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Cancer incidence and incidence rates in Japan in 2009: a study of 32 population-based cancer registries for the Monitoring of Cancer Incidence in Japan (MCIJ) project

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Abstract

The Japan Cancer Surveillance Research Group aimed to estimate the cancer incidence in Japan in 2009 based on data collected from 32 of 37 population-based cancer registries, as part of the Monitoring of Cancer Incidence in Japan (MCIJ) project. The incidence of only primary invasive cancer in Japan for 2009 was estimated to be 775 601. Stomach cancer and breast cancer were the leading types of cancer in males and females, respectively.

Key words: cancer incidence, incidence estimates, extent of disease, cancer registry, Japan

The Japan Cancer Surveillance Research Group has been involved in cancer monitoring in Japan since the year 2000 (1–9). This group aimed to estimate the cancer incidence in Japan in 2009 based on data collected from 32 of 37 population-based cancer registries, as part of the Monitoring of Cancer Incidence in Japan (MCIJ) project. The selected registries were as follows: Aomori, Iwate, Akita, Yamagata, Ibaraki, Tochigi, Gunma, Chiba, Kanagawa, Niigata, Toyama, Ishikawa, Fukui, Yamanashi, Gifu, Aichi, Shiga, Kyoto, Hyogo, Tottori, Shimane, Okayama, Hiroshima, Yamaguchi, Tokushima, Kagawa, Ehime, Kochi, Saga, Nagasaki, Kumamoto and Okinawa.

To avoid a large underestimation of the true national cancer incidence, five registries, which fall to meet standards of data quality, were not used to estimate the national cancer incidence. The methods for registry selection and estimation of incidence, and the limitations of those methods, were previously explained (10–12). Briefly, we have maintained the same methodology used in the MCIJ project since 2003; all 37 population-based cancer registries in Japan were invited to participate in this study. Registries that met the following standards were considered to be of 'high quality': (i) DCO% (death certificate only: proportion of cases reported by death certificate only) of <25%, or DCN% (death certificate notification: proportion of patients first notified via death certificate) of <30%; and (ii) M/I (mortality to incidence ratio) of <0.67. From the total of 37 registries, 32 of 'high quality' were selected to estimate the national cancer incidence in 2009. The selected registries encompassed data for 54.7% of the total population of Japan, which was 10.5 points up compared with that of 2008. The number of selected registries for the estimation of national cancer incidence has been increasing since 2005, as follows: 12 in 2005, 15 in 2006, 21 in 2007, 25 in 2008 and 32 in 2009. In 2009, the new areas having high-quality data registries that were added since the previous estimation in 2008 were Aomori, Gifu, Hyogo, Tokushima, Kagawa, Kochi and Okinawa.

Extent of disease was evaluated by using staging criteria (i.e. carcinoma *in situ*; CIS, cancer limited to the organ of origin; localized, regional lymph node metastasis, direct extension to adjacent organs/tissues; regional, and distant metastasis; distant) that were developed in Japan based on the Surveillance, Epidemiology and End Results (13). The method of first detection was classified into two groups,

Table 1. Incidence (only invasive), completeness of reporting and accuracy of diagnosis in Japan, according to sex and primary site, 2009

