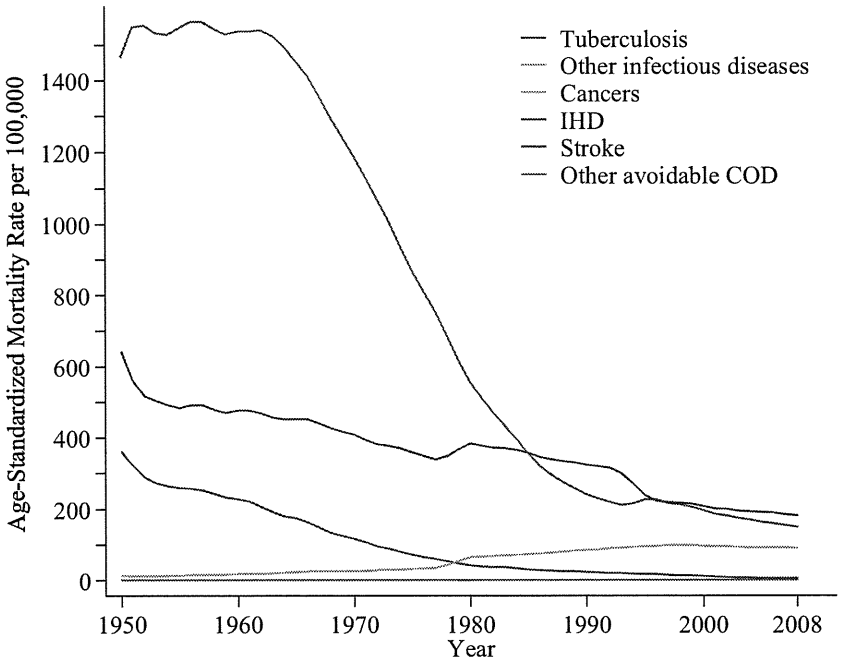
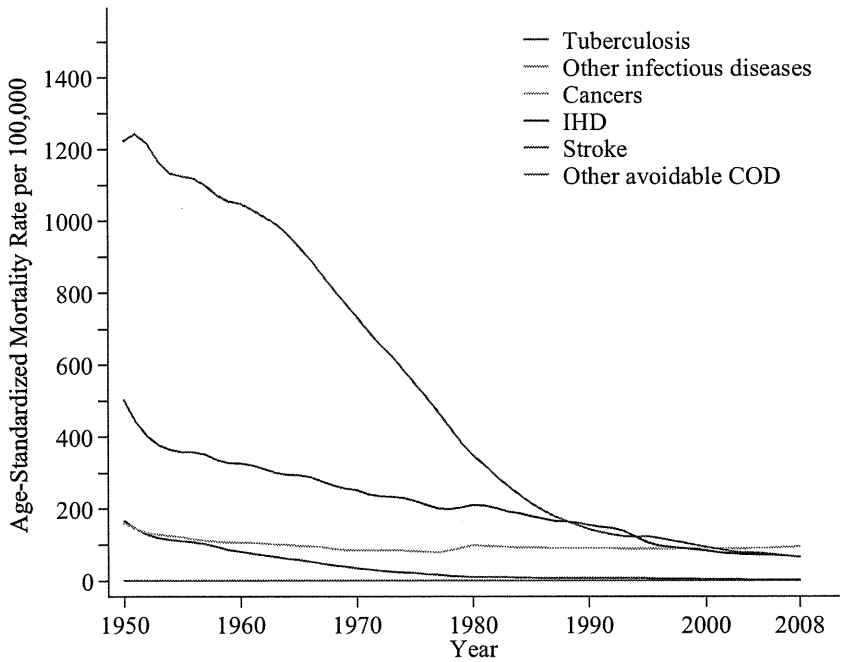
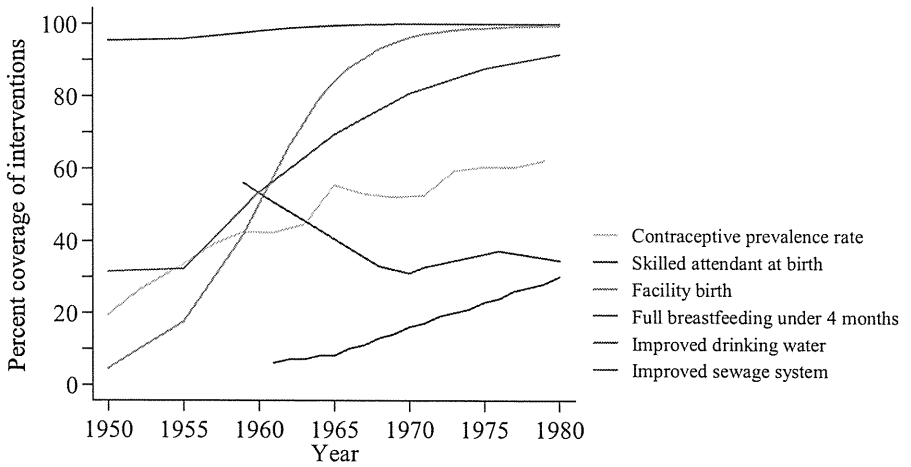
C) 60–74 years
Males



Females



Webfigure 3: Coverage of sanitation and interventions for maternal and child care in Japan, 1950–1980



Skilled attendant at birth includes the births attended by physicians and midwives inside and outside facilities.

Full breastfeeding for 1968, 1971 and 1976 is the coverage of full breastfeeding within 3 months of age.

Improved drinking water through 1955 is the diffusion rate of population having water supply planning to the total population. The data after 1956 is the diffusion rate of the covered population to the total population.

Data sources:

Contraceptive prevalence rate: Japan's Population - Tracking the Post-war 50 Years - Results from the 1st to the 24th Mainichi Newspaper Nationwide Family Planning Surveys. Mainichi Newspaper Population Research Committee.

Skilled attendant at birth: Maternal and child health statistics of Japan, 1960-73,1975-83. Mother's and Children's Health Organization.

Facility birth: Maternal and child health statistics of Japan, 1960-73,1975-83. Mother's and Children's Health Organization.

Expectant and nursing mothers care visits: Maternal and child health statistics of Japan, 1960-73,1975-83. Mother's and Children's Health Organization.

Full breastfeeding at under 4 months: Maternal and child health statistics of Japan, 1960-73,1975-83. Mother's and Children's Health Organization.

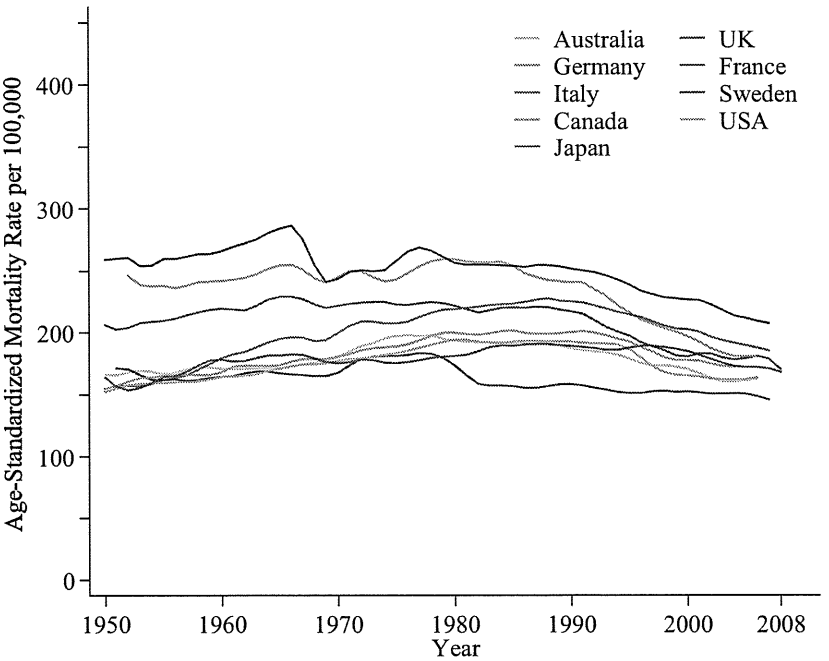
Improved drinking water: Japan Water Works Association. Water Supply Division, Health Service Bureau, Ministry of Health, Labour and Welfare.

