

# **Cancer Statistics and Epidemiology**

**Noncommunicable Diseases and  
Health Promotion  
Kyu-Won Jung**



**World Health  
Organization**

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**Western Pacific Region**

# Outlines

- **Understand the cancer registry data**
- **Understand incidence and the need for standardization**
- **CanReg5: what function does it have?**
- **Understand cancer survival using cancer registry data**

# Need for cancer registration

Global status report  
on noncommunicable diseases  
2010



## Key messages

Population-based cancer registries play a central role in cancer control programmes because they provide the means to plan, monitor and evaluate the impact of specific interventions in targeted populations.

# Uses of Cancer Registry Data

## **1 Epidemiological Research**

**Descriptive Epidemiology**

**Analytic Epidemiology**

## **2 Health Care Planning and Monitoring**

**Patient Care**

**Survival**

**Screening**

**Prevention**

# Use of Cancer Registry data

- **Analyses of cancer registry data**
- **Record linkage studies**
- **Sources of cases for case-control studies**
- **Source of reference rates**

# Analysis of cancer registry data

- **Geographical variations**
- **Time trends**
- **Analyses by sex and ethnic group**
- **Analysis of other risk factors**
  - occupation**
  - place of birth**
  - civil status**
  - religion**

# Limitations of Registry Data

- **Limited data set**
- **Time delays – data can be at least 1 to 2 years old**
- **Lack of information about screenings, health behaviors, co-morbid, recurrence of disease**
- **Follow-up information often limited to vital status – no detailed information on side effects to tx, tx compliance, etc**

# **How much cancer is occurring?**

**Understand incidence rates**



# Definitions

- **Incidence** is the rate of new cases of a disease or condition in a population at risk during a time period

# (Crude) Incidence Rate

Number of *new* cases during a time period

$$\frac{\text{Number of } \textit{new} \text{ cases during a time period}}{\text{Population at risk during that time period}} * 100,000$$

- Incidence is a **rate**
- Calculated for a given time period (time interval)
- Reflects **risk** of disease or condition

# What is crude incidence rates?

Population A

Age group	Population	No of incidence
0-15	30,000	30
15-60	20,000	10
>60	50,000	50
<b>Total</b>	<b>100,000</b>	<b>90</b>

Population B

Age group	Population	No of incidence
0-15	10,000	10
15-60	80,000	40
>60	10,000	10
<b>Total</b>	<b>100,000</b>	<b>60</b>

# Age-specific Incidence Rate

$$\frac{\text{Number of } \textit{new cases in a specific age group} \text{ during a time period}}{\text{Population at risk of the specified age group during that time period}} * 100,000$$

# What is the disadvantage of a crude incidence rates?

Population A

Age group	Population	No of incidence	Age-specific rate
0-15	30,000	30	100
15-60	20,000	10	50
>60	50,000	50	100
Total	100,000	90	

Population A has older generation, therefore it has a higher crude rate compared to Population B

Population B

Age group	Population	No of incidence	Age-specific rate
0-15	10,000	10	100
15-60	80,000	40	50
>60	10,000	10	100
Total	100,000	60	

**How does occurrence vary across period, or other regions?**

# Age-standardized rate

- **How to compare the two population, independently of the effect of the difference in age distribution?**
- **We need to have a summary measure of incidence for all age groups to avoid many tables of rates for each age group**

# Age-standardized rate

- The ASR is a weighted mean of the age-specific rates; the weights are taken from population distribution of the standard population.
- There is no “correct” way to choose a standard. But, In cancer registries, we usually use **World Standard Population**, or **WHO Standard population** for comparing other countries.



# What is the age-standardized incidence rates?

Population A

Age group	Population	No of incidence	Age-specific rate per 100,000
0-15	30,000	30	100
15-60	20,000	10	50
>60	50,000	50	100
Total	100,000	90	<b>90</b>

Let's use **Population A as a standard population** in this example.

**ASR of Population A**  
= 90 per 100,000

**ASR of Population B**  
=  $(100 \times 0.3 + 50 \times 0.2 + 100 \times 0.5)$   
= 90 per 100,000

Population B

Age group	Population	No of incidence	Age-specific rate per 100,000	W
0-15	10,000	10	100	0.3
15-60	80,000	40	50	0.2
>60	10,000	10	100	0.5
Total	100,000	60		1.0

# To calculate incidence rates, you need..

- ***Variables***

***Date of incidence, age, site***

- ***Population stratified by age, and sex***

- **Statistical Program**

- **CanReg5**

- **SAS, STATA, R**

- **Excel**


# Software for registration: CanReg5

- **Cancer registration data that are collected and coded in a standard way make possible the production of comparable cancer incidence among various countries.**
- **CanReg5 contains modules for:**
  - **Data entry**
  - **Quality control**
  - **Analysis of the data**
- **Open source, multi-user & multi-platform**



**Responsible Officer: Mr Ervic Morten, CIN, IARC**



 CanReg5 - Training Cancer Registry

File Data Entry Analysis Management Tools Help



Browse/Edit



Create New Record



Table builder



Options...