Primary sites	ICD-10th	Estimated incidence	Crude rate[a]	Age-standardized rate[a]		Quality and completeness of reporting		Accuracy of diagnosis
				World population	Japanese 1985 model population	DCO/I[b] (%)	M/I	MV/I[b] (%)
Male								
All sites	C00–C96	452 268	727.9	299.5	425.1	12.9	0.46	76.6
Lip, oral cavity and pharynx	C00–C14	10 689	17.2	8.2	11.1	7.8	0.44	88.5
Esophagus	C15	17 492	28.2	12.0	16.8	10.6	0.57	84.4
Stomach	C16	84 563	136.1	55.1	78.9	11.6	0.39	85.0
Colon and rectum	C18–C20	66 859	107.6	45.5	64.2	10.7	0.34	84.2
Colon	C18	40 737	65.6	26.6	38.0	11.6	0.35	82.7
Rectum	C19–C20	26 122	42.0	19.0	26.1	9.3	0.33	86.4
Liver	C22	31 915	51.4	20.9	29.9	20.7	0.68	29.3
Gallbladder, etc.	C23–C24	11 419	18.4	6.6	9.9	19.1	0.75	55.1
Pancreas	C25	16 584	26.7	10.8	15.4	20.2	0.85	41.0
Larynx	C32	4257	6.9	2.8	4.0	5.8	0.21	89.5
Trachea, bronchus and lung	C33–C34	71 722	115.4	43.3	64.0	17.1	0.68	73.1
Skin, including melanoma	C43–C44	6656	10.7	4.2	6.1	2.2	0.09	96.4
Prostate	C61	59 627	96.0	35.2	52.0	7.7	0.17	86.4
Bladder	C67	14 326	23.1	8.6	12.7	10.6	0.31	83.4
Kidney, renal pelvis, ureter, etc.	C64–C66, C68	12 922	20.8	9.4	13.0	10.5	0.35	78.8
Brain and nervous system	C70–C72	2741	4.4	3.0	3.4	14.1	0.37	75.0
Thyroid	C73	3503	5.6	3.3	4.2	5.6	0.15	91.7
Malignant lymphoma	C81–C85, C96	12 074	19.4	9.1	12.4	10.5	0.47	87.7
Multiple myeloma	C88, C90	3211	5.2	2.0	2.9	20.0	0.65	70.6
All leukemias	C91–C95	6837	11.0	6.6	7.8	15.0	0.70	93.7
Female								
All sites	C00–C96	323 333	494.5	211.0	282.6	14.1	0.43	75.1
Lip, oral cavity and pharynx	C00–C14	5097	7.8	3.2	4.3	9.4	0.36	86.4
Esophagus	C15	3295	5.0	1.8	2.5	14.9	0.55	78.8
Stomach	C16	38 069	58.2	19.8	27.9	15.5	0.45	80.1
Colon and rectum	C18–C20	49 483	75.7	26.7	37.3	13.6	0.40	79.2
Colon	C18	35 484	54.3	18.3	25.8	14.2	0.41	77.8
Rectum	C19–C20	13 999	21.4	8.4	11.5	12.1	0.37	82.9
Liver	C22	16 088	24.6	7.1	10.5	25.3	0.69	24.0
Gallbladder, etc.	C23–C24	11 288	17.3	4.4	6.5	25.2	0.80	42.2
Pancreas	C25	14 599	22.3	6.4	9.4	23.7	0.87	34.3
Larynx	C32	519	0.8	0.3	0.4	11.2	0.15	83.0
Trachea, bronchus and lung	C33–C34	31 993	48.9	16.3	23.1	19.6	0.58	70.5
Skin, including melanoma	C43–C44	7502	11.5	3.5	4.9	4.4	0.09	94.4
Breast	C50	61 232	93.7	55.3	71.4	5.7	0.19	90.8
Uterus	C53–C55	21 587	33.0	20.4	26.1	6.9	0.26	90.2
Cervix uteri	C53	10 516	16.1	11.0	13.8	5.1	0.24	92.3
Corpus uteri	C54	10 135	15.5	9.1	11.7	3.2	0.16	94.9
Ovary	C56	9377	14.3	8.4	10.6	13.1	0.49	78.7
Bladder	C67	4392	6.7	1.8	2.7	17.7	0.49	72.8
Kidney, renal pelvis, ureter, etc.	C64–C66, C68	6633	10.1	3.8	5.2	13.0	0.39	74.9
Brain and nervous system	C70–C72	2429	3.7	2.5	2.8	15.3	0.32	68.6
Thyroid	C73	9590	14.7	8.9	11.2	4.3	0.11	92.1
Malignant lymphoma	C81–C85, C96	11 238	17.2	7.5	9.8	11.0	0.38	85.5
Multiple myeloma	C88, C90	2957	4.5	1.4	2.1	21.5	0.67	68.2
All leukemias	C91–C95	4796	7.3	4.2	4.8	16.5	0.65	92.2

ICD-10th, International Classification of Disease, 10th Revision; DCO/I, proportion of cases with the death certificate only to incident cases; M/I, number of mortality/number of incidence; MV/I, proportion of microscopically verified cases to incident cases.