Improved sewer system: Prevalence of water sewage. Japan Sewage Works Association. Retrieved on 22 of July, 2010 from http://www.jswa.jp/05_arekore/07_fukyu/index.html

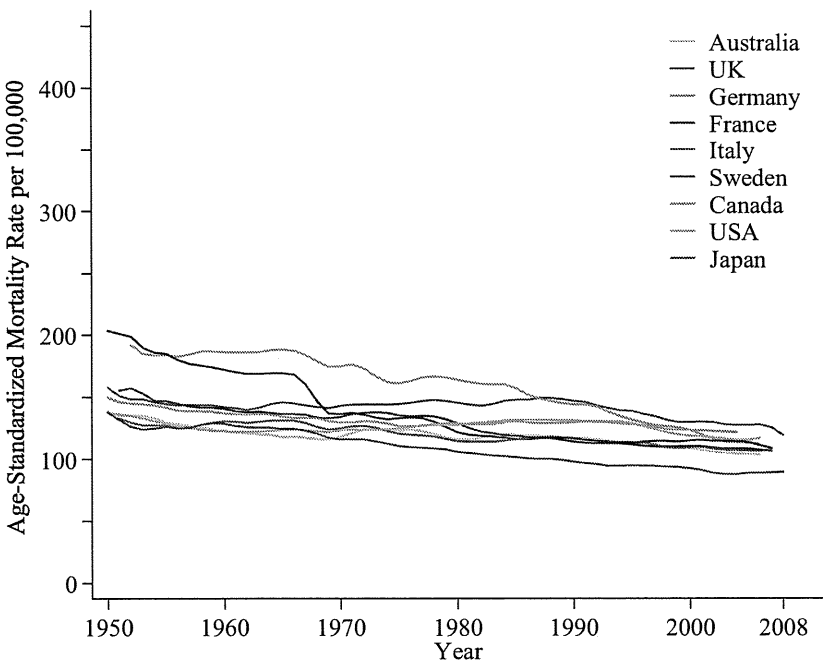
Webfigure 4: Trends in mortality due to non-communicable diseases in Japan and selected countries

