

RESEARCH COMMUNICATION

Estimation of Cancer Incidences in Aichi Prefecture: Use of a Model Area with Good Quality Registry Data

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Abstract

In Japan, local government is responsible for organization of population-based cancer registries and the quality of the registration remains modest, mainly due to dependence on voluntary-based operations without legal obligations. Aichi Prefecture cancer registry covers a large population, estimated at 7 million, and its quality has yet to reach the level required internationally. The derived cancer incidences for Aichi Prefecture therefore tend to be underestimated. In the present study we set up a model area, located in the central part of Aichi Prefecture, with a good quality of registry data, covering a reasonable population, including both urban and rural areas. Our model area has typical demographic features of Aichi Prefecture.

The materials were data on cancer incidence and deaths during the period of 1996-2000 in this model area of Aichi prefecture, with a population of approximately one million, under the jurisdiction of three public health centers, covering nine municipalities. The percentage of death certificated notified (DCN) cases for all sites was around 14% and the incidence/death ratio was around 1.9. Estimated age-adjusted incidence rates were found to be 256.0 (per 100,000) for males and 177.6 for females, these values being 10~15 % higher than those generated using data for the whole prefecture, and quite close to incidence rates in Japan estimated from the highest quality of data available. It is suggested that the cancer incidence in the Aichi prefecture is indeed being underestimated and that the actual figures may be closer to the estimates provided here.

Key Words: Population-based cancer registry - Cancer incidence - regional cancer registry

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Introduction

Aichi Prefecture is located in the approximate center of Japan, with the Pacific Ocean on its southern edge (Figure 1a). The prefecture spans an area of 5,146 square kilometers and has a population of 7 million. The prefectural capital is Nagoya, and the prefecture includes 86 municipalities as well as the 16 wards of Nagoya-city itself.

Population-based cancer registration is the only way to obtain information on cancer incidence on a population basis, and thus it plays an important role in cancer control. The operation of population-based cancer registries varies according to population size, funds for operating costs and manpower available, as well as local laws and regulations. These factors all affect the quality of the registered data, although it is obviously desirable for registration of cancer cases to be as complete as possible.

In Japan, population-based cancer registries are organized by local governments but not by the national



Figure 1. Geography of Aichi Prefecture (a) Aichi Prefecture, (b) Model Area of Aichi Prefecture

government. Aichi Cancer Registry (ACR) was established in 1962 as a population-based cancer registry, with the purpose of providing an accurate picture of cancer in Aichi

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Prefecture, as a basis for effective control by the Department of Health and welfare, Aichi Prefectural Government. Since 1999, a dramatic overhaul of the registration system has been undertaken, with a view to rationalization and strengthening of its effectiveness (Inoue et al., 2000). By reconstructing the operation scheme (Figure 2), commensurate improvements for providing information for cancer control measures among the community were made. However, several issues remain to prevent the ACR from

accomplishing its aim satisfactorily. As with other cancer registries in Japan, data provision is being carried out entirely on a voluntary basis, because of the lack of legal obligations to support population-based cancer registration. Moreover, the limited number of ACR personnel due to the insufficient budget has caused difficulties in active data collection. Especially for registries with a large population, as is here the case, the capture of new cases in the covered area is therefore a great challenge. Mainly due to the above reasons,

Table 1a. Incidences, Completeness of Reporting and Accuracy of Diagnosis in Aichi Prefecture, Japan According to Sex and Primary Site, During the Period of 1996-2000

Gender	Primary sites	ICD-10th	Number of incidences	Crude rate*	Age-	Completeness		Accuracy of
					standardized	of reporting	diagnosis	
					rate*	DCN/I (%)	I/D	HV/I (%)
					World population			
Male	All sites	C00-C96	62127	355.9	226.9	34.0	1.53	61.7
	Lip, oral cavity & pharynx	C00-C14	1465	8.4	5.5	18.0	1.97	79.5
	Esophagus	C15	1950	11.2	7.1	32.9	1.30	62.6
	Stomach	C16	13696	78.5	49.9	28.1	1.72	69.7
	Colon	C18	6192	35.5	22.3	20.1	2.31	76.9
	Rectum	C19-C21	3996	22.9	14.7	19.2	2.09	78.5
	Liver	C22	5985	34.3	21.9	52.5	1.14	37.9
	Gallbladder	C23-C24	1557	8.9	5.5	54.7	1.09	34.9
	Pancreas	C25	2470	14.2	8.8	54.2	1.04	25.9
	Larynx	C32	713	4.1	2.6	13.9	3.32	84.9
	Lung	C33-C34	10464	59.9	36.9	48.7	1.13	48.0
	Skin	C43-C44	576	3.3	2.1	11.3	4.97	88.2
	Prostate	C61	3233	18.5	11.1	21.6	2.25	75.7
	Bladder	C67	2321	13.3	8.3	14.0	3.34	84.7
	Kidney	C64-C66, C68	1472	8.4	5.5	23.4	2.04	71.5
	Brain & nervous system	C70-C72	418	2.4	1.9	41.9	1.31	51.9
	Thyroid	C73	247	1.4	1.0	12.6	2.57	82.2
	Malignant lymphoma	C81-C85, C96	1581	9.1	6.2	34.4	1.53	65.6
	Multiple myeloma	C88-C90	413	2.4	1.5	54.0	1.14	46.0
Leukemia	C91-C95	1076	6.2	4.8	41.6	1.31	58.4	
Female	All sites	C00-C96, D05-D06	46501	267.1	151.2	30.6	1.75	64.9
	Lip, oral cavity & pharynx	C00-C14	693	4.0	2.3	20.1	2.37	77.6
	Esophagus	C15	384	2.2	1.1	39.8	1.35	53.4
	Stomach	C16	7002	40.2	21.0	34.1	1.54	63.9
	Colon	C18	5474	31.4	16.2	25.5	1.97	70.6
	Rectum	C19-C21	2354	13.5	7.5	19.2	2.15	77.4
	Liver	C22	2378	13.7	6.8	54.8	1.16	36.1
	Gallbladder	C23-C24	1981	11.4	4.9	57.9	1.05	27.7
	Pancreas	C25	1864	10.7	5.0	58.9	1.04	21.7
	Larynx	C32	66	0.4	0.2	24.2	2.75	72.7
	Lung	C33-C34	3963	22.8	11.2	50.1	1.18	46.1
	Skin	C43-C44	622	3.6	1.8	7.7	6.10	90.7
	Breast	C50, D05	7980	45.8	31.1	9.6	3.70	87.1
	Uterus	C53-C55, D06	3611	20.7	13.9	15.1	2.91	82.9
	Ovary	C56	1546	8.9	5.8	29.7	1.70	66.2
	Bladder	C67	697	4.0	1.9	23.0	2.31	74.9
	Kidney	C64-C66, C68	640	3.7	2.0	27.5	1.95	67.8
	Brain & nervous system	C70-C72	355	2.0	1.4	49.6	1.32	46.5
	Thyroid	C73	961	5.5	3.7	9.1	5.19	86.9
Malignant lymphoma	C81-C85, C96	1149	6.6	3.7	33.8	1.54	66.2	
Multiple myeloma	C88-C90	385	2.2	1.1	60.5	1.08	39.5	
Leukemia	C91-C95	778	4.5	3.3	39.8	1.35	60.2	