[a]Per 100 000 population.

[b]Arithmetic mean of proportions in the 32 cancer registries with high-quality data.

as follows: by screening for cancers or lifestyle-related disease and medical checkup; or by the others including unknown.

Table 1 summarizes the estimated incidence of only invasive cancer, completeness and accuracy of the registries, by sex and site, in 2009. There were an estimated 775 601 cancer cases diagnosed in Japan in 2009, 452 268 cases occurring in males and 323 333 cases in females. The age-standardized incidence rates (standard population: world population) for males and females were 299.5 and 211.0, respectively (standard population: Japanese 1985 model population, the incidence rate for males was 425.1 and for females was 282.6). Regarding quality and completeness of reporting, the overall DCO% and M/I were 13.4% and 0.46, respectively (males, 12.9%, 0.46; females, 14.1%, 0.43). There were some variations according to the cancer site. For accuracy of diagnosis, the overall MV% (proportion of microscopically verified cases to incident cases) was 76.0% (males, 76.6%; females, 75.1%). Table 2 shows the estimated incidence of cancer including CIS patients. CIS was observed predominantly in females with breast and cervical cancers.

Figure 1 shows the incidence according to the leading cancer types for each sex. Stomach cancer is the most numerous cancer diagnosed in males (84 563 cases, 18.7% of the total in males), followed by lung (71 722, 15.9%), colon and rectum (66 859, 14.8%), prostate (59 627, 13.2%) and liver (31 915, 7.1%). In comparison with 2008, there was not much change in this regard (9). In females, the major cancer was breast (61 232 cases, 18.9% of the total in females), followed by colon and rectum (49 483, 15.3%), stomach (38 069, 11.8%), lung (84 563, 9.9%) and liver (16 088, 5.0%). The five leading primary sites accounted for 69.6% of the total incidence in males and 60.9% in females. These proportions increase to 85.8% in males and 78.8% in females when the 10 leading primary sites are considered.

Figure 2 shows age-specific incidence rates for the five major cancer sites for males and for the eight major cancer sites for females. In males, the age-specific incidence rate increased with age for stomach, colon and rectum and lung cancers. Incidence rates increased in the 45–49-year-old group for stomach and colon and rectum cancers. For lung cancer, the incidence rate increased in the 60–69-year-old group and was the highest of all sites in 75–79-year-old or older groups. For liver and prostate cancers, the incidence rate increased by the 75–79-year-old group, and remained almost flat over that age group. In females, the age-specific incidence rates increased with age for stomach, colon and rectum and lung cancers. For breast cancer, incidence rates peaked in approximately the 45–49-year-old group and decreased in the 60–69-year-old group. For cervical cancer and corpus uteri cancer, incidence rates peaked in approximately in the 40–49-year-old groups, and in the 55–59-year-old group respectively. Both of which were clearly earlier compared with peaks for other primary sites.

Table 3 shows the distribution of cancer by extent of disease at diagnosis. The proportion of patients diagnosed after regional or distant was high for pancreas, gallbladder, lung, esophagus, and lip, oral cavity and pharynx. Cervical cancer was more frequently diagnosed at CIS, which accounted for over half of the total cervical cancer. The proportion of 'stage unknown' patients varied according to the anatomical site of the primary lesion, and was comparatively

Table 2. Incidence (including CIS), completeness of reporting and accuracy of diagnosis in Japan, according to sex and primary site, 2009