A) Cancers

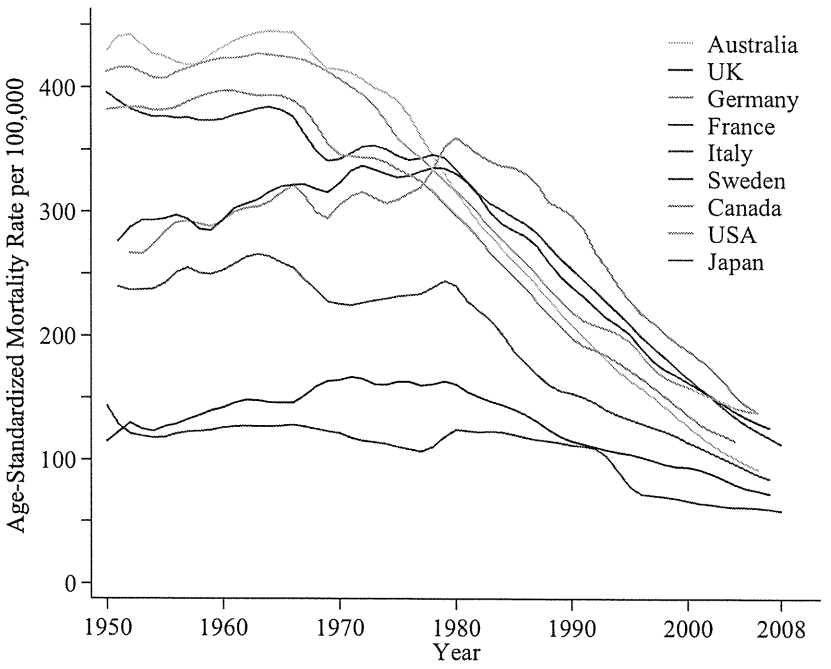
Males



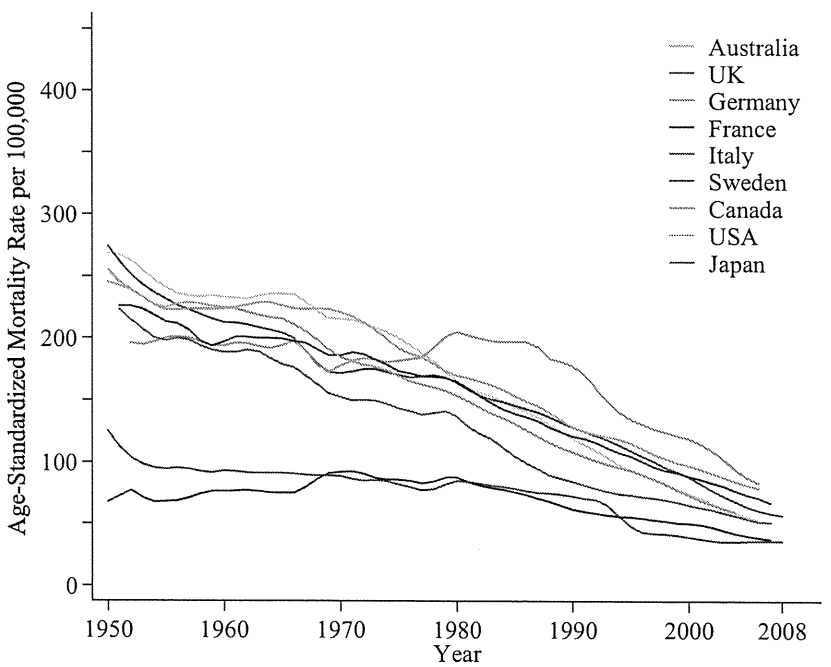
Females



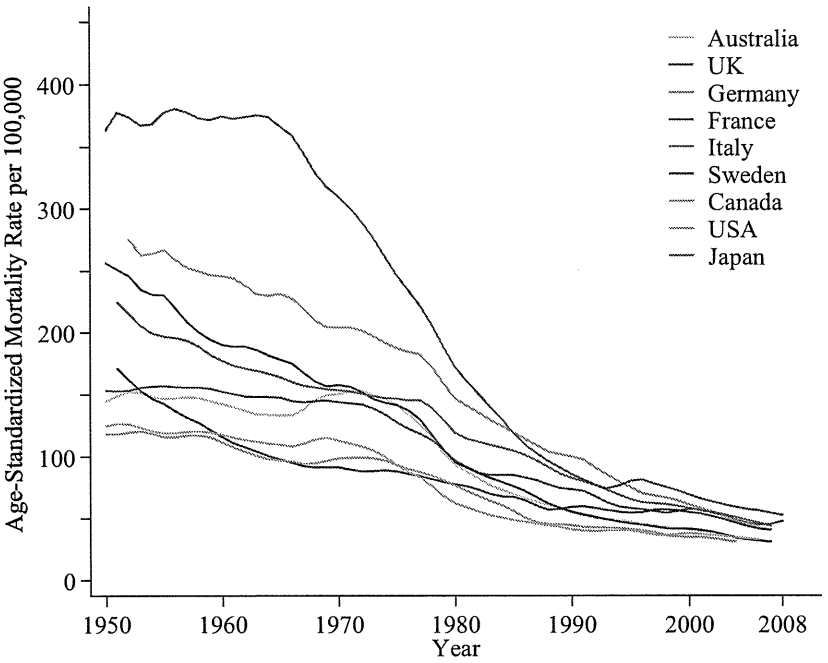
B) Ischemic heart disease
Males



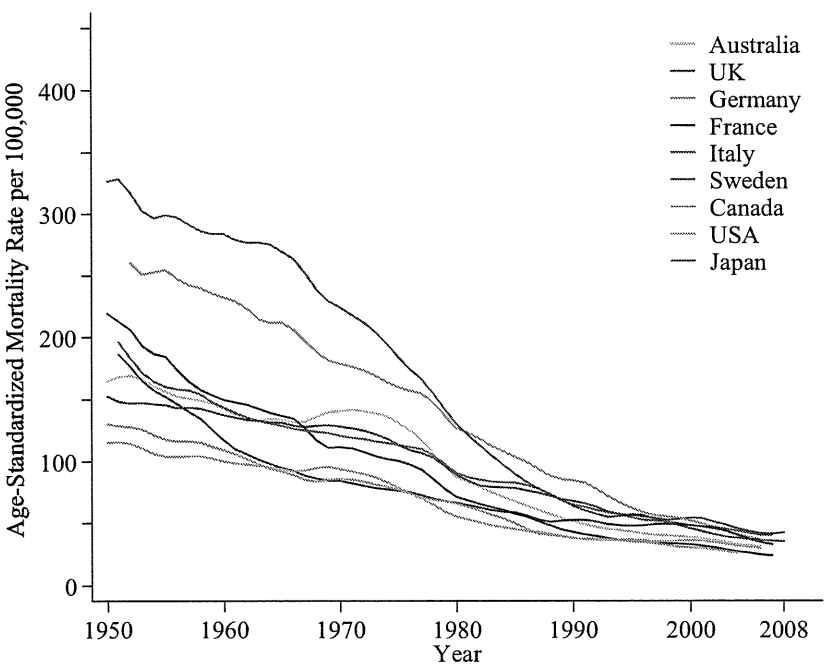
Females



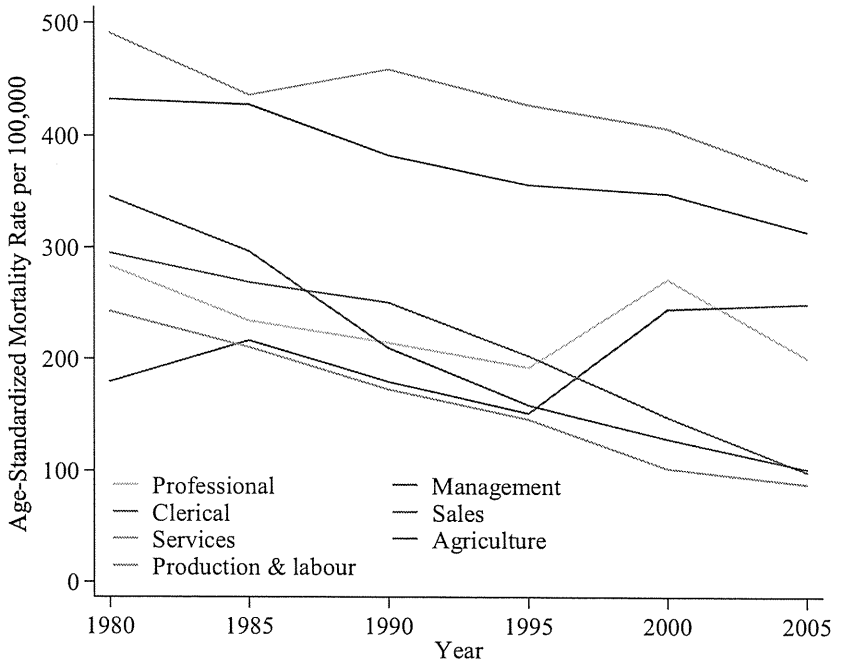
C) Stroke
Males



Females



Webfigure 5: Trends in the age-standardised death rate from all causes in Japanese males aged 30 to 59



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Cancer Incidence and Incidence Rates in Japan in 2005: Based on Data from 12 Population-based Cancer Registries in the Monitoring of Cancer Incidence in Japan (MCIJ) Project

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The Japan Cancer Surveillance Research Group estimated the cancer incidence in 2005 as part of the Monitoring of Cancer Incidence in Japan (MCIJ) project, on the basis of data collected from 12 of 30 population-based cancer registries. The total number of incidences in Japan for 2005 was estimated as 646 802 (C00–C96). The leading cancer site was the stomach for men and the breast for women. Age-standardized incidence rates remained almost the same level as the previous 2 years.

Key words: cancer incidence – incidence estimates – cancer registry – Japan

The Japan Cancer Surveillance Research Group is involved in cancer monitoring in Japan since 2000 (1–5). This group estimated the cancer incidence in 2005 as part of the Monitoring of Cancer Incidence in Japan (MCIJ) project, on the basis of data collected from 12 of 30 population-based cancer registries: Miyagi, Yamagata, Chiba, Kanagawa, Niigata, Fukui, Shiga, Tottori, Okayama, Hiroshima, Nagasaki and Kumamoto. If data from all 30 registries were used, this would have led to a large underestimation of national cancer incidence because of under-registration. The methods of registry selection, estimation of incidence and the limitations of these methods have been explained in previous studies (6–8). We maintained the same methodology since the MCIJ2003: (i) we invited all 30 population-based cancer registries in Japan to participate, and from these, we selected the 12 cancer registries with high-quality data in order to estimate the national incidence, and (ii) we used 2005 data alone for the national estimation. For this year, data from Osaka and Saga prefectures, regularly considered as one of the registries with high quality, were not available for the MCIJ project. The other registries remained since the previous estimation in 2004.

The number of incidences, crude rates, age-standardized rates and quality indicators of registration in 2005 are shown in Table 1, and the age-specific number of incidences and the rates according to sex and primary site are shown in Tables 2 and 3. The total number of incidences in Japan for 2005 was estimated as 646 802 (C00–C96). The time trends of age-standardized incidence rates for the five major sites and male- and female-specific sites in 1975–2005 are shown in Fig. 1 (standard population: the world population) and in Fig. 2 (standard population: the 1985 Japanese model population). The leading cancer site according to the crude and age-standardized incidence rates was the stomach for men and the breast for women since the research group took over national estimation of incidence, as shown in Figs 1 and 2. Age-standardized incidence rates remained almost the same level as the previous 2 years. It is thought to be partly due to that the development of hospital-based cancer registry in designated cancer care hospitals was calmed down in 2005. The estimated cancer incidence data in Japan by sex, site, 5-year age group and calendar year during the period 1975–2005 are available as a booklet and as an electronic database

Table 1. Incidence, completeness of reporting and accuracy of diagnosis in Japan according to sex and primary site, 2005

Primary sites	ICD-10th	Number of incidence	Crude rate[a]	Age-standardized rate[a]		Completeness of reporting		Accuracy of diagnosis
				World population	Japanese 1985 model population	DCO/I (%)	I/M	MV/I (%)
Male								
All sites (incl. CIS)	C00–C96, D00–D09	390 835	626.9	288.5	408.4	14.9	1.99	74.8
All sites	C00–C96	379 436	608.6	279.7	396.1	15.2	1.93	74.3
Lip, oral cavity and pharynx	C00–C14	7417	11.9	6.0	8.2	12.8	1.79	80.6
Esophagus	C15	14 818	23.8	11.1	15.5	13.1	1.57	80.0
Stomach	C16	80 102	128.5	59.3	83.9	12.1	2.45	84.0
Colon	C18	37 126	59.5	27.1	38.7	10.3	2.76	84.1
Rectum	C19–C20	22 344	35.8	17.5	24.2	10.3	2.57	85.3
Colon and rectum	C18–C20	59 470	95.4	44.6	62.9	10.3	2.69	84.6
Liver	C22	28 729	46.1	21.4	30.1	23.5	1.24	31.3
Gallbladder etc.	C23–C24	9237	14.8	6.1	9.1	25.3	1.18	48.8
Pancreas	C25	13 108	21.0	9.5	13.5	26.5	1.07	35.9
Larynx	C32	3903	6.3	2.9	4.0	6.1	3.88	89.3
Trachea, bronchus and lung	C33–C34	58 264	93.4	39.4	58.5	21.7	1.29	68.8
Melanoma of skin etc.	C43–C44	4798	7.7	3.5	5.0	4.2	7.64	92.5
Prostate	C61	42 997	69.0	28.2	42.0	10.3	4.64	83.5
Bladder	C67	12 619	20.2	8.8	12.9	10.3	3.05	83.2
Kidney, renal pelvis, ureter etc.	C64–C66, C68	9758	15.7	7.7	10.6	13.2	2.43	76.1
Brain and nervous system	C70–C72	2496	4.0	2.8	3.3	25.3	2.71	68.2
Thyroid	C73	2126	3.4	2.0	2.6	4.5	4.77	91.0
Malignant lymphoma	C81–C85, C96	9667	15.5	8.0	10.9	12.4	1.99	86.1
Multiple myeloma	C88, C90	2242	3.6	1.5	2.3	23.2	1.14	67.4
All leukaemias	C91–C95	5200	8.3	5.3	6.3	21.6	1.21	85.9

