RESEARCH ARTICLE

Patterns and Trends with Cancer Incidence and Mortality Rates Reported by the China National Cancer Registry

Peng-Lai Chen, Ting Zhao, Rui Feng, Jing Chai, Gui-Xian Tong, De-Bin Wang*

Abstract

National cancer registration reports provide a huge potential for identifying patterns and trends of important policy, research, prevention and treatment significance. As summary reports written on an annual basis, the China Cancer Registry Annual Reports (CCRARs) fall short from fully addressing their potential. This paper attempts to explore part of the patterns and trends hidden behind published CCRARs. It extracted data for cancer incidence rates (IRs) and mortality rates (MRs) for 2004, 2006 and 2009 from relevant CCRARs and portrayed 4 kinds of indicators in line graphs. The study showed that: a) all of the line graphs of age-specific IRs and MRs characterized typical "growth curves or histogram"; b) graphs of IRs and MRs for males and urban areas had higher peaks than that for females and rural regions; c) most of the line graphs of IR/MR ratios comprised a starting peak, a secondary peak and a decreasing tail and the secondary peaks for females and urban areas were higher than those for males and rural areas; d) most of the urban versus rural IR ratios valued above one, but most the urban versus rural MR ratios, below one; e) the accumulative IRs and MRs showed a stable increasing trend from 2004 to 2009 for urban areas, but mixed for rural regions.

Keywords: National cancer registry data - incidence - mortality - urban - rural

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Introduction

Cancer registry (CR) plays an important role in steming the epidemic. It provides fundamental information for describing cancer patterns and trends (Brecht et al., 2014; Park et al., 2013), interpreting cancer causes (Band et al., 1990; Schlesinger-Raab et al., 2013), following up patients (Sengoku et al., 2014), evaluating survival (Hanna et al., 2010), enhancing the planning and promotion of cancer control policies and the care of individual patients (Parkin 2006). Some developed countries have started CR programms quite early. For example, the United States started reporting cancer data as early as in 1973 (Siegel, 2012) and have established relatively complete and reliable cancer report systems. In Australia, CR becomes a valuable tool of assessing need for screening and planing and evaluating screening services for cervical, breast and large bowel cancers. Developing countries like Korea and Thailand have also set up national CR networks since the 1980s and been publishing national level annual cancer statistics for decades.

The history of China cancer registration (CCR) can be traced back to more than 50 years. However, the progress of the registry system in China had been relatively slow (Chen et al., 2011). The publications of Cancer Incidence in Five Continents Volume IX (2008) and Guideline of Chinese Cancer Registration have greatly promoted CCR. The number of CCR sites increased from only two in 1960s to 104 in 2009, covering 8.2% of the nation's total population (Chen et al., 2013). A three-tier cancer registration network (consisting of municipal CDCs, county CDCs and hospitals or cancer institutes, town hospitals and community health stations) and a three-tier cancer follow-up and comprehensive intervention network (municipal CDCs, county/regional CDCs and community health station or town hospitals) have become two main means for collecting cancer incidence and mortality data. (Pan et al., 2009). Incidence rates (IRs) of cancers derive from both population-based and hospital-based cancer registries (PBCR & HBCR) with PBCR collecting cancer cases from the population in resource intensive areas and HBCR gathering information about patients with cancer treated by the hospitals; while mortality rates (MRs), from population-based death cause registries (Wei et al., 2012).

By far, CCR has published 7 annual reports (CCRARs) documenting registered cancer statistics in the years of 2003-2009 (Chen et al., 2013). These reports provide large scale data about IRs and MRs of specific and combined cancers by age, gender and region groups and thus a huge potential for identifying patterns and trends of important policy, research, prevention and treatment significance. Yet, being summary reports written on an annual base, they fall short from fully addressing their potential. This paper attempts to explore part of the patterns and trends hidden behind these published CCRARs. Although a few researchers have performed some secondary analysis using

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data from certain single CCRAR (Luo et al., 2013), there lack published studies that tried to pool and analyze data from multiple CCRARs.