*Per 100,000 population. ICD-10th, International Classification of Diseases, 10th Revision; DCN/I, proportion of cases with the death certificate notify; I/D, number of incidence/number of deaths; HV/I, proportion of histologically verified to incident cases.

the quality of the cancer registry data has not reached the level required internationally, as with most other population-based cancer registries in Japan (Parkin et al., 2003). Fortunately, ACR has a model area, located in the central part of Aichi prefecture (Figure 1b), with a good quality of registry data and a reasonable population of approximately one million, under the jurisdiction of three public health centers covering nine municipalities, including both urban and rural areas.

The purpose of the present study was to estimate the actual cancer incidence in Aichi Prefecture, using data from our model area.

Materials and Methods

In the present study, the data for cancer registration in Aichi Prefecture, Japan, for the 5-year period in 1996-2000 were used. For the whole Aichi Prefecture and the model

Table 1b. Incidences, Completeness of Reporting and Accuracy of Diagnosis in the Central model Area of Aichi Prefecture, Japan According to Sex and Primary Site, During the Period of 1996-2000

Gender	Primary sites	ICD-10th	Number of incidences	Crude rate*	Age-standardized rate*	Completeness of reporting		Accuracy of diagnosis
					World population	DCN/I (%)	I/D	HV/I (%)
Male	All sites	C00-C96	9217	343.9	256.0	15.0	1.81	78.8
	Lip, oral cavity & pharynx	C00-C14	188	7.0	5.2	9.6	1.77	90.4
	Esophagus	C15	239	8.9	6.5	15.1	1.48	82.4
	Stomach	C16	2063	77.0	56.8	11.1	2.05	86.9
	Colon	C18	979	36.5	26.8	6.4	3.38	90.6
	Rectum	C19-C21	637	23.8	17.6	7.4	2.94	90.9
	Liver	C22	864	32.2	24.0	26.2	1.27	55.3
	Gallbladder	C23-C24	211	7.9	5.8	26.5	1.14	49.3
	Pancreas	C25	355	13.2	9.7	23.7	1.11	34.4
	Larynx	C32	104	3.9	2.8	3.8	4.95	95.2
	Lung	C33-C34	1434	53.5	38.9	24.3	1.22	72.4
	Skin	C43-C44	115	4.3	3.2	4.3	6.76	95.7
	Prostate	C61	511	19.1	13.9	8.8	2.75	89.4
	Bladder	C67	364	13.6	10.0	5.2	4.85	93.7
	Kidney	C64-C66, C68	241	9.0	6.8	10.8	2.48	83.4
	Brain & nervous system	C70-C72	72	2.7	2.3	13.9	1.53	73.6
	Thyroid	C73	46	1.7	1.3	2.2	2.88	93.5
	Malignant lymphoma	C81-C85, C96	219	8.2	6.4	14.2	1.96	85.8
	Multiple myeloma	C88-C90	58	2.2	1.6	24.1	1.09	75.9
	Leukemia	C91-C95	156	5.8	5.0	18.6	1.59	81.4
Female	All sites	C00-C96, D05-D06	6983	275.8	177.6	13.5	2.15	80.1
	Lip, oral cavity & pharynx	C00-C14	92	3.6	2.4	9.8	3.29	88.0
	Esophagus	C15	35	1.4	0.8	28.6	1.35	68.6
	Stomach	C16	998	39.4	24.6	16.4	1.84	81.2
	Colon	C18	815	32.2	19.1	12.4	2.54	83.4
	Rectum	C19-C21	372	14.7	9.1	6.7	3.13	90.9
	Liver	C22	377	14.9	8.8	26.8	1.44	53.1
	Gallbladder	C23-C24	262	10.3	5.3	27.1	1.04	37.8
	Pancreas	C25	245	9.7	5.5	28.2	1.03	29.0
	Larynx	C32	16	0.6	0.3	18.8	4.00	81.3
	Lung	C33-C34	536	21.2	11.9	24.6	1.31	71.1
	Skin	C43-C44	131	5.2	2.8	3.1	6.89	96.9
	Breast	C50, D05	1259	49.7	36.1	3.7	4.63	94.8
	Uterus	C53-C55, D06	554	21.9	16.0	5.4	3.62	92.6
	Ovary	C56	224	8.8	6.3	10.3	2.09	86.2
	Bladder	C67	107	4.2	2.3	10.3	3.24	88.8
	Kidney	C64-C66, C68	88	3.5	2.3	6.8	2.38	89.8
	Brain & nervous system	C70-C72	47	1.9	1.5	21.3	1.31	72.3
	Thyroid	C73	238	9.4	6.9	2.9	7.93	95.0
	Malignant lymphoma	C81-C85, C96	183	7.2	4.4	16.4	1.83	83.6
Multiple myeloma	C88-C90	52	2.1	1.1	36.5	1.11	63.5	
Leukemia	C91-C95	110	4.3	3.7	16.4	1.64	83.6	