Primary sites	ICD-10th	Estimated incidence	Crude rate[a]	Age-standardized rate[a]		Quality and completeness of reporting		Accuracy of diagnosis
				World population	Japanese 1985 model population	DCO/I[b] (%)	M/I	MV/I[b] (%)
Male								
All sites	C00–C96, D00–D09	474 168	763.2	315.2	446.9	12.3	0.44	77.7
Esophagus	C15, D001	18 670	30.0	12.9	17.9	10.0	0.53	85.3
Colon and rectum	C18–C20, D010–D012	80 721	129.9	55.9	78.4	9.1	0.28	86.5
Trachea, bronchus and lung	C33–C34, D021–D022	71 767	115.5	43.4	64.1	17.1	0.68	73.2
Skin, including melanoma	C43–C44, D030–D049	8369	13.5	5.2	7.6	1.8	0.07	96.8
Bladder	C67, D090	20 385	32.8	12.5	18.3	7.6	0.22	88.0
Female								
All sites	C00–C96, D00–D09	354 939	542.9	244.8	324.5	12.9	0.39	77.2
Esophagus	C15, D001	3491	5.3	1.9	2.7	14.0	0.52	80.0
Colon and rectum	C18–C20, D010–D012	56 686	86.7	31.5	43.8	12.1	0.35	81.5
Trachea, bronchus and lung	C33–C34, D021–D022	32 023	49.0	16.3	23.1	19.6	0.58	70.5
Skin, including melanoma	C43–C44, D030–D049	9514	14.6	4.3	6.1	3.5	0.07	95.4
Breast	C50, D05	67 619	103.4	61.8	79.7	5.2	0.18	91.5
Uterus	C53–C55, D06	35 370	54.1	40.4	49.7	4.5	0.16	93.6
Cervix uteri	C53, D06	24 299	37.2	30.9	37.4	2.4	0.10	96.4
Bladder	C67, D090	5808	8.9	2.6	3.8	13.7	0.37	78.9

CIS, carcinoma *in situ*.

[a]1 Per 100 000 population.

[b]Arithmetic mean of proportions in the 32 cancer registries with high-quality data.