Female								
All sites (incl. CIS)	C00–C96, D00–D09	285 240	436.0	202.6	271.1	15.0	2.21	74.9
All sites	C00–C96	267 366	408.7	183.8	247.7	15.8	2.07	73.7
Lip, oral cavity and pharynx	C00–C14	3498	5.3	2.3	3.1	14.6	2.29	80.4
Esophagus	C15	2678	4.1	1.5	2.1	20.9	1.56	71.6
Stomach	C16	37 035	56.6	21.8	30.7	15.6	2.10	80.2
Colon	C18	31 069	47.5	17.9	25.1	14.3	2.27	79.5
Rectum	C19–C20	13 517	20.7	8.9	12.1	11.0	2.70	83.8
Colon and rectum	C18–C20	44 586	68.2	26.8	37.2	13.3	2.39	80.7
Liver	C22	13 465	20.6	6.9	10.1	27.6	1.22	26.7
Gallbladder etc.	C23–C24	9399	14.4	4.0	6.1	30.9	1.08	38.4
Pancreas	C25	11 691	17.9	5.8	8.4	28.8	1.10	30.7
Larynx	C32	214	0.3	0.1	0.2	16.2	2.55	73.7
Trachea, bronchus and lung	C33–C34	25 617	39.2	14.3	20.2	23.3	1.52	68.0
Melanoma of skin etc.	C43–C44	4342	6.6	2.3	3.2	8.2	7.50	90.1
Breast (incl. CIS)	C50, D05	50 695	77.5	47.5	61.4	5.0	4.73	90.4
Breast (only invasive)	C50	47 583	72.7	44.4	57.4	5.3	4.44	89.9
Uterus (incl. CIS)	C53–C55, D06	25 424	38.9	27.5	34.3	5.5	4.73	89.9
Uterus (only invasive)	C53–C55	17 476	26.7	16.4	21.1	7.4	3.25	87.2
Cervix uteri	C53	8474	13.0	8.7	11.0	6.1	3.44	88.6
Corpus uteri	C54	8189	12.5	7.3	9.5	3.2	5.61	92.1
Ovary	C56	8304	12.7	7.4	9.4	13.4	1.86	77.7
Bladder	C67	3858	5.9	1.8	2.7	19.8	2.04	71.7
Kidney, renal pelvis, ureter etc.	C64–C66, C68	4884	7.5	3.1	4.2	16.8	2.31	71.4
Brain and nervous system	C70–C72	2567	3.9	2.3	2.7	28.2	3.49	64.6
Thyroid	C73	7093	10.8	6.7	8.5	7.5	6.93	88.5
Malignant lymphoma	C81–85 C96	7324	11.2	5.0	6.6	13.7	1.97	83.7
Multiple myeloma	C88 C90	2171	3.3	1.2	1.7	26.3	1.13	66.8
All leukaemias	C91–C95	3832	5.9	3.4	4.0	22.6	1.29	83.5

ICD-10th, International Classification of Disease, 10th Revision; DCO/I, proportion of cases with the death certificate only to incident cases; I/M, number of incidence/number of deaths; MV/I, proportion of microscopically verified cases to incident cases; CIS, carcinoma *in situ*.
[a]Per 100 000 population.

Table 2. Age-specific incidence in Japan according to sex and primary site, 2005

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 (incl. CIS)	C00–C96, D00–D09	411	251	264	325	694	915	1592	2633	4640	7543	17 618	34 039	47 157	60 310	73 404	69 067	40 247	29 725
All sites	C00–C96	411	247	264	320	694	895	1577	2540	4422	7221	16 847	32 892	45 627	58 269	71 267	67 254	39 392	29 297
Lip, oral cavity and pharynx	C00–C14	1	7	14	2	36	39	58	71	123	261	543	1125	1157	1040	1060	1054	494	332
Esophagus	C15	0	2	0	0	0	0	0	22	61	304	717	1779	2364	2846	2604	2304	1196	619
Stomach	C16	4	0	0	6	46	66	168	435	1060	1708	4174	7786	10 330	12 802	14 933	13 373	7552	5659
Colon	C18	0	0	0	6	1	62	115	311	456	658	1786	3257	4635	5947	6828	6253	3979	2832
Rectum	C19–C20	0	0	0	5	4	20	120	171	406	734	1437	2830	3320	3508	3825	3184	1640	1140
Colon and rectum	C18–C20	0	0	0	11	5	82	235	482	862	1392	3223	6087	7955	9455	10 653	9437	5619	3972
Liver	C22	15	0	0	0	6	22	56	160	271	501	1523	2795	4111	4824	5840	4716	2448	1441
Gallbladder etc.	C23–C24	0	0	0	0	11	1	0	41	24	77	282	481	877	1241	1541	1908	1481	1272
Pancreas	C25	0	0	1	0	0	10	7	59	114	181	698	1216	1625	2214	2301	2049	1503	1130
Larynx	C32	0	0	0	0	0	0	0	12	23	28	160	454	723	690	550	721	343	199
Trachea, bronchus and lung	C33–C34	0	0	5	0	0	46	71	205	388	802	1889	4084	6049	7396	11 080	12 646	7755	5848
Melanoma of skin etc.	C43–C44	0	0	1	6	8	16	28	83	103	75	169	330	338	737	866	701	602	735
Prostate	C61	0	0	0	0	0	0	8	0	7	66	487	1844	4333	7797	10 615	9458	4869	3513
Bladder	C67	5	0	0	0	0	10	46	49	188	254	402	1051	1286	1506	2280	2461	1687	1394
Kidney, renal pelvis, ureter etc.	C64–C66 C68	16	23	0	0	1	23	29	85	262	306	649	1149	984	1565	1903	1462	765	536
Brain and nervous system	C70–C72	31	44	89	48	129	63	85	59	114	100	126	194	269	293	285	294	178	95
Thyroid	C73	0	0	0	18	36	58	81	105	65	123	215	361	247	245	221	217	106	28
Malignant lymphoma	C81–85 C96	9	43	22	77	48	69	141	228	264	381	597	674	1046	1302	1604	1521	892	749
Multiple myeloma	C88 C90	0	0	0	0	3	0	2	5	5	44	75	160	239	270	478	421	297	243
All leukaemias	C91–C95	162	84	48	64	112	82	156	149	117	164	275	365	439	671	777	750	478	307

