Croccetti's (Crocetti et al., 2001) study in Tuscany, Italy, and Seddon's (Seddon DJ and Williams EMI., 1997) in England. According to the WHO's (2008) report the patterns of stomach cancer registration are similar in males and females (Boyle and Levin, 2008).

In conclusion, the results totally show that breast cancer had the highest registration in the selected hospitals and colorectal had the lowest registration there. The completeness of cancer registration in all the selected centers was not satisfactory. Patients, who had operation o radiotherapy before, had higher registration. The low percentages in cancer registration show the need of paying more attention to improve the methods and plans of cancer registration from the principals. Appropriate training about documenting data for physicians and other staffs, precise diagnosis about the types of cancer and correctness of medical documents, high accuracy in recording data on the computer, and some other activities for improving the cancer registration system are some important factors to complete the information in health and treatment system. The results of the current study provide useful implications for Health Information managers and cancer registrars.

First, hospital managers and other authorized people should design special and efficient training programs with retraining points in cancer documentation and registration for their staffs and physicians. Second, managers can create opportunities for research on cancer registry and documentation. Third, participating users, managers, external consultants, and all those who are somehow related to Cancer Information Systems or work with them in planning for information systems can be helpful in better cancer registering.

Therefore, it is necessary to strengthen these factors in all organizations, especially hospitals due to the importance of data and information completeness. Investigating different aspects of the completeness of cancer registration in the society based on cancer registration in other geographic situations and regions and comparing the results with the present study is recommended.

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References

Abdelhak M, Grostick S, Hanken MA, et al (2003). Health information: management of a strategicresource, Jacobs E. pp. 511.

Achagani H, Eetemad K, Gouya MM, et al (2008). Iranian annual of national cancer registration report 2008-2009. Islamic Republic of Iran, ministry of health and medical education, 16.

Aghaei A, Ahmadi-Jouibari T, Baiki O, et al (2013). Estimation of the gastric cancer incidence in tehran by two- source capture recapture. *Asian Pac J Cancer Prev*, **14**, 673-7.

Azevedo-Siva F, Souza Reis RD, Oliveira Santos MD, et al (2009). Evaluation of childhood acute leukemia incidence and underreporting in Brazil by capture-recapture methodology. *Cancer Epidemiology*, **33**, 403-5.

Bahador A (2008). Cancer prevention. publications of Shiraz university of medical sciences, Shiraz. p. 35.

Bailly L, Giusiano B, Barjoan EM, et al (2011). Investigating the completeness of a histopathological cancer registry: Estimation by capture-recapture analysis in a French geographical unit Alpes-Maritimes, 2008. *Cancer Epidemiol*, **35**, 62-68.

Bickell NA, Chassin MR (2000). Determining the quality of breast cancer care: do tumor registries measure up? *Ann Intern Med*, **132**, 705-10.

Boyle P, Levin B (2008). World cancer report 2008. IARC Press, WHO, 308-10.

Brenner H, Stegmaier C, Ziegler H (1994). Estimating completeness of cancer registration in saarland/germany with capture-recapture methods. *Euro J Cancer*, **30**, 1659-63.

Brenner H, Stegmaier CH, Ziegle H (1995). Estimating completeness of cancer registration: an empirical evaluation of the two source capture-recapture approach in Germany. *J Epidemiol Commun Health*, **49**, 426-430.

Crocetti E, Miccinesi G, Paci E, et al (2001). An application of the two-source capture- recapture method to estimate the completeness of the Tuscany Cancer Registry, Italy. *Eur J Cancer Prev*, **10**, 417-23.

Dortag E, Bahrampour A, Haghdost AA, et al (2011). Completeness of fars province deaths registry on cancer death using capture recaptures method. journal of north khorasan university of medical sciences, pp.33-43, [in Persian].

Esteban D, Whelan S, Laudico A, et al (1995). Manual for cancer registry personnel. lyon: international agency for research on cancer and international association of cancer registries (IARC Technical Reports, No. 10).

Ferlay J, Burkhard C, Whelan S, et al (2005). Check and conversion programs for cancer registries (IARC/IACR tools for cancer registries). IARC technical report. Lyon, No.42.

Ghojazadeh M, Mohammadi M, Azami-Aghdash S, et al (2013). Estimation of cancer cases using capture-recapture method in Northwest Iran. *APJCP*, **14**, 3237-41.

Jensen OM, Parkin DM, MacLennan R, et al (1991). Cancer registration. principles and methods. IARC Scientific Publications, Lyon, No.95.

Jeong-Soo Im, JS Kweon SS, Kim SS, et al (2000). Competeleness estimation of the population-based cancer registration with capture re capture methods. *Korean J Prev Med*, **33**, 31-35.

Keshtkaran A, Sharifian R, Barzegari S, et al (2013). Agreement of Iranian breast cancer data and relationships with measuring quality of care in a 5-year period (2006-2011). *Asian Pac J Cancer Prev*, **14**, 2107-11

Kroll ME, Murphy MFG, Carpenter LM, et al (2011). Childhood cancer registration in Britain: capture-recapture. -*Br J Cancer*, **104**, 1227-33.

Mohagheghi MA, Mosavi-Jarrahi A (2010). Review of cancer registration and cancer data in Iran, a historical prospect. *Asian Pac J Cancer Prev*, **11**, 1155-7.

Parkin DM, Chen VW, Ferlay J, et al (1994). Comparability and quality control in cancer registration (IARC Technical Reports No. 19), Lyon.

Paula curado MA, Voti LY, Sortino-Rachou AM (2009). Cancer registration data and quality indicators in low and middle income countries: their interpretation and potential use for the improvement of cancer care. *Cancer Cause Control*, **20**, 751-6.

Peragallo MS, Urbano F, Lista F, et al (2011). Evaluation of cancer surveillance completeness among the Italian army personnel, by capture-recapture methodology. *Cancer Epidemiology*. **35**, 132-8.

Poorolajal J, Haghdoost AK, Mahmoodi M, et al (2010). Capture-recapture method for assessing publication bias. *JRMS*, **15**.

McClish D, Penberthy L (2004). Using multivariate capture-recapture techniques and statewide hospital discharge data to assess the validity of a cancer registry for epidemiologic use. *Health Services Outcomes Res Methodol*, **5**, 141-52.

Seddon DJ, Williams EMI (1997). Data quality in population-based cancer registration: an assessment of the Merseyside and Cheshire Cancer Registry. *Br J Cancer*, **76**, 667-74.

Schmidtmann I (2008). Estimating completeness in cancer registries comparing capture-recapture methods in a simulation study. *Biometrical Journal*, **6**, 1077-92 .

Suwanrungruang K, Sriplung H, Attasara P, et al (2011). Quality of case ascertainment in cancer registries: A proposal for a virtual three-source capture-recapture technique. *Asian Pac J Cancer Prev*, **12**, 173-78.

Zemestani AL, Mahmoudi M, Keshtkar AA, et al (2013). Estimation of cancer cases in golestan province between 2004-2006 by using capture-recapture method. *Medical J Tabriz Univ Med Sci Health Serv*, **35**, 26-33.

Zendehdel K, Sedighi Z, Hassanloo J, et al (2010). Improving quality of cancer registration in Iran. Part 1: Evaluation and comparison of cancer registration results in the county. *Hakim Research J*, **12**, 42-9.

Zendehdel K, Hassanloo J, Sedighi Z, et al (2010). Improving quality of cancer registration in Iran. Part 2: suggesting new national cancer registration program in Iran, Based on comparative study of 18 countries. *Hakim Res J*, **12**, 50-7.