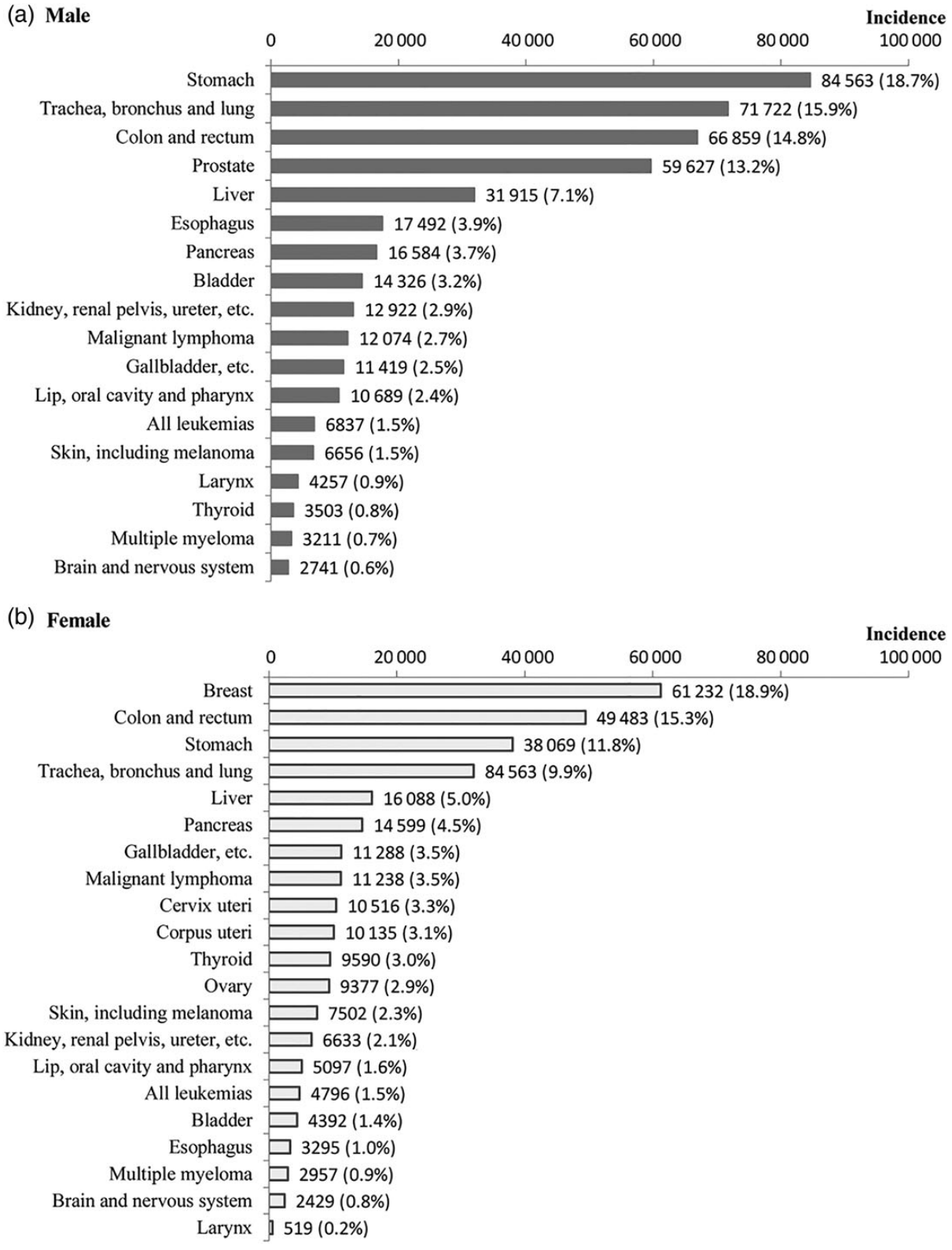

Figure 1. Incidence of cancer (invasive only) in Japan in 2009, according to primary site, in males (a) and females (b). Data are expressed as number (percentage).

high for liver, gallbladder, pancreas and prostate cancers, but low for cervical cancers. It should be noted that the proportion of 'stage unknown' classifications may primarily be influenced by differing methods of diagnosis and the fact that the prevalence of accurate staging may vary considerably among sites of primary lesions. Some primary sites may be often diagnosed by tissue examination,