Female																			
All sites (incl. CIS)	C00–C96 D00–D09	248	178	209	298	972	2407	4945	6920	10 446	14 101	18 686	26 896	28 609	30 500	35 638	36 211	31 284	36 692
All sites	C00–C96	248	178	209	285	596	1372	3149	5140	8819	12 773	17 301	25 607	27 125	29 124	34 121	34 887	30 392	36 040
Lip, oral cavity and pharynx	C00–C14	0	2	14	4	21	28	80	30	53	144	124	280	362	440	520	508	346	542
Esophagus	C15	0	0	0	0	0	0	4	2	10	81	147	258	279	328	329	378	395	467
Stomach	C16	0	0	0	4	0	41	281	399	781	1087	1644	2922	3333	4238	5397	5993	5080	5835
Colon	C18	0	0	17	0	7	25	117	173	356	703	1560	2313	3030	4278	4351	4720	4273	5146
Rectum	C19–C20	0	0	0	0	0	6	63	189	324	474	926	1361	1635	1773	1764	1761	1408	1833
Colon and rectum	C18–C20	0	0	17	0	7	31	180	362	680	1177	2486	3674	4665	6051	6115	6481	5681	6979
Liver	C22	23	0	0	0	4	5	30	18	81	62	250	707	1122	1806	2569	2787	2060	1941
Gallbladder etc.	C23–C24	0	0	0	0	5	0	6	24	30	68	209	262	512	801	1265	1553	1987	2677
Pancreas	C25	0	0	0	0	2	8	12	20	73	160	295	762	891	1171	1734	2006	1873	2684
Larynx	C32	0	0	0	0	0	0	0	0	7	14	4	14	31	11	23	10	43	57
Trachea, bronchus and lung	C33–C34	0	0	0	0	0	47	93	73	261	449	978	2186	2686	3021	3871	4159	3418	4375
Melanoma of skin etc.	C43–C44	0	0	17	7	26	17	71	22	81	99	91	193	290	303	492	689	755	1189
Breast (incl. CIS)	C50 D05	0	0	0	7	19	159	805	2092	4374	6139	6244	7245	6667	4930	4573	3352	2336	1753
Breast (only invasive)	C50	0	0	0	7	19	146	761	1973	4038	5732	5751	6903	6246	4629	4275	3179	2218	1706
Uterus (incl. CIS)	C53–C55 D06	0	0	6	28	413	1397	2412	2697	2455	2156	2446	3031	2157	1566	1589	1338	836	897
Uterus (only invasive)	C53–C55	0	0	6	19	64	402	726	1142	1309	1439	1966	2676	1915	1378	1464	1286	804	880
Cervix uteri	C53	0	0	0	19	50	334	553	908	920	704	857	1018	566	562	625	590	357	411
Corpus uteri	C54	0	0	6	0	14	67	171	226	361	709	1088	1579	1298	764	797	585	313	211
Ovary	C56	0	11	22	45	111	166	203	289	348	663	969	1186	985	805	757	629	513	602
Bladder	C67	0	0	0	0	0	13	9	23	17	55	143	156	242	293	553	621	748	985
Kidney, renal pelvis, ureter etc.	C64–C66 C68	15	35	2	10	9	29	17	32	83	93	281	433	474	521	812	725	662	651
Brain and nervous system	C70–C72	46	32	51	17	28	21	88	56	76	96	191	177	258	317	258	247	279	329
Thyroid	C73	0	0	4	22	110	200	279	313	451	626	672	935	857	767	663	522	361	311
Malignant lymphoma	C81–85 C96	5	14	14	84	32	125	58	94	158	217	382	724	676	812	1076	981	895	977
Multiple myeloma	C88 C90	0	0	0	0	0	0	0	4	13	55	44	183	224	269	330	293	400	356
All leukaemias	C91–C95	60	66	37	35	58	47	174	77	93	180	196	343	388	387	393	498	388	412

Table 3. Age-specific incidence rate per 100 000 population in Japan according to sex and primary site, 2005

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 (incl. CIS)	C00–C96, D00–D09	14.4	8.3	8.6	9.6	18.5	21.8	32.3	59.8	114.1	195.0	401.9	670.4	1135.1	1701.3	2414.8	3061.1	3291.8	3665.7
All sites	C00–C96	14.4	8.1	8.6	9.5	18.5	21.3	32.0	57.7	108.8	186.7	384.4	647.8	1098.2	1643.7	2344.5	2980.7	3221.9	3612.9
Lip, oral cavity and pharynx	C00–C14	0.0	0.2	0.5	0.1	1.0	0.9	1.2	1.6	3.0	6.7	12.4	22.2	27.8	29.3	34.9	46.7	40.4	40.9
Esophagus	C15	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.5	1.5	7.9	16.4	35.0	56.9	80.3	85.7	102.1	97.8	76.3
Stomach	C16	0.1	0.0	0.0	0.2	1.2	1.6	3.4	9.9	26.1	44.2	95.2	153.3	248.6	361.1	491.3	592.7	617.7	697.9
Colon	C18	0.0	0.0	0.0	0.2	0.0	1.5	2.3	7.1	11.2	17.0	40.7	64.1	111.6	167.8	224.6	277.1	325.4	349.2
Rectum	C19–C20	0.0	0.0	0.0	0.1	0.1	0.5	2.4	3.9	10.0	19.0	32.8	55.7	79.9	99.0	125.8	141.1	134.1	140.6
Colon and rectum	C18–C20	0.0	0.0	0.0	0.3	0.1	2.0	4.8	10.9	21.2	36.0	73.5	119.9	191.5	266.7	350.5	418.2	459.6	489.8
Liver	C22	0.5	0.0	0.0	0.0	0.2	0.5	1.1	3.6	6.7	13.0	34.7	55.0	99.0	136.1	192.1	209.0	200.2	177.7
Gallbladder etc.	C23–C24	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.9	0.6	2.0	6.4	9.5	21.1	35.0	50.7	84.6	121.1	156.9
Pancreas	C25	0.0	0.0	0.0	0.0	0.0	0.2	0.1	1.3	2.8	4.7	15.9	23.9	39.1	62.5	75.7	90.8	122.9	139.4
Larynx	C32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.7	3.7	8.9	17.4	19.5	18.1	32.0	28.1	24.5
Trachea, bronchus and lung	C33–C34	0.0	0.0	0.2	0.0	0.0	1.1	1.4	4.7	9.5	20.7	43.1	80.4	145.6	208.6	364.5	560.5	634.3	721.2
Melanoma of skin etc.	C43–C44	0.0	0.0	0.0	0.2	0.2	0.4	0.6	1.9	2.5	1.9	3.9	6.5	8.1	20.8	28.5	31.1	49.2	90.6
Prostate	C61	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	1.7	11.1	36.3	104.3	219.9	349.2	419.2	398.2	433.2
Bladder	C67	0.2	0.0	0.0	0.0	0.0	0.2	0.9	1.1	4.6	6.6	9.2	20.7	31.0	42.5	75.0	109.1	138.0	171.9
Kidney, renal pelvis, ureter etc.	C64–C66, C68	0.6	0.8	0.0	0.0	0.0	0.5	0.6	1.9	6.4	7.9	14.8	22.6	23.7	44.1	62.6	64.8	62.6	66.1
Brain and nervous system	C70–C72	1.1	1.4	2.9	1.4	3.4	1.5	1.7	1.3	2.8	2.6	2.9	3.8	6.5	8.3	9.4	13.0	14.6	11.7
Thyroid	C73	0.0	0.0	0.0	0.5	1.0	1.4	1.6	2.4	1.6	3.2	4.9	7.1	5.9	6.9	7.3	9.6	8.7	3.5
Malignant lymphoma	C81–85, C96	0.3	1.4	0.7	2.3	1.3	1.6	2.9	5.2	6.5	9.9	13.6	13.3	25.2	36.7	52.8	67.4	73.0	92.4
Multiple myeloma	C88, C90	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	1.1	1.7	3.2	5.8	7.6	15.7	18.7	24.3	30.0
All leukaemias	C91–C95	5.7	2.8	1.6	1.9	3.0	2.0	3.2	3.4	2.9	4.2	6.3	7.2	10.6	18.9	25.6	33.2	39.1	37.9