*Per 100,000 population. CD-10th, International Classification of Diseases, 10th Revision; DCN/I, proportion of cases with the death certificate notify; I/D, number of incidence/number of deaths; HV/I, proportion of histologically verified to incident cases.

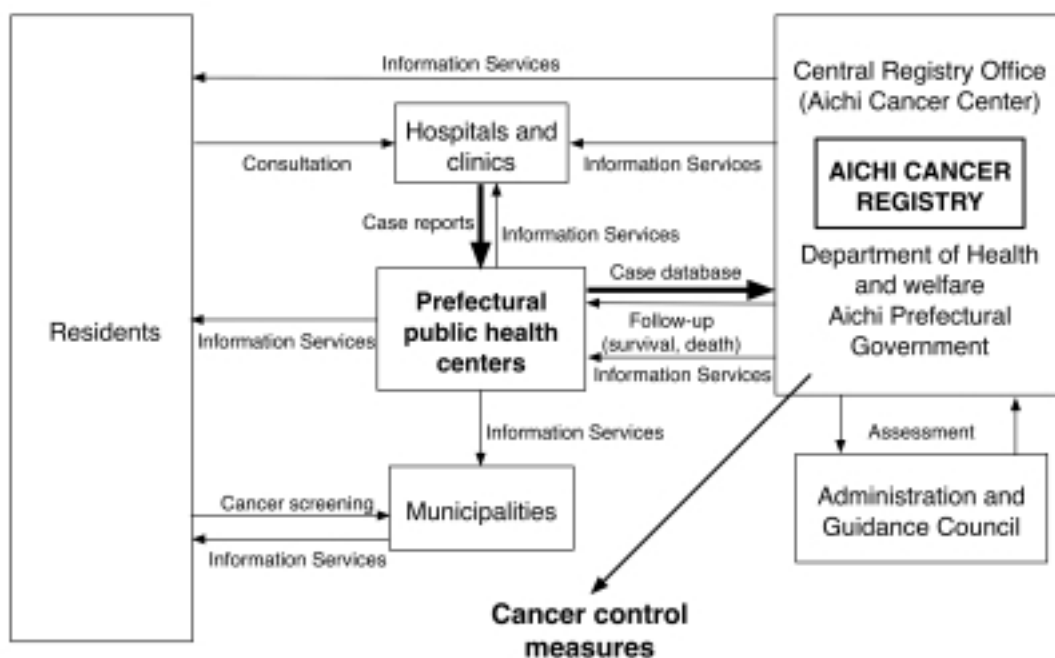


Figure 2. Cancer Registration system in Aichi Prefecture

area, incidences, deaths, histologically verified cases (HV), and cases first notified via death certificate (DCN) were available by gender and age-group for total cancers and major sites; oral cavity and pharynx, esophagus, stomach, colon, rectum, liver, gallbladder and biliary tract, pancreas, larynx, lung, skin, bladder, kidney, brain and central nerves, thyroid, lymphoma, multiple myeloma and leukemia for both genders, prostate for males, and breast, uterus and ovary for females. The international Classification of Disease, 10th Revision (ICD-10) (WHO, 1992) was used to classify the tumours for these sites. In the Aichi Cancer Registry, there is a two-year time lag between the year of diagnosis and determination of DCN cases of cancer (ICD-10 C00-C99, D05-D06) of the year. Cancer cases determined before the arrival of notification were defined as DCN cases when registration reports were provided. The proportions of DCN cases, the incidence/deaths ratios (I/D) and ratios of HV to

incident cases (HV/I) were calculated by gender and cancer site using the data mentioned above. The population at risk for the period of 1996-2000 was estimated by linear interpolation within sex and age groups, with the census data of 1995 and 2000 (Figure 3a and b). Age standardization was performed by direct methods, using the world standard population (Figure 3c, Parkin and Whelan, 2002). Each estimated Age-standardized rate (ASR), DCN, I/D and HV/I for the model area were compared with those for the whole Aichi Prefecture. Moreover, expected incidences, using the age-specific rate in the model area, were estimated and compared with observed cancer incidences in the entire Aichi Prefecture. For comparison, the present study used the most recent data for cancer incidence in 1998 (1997-1999) from the research group for Population-based Cancer Registration in Japan (The Research Group for Population-based Cancer Registration in Japan, 2003).