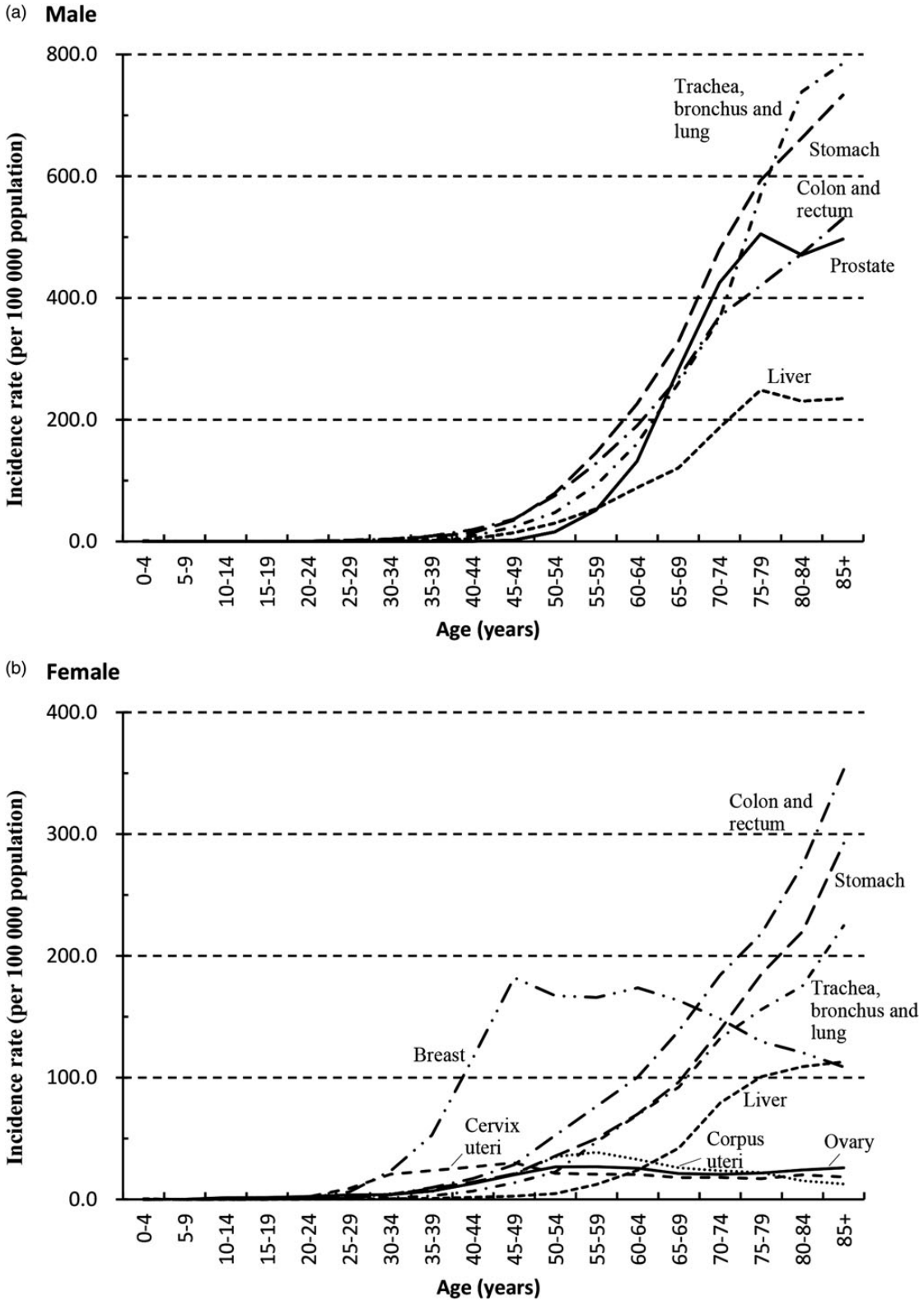

Figure 2. Age-specific incidence rate per population of 100 000 in 2009 for major cancer sites (only invasive) in males (a) and females (b).

Table 3. Distribution of extent of disease at diagnosis for the 32 selected cancer registries, 2009