Female																			
All sites (incl. CIS)	C00–C96, D00–D09	9.1	6.2	7.1	9.3	27.0	59.0	102.6	159.7	260.2	365.5	423.4	519.4	651.7	784.5	990.6	1204.4	1428.7	1734.2
All sites	C00–C96	9.1	6.2	7.1	8.9	16.6	33.6	65.3	118.6	219.6	331.0	392.0	494.6	617.9	749.2	948.4	1160.4	1387.9	1703.4
Lip, oral cavity and pharynx	C00–C14	0.0	0.1	0.5	0.1	0.6	0.7	1.7	0.7	1.3	3.7	2.8	5.4	8.2	11.3	14.5	16.9	15.8	25.6
Esophagus	C15	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	2.1	3.3	5.0	6.4	8.4	9.1	12.6	18.0	22.1
Stomach	C16	0.0	0.0	0.0	0.1	0.0	1.0	5.8	9.2	19.5	28.2	37.3	56.4	75.9	109.0	150.0	199.3	232.0	275.8
Colon	C18	0.0	0.0	0.6	0.0	0.2	0.6	2.4	4.0	8.9	18.2	35.3	44.7	69.0	110.0	120.9	157.0	195.1	243.2
Rectum	C19–C20	0.0	0.0	0.0	0.0	0.0	0.1	1.3	4.4	8.1	12.3	21.0	26.3	37.2	45.6	49.0	58.6	64.3	86.6
Colon and rectum	C18–C20	0.0	0.0	0.6	0.0	0.2	0.8	3.7	8.4	16.9	30.5	56.3	71.0	106.3	155.6	170.0	215.6	259.4	329.9
Liver	C22	0.8	0.0	0.0	0.0	0.1	0.1	0.6	0.4	2.0	1.6	5.7	13.7	25.6	46.5	71.4	92.7	94.1	91.7
Gallbladder etc.	C23–C24	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.6	0.7	1.8	4.7	5.1	11.7	20.6	35.2	51.7	90.7	126.5
Pancreas	C25	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.5	1.8	4.1	6.7	14.7	20.3	30.1	48.2	66.7	85.5	126.9
Larynx	C32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.1	0.3	0.7	0.3	0.6	0.3	2.0	2.7
Trachea, bronchus and lung	C33–C34	0.0	0.0	0.0	0.0	0.0	1.2	1.9	1.7	6.5	11.6	22.2	42.2	61.2	77.7	107.6	138.3	156.1	206.8
Melanoma of skin etc.	C43–C44	0.0	0.0	0.6	0.2	0.7	0.4	1.5	0.5	2.0	2.6	2.1	3.7	6.6	7.8	13.7	22.9	34.5	56.2
Breast (incl. CIS)	C50, D05	0.0	0.0	0.0	0.2	0.5	3.9	16.7	48.3	108.9	159.1	141.5	139.9	151.9	126.8	127.1	111.5	106.7	82.9
Breast (only invasive)	C50	0.0	0.0	0.0	0.2	0.5	3.6	15.8	45.5	100.6	148.6	130.3	133.3	142.3	119.1	118.8	105.7	101.3	80.6
Uterus (incl. CIS)	C53–C55, D06	0.0	0.0	0.2	0.9	11.5	34.2	50.0	62.2	61.1	55.9	55.4	58.5	49.1	40.3	44.2	44.5	38.2	42.4
Uterus (only invasive)	C53–C55	0.0	0.0	0.2	0.6	1.8	9.8	15.1	26.4	32.6	37.3	44.5	51.7	43.6	35.4	40.7	42.8	36.7	41.6
Cervix uteri	C53	0.0	0.0	0.0	0.6	1.4	8.2	11.5	21.0	22.9	18.2	19.4	19.7	12.9	14.5	17.4	19.6	16.3	19.4
Corpus uteri	C54	0.0	0.0	0.2	0.0	0.4	1.6	3.5	5.2	9.0	18.4	24.7	30.5	29.6	19.7	22.2	19.5	14.3	10.0
Ovary	C56	0.0	0.4	0.7	1.4	3.1	4.1	4.2	6.7	8.7	17.2	22.0	22.9	22.4	20.7	21.0	20.9	23.4	28.5
Bladder	C67	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.5	0.4	1.4	3.2	3.0	5.5	7.5	15.4	20.7	34.2	46.6
Kidney, renal pelvis, ureter etc.	C64–C66, C68	0.6	1.2	0.1	0.3	0.3	0.7	0.4	0.7	2.1	2.4	6.4	8.4	10.8	13.4	22.6	24.1	30.2	30.8
Brain and nervous system	C70–C72	1.7	1.1	1.7	0.5	0.8	0.5	1.8	1.3	1.9	2.5	4.3	3.4	5.9	8.2	7.2	8.2	12.7	15.5
Thyroid	C73	0.0	0.0	0.1	0.7	3.1	4.9	5.8	7.2	11.2	16.2	15.2	18.1	19.5	19.7	18.4	17.4	16.5	14.7
Malignant lymphoma	C81–C85, C96	0.2	0.5	0.5	2.6	0.9	3.1	1.2	2.2	3.9	5.6	8.7	14.0	15.4	20.9	29.9	32.6	40.9	46.2
Multiple myeloma	C88, C90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.4	1.0	3.5	5.1	6.9	9.2	9.7	18.3	16.8
All leukaemias	C91–C95	2.2	2.3	1.3	1.1	1.6	1.2	3.6	1.8	2.3	4.7	4.4	6.6	8.8	10.0	10.9	16.6	17.7	19.5

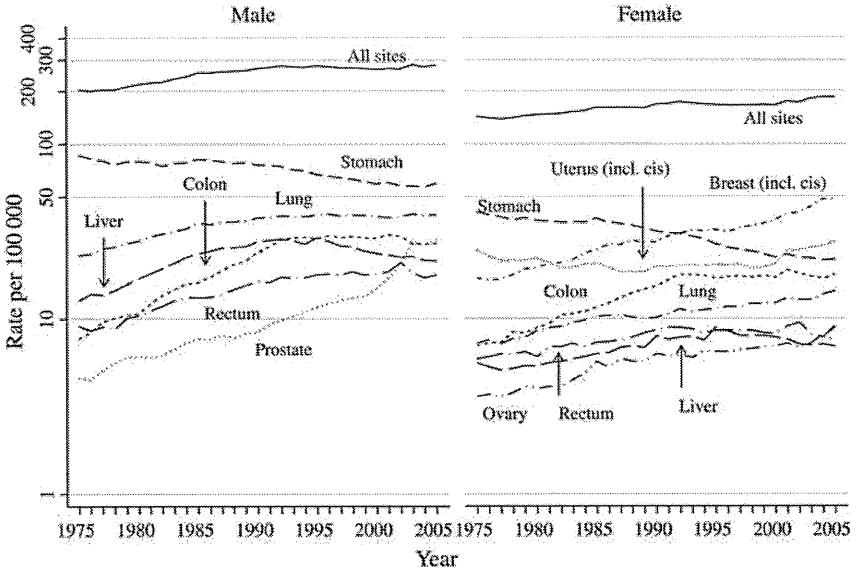

Figure 1. Trends of age-standardized cancer incidence rates for five major sites and specific sites for each sex (standard population: world population).

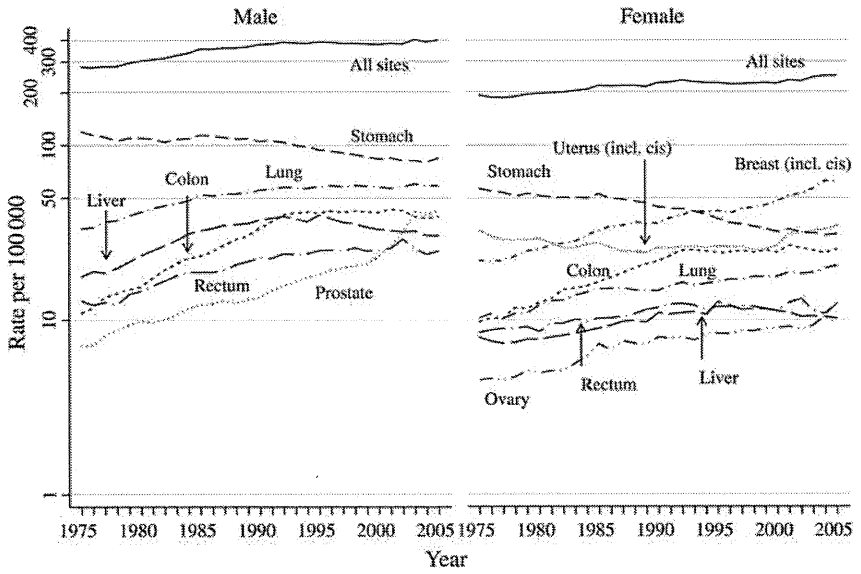

Figure 2. Trends of age-standardized cancer incidence rates for five major sites and specific sites for each sex (standard population: 1985 Japanese model population).

on the website (only available in Japanese, http://ganjoho.jp/professional/statistics/monita.html).

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Conflict of interest statement

None declared.