Open CanReg5 Handbook



World Health  
Organization

Western Pacific Region

# Data entry

You can input cancer registry data by using browser menu.

Data is split over 3 main tables: patient, tumor, source

**Patient table:** the unique patient related information

**Information of patient:** surname, first name, maiden name, middle name, sex, birth date, tribe, occupation

**Follow up:** last contact date, status

**Tumor table:** pretty much the rest of patient and source data

**Patient:** age, address

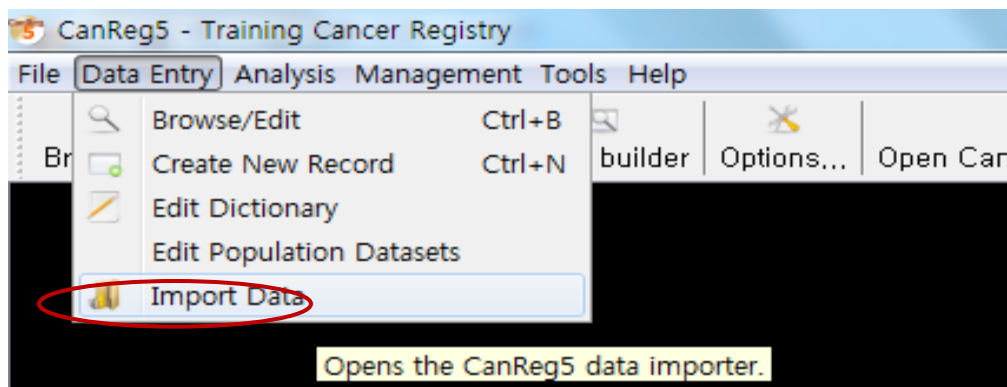
**Tumor:** incidence date, topography, morphology, behavior, basis diagnosis, ICD-10, ICCC

**Source table:** source information

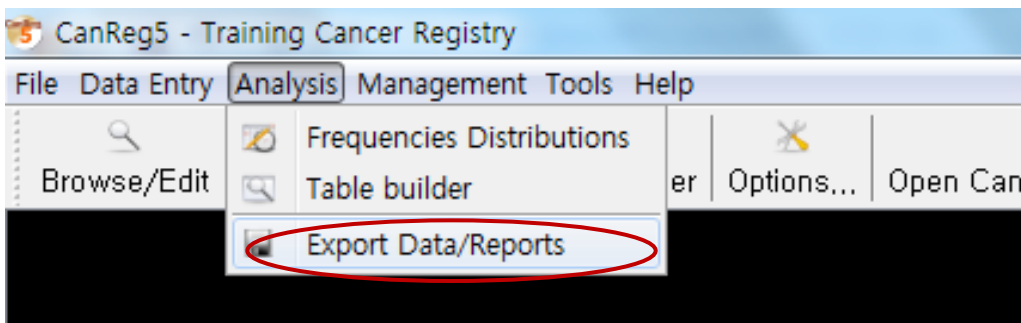
hospital, unit, path lab number, case number

# Import/Export cancer registry data

**"Import Data" is used to import data from other CanReg systems or other programs.**



**"Export Data/Reports" is used to export all, or part of, your Canreg5 data to an external text file.**



# Quality control and Consistency check

You can do quality control and consistency checks.

The screenshot shows two windows from the CanReg software. The top window, titled 'Patient record', has a 'Run' button circled in red. Below it is a form for patient information with fields for Surname, First names, Maiden name, Sex, Birth date, Tribe, Occupation, and MiddleName. The bottom window, titled 'Tumour record', has two 'Run' buttons circled in red. It includes a 'Checks' section with 'MP Search' selected, a 'Record Status' dropdown set to 'Pending (0)', and a 'Sequence Number' field. Below this is a form for tumour information with fields for Incidence date, Topography, Morphology, Behaviour, Basis diagnosis, ICD-10, and ICCC code. At the bottom of the tumour window is a 'Sources' section with 'Add Source' and 'Remove Source' buttons, and a table for hospital information with columns for Hospital, Unit, Path lab n°, and Case n°.