Materials and Methods

Data sources

Incidence and mortality data of cancers in 2004, 2006 and 2009 are derived from CCRAR2004, CCRAR2009 and CCRAR2012, respectively. CCRAR2004, the earliest available CCRAR, documents cancer cases and deaths registered by 43 China national registery sites covering a 71.91 million population. CCRAR2009 discribes cancer statistics reported in 2006 from 34 sites among 59.57 million Chinese. While CCRAR 2012, the latest available CCRAR, analyzes cancer registry data collected in 2009 by 72 sites from 85.47 million residents.

Data Analysis

The study adopts a descriptive data analysis. It tries to portray the patterns and trends of 4 kinds of indicators in line graphs or histograms using Microsoft Excel 2010. The 4 kinds of indicators include: a) Age- specific IRs and MRs by gender, region (urban or rural) and year of reporting; b) IR/MR ratios by age, gender, region and year of reporting; c) IR or MR ratios between urban and rural areas by age, gender and year of reporting; and d) changes in accumulative IR and MR by age, gender, region and year of reporting. Here, a IR/MR ratio = the IR in a certain year divided by the MR in the same year, a IR (or MR) ratio between urban and rural areas = the IR (or MR) of urban areas in a certain year divided by the IR (or MR) of rural areas in the same year, change in accumulative IR = ∑ ((IR in year X- IR in year Y)/ (IR in year Y))* 100% and change in accumulative MR = ∑ ((MR in year X- MR in year Y)/ (MR in year Y))* 100%.

Results

Age-specific IRs and MRs by gender, region and year of reporting

Figure 1 depicts, in line graphs, age-specific IRs and MRs by gender (males, females), region (urban, rural) and year of reporting (2004, 2006 and 2009) using data extracted from CCRAR 2004, 2009 and 2012 (Chen et al., 2011; Chen et al., 2013) respectively (Table 1 and Table 2). As shown in the figure, all of the line graphs characterized typical logistic "growth (or S-shape) curve" dividing into 3 to 4 phases. More specifically, each of the graphs started, from age group 0, with generally a bit elevated value and kept relatively low for 6 to 8 age groups and then began to rise more and more radpidly until a certain age group when the line decreased its growing velocity and reached its highest value and turned, for part of the graphs, to drop thereafter. Other apparent features of the line graphs include: a) graphs representing age-specific IRs located higher than that representing MRs for most except a couple of the oldest age-groups; b) graphs of IRs and MRs for males had higher peaks than that for females; c) graphs of IRs and MRs for urban areas had higher peaks than that for rural areas.

IR/MR ratios by age, gender, region and year of reporting

As shown in Figure 2, the IR/MR ratios ranged from 0.79 to 8.00 with the majority of them being greater than 1. Most of the line graphs of the ratios showed a starting peak (at around ages 0 to 9), a secondary peak (at around ages 20 to 39) and a decreasing tail (starting from around age 40). The line graphs of the ratios demonstrate higher secondary peaks for females than for males and the line graphs of the ratios display bigger secondary peaks for urban areas than for rural areas. Greater variations in the IR/MR ratios are observable for younger age groups than that for older ones.

IR and MR ratios between urban and rural areas by age, gender and year of reporting

Figure 3 shows the characteristics and trends of age-specific IRs and MRs between urban and rural areas. All of the line graphs of the ratios displayed a similar pattern consisting of a starting peak (from 0 to 9 years old), a decreasing middle (around age 10 to age 64), and a slightly increasing tail (from around age 65 onwards). Most of the urban versus rural IR ratios valued above one; while most of the urban versus rural MR ratios, below one. Similar to the IR/MR ratios shown in Figure 2, greater variations in both the ratios of IRs and MRs were observable for younger age groups than that for older ones.