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Original Article

Demonstration of quality of care measurement using the Japanese liver cancer registry

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Aim: Despite advances in medical therapy, studies have reported gaps between current evidence and actual practice in many areas of medicine. Process-of-care quality indicators (QIs) are tools to measure the evidence–practice gap. This study aims to examine the feasibility of applying QIs for liver cancer care to the national registry database operated by the Liver Cancer Study Group of Japan.

Methods: Prior research developed a set of process-of-care QIs developed on the basis of the Japanese Clinical Practice Guidelines for hepatocellular carcinoma. Each QI describes target patients and care processes indicated for such patients. Among the 25 developed QIs, six appeared scorable using the information contained in the dataset from the 17th Nationwide Survey of Primary Liver Cancer.

Results: In total, 16 187 patients were eligible for the six QIs for 34 599 times, among which the indicated care was provided 83.9% times. The scores ranged from 64.4% (surgical therapy in patients with HCC 3–5 cm in diameter) to 91.1% (indocyanine green checkup before surgical resection). The information was generally available to determine eligibility (78.3%–100%) and pass/fail (91.9%–99.9%) for the QIs.

Conclusions: Applying QIs to the liver cancer registry, the quality of hepatocellular carcinoma care can be measured. In future, providing feedback regarding the results to the participating society may improve the quality of liver cancer care nationwide.

Key words: cancer registry, hepatocellular carcinoma, quality indicators, quality of health care.

INTRODUCTION

LIVER CANCER IS the third leading cause of cancer deaths worldwide.[1] Eastern countries generally exhibit higher incidences of liver cancer, but many Western countries have experienced a steady increase.[2,3] Liver cancer is prevalent in Japan, and it was the fourth leading cause of cancer deaths in 2009.[4] Despite recent advances in diagnostics and therapeutics, the 5-year survival rates based on population-based cancer registries remains relatively low at 23.1%.[5]

To improve survival, both medical therapeutic advances and their dissemination into clinical practice are necessary. To distribute current knowledge and facilitate clinical decision making for liver cancer treatment, the first evidence-based Clinical Practice

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Guidelines for Hepatocellular Carcinoma in Japan were published in 2005 with financial support from the Ministry of Health, Labor, and Welfare.[6,7] A follow-up survey of specialists and generalists involved in liver cancer care demonstrated successful outreach and acceptance of these guidelines among frontline practitioners of hepatocellular carcinoma (HCC) care.[8]

The next step in monitoring the effectiveness of the HCC clinical practice guidelines is the assessment of the quality of care. Although the quality of care can be assessed by structure, process, and outcome,[9] an evaluation of the process best fits the context of guideline implementation. Quality assessments that examine the processes of care compare the actual care provided to the patient against the pre-specified standards of care. Although standards may not exist for all aspects of care, examining how well the standards are incorporated into daily practice in those areas that do exist can reveal aspects of quality and create a basis for improvement. In addition, gaps in the process quality highlight areas for the guideline committee to focus on in the next round of revisions. Accordingly, we developed a set of process quality indicators (QIs) that describe standards for HCC patient care.[10,11] Although the QIs were designed to be implemented through the review of medical records, some QIs can be used on the Nationwide Survey of Primary Liver Cancer – the liver cancer registry operated by the Liver Cancer Study Group of Japan. This provided a unique opportunity to pilot test the QIs and examine certain aspects of the quality of care of some liver cancer patients in Japan.

METHODS

Development of the QIs

THE QIS WERE developed using Japanese HCC guidelines, adopting the RAND/University of California, Los Angeles appropriateness methods.[12] Details of processes and results were previously reported in Japanese.[11] Briefly, we first created candidate QIs based on the recommendations of the Japanese HCC guidelines and the medical literature. Each QI described the care standards defining target patients and indicated the care processes. From a literature review, we summarized the rationale for each candidate QI.

Next a nine-member multidisciplinary panel was convened that consisted of two hepatobiliary surgeons, three hepatologists, a gastrointestinal surgeon, a general internist, and two interventional radiologists. The panel members were nationally recognized clinicians from various practice settings, including the university and general hospital settings. The geographic distributions of the clinical practices were also taken into account.

The panel examined candidate QIs by following the modified Delphi process that consisted of two rounds of anonymous rating of the validity (scale of 1–9; 1 = definitely invalid, 9 = definitely valid) coupled with a face-to-face group discussion between rounds. During the process, the panel was allowed to modify the QIs. As per prior studies, QIs that had a median rating of 7 or higher and were rated 3 or lower by two or fewer panelists in the second ratings were accepted.[12,13]

Liver cancer registry database

The Liver Cancer Study Group of Japan operates the Nationwide Survey of Primary Liver Cancer in Japan, which is a cancer registry specifically for liver cancer.[14] Biannually, it collects 178 data items from the newly treated primary liver cancer patients and 46 items for following the previously registered patients. Participation is voluntary and is estimated to cover approximately 20% of all primary liver cancer patients in Japan.[15] We used data on patients receiving therapy for liver cancer at 645 participating institutions during 2002 and 2003. The data consisted of detailed clinical information and included the patients' baseline conditions, imaging findings, treatment modality, and pathological findings. Here, we have limited our analysis to HCC patients ≥20 years of age and have excluded patients who lacked age or diagnosis information.

Quality scores

The expert panel process resulted in 25 QIs,[11] which targeted a wide range of care processes including the pre-therapeutic evaluation, treatment choice, patient explanation of the treatment and results, and follow-ups. Of the 25 QIs, six could be scored using the information in the Liver Cancer Registry Database (Table 1). Patients were eligible for QIs if they met the criteria described in the denominator, and they were considered to have "passed" the QI if they received the care processes stated in the numerator. The quality score was calculated for each QI as the percentage of "passed" patients among those eligible. For example, the first QI in Table 1 was scored as the percentage of the patients whose alpha-phetoprotein (AFP) and protein indiced by vitamin K absence -2 (PIVKA-2) levels were measured before treatment (numerator) among those who were diagnosed with hepatocellular carcinoma (denominator). When necessary information was unavailable (i.e. either missing or coded as "unknown" in the dataset),

Table 1 Quality indicators (QIs) applied to the liver cancer registry, quality scores, and data completeness

Denominator (target patients)	Numerator (standard care processes)	*n*	Quality score (%)	Data availability (%)	
				Denominator	Numerator
Tumor marker before initiation of therapy					
Patients who were diagnosed with hepatocellular carcinoma (HCC)	AFP and PIVKA-2 levels were measured before treatment†	16 187	82.3%	100%	94.3%
ICG check-up before surgery					
Patients who underwent surgical resection of HCC for the first time	15-min ICG retention rate was measured before treatment†	4 802	91.1%	99.2%	94.6%
Local therapy for new HCC (≤3 cm)					
HCC patients with liver damage class A, having three or less tumors of 3 cm or smaller in diameter	Surgical resection or percutaneous local ablation therapy (PEI, MCT, or RFA) was performed.	3 934	76.9%	78.3%	99.5%
Surgical therapy for new HCC (3–5 cm)					
HCC patients with liver damage class A having a solitary tumor of 3–5 cm in diameter	Surgical resection was performed.	1 029	64.4%	78.3%	99.9%
TACE indication					
HCC patients with Stage IVa or earlier, Vp 0–2 and Child–Pugh class A or B, in whom surgery and percutaneous local ablation therapy were not possible (patients who did not receive surgery or percutaneous local ablation therapy within 3 months after diagnosis)	TACE was performed.	3 741	84.5%	82.0%	99.9%
Documentation of after surgical resection					
HCC patients who received surgical resection	Medical record (including pathological report) documented the degrees of vascular invasion‡ and tumor differentiation was postoperatively determined.	4 906	81.4%	99.5%	91.9%

†Timing of the measurement was uncertain because the date of the test was not present in the registry.
Whether surgical resection was the first-line therapy was unclear because the registry did not distinguish the first-line therapy from subsequent therapies. ‡Includes invasion to the portal vein (vp), hepatic vein (vv), hepatic artery (va), and bile duct (b).
HCC, hepatocellular carcinoma; ICG, indocyanine green; MCT, microwave coagulation therapy; PEI, percutaneous ethanol injection; RFA,radiofrequency ablation; TACE, transarterial chemoembolization.

we treated the patients as follows: if QI eligibility information (applicability to the denominator) was missing, we excluded the patients from the denominator; if the information needed to determine the "pass" or "fail" status (the numerator) was unavailable, we considered that the care was not provided, and thus, the patient was counted as "fail" on the QI.