**Patient table:** Person search check

**Tumour table:** Edit check, MP search

**Edit check:**

Mandatory variables

Cross checks

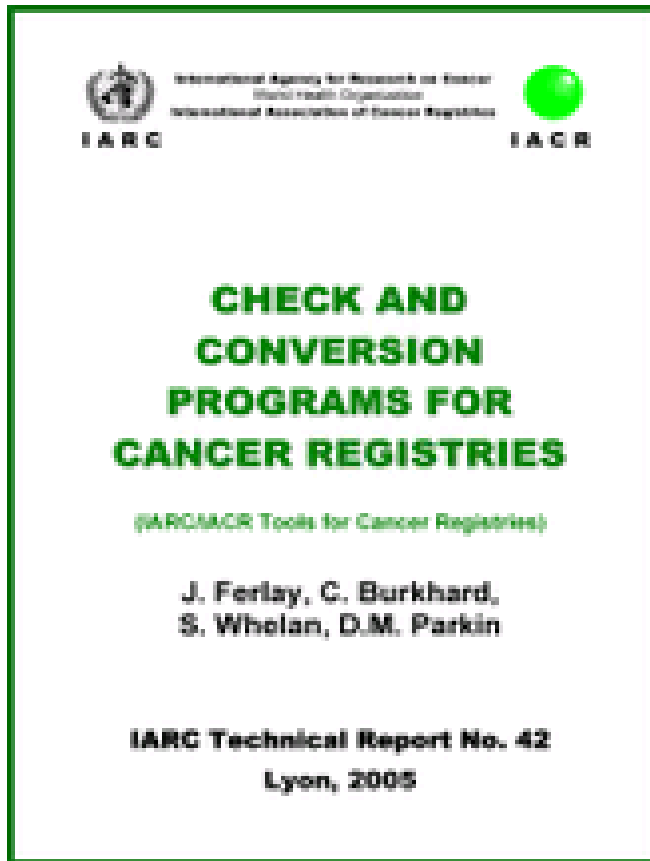
making ICD-10 and ICCC

**MP search:** checking multi primary cancer



# Quality control and Consistency check

The Edit checks carried out by program are described below:



- **Individual data item edits**

Incidence date, Age at incidence, Sex, Site, Morphology, Behavior, Grade

- **Data combination edits**

- Age/site/histology
- Age/incidence/histology
- Site/histology
- Sex/site
- Sex/histology
- Behavior/site
- Behavior/histology
- Grade/histology
- Basis of diagnosis/histology

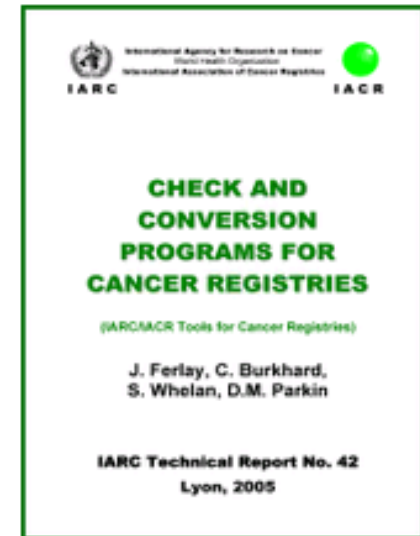
# Quality control and Consistency check

## Appendix 1. Site-morphology combinations used in CHECK

Note: Morphological terms that are usually associated with a non-malignant behaviour code are in *italics*.

Family number	Family name	Family description	ICD O 3 Codes	Specific sites	Non-specific sites
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<i>Group 2: Tumours with specific site-profile</i>					
8	Liver tumours	8170 Hepatocellular carcinoma 8171 Hepatocellular carcinoma, fibrolamellar 8172 Hepatocellular carcinoma, scirrhous 8173 Hepatocellular carcinoma, spindle cell variant 8174 Hepatocellular carcinoma, clear cell type 8175 Hepatocellular carcinoma, pleomorphic type 8970 Hepatoblastoma 9124 Kupffer cell sarcoma		C22 Liver and intrahepatic bile ducts	
9	Biliary tumours	8160 Cholangiocarcinoma 8161 Bile duct cystadenocarcinoma 8162 Klatskin tumour 8180 Combined hepatocellular carcinoma and cholangiocarcinoma 8264 Papillomatosis, glandular		C22 Liver and intrahepatic bile ducts C23 Gallbladder C24 Other and unspecified parts of biliary tract	



***Bile duct cystadenocarcinoma and Intrahepatic bile ducts are unlikely combinations***

# Multiple primary cancer check (1)

You can check multiple primary cancer for cancer registry data.

URL: <http://codes.iarc.fr/>

[http://whqlibdoc.who.int/publications/2000/9241545348\\_eng.pdf](http://whqlibdoc.who.int/publications/2000/9241545348_eng.pdf)

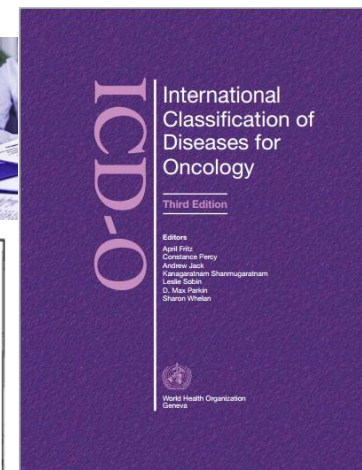


Table 24. Groups of Topography Codes from the Second and Third Editions of ICD-O Considered a Single Site in the Definition of Multiple Cancers