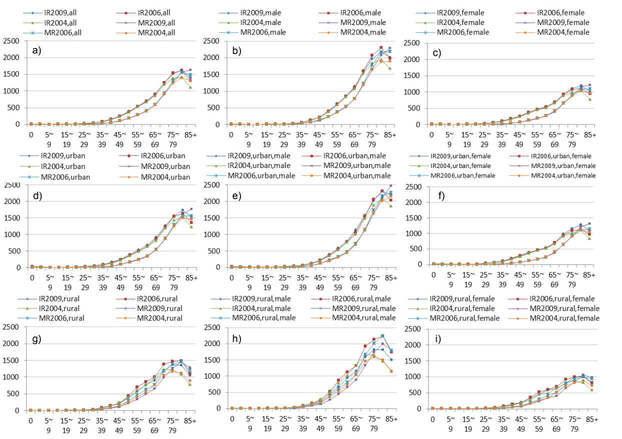

Figure 1. Age-Specific IRs and MRs by Gender, Region and Year of Reporting

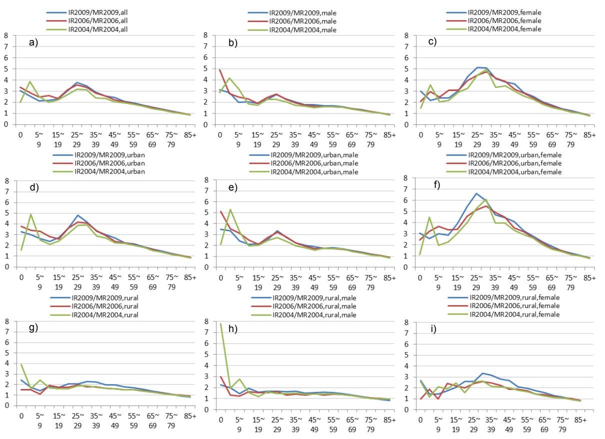

Figure 2. IR/MR Ratios by Age, Gender, Region and Year of Reporting.

Table 1. Incidence Rates (IRs) Extracted from Chinese Cancer Registratry Annual Reports (1/100000)