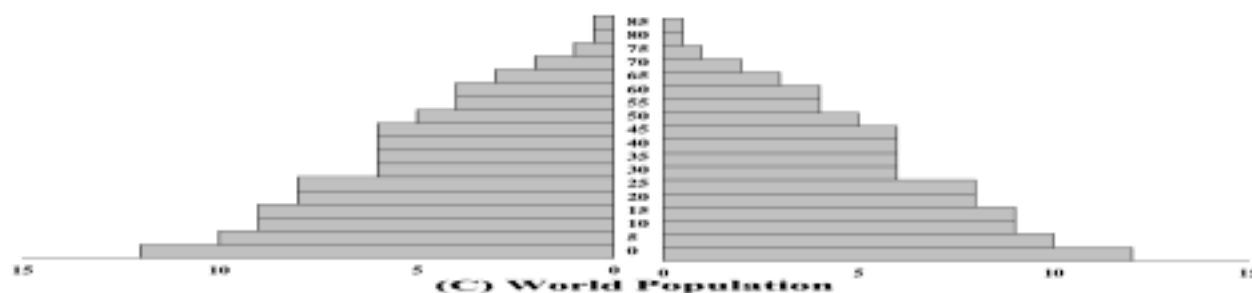


Figure 3. Population Pyramid of Model area of Aichi Prefecture, Aichi Prefecture and world population.

Results and Discussion

Table 1a and 1b shows the incidences, crude rates, age-standardized rates and completeness of registration during the period of 1996-2000, for the whole and model areas of Aichi prefecture. The population at risk for this period was 34,866,572 in the whole area and 5,212,312 in the model area of Aichi Prefecture. Compared with the whole of Aichi Prefecture (34.0% in males and 30.6% in females, Table 1a), the DCN percentages for all sites of cancer in the model

area were appreciably low (15.0% in males and 13.5% in females, Table 1b). As shown in Figure 2, the DCN values in the model area were lower than those based on data from 12 representative population-based registries in Japan (All Japan), even with the same population size (Department of Health, Aichi Prefectural Government, 2004; The Research Group for Population-based Cancer Registration in Japan, 2003). The I/D ratio in the model area was around 1.9 (1.81 in males and 2.15 in females) for all sites (Table 1b) and higher than that for All Japan (Figure 2). Likewise, the HV/

Table 2a. Age-specific Incidence Rate (per 100,000) in the Model Area of Aichi Prefecture According to Gender and Primary Site, During the Period of 1996-2000