To evaluate the feasibility of applying these QIs to the liver cancer registry, we examined the completeness of the data to determine patient eligibility (the proportion of patients having all data items necessary to examine the denominator criteria [i.e. target patients]) and pass/fail (the proportion of patients having all necessary data items among all eligible patients) for QIs. Because the analysis revealed that the liver damage classification of the Liver Cancer Study Group[16] was the most frequently missing information, we further evaluated the usability of Child–Pugh classification to substitute for the liver

damage classification by examining the agreement between the two classification systems among patients with both sets of data. Because the QIs that target treatment choice focused on patients with class A liver damage, we calculated the sensitivity and specificity of the Child–Pugh class A in predicting liver damage class A. All of the statistical analyses were performed using STATA 11.1 (College Station, TX, USA). The study protocol was approved by the institutional review board of the National Cancer Center of Japan.

RESULTS

Sample characteristics

IN TOTAL, 16 187 patients were included. Table 2 presents the sample characteristics. The mean age of patients was 67 years (71.6% male). Approximately 50% of patients had liver damage of class A and 50% had solitary tumors. Similar numbers of patients underwent surgery, percutaneous local ablation, and transcatheter arterial chemoembolization (TACE).

Table 2 Sample characteristics

	n (%)
Age, mean (SD)	67 (SD = 9.4)
Male *n* (%)	11 592 (71.6%)
Liver damage class	
A	8089 (50.0%)
B	4439 (27.4%)
C	1058 (6.5%)
Unknown/No response	2601 (16.1%)
Child–Pugh class	
A	10 585 (65.4%)
B	3444 (21.3%)
C	867 (5.4%)
Unknown/No response	1291 (8.0%)
Number of tumors	
1	8970 (55.4%)
2	2727 (16.9%)
3	1198 (7.4%)
>3	3733 (15.7%)
Unknown/No response	757 (4.9%)
Tumor diameter (cm), mean (SD)	4.1 (4.0)
Primary treatment modality	
No treatment	1238 (7.7%)
Surgical resection, transplantation	4895 (30.2%)
Percutaneous local ablation	4733 (29.2%)
TACE	4423 (27.3%)
Systemic chemotherapy	718 (4.4%)
Other treatment	110 (0.7%)
No answer	70 (0.4%)

SD, standard deviation; TACE, transarterial chemoembolization.

Table 3 Cross-tabulation of Child–Pugh and Liver damage classes

CP	LD				
	A	B	C	Unknown	Total
A	7729	1813	35	1008	10 585
B	131	2445	290	578	3 444
C	6	56	693	112	867
Unknown	223	125	40	903	1 291
Total	8089	4439	1058	2601	16 187

CP, Child–Pugh classification; LD, liver damage.

Quality scores

On average, quality indicators had 5767 patients applicable, and overall the indicated care processes were provided 83.9% of the time. Table 1 presents quality scores and data completeness for each QI. The score was lowest for the QI "Surgical therapy in patients with HCC 3–5 cm in diameter" (64.4%) and highest for the QI "Indocyanine green (ICG) checkup before surgical resection" (91.1%). Although the availability of data for denominators ranged from 78.3% to 100%, information for numerators was available for more than 90% of patients for all QIs. QIs that use liver damage classification, tumor number, and tumor size were least commonly available for the denominator (78.3%). Liver damage classification, tumor number, and tumor size were missing or unknown for 2601 (16%), 757 (4.7%), and 1134 patients (7.0%), respectively.

Distribution of liver damage and the Child–Pugh classification

Table 3 presents the analysis of the concordance between Child–Pugh and liver damage classifications. These two classification systems agreed in 82.3% of patients for whom sufficient data were available. Child–Pugh A could predict liver damage class A with 98.3% sensitivity and 65.3% specificity.

DISCUSSION

WE HAVE DEMONSTRATED that certain aspects of the quality of care for patients with liver cancer can be measured using the liver cancer registry operated by the Liver Cancer Study Group of Japan. To our

knowledge, this was the first study to measure the quality of care for HCC. Standardizing the care process is challenging given the complexity of HCC care, as a range of treatment modalities from surgical resection to percutaneous and transcatheter therapy exists. The choice of treatment is influenced not only by the cancer stage but also by the baseline liver function. The QIs in this study, developed by the consensus of clinical experts, examined the actual care provided against the standards of pretherapeutic evaluation, the collection of pertinent tumor information, and treatment choice. The quality scores were high for most of the QIs, but there was also room for improvement. Although not all of the QIs developed were used for this analysis, we believe that the identification of a focus for improvement is an important initial step.

The information available in the registry was sufficiently complete for quality measurements to be made. Although information required to determine eligibility for QIs was occasionally missing, the information required to assign each QI a "pass" or "fail" status was generally available, which indicated little ambiguity in the scoring of the eligible patients. Among the missing information, the liver damage classification was the most frequently missing, presumably due to the lack of the ICG test. Although the liver damage classification was used for the QIs that focused on treatment choice in accordance with the Japanese Clinical Practice Guidelines, alternative criteria would be necessary to review actual practices. The comparison of the Child–Pugh class and liver damage class, however, revealed that the former underestimated the liver damage. For example, the Child–Pugh class A includes patients with more severe disease and is broader than liver damage class A. This result was expected, as the prothrombin criteria threshold is lower for the Child–Pugh classification.[16] Furthermore, this is consistent with a previous report that reviewed the medical records of the HCC patients.[17] If the Child–Pugh classification is used in place of the liver damage classification for the patients whose liver damage classification data are missing, the QIs targeting patients with liver damage class A would also include a broader group of the patients with liver damage class B or C. Thus, caution should be exercised when using these liver function classifications interchangeably.

For other types of cancer, we have a predecessor on using the national database for quality measurements and feedback. In the National Cancer Database, the Commission on Cancer of the American College of Surgeons measured six QIs (three for breast cancer and three for colorectal cancer) and provided feedback regarding the scores of the individual participating facilities and the distribution of these scores among other facilities.[18] This program is now developing the Rapid Quality Reporting System, in which the facilities submit and update the information continuously and the quality of care is monitored in real time. Our study indicates that the same service is theoretically possible in Japan using the liver cancer registry.

Some limitations must be considered when interpreting the results of the current study. First, the QIs that examined the appropriate documentation of vascular invasion and tumor differentiation were scored based on the availability of data in the dataset rather than on the actual medical records. This may underestimate or overestimate the quality scores for these QIs. Underestimation occurs when physicians keep appropriate documentation but fail to enter that information into the dataset, and overestimation occurs when physicians enter the information into the dataset but fail to document it in the medical record. Accordingly, caution must be exercised while interpreting these scores. Second, quality assessment requires the consideration of exceptional cases. For example, in some cases where a QI indicated surgery, surgery may not be appropriate due to compromised cardiac or respiratory functions. As the database does not contain information on the reasons why surgery was not performed, it is possible that patients who were appropriately excluded from surgery may be labeled as having received poor quality care. Hence, the results of the measurements of quality from the database should be regarded as starting points for discussions of quality and not as the final conclusions about quality. Third, the fact that the facilities participated in the registry voluntarily must be taken into account, as they are motivated and likely to be more specialized than the average Japanese hospitals. Therefore, the quality scores from these facilities may be higher than those provided by typical hospitals in Japan. Fourth, the QIs were based on the clinical practice guidelines issued in 2005, [6] but our study was comprised of patients diagnosed in 2002 and 2003. Thus, the guidelines used may have already improved some of the aspects of care scored in this analysis, but our study has demonstrated that the Liver Cancer Registry Database can be a useful data source for analyzing quality of care. Finally, the timing of the evaluation and the start of treatment for each patient was uncertain. Although the QIs targeting pretherapeutic laboratory tests (tumor markers and ICG retention) require knowledge of whether these tests were performed before the treatment was initiated, the test dates were not available in the