Indicators	Age groups																	
	0	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IR2009, all	14.8	13.7	7.1	7.8	11.4	16.5	27	48	87.1	154.5	242.1	394.8	544.3	708.6	906.8	1245.5	1511.1	1635.3	1397.5
IR2006, all	20.2	13.4	6.9	9.3	12.3	16.9	28.5	47.9	86.6	156.9	241.7	384.2	542.9	688.4	899	1256.9	1538.1	1609.3	1309.6
IR2004, all	13.5	19.6	7.2	8.2	11.8	15.1	27.2	51.1	79.7	140.4	231.5	367.4	520.7	665.6	856.9	1199.8	1382.1	1418.4	1108.3
IR2009, male	13.5	15.9	7.4	8.5	11.9	14.7	21	36.4	69.4	129.5	219.5	410.9	618.1	852	1138.3	1583.1	1965.7	2178.2	2008.6
IR2009, female	16.4	11.3	6.7	7	10.8	18.3	33.2	59.7	104.9	180	265.6	378.2	470	564.8	680.7	935.1	1107.2	1204.4	1010.8
IR2006, male	25.5	14.3	7.4	9.9	12.2	14.1	22.2	35.8	69.9	130.6	223.1	396.5	611.1	844.5	1114.3	1608.4	2079.7	2304.2	1979.6
IR2006, female	14.3	12.4	6.2	8.8	12.4	19.9	34.9	60	103.5	184.4	261	371.8	473.8	536	696.6	936.6	1079.7	1110.2	939.2
IR2004, male	13.9	20.2	7.5	7.9	11.4	13.7	21.5	39.8	67.6	121.7	219.5	388.8	592.9	832.9	1074.5	1530.2	1836.9	1935.7	1683.8
IR2004, female	13.1	19	6.9	8.6	12.3	16.7	33.1	62.5	92.2	159.9	243.8	345.5	448.1	507.1	654.9	889.5	988.2	1029	767
IR2009, urban	19.5	17.1	8.7	9.3	11.6	17.5	31	56.3	93	160.5	258.8	397.7	532.9	676.2	910.7	1264.3	1564.5	1745	1531.1
IR2009, rural	7.2	8.3	4.8	5.7	10.8	13.9	17.9	32.8	75.3	142.5	204.4	387.4	571.4	778.7	898.9	1200.1	1372.6	1357.5	1049
IR2006, urban	27.6	16.6	8.3	11	12.9	17.8	30.8	52.7	87.5	157.1	247.4	371.1	506.2	643.8	872.7	1230.9	1550.7	1635.4	1357.6
IR2006, rural	5	6.4	3.7	5.7	10.5	13	20.3	33	83.5	155.9	217.6	442.3	700	867.4	1010.6	1385.2	1479.2	1489.4	1103.7
IR2004, urban	14.7	26.8	8.8	9.3	12.7	16.1	30	55.6	78.5	140.1	228.7	359.9	486.2	633.3	820.2	1194.9	1429.2	1540.2	1218.7
IR2004, rural	11.7	7.1	4	6.1	9.3	11.5	19.4	38.9	83.2	141.4	242	391.4	620.2	761.8	992.1	1218.3	1223.6	1077.4	780.4
IR2009, male, urban	17.4	19.8	8.7	10.1	11.9	15.3	23.1	40.5	70.8	127.3	225	397.4	590.5	803.1	1129.7	1578.3	2019.9	2311.1	2192.7
IR2009, female, urban	21.8	14.1	8.7	8.4	11.4	20	39.2	72.4	115.4	194.3	294	397.9	476	551.9	702.8	980.7	1155.9	1284.8	1101.6
IR2009, male, rural	7.1	9.9	5.7	6.4	11.9	13.3	16.1	29.1	66.6	134.1	206.9	444.9	682.1	953.8	1154.6	1594.3	1822.4	1825.3	1500.2
IR2009, female, rural	7.3	6.4	3.8	5	9.7	14.4	19.8	36.6	84.1	151.2	201.9	327.4	455.2	593.7	634.7	822.4	982.8	1008.4	781.8
IR2006, male, urban	35.9	17.6	9.1	11.7	12.5	14.3	23	37.3	65.9	123.8	216.4	368.3	551.1	773.2	1062	1547.2	2067.9	2315.9	2027
IR2006, female, urban	18.7	15.4	7.4	10.2	13.3	21.5	38.9	68.4	109.4	192.3	279.7	373.9	460.9	519.4	696.3	939.2	1099.6	1127.9	969.5
IR2006, male, rural	4.7	7.2	3.9	5.8	11.3	12.9	19.2	31.2	84.5	160.5	251.8	522	867.6	1120.2	1330.1	1921.2	2141	2243.5	1738.1
IR2006, female, rural	5.3	5.4	3.5	5.6	9.6	13	21.4	34.7	82.6	151.2	183.1	362.6	529.1	605.3	697.5	924.1	992.8	1035.6	820.5
IR2004, male, urban	15.8	26.6	9.1	9.1	12.1	14.1	22.7	40	59.4	110.7	202.1	355.5	525.6	763.4	1000.2	1493.6	1888.5	2095.7	1854.5
IR2004, female, urban	13.4	27.1	8.5	9.5	13.3	18.4	37.8	71.9	98.5	171.1	256.1	364.4	447.1	513.4	655.5	910.7	1022.6	1110.9	831.8
IR2004, male, rural	11.1	9.1	4.4	5.4	9.1	12.3	17.8	39.4	91.7	163.3	286.5	495.9	782.7	1028.1	1338.7	1671.2	1653.7	1461.2	1142.5
IR2004, female, rural	12.5	4.8	3.7	6.8	9.5	10.6	21	38.4	74.7	119.3	196.7	286	451.3	487.4	652.7	812.1	877.2	809.5	581.6

Table 2. Mortality Rates (MRs) Extracted from Chinese Cancer Registratry Annual Reports (1/100000)