Sex	Primary sites ICD-10th	Age group (years)																		
		0-4	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-	
Male	All sites	C00-C96	18.8	6.2	8.7	11.7	13.1	15.3	30.1	54	106.9	229.4	358.6	631.6	917.4	1606.5	2156.2	2223.3	3026	3037.8
	Lip, oral cavity & pharynx	C00-C14	0	0	0.7	0	1.2	0.8	2.2	4.3	2.3	9.3	8.7	17.2	16.4	26.3	41.5	27.2	37.6	13.1
	Esophagus	C15	0	0	0	0	0	0	0	1.6	2.9	4.1	10.2	27.8	29.1	41	41.5	49.5	79.4	39.2
	Stomach	C16	0	0	0	0	0.4	2.3	4.4	12.3	31.1	67.4	92.8	148.6	205.4	372.6	457.8	437.7	631.1	601
	Colon	C18	0	0	0	0	0	0.4	3.1	3.7	12.9	23.7	46.6	81.7	112.8	170.7	211.8	200.3	275.9	267.9
	Rectum	C19-C21	0	0	0	0	0.4	0.4	3.1	3.2	11.7	22.6	30.6	59.8	82.2	115.1	117.3	94	117	117.6
	Liver	C22	0.6	0.7	0	0	0	0.4	0.4	1.6	4.1	21.6	35	64.5	115.1	209.7	168.8	188	150.5	182.9
	Gallbladder	C23-C24	0	0	0	0	0	0	0	1.6	2.9	1.5	6.3	10.1	26.1	32.2	60.1	64.3	83.6	91.5
	Pancreas	C25	0	0	0.7	0	0	0	0.4	1.6	1.8	6.7	15.5	27.8	33.6	56.6	90.1	71.7	150.5	156.8
	Larynx	C32	0	0	0	0	0	0	0	0	0	1.5	4.4	8.9	17.9	15.6	25.8	17.3	33.4	26.1
	Lung	C33-C34	0	0	0	0	0.4	0	1.8	3.2	11.2	20.6	36.9	81.7	109.8	225.3	422.1	531.7	681.3	646.8
	Skin	C43-C44	0	0	0	0	0	1.2	0.9	1.1	2.3	4.6	1.9	7.1	9.7	12.7	22.9	29.7	54.3	78.4
	Prostate	C61	0	0	0	0	0	0	0	0	0	0	3.4	11.2	31.4	95.6	184.6	225	296.7	352.8
	Bladder	C67	0.6	0	0	0	0	0	0.4	1.6	1.8	7.7	16	20.1	32.9	68.3	91.6	98.9	150.5	130.7
	Kidney	C64-C66, C68	0.6	0	1.3	0	0	0	0	2.1	4.1	10.3	13.6	19.5	26.9	37.1	55.8	34.6	54.3	39.2
	Brain & nervous system	C70-C72	1.3	2.1	0.7	1.6	1.2	1.2	1.3	1.6	1.2	3.1	3.9	4.7	5.2	4.9	5.7	4.9	20.9	26.1
	Thyroid	C73	0	0	0	0	0	0	0.9	1.1	2.3	2.6	2.4	5.3	6	4.9	2.9	2.5	8.4	6.5
	Malignant lymphoma	C81-C85, C96	1.3	0.7	0.7	3.2	1.2	0.4	0.9	4.3	4.1	6.7	13.1	9.5	19.4	40	40.1	42	50.2	52.3
	Multiple myeloma	C88-C90	0	0	0	0	0	0	0.4	0	0	1.5	1.5	3	4.5	6.8	24.3	19.8	16.7	26.1
	Leukemia	C91-C95	3.9	2.8	2	1.1	1.6	2.3	3.1	1.6	4.1	6.7	6.8	7.1	9.7	25.4	28.6	17.3	20.9	26.1
Female	All sites	C00-C96	10.3	5.9	7.7	11.4	12.6	32.2	61.8	124.9	221.8	334.1	341.6	441.8	584.4	781.3	930.5	1136.6	1392.6	1487.5
	Lip, oral cavity & pharynx	C00-C14	0	0	0.7	0	0.5	0.9	1	1.8	2.5	3.7	3.1	7	7.1	12.4	13.4	9.8	9.2	33.7
	Esophagus	C15	0	0	0	0	0	0	0	0	0	0.5	1.5	3.2	4.7	2.9	6.1	4.9	6.9	16.8
	Stomach	C16	0	0	0.7	1.2	1	2.3	6.3	11	36.1	34.3	36.7	48.9	90.8	122.3	186.1	177.2	230.9	227.3
	Colon	C18	0	0	0	1.2	1	0.9	2.6	4.3	12.5	26.9	31.6	51.5	76.6	99.3	125.3	159.3	247.1	207.7
	Rectum	C19-C21	0	0	0	0.6	0	0.5	2.1	3.7	6.9	16.3	14.8	29.9	38.7	43.9	48.7	66.7	87.8	78.6
	Liver	C22	0.7	0	0	0	0	0.5	1	1.2	2.5	3.7	5.1	14	41.1	76.4	76.6	78	120.1	92.6
	Gallbladder	C23-C24	0	0	0	0	0	0	0	0.6	0.6	3.7	6.1	10.8	15.8	30.6	37.7	66.7	110.9	145.9
	Pancreas	C25	0	0	0	0	0	0	0	0.6	2.5	4.7	6.6	19.7	15.8	42	37.7	56.9	57.7	89.8
	Larynx	C32	0	0	0	0	0	0	0	0	0	0	0.5	1.9	1.6	1.9	1.2	4.9	6.9	2.8
	Lung	C33-C34	0	0	0	0.6	0.5	0.9	2.6	1.8	1.9	14.8	15.8	34.3	33.2	69.7	88.8	151.2	154.7	168.4
	Skin	C43-C44	0	0	0	0	1	0.5	0	0	1.2	3.7	3.6	8.9	9.5	7.6	14.6	30.9	46.2	75.8
	Breast	C50, D05	0.7	0	0	0	0	1.8	15.7	47.1	81	128.1	105.4	96.6	103.5	97.4	86.4	100.8	62.4	61.7
	Uterus	C53-C55, D06	0	0	0	0.6	1	10.4	15.7	26.3	34.9	37.9	42.3	35.6	41.9	42	42.6	37.4	39.3	44.9
	Ovary	C56	0	0	0	2.4	1.9	5	1	4.9	10.6	15.8	19.3	19.7	12.6	22	15.8	4.9	32.3	28.1
	Bladder	C67	0	0	0	0	0.5	0	0	1.8	0	0.5	4.6	5.7	9.5	11.5	15.8	27.6	30	47.7
	Kidney	C64-C66, C68	0.7	0	0	0	0	0.5	0	1.8	1.9	4.2	3.6	3.2	10.3	12.4	15.8	21.1	9.2	11.2
	Brain & nervous system	C70-C72	1.4	1.5	0.7	0	0.5	0.9	0.5	0.6	1.2	1.1	1.5	4.4	3.2	5.7	4.9	9.8	4.6	2.8
	Thyroid	C73	0	0.7	0	1.2	1.9	3.6	5.8	8.6	16.2	15.3	17.3	19.1	20.5	15.3	15.8	17.9	23.1	8.4
	Malignant lymphoma	C81-C85, C96	0	0	0	0	1	0.9	1	1.8	3.1	5.3	4.6	8.3	13.4	26.7	37.7	43.9	39.3	47.7
Multiple myeloma	C88-C90	0	0	0	0	0	0	0	0	0	1.6	0.5	1.9	6.3	4.8	12.2	16.3	16.2	14	
Leukemia	C91-C95	3.4	2.2	3.5	1.2	1	0.9	4.2	3.1	3.7	4.2	3.6	6.4	12.6	7.6	14.6	11.4	4.6	5.6	

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Table 2b. Age-specific Expected Incidence in the Whole Aichi Prefecture According to Gender and Primary Site, by Using the Data of the Model Area, During the Period of 1996-2000