Primary sites	ICD-10th	Incidence in the 32 registries (except DCO)	CIS		Localized		Regional		Distant		Other, unknown	
			n	%	*n*	%	*n*	%	*n*	%	*n*	%
Male												
All sites	C00–C96, D00–D09	217 354	13 089	6.0	85 307	39.2	46 622	21.4	38 805	17.9	33 531	15.4
Lip, oral cavity and pharynx	C00–C14	5314	–	–	1757	33.1	2667	50.2	277	5.2	613	11.5
Esophagus	C15, D001	8267	538	6.5	2275	27.5	2845	34.4	1592	19.3	1017	12.3
Stomach	C16	38 476	–	–	19 795	51.4	7674	19.9	6751	17.5	4256	11.1
Colon and rectum	C18–C20, D010–D012	37 519	7203	19.2	13 263	35.4	8027	21.4	5379	14.3	3647	9.7
Colon	C18	18 574	–	–	8182	44.1	4669	25.1	3345	18.0	2378	12.8
Rectum	C19–C20	11 891	–	–	5079	42.7	3357	28.2	2034	17.1	1421	12.0
Liver	C22	12 921	–	–	6709	51.9	2348	18.2	1209	9.4	2655	20.5
Gallbladder, etc.	C23–C24	4859	–	–	876	18.0	2149	44.2	944	19.4	890	18.3
Pancreas	C25	6938	–	–	407	5.9	2312	33.3	3125	45.0	1094	15.8
Larynx	C32	2220	–	–	1465	66.0	470	21.2	53	2.4	232	10.5
Trachea, bronchus and lung	C33–C34, D021–D022	31 249	18	0.1	7390	23.6	8390	26.8	11 373	36.4	4078	13.1
Skin, including melanoma	C43–C44, D030–D049	4419	819	18.5	2729	61.8	334	7.6	61	1.4	476	10.8
Prostate	C61	28 851	–	–	16 754	58.1	4563	15.8	3063	10.6	4471	15.5
Bladder	C67, D090	10 028	3348	33.4	4410	44.0	817	8.1	265	2.6	1188	11.8
Kidney, renal pelvis, ureter, etc.	C64–C66, C68	6143	–	–	3397	55.3	1152	18.8	959	15.6	635	10.3
Thyroid	C73	1419	–	–	477	33.6	704	49.6	105	7.4	133	9.4
Female												
All sites	C00–C96, D00–D09	157 758	15 392	9.8	59 628	37.8	35 850	22.7	22 745	14.4	24 143	15.3
Lip, oral cavity and pharynx	C00–C14,	2264	–	–	1000	44.2	871	38.5	87	3.8	306	13.5
Esophagus	C15, D001	1477	107	7.2	375	25.4	532	36.0	251	17.0	212	14.4
Stomach	C16	17 339	–	–	8270	47.7	3735	21.5	3069	17.7	2265	13.1
Colon and rectum	C18–C20, D010–D012	26 100	3786	14.5	8782	33.6	6374	24.4	4260	16.3	2898	11.1
Colon	C18	15 848	–	–	6086	38.4	4521	28.5	3139	19.8	2102	13.3
Rectum	C19–C20	6551	–	–	2693	41.1	1852	28.3	1121	17.1	885	13.5
Liver	C22	6091	–	–	3302	54.2	886	14.5	548	9.0	1355	22.2
Gallbladder, etc.	C23–C24	4442	–	–	633	14.3	1680	37.8	1185	26.7	944	21.3
Pancreas	C25	5864	–	–	401	6.8	1926	32.8	2524	43.0	1013	17.3
Larynx	C32	169	–	–	112	66.3	37	21.9	2	1.2	18	10.7
Trachea, bronchus and lung	C33–C34, D021–D022	12 764	15	0.1	4536	35.5	2535	19.9	3999	31.3	1679	13.2
Skin, including melanoma	C43–C44, D030–D049	4607	1071	23.2	2778	60.3	254	5.5	63	1.4	441	9.6
Breast	C50, D05	32 093	3215	10.0	16 189	50.4	7711	24.0	1489	4.6	3489	10.9
Uterus	C53–C55, D06	16 076	5798	36.1	5259	32.7	3142	19.5	872	5.4	1005	6.3
Cervix uteri	C53, D06	10 651	5792	54.4	2124	19.9	1872	17.6	388	3.6	475	4.5
Corpus uteri	C54	5251	–	–	3112	59.3	1253	23.9	461	8.8	425	8.1
Ovary	C56	4266	–	–	1097	25.7	1782	41.8	728	17.1	659	15.4
Bladder	C67, D090	2805	803	28.6	1143	40.7	341	12.2	128	4.6	390	13.9
Kidney, renal pelvis, ureter, etc.	C64–C66, C68	2904	–	–	1564	53.9	582	20.0	423	14.6	335	11.5
Thyroid	C73	4200	–	–	1751	41.7	1803	42.9	195	4.6	451	10.7

Localized, cancer limited to the organ of origin; regional, regional lymph node metastasis, direct extension to adjacent organs/tissues; distant, distant metastasis.

and other sites may be usually diagnosed by imaging test as computed tomography, magnetic resonance imaging or positron emission tomography. The proportion of stage unknown is comparatively high in the sites diagnosed by imaging test because that the tissue examination provides more information.

Distribution of cancer by the method of first detection is presented in Table 4. Cervical cancer, including CIS, had a high proportion detected by screening (35.3%). The proportion of screening was comparatively higher in each of prostate (26.0%), breast (female only) (24.9%), stomach (20.3%: 20.3% males, 16.1% females), thyroid (19.5%: 20.7% males, 18.6% females) and colon and rectum cancers (19.2%: 20.2% males, 17.0% females). It should be noted that prostate and thyroid cancers had a high proportion of detection by screening, as did stomach, colon and rectum, lung, breast and cervical cancers. For stomach, colon and rectum, lung, breast and cervical cancers, organized screening has been offered based on guideline for cancer screening by the municipalities. Additionally, in Japan, screening which was not always recommended by Ministry of Health, Labour and Welfare has been conducted in some municipalities. Also, Japan has conducted periodical worksite health check-up and some establishments provide comprehensive health examinations for employees.