Indicators	Age groups																	
	0	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
MR2009, all	4.8	5.3	3.3	3.6	4.9	5.4	7.1	13.8	29.8	59.8	99.1	187.8	277.1	403.5	582.9	905.1	1252.5	1576.8	1634.3
MR2006, all	6	4.7	2.7	3.6	5.2	5.4	8	14.2	30.4	61.6	109.7	188.1	288.3	404.3	594.3	935	1314.9	1549.8	1491.2
MR2004, all	6.7	5.1	2.8	4.1	5.4	5.6	8.5	16.2	33.1	60	113.2	187.7	285.6	398.3	592.8	921.5	1234	1399.1	1310.8
MR2009, male	4.3	5.5	3.7	4.2	6.3	6.5	7.7	15.9	34.1	72.3	124.4	242.7	366.1	532.9	783.6	1182.8	1662.8	2087.3	2297.3
MR2009, female	5.5	5.1	2.8	2.9	3.5	4.2	6.5	11.7	25.3	47.1	72.9	131.3	187.5	273.8	386.9	649.9	887.9	1171.6	1214.7
MR2006, male	5.2	5.1	3	4.3	6.3	5.8	8.1	15.7	36	75	135.9	243.1	377.2	538.1	777.4	1235.4	1783.6	2182.3	2195.6
MR2006, female	6.9	4.2	2.5	2.8	4	5	7.9	12.7	24.8	47.5	82.6	132.2	198.2	273.6	422.1	661.2	918.1	1095.5	1101.9
MR2004, male	4.9	4.9	2.3	4.3	6.5	6.1	9.5	19.7	38.5	73.2	143.7	240.5	372.6	525.2	770.9	1201	1641.3	1884.7	1902.9
MR2004, female	8.7	5.3	3.4	4	4.2	5.1	7.5	12.6	27.7	46.1	81.7	133.8	197.9	277.1	426.5	658.9	883.3	1037.1	966.1
MR2009, urban	6	5.7	3.3	3.9	4.3	4.9	6.4	13.5	28	53.5	96.5	176	250.1	357.3	548.8	871.5	1248.1	1621.4	1768.5
MR2009, rural	3	4.8	3.3	3.1	6.2	6.7	8.6	14.3	33.2	72.4	104.8	217.8	341.5	503.5	650.9	985.8	1263.9	1463.9	1284.1
MR2006, urban	7.3	4.9	2.5	3.9	5	5	7.3	12.9	25.8	53.9	103.5	164.7	247.1	350.1	550.9	883.8	1301.2	1569.2	1557.8
MR2006, rural	3.3	4.2	3.3	3	6	7.4	10.3	18.2	46.8	94	136	291.4	464.7	621.6	778	1186.9	1379.6	1461.3	1205.6
MR2004, urban	9.4	5.5	3.5	4.4	5.2	5.2	7.8	14.3	27.5	52.3	102.6	164.5	240.5	344.3	540.5	879.9	1256	1503.2	1465.1
MR2004, rural	3	4.4	1.7	3.6	5.8	7.2	10.3	20.9	48	86.6	150.4	257.6	408.2	548.2	771.3	1066.2	1165.5	1128	883.6
MR2009, male, urban	5	5.9	3.6	4.8	5.5	6	6.9	14.9	31.4	63.3	120.2	228.6	330.8	473.6	732.2	1114.5	1632.7	2119.4	2475.9
MR2009, female, urban	7.1	5.5	2.9	2.9	2.9	3.7	5.9	12.1	24.6	43.7	71.8	122.1	170.3	243.2	374.7	652.1	903	1216.5	1309.4
MR2009, male, rural	3.2	5	3.9	3.3	7.6	7.9	9.6	17.6	39.7	90.4	133.7	278	447.9	656.2	881.9	1341.9	1742.4	2002.1	1804
MR2009, female, rural	2.7	4.6	2.7	2.9	4.7	5.6	7.7	11	26.7	53.9	75.1	155	229.7	342.2	412.2	644.6	849.2	1062.3	976.2
MR2006, male, urban	7	5	2.9	4.6	6	5.2	7.1	13.4	29.3	64.6	127.1	210.6	319.9	467.6	711	1151.9	1740.4	2172.2	2274.2
MR2006, female, urban	7.6	4.8	2	3.1	3.9	4.7	7.6	12.4	22.3	42.7	78.9	117.9	173.6	237.1	401.8	636.6	918.2	1119.3	1142.4
MR2006, male, rural	1.6	5.4	3.1	3.5	7.4	8.3	11.7	23.3	60.1	120.2	173.5	388	622	810.5	1051.3	1661.8	2007.8	2234.9	1794.6
MR2006, female, rural	5.3	2.9	3.5	2.3	4.4	6.5	8.9	13.3	33.6	67.5	98.2	194.7	304.3	425.7	510.2	778.4	918.1	995.6	942.7
MR2004, Male, urban	7.5	5	2.8	4.6	6	5.7	8.4	16.7	30.1	61.1	127	202.7	310.7	441.8	691	1130.2	1653.7	2024.5	2155.1
MR2004, female, urban	11.5	6	4.3	4.2	4.4	4.6	7.2	11.8	24.9	42.9	77.3	125.4	170.5	253.8	401.9	641.6	904.9	1103.9	1054
MR2004, male, rural	1.4	4.6	1.6	3.6	7.6	7.6	12.4	27.2	61.3	115.9	202.8	355.5	537	744.4	1034.1	1455.9	1600.6	1499.1	1164.1
MR2004, female, rural	4.8	4.2	1.8	3.5	3.9	6.8	8.2	14.7	34.8	56.9	97	159	274	345.2	513.1	717.3	818.7	870.4	730.8