Second/Third Editions		First Edition
C01	Base of tongue	
C02	Other and unspecified parts of tongue	141
C05	Palate	
C06	Other and unspecified parts of mouth	145
C07	Parotid gland	
C08	Other and unspecified major salivary glands	142
C09	Tonsil	
C10	Oropharynx	146
C12	Pyriform sinus	
C13	Hypopharynx	148
C19	Rectosigmoid junction	
C20	Rectum	154
C23	Gallbladder	
C24	Other and unspecified parts of biliary tract	156
C30	Nasal cavity and middle ear	
C31	Accessory sinus	160
C33	Trachea	
C34	Bronchus and lung	162
C37	Thymus	164
C38.0-3	Heart and mediastinum	164
C38.8	Overlapping lesion of heart, mediastinum and pleura	165.8
C40	Bones, joints and articular cartilage of limbs	
C41	Bones, joints and articular cartilage of other and unspec. sites	170
C51	Vulva	184.4
C52	Vagina	184.0
C57.7	Other specified female genital	184.9
C57.8-9	Overlapping lesion and female genital tract, NOS	184.8, 184.9
C60	Penis	
C63	Other and unspecified male genital organs	187
C64	Kidney	
C65	Renal pelvis	
C66	Ureter	
C68	Other and unspecified urinary organs	189
C74	Adrenal gland	194.0
C75	Other endocrine glands and related structures	194

Table 25. Groups of Malignant Neoplasms Considered to Be Histologically "Different" for the Purpose of Defining Multiple Tumors (adapted from Berg, 1994) (24)

Carcinomas	
1. Squamous carcinomas	M-805-M-808, M-812, M-813
2. Basal cell carcinomas	M-809-M-811
3. Adenocarcinomas	M-814, M-816, M-819-M-822, M-826-M-833, M-835-M-855, M-857, M-894
4. Other specific carcinomas	M-803, M-804, M-815, M-817, M-818, M-823-M-825, M-834, M-856, M-858-M-867
(5.) Unspecified carcinomas (NOS)	M-801, M-802
6. Sarcomas and soft tissue tumors	M-868-M-871, M-880-M-892, M-899, M-904, M-912, M-913, M-915-M-925, M-937, M-954-M-958
7. Lymphomas	M-959-M-972
8. Leukemia	M-980-M-994, M-995, M-996, M-998
9. Kaposi sarcoma	M-914
10. Mesothelioma	M-905
11. Other specified types of cancer	M-872-M-879, M-893, M-895-M-898, M-900-M-903, M-906-M-911, M-926-M-936, M-938-M-953, M-973-M-975, M-976
(12.) Unspecified types of cancer	M-800, M-997

Registries may follow different rules; in the United States of America, for example, most registries follow the rules of the Surveillance, Epidemiology and End Results (SEER) Program. The detailed instructions are outlined in the *SEER Program Code Manual* (25). SEER takes timing of the diagnoses into consideration, and counts as an individual site each segment of the colon, whereas IARC would consider the colon as one site. For histology, SEER counts each three-digit morphologic type mentioned as occurring in a site as one cancer, whereas the IARC guidelines use the broad groups outlined in Table 25 to define "different" histology. The *SEER Program Code Manual* contains more than 25 pages of discussion and instructions for determining and coding multiple combinations of lymphomas and leukemias.

Each registry must decide what rules to use for handling multiple tumors and the conventions followed should be outlined when presenting data.

# Multiple primary cancer check (2)

When a patient has two topographies (C33, C34) and two morphologies (81403, 82603), since they are duplicate cases, you should make one topography and one morphology.

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(5.) Unspecified carcinomas (NOS)	81403: Adenocarcinoma, NOS 82603: Papillary adenoma, NOS
6. Sarcomas and soft tissue tumors	M-954-M-958
7. Lymphomas	M-959-M-972
8. Leukemia	M-980-M-994, M-995, M-996, M-998
9. Kaposi sarcoma	M-914
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# CanReg5 - Training Cancer Registry

File Data Entry Analysis Management Tools Help

Browse/Edit Create New Record Table builder Options... Open CanReg5 Handbook

The screenshot shows the main application window with the 'Analysis' menu open. The 'Table builder' option is highlighted, and a tooltip below it reads 'Opens the CanReg5 tab'. Other menu items visible include 'Frequencies Distributions' and 'Export Data/Reports'.

The 'Table builder' dialog box is open, showing a list of table types. The 'Incidence per 100,000 by age group (Period)' option is selected. Below the list is a preview of a table titled 'ALGERIA, 2017 (1980-2017)'. The table contains columns for age groups and incidence rates. At the bottom of the dialog are 'Back', 'Cancel', and 'Next' buttons.