Sex	Primary sites	ICD-10th	All ages Age group (years)																	
			0-4	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-
Male																				
All sites	C00-C96	69899	175	57	84	133	183	231	402	632	1194	2974	5016	7607	9237	12917	11981	7302	5942	3832
Lip, oral cavity & pharynx	C00-C14	1378	0	0	6	0	17	12	30	50	26	120	122	207	165	212	231	89	74	16
Esophagus	C15	1804	0	0	0	0	0	0	0	19	33	53	143	335	293	329	231	162	156	49
Stomach	C16	15596	0	0	0	0	6	35	59	144	348	874	1298	1790	2069	2996	2544	1438	1239	758
Colon	C18	7401	0	0	0	0	0	6	41	44	144	307	652	984	1136	1373	1177	658	542	338
Rectum	C19-C21	4755	0	0	0	0	6	6	41	38	131	293	428	720	827	925	652	309	230	148
Liver	C22	6562	6	6	0	0	0	6	6	19	46	280	489	777	1158	1686	938	617	295	231
Gallbladder	C23-C24	1628	0	0	0	0	0	0	0	19	33	20	88	121	263	259	334	211	164	115
Pancreas	C25	2713	0	0	6	0	0	0	6	19	20	87	217	335	339	455	501	236	295	198
Larynx	C32	793	0	0	0	0	0	0	0	0	0	20	61	107	181	125	143	57	66	33
Lung	C33-C34	11121	0	0	0	0	6	0	24	38	125	267	517	984	1106	1812	2345	1746	1338	816
Skin	C43-C44	871	0	0	0	0	0	17	12	13	26	60	27	86	98	102	127	97	107	99
Prostate	C61	4060	0	0	0	0	0	0	0	0	0	0	48	135	316	769	1026	739	583	445
Bladder	C67	2791	6	0	0	0	0	0	6	19	20	100	224	242	331	549	509	325	295	165
Kidney	C64-C66, C68	1798	6	0	13	0	0	0	0	25	46	133	190	235	271	298	310	114	107	49
Brain & nervous system	C70-C72	505	12	19	6	18	17	17	18	19	13	40	54	57	53	39	32	16	41	33
Thyroid	C73	330	0	0	0	0	0	0	12	13	26	33	34	64	60	39	16	8	16	8
Malignant lymphoma	C81-C85, C96	1618	12	6	6	36	17	6	12	50	46	87	184	114	196	322	223	138	98	66
Multiple myeloma	C88-C90	448	0	0	0	0	0	0	6	0	0	20	20	36	45	55	135	65	33	33
Leukemia	C91-C95	1116	36	25	19	12	23	35	41	19	46	87	95	86	98	204	159	57	41	33
Female																				
All sites	C00-C96	53474	91	51	71	122	166	451	766	1376	2390	4252	4671	5164	5855	6651	6320	5814	4944	4320
Lip, oral cavity & pharynx	C00-C14	704	0	0	6	0	6	13	13	20	27	47	42	82	71	106	91	50	33	98
Esophagus	C15	276	0	0	0	0	0	0	0	0	0	7	21	37	47	24	41	25	25	49
Stomach	C16	7763	0	0	6	13	13	32	78	121	389	436	501	572	910	1041	1264	907	820	660
Colon	C18	6387	0	0	0	13	13	13	32	47	134	342	432	602	768	846	851	815	877	603
Rectum	C19-C21	2885	0	0	0	6	0	6	26	40	74	208	202	349	388	374	330	341	312	228
Liver	C22	3023	6	0	0	0	0	6	13	13	27	47	70	163	411	650	520	399	426	269
Gallbladder	C23-C24	2103	0	0	0	0	0	0	0	7	7	47	84	126	158	260	256	341	394	424
Pancreas	C25	1944	0	0	0	0	0	0	0	7	27	60	90	230	158	358	256	291	205	261
Larynx	C32	127	0	0	0	0	0	0	0	0	0	7	22	16	16	8	25	25	8	
Lung	C33-C34	4244	0	0	0	6	6	13	32	20	20	188	216	401	332	594	603	774	549	489
Skin	C43-C44	1033	0	0	0	0	13	6	0	0	13	47	49	104	95	65	99	158	164	220
Breast	C50, D05	9187	6	0	0	0	0	25	195	519	873	1630	1441	1129	1037	829	587	516	221	179
Uterus	C53-C55, D06	4030	0	0	0	6	13	146	195	290	376	483	578	416	419	358	289	191	139	130
Ovary	C56	1640	0	0	0	26	26	70	13	54	114	201	265	230	127	187	107	25	115	82
Bladder	C67	849	0	0	0	0	6	0	0	20	0	7	63	67	95	98	107	141	107	139
Kidney	C64-C66, C68	682	6	0	0	0	0	6	0	20	20	54	49	37	103	106	107	108	33	33
Brain & nervous system	C70-C72	351	12	13	6	0	6	13	6	7	13	13	21	52	32	49	33	50	16	8
Thyroid	C73	1731	0	6	0	13	26	51	71	94	175	194	237	223	206	130	107	91	82	24
Malignant lymphoma	C81-C85, C96	1439	0	0	0	0	13	13	13	20	34	67	63	97	135	228	256	225	139	139
Multiple myeloma	C88-C90	417	0	0	0	0	0	0	0	0	0	20	7	22	63	41	83	83	57	41
Leukemia	C91-C95	804	30	19	32	13	13	13	52	34	40	54	49	74	127	65	99	58	16	16

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I of the model area was 78.8% for males and 80.1% for females, and higher than those based on data from all Japan (Figure 2).