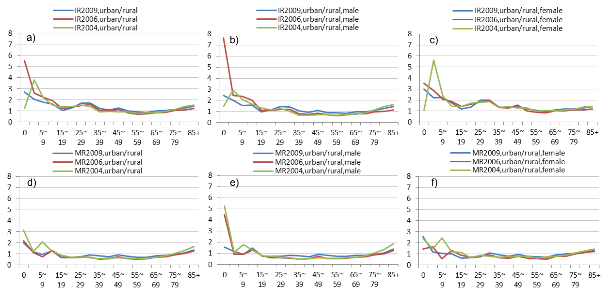

Figure 3. IR and MR Ratios between Urban and Rural Areas by Age, Gender and Year of Reporting

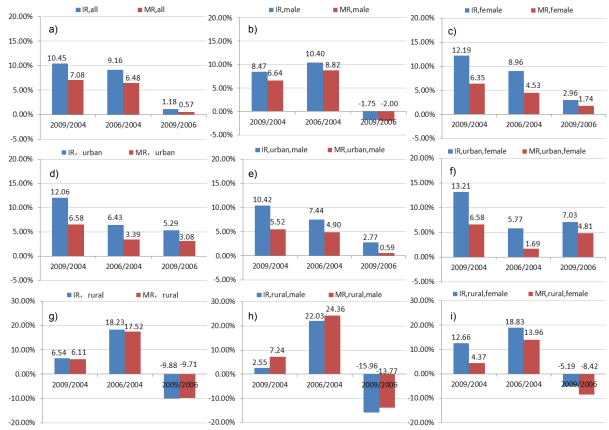

Figure 4. Changes in Accumulative IR and MR by Age, Gender, Region and Year of Reporting

Changes in accumulative IR and MR by age, gender, region and year of reporting

Fiugre 4 displays the percentage changes in accumulative IRs (AIRs) and MRs (AMRs) between different years and genders and regions. The biggest increase was found with registered AIR and AMR for rural males between year 2006 and year 2004, being 22.03% and 24.36% respectively. The AIRs and AMRs for urban areas showed a stable increasing trend from 2004 to 2006 and 2009 and the growth rates of the AIRs were greater than that of AMRs; while these two indicators for rural regions presented a mixed tend, i.e., a decrease in the AIRs and AMRs for males and females from year 2006 to 2009, a moderate increase for both genders from 2004 to 2006, and a slight increase from 2006 to 2009.

Discussion

Given the huge amount of scarce resources input annually on CCR and the vast data it produces every year, interpreting and using these data to leverage more and more cost-effective policies and interventions against cancer epidemic can not be overestimated. Yet, this is a challanging task since a whole range of factors are involved in cancer onset, case identification, progression and reporting (Perdue et al., 2014; Kharazmi et al., 2014; Barayan et al., 2014; Cheung 2013). Pin-pointing this complexity requires systematic thinking of determinants of each of the major indicators derived from CCRARs.

The typical S-shaped line graphs of IRs and MRs (as shown in Figure 1) reflect the fact that cancers are caused by the accumulative effects of multiple factors. Each of these factors exerts its effect at a certain possibility and it takes time for multiple factors to pool enough effect to develop cancers. Thus the younger the age of a population group, the lower the chances for them to get cancers; and as the age of the population grows older and older, their chances for developing cancers become greater and greater. The drops, from age group 81-84 to age group 85+, in the IRs of all the 3 years may be explained by reduction, due to high age, in risk behaviors (e.g., smoking, unprotected sex), in exposure to environmental carcinogenesis factors and in uptake of cancer screening, diagnosis and treatment services.