Age Group	Incidence Rate
0-4	0.0
5-9	0.0
10-14	0.0
15-19	0.0
20-24	0.0
25-29	0.0
30-34	0.0
35-39	0.0
40-44	0.0
45-49	0.0
50-54	0.0
55-59	0.0
60-64	0.0
65-69	0.0
70-74	0.0
75-79	0.0
80-84	0.0
85-89	0.0
90-94	0.0
95-99	0.0

## Data Quality Indicators (beta)

### Training Cancer Registry (1995)

#### Data Quality Indicators

#### MALE

SITE	Cases	% Total
Mouth & pharynx	41	5.01
Oesophagus	40	4.89
Stomach	24	2.93
Colon, rectum, anus	26	3.18
Liver	24	2.93
Pancreas	2	0.24
Larynx	5	0.61
Lung, trachea, bronchus	5	0.61
Pleura & other thoracic	1	0.12
Melanoma of skin	13	1.59
Prostate	67	8.19
Testis	1	0.12
Kidney & urinary NOS	8	0.98
Bladder	6	0.73
Brain & nervous system	2	0.24
Thyroid	1	0.12
Ill-defined	45	5.50
Lymphoma	58	7.09
Leukaemia	9	1.10
All sites but C44	798	97.56

ASR(se) MV(%) CLIN(%) DCO(%)

ICD10

#### FEMALE

SITE	Cases	% Total	ASR(se)	MV(%)	CLIN(%)	DCO(%)	ICD10
Mouth & pharynx	16	1.94	7.87 ( 2.21)	93.75	6.25	0	C00-14
Oesophagus	34	4.12	25.51 ( 4.54)	47.06	52.94	0	C15
Stomach	15	1.82	9.15 ( 2.63)	86.67	13.33	0	C16
Colon, rectum, anus	11	1.33	7.08 ( 2.34)	90.91	9.09	0	C18-21
Liver	17	2.06	9.03 ( 2.49)	35.29	64.71	0	C22
Pancreas	4	0.48	1.42 ( 0.92)	75.00	25.00	0	C25
Larynx	3	0.36	1.97 ( 1.16)	100.00	0.00	0	C32
Lung, trachea, bronchus	1	0.12	0.75 ( 0.75)	100.00	0.00	0	C33-34
Pleura & other thoracic	3	0.36	2.55 ( 1.48)	66.67	33.33	0	C37-38
Melanoma of skin	16	1.94	11.81 ( 3.06)	93.75	6.25	0	C43
Breast	76	9.21	38.63 ( 4.95)	80.26	19.74	0	C50
Cervix	196	23.76	97.53 ( 7.86)	83.67	16.33	0	C53
Corpus & Uterus NOS	18	2.18	10.41 ( 2.66)	94.44	5.56	0	C54-55
Ovary & adnexa	24	2.91	11.10 ( 2.62)	66.67	33.33	0	C56
Kidney & urinary NOS	1	0.12	0.12 ( 0.12)	100.00	0.00	0	C64-66,68
Bladder	3	0.36	2.53 ( 1.47)	66.67	33.33	0	C67
Brain & nervous system	5	0.61	2.11 ( 1.02)	100.00	0.00	0	C70-72
Thyroid	20	2.42	9.03 ( 2.36)	95.00	5.00	0	C73
Ill-defined	23	2.79	11.73 ( 2.78)	82.61	17.39	0	C76-80
Lymphoma	49	5.94	10.75 ( 2.06)	81.63	18.37	0	C81-85,90,88,96
Leukaemia	5	0.61	1.30 ( 0.70)	20.00	80.00	0	C91-95
All sites but C44	814	98.67	341.92 ( 14.52)	80.84	19.16	0	ALLbC44