Estimated age-adjusted total incidences were found to be 256.0 (per 100,000) for males and 177.6 for females, these values being appreciably higher than those estimated using data for the whole area of the prefecture (226.9 in males and 151.2 in females), but quite close to incidences

for other areas with the highest quality of data (Figure 3). The present study thus suggested that the cancer incidences in the prefecture are indeed being underestimated and that the actual figures may be closer to our estimates.

Using the age-specific incidence rates in the model area (Table 2a), the expected cancer incidence (EIN) in the whole of Aichi Prefecture was estimated (Table 2b). Estimated total numbers were 69,899 for males and 53,474 for

Table 3. Age-specific Observed Incidences in the Whole Aichi Prefecture According to Gender and Primary Site During the Period of 1996-2000

Sex	Primary sites	ICD-10th	All ages Age group (years)																	
			0-4	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-
Male																				
All sites	C00-C96	62127	109	45	73	94	154	241	341	560	1012	2504	4227	6413	8745	11157	10323	6985	5279	3865
Lip, oral cavity & pharynx	C00-C14	1465	0	0	1	1	8	11	14	24	47	107	152	224	226	211	206	117	70	46
Esophagus	C15	1950	0	0	1	0	0	2	7	19	67	167	321	365	362	288	171	98	82	
Stomach	C16	13696	3	2	0	2	7	20	49	138	272	702	1027	1520	1989	2434	2248	1465	1010	808
Colon	C18	6192	0	0	0	1	5	8	26	46	92	228	482	727	954	1149	993	642	508	331
Rectum	C19-C21	3996	0	0	0	0	4	9	24	29	75	220	364	557	710	755	547	332	210	160
Liver	C22	5985	5	1	2	0	0	8	18	22	58	227	418	661	1142	1497	911	506	328	181
Gallbladder	C23-C24	1557	0	0	0	0	0	0	5	9	13	39	61	117	187	245	269	222	216	174
Pancreas	C25	2470	0	0	1	1	1	1	3	8	29	90	175	278	330	390	426	301	255	181
Larynx	C32	713	0	0	0	0	0	1	0	4	9	20	63	81	123	134	121	64	57	36
Lung	C33-C34	10464	0	0	1	0	4	3	14	56	119	265	557	824	1199	1855	2056	1576	1165	770
Skin	C43-C44	576	0	0	0	0	0	6	7	9	16	28	32	48	67	71	88	73	56	75
Prostate	C61	3233	0	0	0	0	0	1	0	1	0	3	30	104	253	583	750	569	532	407
Bladder	C67	2321	3	0	1	1	2	2	6	18	34	82	151	212	289	388	418	286	245	183
Kidney	C64-C66, C68	1472	4	1	4	0	0	4	2	15	42	96	137	157	227	256	222	146	102	57
Brain & nervous system	C70-C72	418	13	9	10	12	8	16	17	18	17	27	29	47	48	48	43	26	22	8
Thyroid	C73	247	0	0	0	1	4	7	15	11	14	20	21	38	29	26	27	12	11	11
Malignant lymphoma	C81-C85, C96	1581	3	8	15	23	15	19	26	38	48	91	137	156	197	249	214	141	112	89
Multiple myeloma	C88-C90	413	0	0	0	0	0	1	1	1	2	11	20	38	45	67	83	43	45	56
Leukemia	C91-C95	1076	31	21	19	12	29	37	30	33	34	70	82	97	118	139	131	80	65	48
Female																				
All sites	C00-C96	46501	84	38	47	99	163	363	670	1071	1862	3479	4030	4364	4968	5412	5642	5325	4595	4289
Lip, oral cavity & pharynx	C00-C14	693	0	0	1	5	6	11	15	16	24	46	41	61	77	82	104	74	73	57
Esophagus	C15	384	0	0	0	0	1	0	0	2	5	19	26	47	48	42	50	42	39	63
Stomach	C16	7002	0	1	1	2	7	22	49	112	222	419	463	552	726	827	957	947	886	809
Colon	C18	5474	1	0	0	2	3	10	25	43	107	238	398	500	642	728	794	726	653	604
Rectum	C19-C21	2354	0	0	0	2	3	6	18	36	62	136	231	278	321	300	274	264	230	193
Liver	C22	2378	1	1	0	1	1	2	6	6	14	32	73	131	305	463	452	372	278	240
Gallbladder	C23-C24	1981	0	0	0	0	1	1	1	3	15	36	55	113	162	213	278	338	389	376
Pancreas	C25	1864	0	0	0	0	1	2	4	6	21	58	74	137	151	255	282	328	290	255
Larynx	C32	66	0	0	0	0	0	0	0	0	2	1	3	12	7	9	5	13	10	4
Lung	C33-C34	3963	0	0	1	2	2	6	21	22	55	155	239	327	417	502	564	641	519	490
Skin	C43-C44	622	2	1	0	1	4	8	6	8	15	22	32	42	49	58	69	85	85	135
Breast	C50, D05	7980	3	0	1	2	7	52	179	383	722	1364	1240	1007	916	728	589	402	224	161
Uterus	C53-C55, D06	3611	0	0	0	1	13	112	179	242	292	418	477	403	373	323	267	202	161	148
Ovary	C56	1546	2	1	4	13	22	27	41	49	94	185	227	224	151	151	121	83	80	71
Bladder	C67	697	0	0	0	0	2	2	2	6	6	11	29	40	76	77	106	115	99	126
Kidney	C64-C66, C68	640	3	1	2	0	1	4	4	10	20	27	40	45	66	87	91	106	62	71
Brain & nervous system	C70-C72	355	10	8	4	6	10	14	8	8	14	21	32	33	27	37	40	38	21	24
Thyroid	C73	961	0	1	1	12	22	30	39	36	66	110	120	109	101	94	85	62	42	31
Malignant lymphoma	C81-C85, C96	1149	2	0	2	9	20	13	16	26	27	63	82	87	104	143	165	154	131	105
Multiple myeloma	C88-C90	385	0	0	0	0	0	0	1	1	6	8	14	28	36	55	72	66	53	45
Leukemia	C91-C95	778	29	19	18	22	22	16	29	24	28	37	39	81	82	66	72	76	68	50