Plotting the age-specific IRs and MRs together provides an unique visualization of the similarities and differences between the two indicators. The patterns (ups and downs) of the lines representing MRs mimic that of IRs for all the 3 years. This reflects the fact that there is no radical cure for most cancers and one incidence case of cancer occurred at age 1 generally follows one mortality case some years later (i.e., at age1 plus years of survival of the individual under concern). The differences between age-specific IRs and MRs (i.e., IR minuses MR) were positive for almost all the age groups except the oldest couple ones (i.e., 80-84 and 85 years plus). This may be explained by: a) onset of cancer preceeds death due to cancer and IR increases as age grows; b) part of the individuals diagnosed with cancer died to non-cancer diseases and thus did not enter into the calculation of MRs. The big difference between the secondary peaks of the lines representing IR/MR ratios for urban and rual females worths particular attention. It may hint much superior early detection, treatment and repoting of cancers for women in urban than in rural areas (Liu et al, 2014).

The gender differences in the IRs and MRs may be attributed to: a) males and females had varied susceptibility for different types of cancers due to gender-related discrepancies in genetics, physiology and psychology; b) males and females differed in lifestyles and in exposure to environmental factors with significance of cancer genesis and prognosis; c) males and females responded differently to cancer-related symptoms and prevention and treatment services that lead to uneven registration of cancer incidence cases and deaths.

The urban versus rural ratios of age-specific IRs and MRs (Figure 3) suggest that cancer incidence and mortality rates were lower among urban residents than rural ones for the middle age groups; while higher, for residents belonging to the two extremes of age groups. One possible explanation for this phenomenon may be that the actual cancer IRs and MRs were higher among rural residents for all the age groups and the seemingly lower IRs and MRs in rural than urban areas for the two extremes age groups were caused by under reporting. In China, most cancer diagnosis and treatment services are only available from large hospitals that are often far away from rural residents and outside the jurisdiction of their local cancer registries. This poses accessibility barriers not only for rural residents (especially the aged ones) to get cancer services but also for local rural cancer registries to obtain relevant cancer case records and check and complete required data. In addition, a substantial part of rural children did not register formal residence until their school age due to "un-planned" birth and given current mechanisms, it is highly probable that "non-residence" children diagnosed with and died of cancers will never enter the cancer registry system.

Regarding changes in the IRs and MRs between different years, it is hard to draw consistent trends or patterns. For instance, the accumulative IRs and MRs for urban areas increased by 6.43% and 3.39% respectively from 2004 to 2006 and by 5.29% and 3.08% respectively from 2006 to 2009; while the same indicators for rural areas increased from 2004 to 2006 yet decreased from 2006 to 2009. Similar contradictive results were also observable with the IRs and MRs for males and females. These may be attributed to a variety of reasons. First, the CCRAR2004 utilized data provided by 38 out of all the then 43 national cancer registries; while the CCRAR2006, 34 out 49 registries; and the CCRAR2009, 72 out of 104 regisitries. Second, China cancer registry system made foundamental changes in 2006 and shifted from the original 5-year reporting into annual reporting. Third, China started its new nationwide health reforms in 2009 and began to implement the New Cooperative Medical Systems in rural areas throughout the country.

The patterns and trends in the IRs and MRs described in this paper have important implications: a) cancer control depends on comprehensive strategies targeting at multiple factors since the disease is not caused by single or limited major determinants; b) cancer control requires enduring efforts covering the whole lifespan of target population since cancer IRs remain almost the highest until the oldest age groups and there is no time point when it becomes too late for an individual to take action preventing the disease as long as he/she is still cancer free; c) given that cancer progresses from a minimum accumulative effects of influencing factors (Moore, 2013), identifying (via e.g., detection of proven biomarkers, use of comprehensive risk assessment questionnaires) a limited number of individuals who have already had enough exposure yet not reached the minimum threshold might prove to be a cost-effective strategy; d) there is a clear need to tackle cancer control differently, taking full consideration of the discrepancies between the males and females, between rural and urban residents, and between youngsters, the middle aged and the elderly; e) uses and interpretation of CCRARs should be cautious and take full account of all related factors including determinants of cancers genesis and prognosis as well as cancer registry system; f) although there are indications that CCR system had made substantial progress during 2004 and 2009, there is still great room for improvement and future efforts in this regard should pay special attention to under-reporting of cancer incidence and mortality cases for children and the elderly in rural areas (Belasco et al., 2014; Tripathi et al., 2014).

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