# Cases by age group and site

## Training Cancer Registry (1995)

POPULATION ESTIMATE

Cases by age group (Period) - Male

SITE	ALL AGES	AGE UNK	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85+	(%)	ICD (10th)
Lip	1	0	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	0.1	C00
Tongue	2	0	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	0.3	C01-02
Mouth	17	0	-	1	-	-	1	2	2	2	2	-	2	1	-	-	-	2	2	-	2.1	C03-06
Salivary glands	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	0.1	C07-08
Tonsil	3	0	-	-	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-	-	0.4	C09
Other oropharynx	2	0	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	0.3	C10
Nasopharynx	10	0	-	-	-	1	1	1	3	-	1	-	-	2	-	1	-	-	-	-	1.3	C11
Hypopharynx	2	0	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	0.3	C12-13
Pharynx unspecified	3	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	0.4	C14
Oesophagus	40	1	-	-	-	-	1	-	2	-	5	8	8	1	2	2	6	1	3	-	5.0	C15
Stomach	24	0	-	-	-	-	-	2	-	-	2	2	2	2	5	2	4	3	-	-	3.0	C16
Small intestine	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C17
Colon	5	1	-	-	-	-	-	-	-	-	-	-	1	-	-	1	2	-	-	-	0.6	C18
Rectum	15	1	-	-	-	1	2	1	-	1	1	1	1	-	1	3	1	1	1	-	1.9	C19-20
Anus	6	0	-	-	-	1	-	-	-	-	1	-	1	-	-	1	1	-	-	1	0.8	C21
Liver	24	1	-	-	-	-	-	1	5	4	1	1	5	-	2	2	2	-	-	-	3.0	C22
Gallbladder etc.	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C23-24
Pancreas	2	0	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	0.3	C25
Nose, sinuses etc.	1	0	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	0.1	C30-31
Larynx	5	0	-	-	-	-	-	-	-	1	-	-	-	1	2	1	-	-	-	-	0.6	C32
Trachea, bronchus and lung	5	1	-	-	-	-	-	2	-	-	-	-	-	-	1	-	1	-	-	-	0.6	C33-34
Other thoracic organs	1	0	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	0.1	C37-38
Bone	8	0	-	-	1	3	2	-	1	-	1	-	-	-	-	-	-	-	-	-	1.0	C40-41
Melanoma of skin	13	0	-	-	-	-	-	-	2	-	2	-	1	2	1	3	4	-	-	-	1.6	C43
Other skin	20	2	-	1	-	-	-	-	1	2	1	2	1	1	1	3	1	3	1	1	2.5	C44
Mesothelioma	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C45
Kaposi sarcoma	338	6	11	17	5	4	23	61	71	52	36	22	8	8	5	2	3	4	-	-	42.4	C46
Connective and soft tissue	14	1	-	1	1	-	2	-	-	2	2	1	-	2	1	-	1	-	-	-	1.8	C47, C49
Breast	8	2	-	-	-	-	1	-	-	-	1	1	1	-	-	-	1	-	1	-	1.0	C50
Penis	24	2	-	-	-	-	-	-	-	-	1	2	5	6	2	3	-	3	-	-	3.0	C60
Prostate	67	3	-	-	-	-	1	-	-	-	2	1	2	15	8	22	3	3	7	-	8.4	C61
Testis	1	0	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	C62
Other male genital organs	1	0	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	0.1	C63
Kidney	6	0	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	C64
Renal pelvis	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C65
Ureter	1	0	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	0.1	C66
Bladder	6	0	-	-	-	-	-	-	-	-	1	-	-	-	-	1	2	-	1	1	0.8	C67
Other urinary organs	1	0	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	0.1	C68
Eye	25	0	5	-	-	-	3	3	5	2	2	-	2	-	1	2	-	-	-	-	3.1	C69
Brain, nervous system	2	0	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	0.3	C70-72
Thyroid	1	0	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	0.1	C73
Adrenal gland	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C74
Other endocrine	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C75
Hodgkin disease	8	0	-	-	1	2	-	2	1	-	-	-	-	1	-	-	1	-	-	-	1.0	C81
Non-Hodgkin lymphoma	50	0	6	18	6	2	-	1	3	3	2	2	3	-	4	-	-	-	-	-	6.3	C82-85, C96
Immunoproliferative diseases	0	0	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	0.0	C88
Multiple myeloma	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	C90
Lymphoid leukaemia	3	0	-	-	1	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	0.4	C91
Myeloid leukaemia	4	0	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	C92-94
Leukaemia unspecified	2	0	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	C95
Myeloproliferative disorders	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	MPD
Myelodysplastic syndromes	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	MDS
Other and unspecified	46	4	-	4	1	3	3	2	1	-	2	4	5	3	8	2	2	1	1	-	5.8	O&U
All sites	818	26	29	45	17	18	42	79	97	72	62	47	49	35	57	37	62	18	16	10		ALL
All sites but C44	798	24	29	44	17	18	42	79	96	71	60	46	47	34	56	37	59	15	15	9	100.0	ALLbC44