Table 4. The method of first detection for the 32 selected cancer registries, 2009

Primary sites	ICD-10th	Incidence in the 32 registries (except DCO)	Screening for cancers or lifestyle related disease and medical checkup		Other, unknown	
			n	%	*n*	%
Male						
All sites	C00–C96, D00–D09	217 354	32 587	15.0	184 767	85.0
Lip, oral cavity and pharynx	C00–C14	5314	122	2.3	5192	97.7
Esophagus	C15, D001	8267	957	11.6	7310	88.4
Stomach	C16	38 476	7795	20.3	30 681	79.7
Colon and rectum	C18–C20, D010-D012	37 519	7595	20.2	29 924	79.8
Colon	C18	18 574	3272	17.6	15 302	82.4
Rectum	C19–C20	11 891	1937	16.3	9954	83.7
Liver	C22	12 921	584	4.5	12 337	95.5
Gallbladder, etc.	C23–C24	4859	235	4.8	4624	95.2
Pancreas	C25	6938	306	4.4	6632	95.6
Larynx	C32	2220	54	2.4	2166	97.6
Trachea, bronchus and lung	C33–C34, D021–D022	31 249	4801	15.4	26 448	84.6
Skin, including melanoma	C43–C44, D030–D049	4419	41	0.9	4378	99.1
Prostate	C61	28 851	7496	26.0	21 355	74.0
Bladder	C67, D090	10 028	479	4.8	9549	95.2
Kidney, renal pelvis, ureter, etc.	C64–C66, C68	6143	742	12.1	5401	87.9
Thyroid	C73	1419	294	20.7	1125	79.3
Female						
All sites	C00–C96, D00–D09	157 758	25 060	15.9	132 698	84.1
Lip, oral cavity and pharynx	C00–C14,	2264	35	1.5	2229	98.5
Esophagus	C15, D001	1477	124	8.4	1353	91.6
Stomach	C16	17 339	2794	16.1	14 545	83.9
Colon and rectum	C18–C20, D010–D012	26 100	4438	17.0	21 662	83.0
Colon	C18	15 848	2376	15.0	13 472	85.0
Rectum	C19–C20	6551	871	13.3	5680	86.7
Liver	C22	6091	173	2.8	5918	97.2
Gallbladder, etc.	C23–C24	4442	145	3.3	4297	96.7
Pancreas	C25	5864	176	3.0	5688	97.0
Larynx	C32	169	1	0.6	168	99.4
Trachea, bronchus and lung	C33–C34, D021–D022	12 764	2540	19.9	10 224	80.1
Skin, including melanoma	C43–C44, D030–D049	4607	41	0.9	4566	99.1
Breast	C50, D05	32 093	7997	24.9	24 096	75.1
Uterus	C53–C55, D06	16 076	4366	27.2	11 710	72.8
Cervix uteri	C53, D06	10 651	3758	35.3	6893	64.7
Corpus uteri	C54	5251	602	11.5	4649	88.5
Ovary	C56	4266	327	7.7	3939	92.3
Bladder	C67, D090	2805	96	3.4	2709	96.6
Kidney, renal pelvis, ureter, etc.	C64–C66, C68	2904	266	9.2	2638	90.8
Thyroid	C73	4200	783	18.6	3417	81.4

The estimated cancer incidence data for Japan according to sex, cancer site, 5-year age groups and calendar year during the period of 2003–09 are available in the booklet format (in Japanese only), as well as via an electronic database on the following website: http://ganjoho.jp/en/professional/statistics/table_download.html. Additionally, an article about the trend analyses of the cancer incidence and mortality in Japan from 1985 to 2007 was published in 2013 (14). The data are provided as an electronic database on the following website: http://ganjoho.jp/en/professional/statistics/table_download.html. An article about the trend analyses from 1985 to 2010 will be published shortly (15).

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Conflict of interest statement

None declared.

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