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females during the period of 1996-2000, these values being about 10% higher than those observed for the whole of Aichi Prefecture (62,127 for males and 46,501 for females, Table 3). For all major sites of cancers except lip, oral cavity and pharynx in males and esophagus in both sexes expected incidences in both genders were 10~50% higher than the figures observed. Because the completeness of reporting and accuracy of diagnosis in the model area were higher than

those in the whole Aichi Prefecture for these cancers, the low numbers may reflect the lower age-standardized rate for the model area compared with that for the whole Aichi Prefecture, rather than the quality of the data. Therefore, in order to extrapolate from the good quality of the model area to the whole Aichi Prefecture, it may be necessary to estimate the true cancer incidence by other methods, using completeness of registration (Ajiki et al., 1997; Inoue et al.,

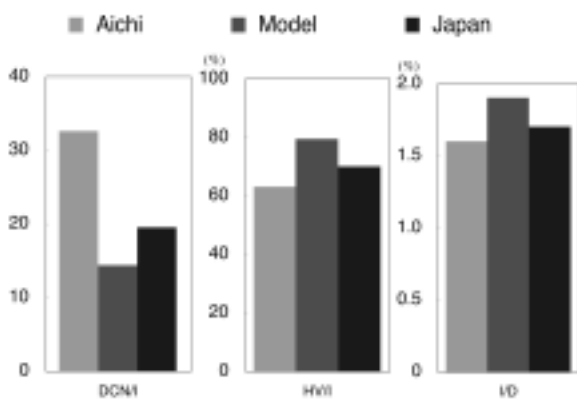


Figure 4. Completeness of reporting and accuracy of diagnosis in the model area of Aichi Prefecture, JAPAN, compared with those of whole area of the Aichi prefecture and whole Japan estimated by the research group for Population-based Cancer Registration in Japan, 2003(The Research Group for Population-based Cancer Registration in Japan, 2003)

DCN/I, proportion of cases with death certificate notification; I/D, incidence/number of deaths; HV/I, ratio of histologically verified to incident cases.

1998; Parkin et al., 1994), for example.

In the present study, the data estimated from the model area were found to be applicable as representative for the cancer incidence in Aichi Prefecture. Even the quality of the model area has yet to reach the level required internationally. It will be difficult to increase the quality of cancer registration in the whole of Aichi Prefecture without regulation by law and sufficient registry personnel; therefore it may be important for the Aichi Cancer registry to rather make efforts preferentially to improve the quality of cancer registration in the model area.

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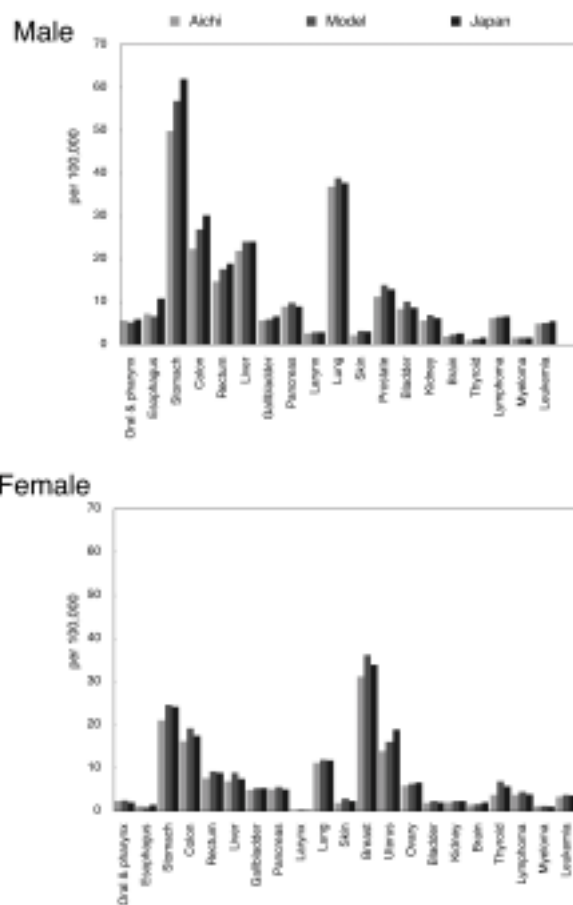


Figure 5. Cancer incidence in the model area of Aichi Prefecture, JAPAN, compared with that of whole area of the prefecture and that based on data from all-Japan estimates(The Research Group for Population-based Cancer Registration in Japan, 2003)

Cancer incidence: age-standardized rate (ASR) by world population.

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