# Incidence table by site, and age group

## - Incidence per 100,000 by age group (Period)

**Training Cancer Registry (1995)**  
POPULATION ESTIMATE

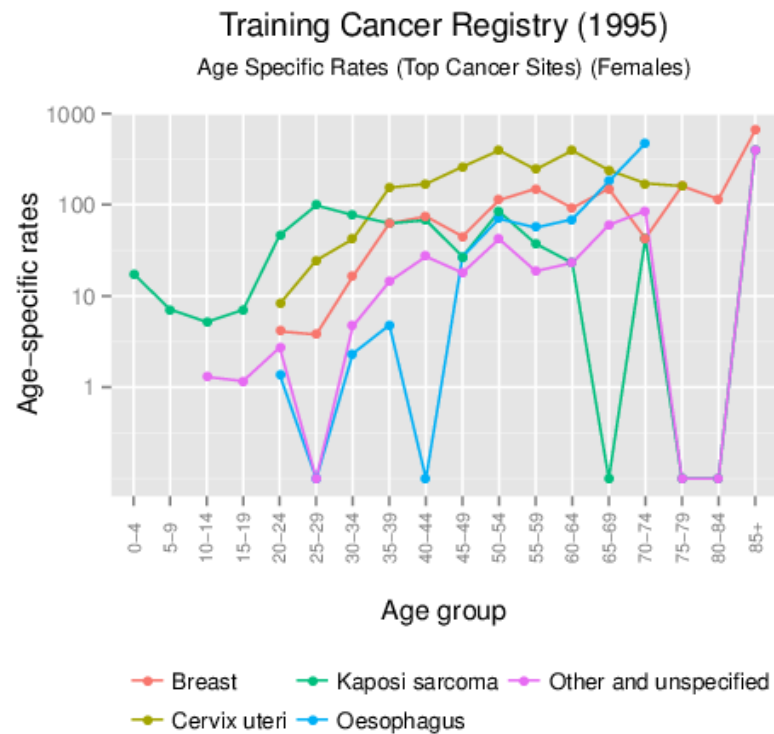
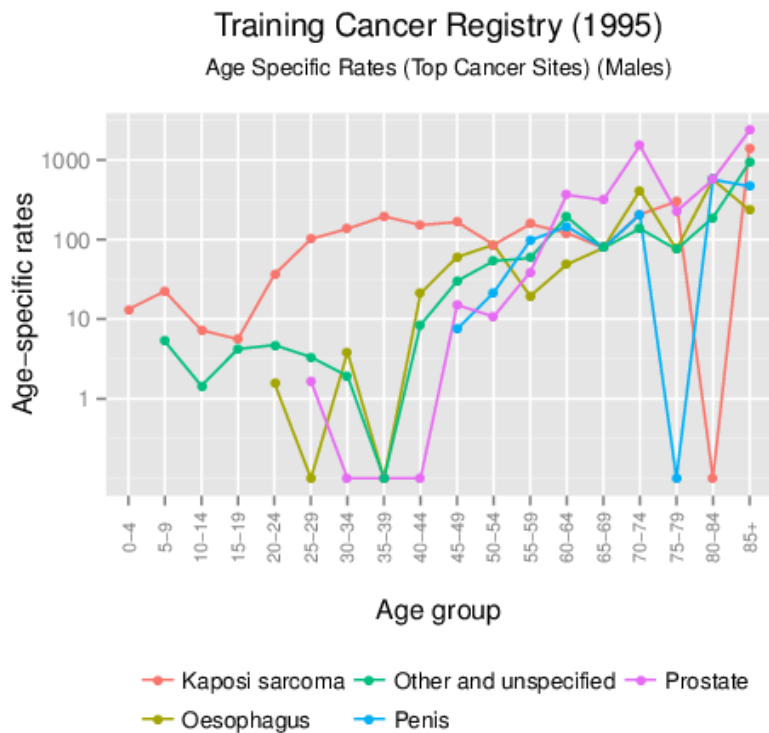
Incidence per 100,000 by age group (Period) - Male

S I T E	ALL AGES	AGE UNK	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85+	CRUDE RATE	(%)	CUM 0-64	CUM 0-74	ASR	ICD (10th)
Lip	1	0	-	-	-	-	-	-	-	-	-	-	-	-	24.2	-	-	-	-	-	0.2	0.1	0.12	0.12	<b>1.0</b>	C00
Tongue	2	0	-	-	-	-	-	-	-	3.7	-	-	-	-	-	-	-	-	-	-	0.4	0.3	0.02	0.21	<b>1.4</b>	C01-02
Mouth	17	0	-	1.3	-	-	-	1.6	3.3	3.8	7.5	8.4	-	21.5	19.5	-	-	-	-	-	3.0	2.1	0.33	0.33	<b>6.9</b>	C03-06
Salivary glands	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68.5	-	150.0	376.6	0.2	0.1	0.00	0.34	<b>1.4</b>	C07-08
Tonsil	3	0	-	-	-	-	-	-	-	-	4.2	7.5	-	-	-	39.1	-	-	-	-	0.5	0.4	0.06	0.25	<b>1.9</b>	C09
Other oropharynx	2	0	-	-	-	-	-	-	-	-	-	-	19.5	-	-	68.5	-	-	-	-	0.4	0.3	0.10	0.44	<b>2.1</b>	C10
Nasopharynx	10	0	-	-	-	1.4	1.6	1.7	5.8	-	4.2	-	-	38.9	-	39.1	-	-	-	-	1.8	1.3	0.27	0.46	<b>3.7</b>	C11
Hypopharynx	2	0	-	-	-	-	-	-	-	-	-	-	10.7	-	-	39.1	-	-	-	-	0.4	0.3	0.05	0.25	<b>1.7</b>	C12-13
Pharynx unspecified	3	1	-	-	-	-	-	-	-	-	-	-	10.7	19.5	-	-	-	-	-	-	0.5	0.4	0.23	0.23	<b>2.0</b>	C14
Esophagus	40	1	-	-	-	-	1.6	-	3.8	-	21.1	60.1	85.9	19.5	48.4	78.2	411.2	75.0	565.0	-	7.1	5.0	1.23	3.74	<b>27.1</b>	C15
Stomach	24	0	-	-	-	-	-	3.3	-	-	8.4	15.0	21.5	38.9	121.1	78.2	274.2	225.1	-	-	4.3	3.0	1.04	2.80	<b>19.2</b>	C16
Small intestine	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C17
Colon	5	1	-	-	-	-	-	-	-	-	-	-	10.7	-	-	39.1	137.1	-	-	-	0.9	0.6	0.07	1.17	<b>5.6</b>	C18
Rectum	15	1	-	-	-	1.4	3.1	1.7	-	3.7	4.2	-	10.7	-	24.2	117.2	68.5	75.0	188.3	-	2.7	1.9	0.26	1.26	<b>9.7</b>	C19-20
Anus	6	0	-	-	-	1.4	-	-	-	4.2	-	-	10.7	-	-	39.1	68.5	-	233.1	-	1.1	0.8	0.08	0.62	<b>4.6</b>	C21
Liver	24	1	-	-	-	-	-	1.7	9.6	15.0	4.2	7.5	53.7	-	48.4	78.2	137.1	-	-	-	4.3	3.0	0.73	1.85	<b>12.5</b>	C22
Gallbladder etc.	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C23-24
Pancreas	2	0	-	-	-	-	-	-	-	-	-	-	10.7	-	-	-	-	-	-	-	0.4	0.3	0.05	0.40	<b>1.9</b>	C25
Nose, sinuses etc.	1	0	-	-	-	-	-	-	-	-	-	-	-	19.5	-	-	-	-	-	-	0.2	0.1	0.10	0.10	<b>0.8</b>	C30-31
Larynx	5	0	-	-	-	-	-	-	-	3.7	-	-	-	19.5	48.4	39.1	-	-	-	-	0.9	0.6	0.36	0.55	<b>4.1</b>	C32
Trachea, bronchus and lung	5	1	-	-	-	-	-	3.3	-	-	-	-	-	-	24.2	-	68.5	-	-	-	0.9	0.6	0.17	0.60	<b>3.3</b>	C33-34
Other thoracic organs	1	0	-	-	-	-	-	-	-	-	-	-	-	19.5	-	-	-	-	-	-	0.2	0.1	0.10	0.10	<b>0.8</b>	C37-38
Bone	8	0	-	-	1.4	4.2	3.1	-	1.9	4.2	-	-	-	-	-	-	-	-	-	-	1.4	1.0	0.07	0.07	<b>1.1</b>	C40-41
Melanoma of skin	13	0	-	-	-	-	-	-	-	7.5	-	-	10.7	38.9	24.2	117.2	274.2	-	-	-	2.3	1.6	0.41	2.26	<b>12.5</b>	C43
Other skin	20	2	-	1.3	-	-	-	-	1.9	3.7	8.4	7.5	21.5	19.5	24.2	-	205.6	225.1	188.3	233.1	3.5	2.5	0.49	1.63	<b>14.1</b>	C44
Mesothelioma	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C45
Kaposi sarcoma	338	6	13.2	22.3	7.2	5.6	36.2	101.4	136.2	194.9	152.0	165.3	85.9	155.6	121.1	78.2	205.6	300.1	-	-	59.9	42.4	6.09	7.54	<b>81.2</b>	C46
Connective and soft tissue	14	1	-	1.3	1.4	-	-	3.1	-	7.5	8.4	7.5	-	38.9	24.2	-	68.5	-	-	-	2.5	1.8	0.50	0.87	<b>6.3</b>	C47, C49
Breast	8	2	-	-	-	-	1.6	-	-	4.2	7.5	10.7	-	-	-	-	68.5	-	188.3	-	1.4	1.0	0.16	0.62	<b>4.9</b>	C50
Penis	24	2	-	-	-	-	-	-	-	-	-	7.5	21.5	97.3	145.3	78.2	205.6	-	565.0	-	4.3	3.0	1.48	3.03	<b>22.4</b>	C60
Prostate	67	3	-	-	-	-	1.7	-	-	-	-	15.0	10.7	38.9	363.2	312.6	1507.9	225.1	565.0	1631.7	11.9	8.4	2.25	11.78	<b>73.7</b>	C61
Testis	1	0	-	-	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.1	0.01	0.01	<b>0.1</b>	C62
Other male genital organs	1	0	-	-	-	-	-	-	1.9	-	-	-	-	-	-	-	-	-	-	-	0.2	0.1	0.01	0.01	<b>0.1</b>	C63
Kidney	6	0	7.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	0.8	0.04	0.04	<b>0.9</b>	C64
Renal pelvis	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C65
Ureter	1	0	-	-	-	-	-	-	-	-	-	-	-	19.5	-	-	-	-	-	-	0.2	0.1	0.10	0.10	<b>0.8</b>	C66
Bladder	6	0	-	-	-	-	-	-	-	-	7.5	-	-	-	-	39.1	137.1	-	188.3	233.1	1.1	0.8	0.04	0.92	<b>6.5</b>	C67
Other urinary organs	1	0	-	-	-	-	-	-	-	-	-	-	-	-	24.2	-	-	-	-	-	0.2	0.1	0.12	0.12	<b>1.0</b>	C68
Eye	25	0	6.0	-	-	-	4.7	5.0	9.6	7.5	8.4	-	21.5	-	24.2	78.2	-	-	-	-	4.4	3.1	0.43	0.83	<b>7.4</b>	C69
Brain, nervous system	2	0	-	1.3	-	-	-	-	-	-	3.7	-	-	-	-	-	-	-	-	-	0.4	0.3	0.03	0.03	<b>0.4</b>	C70-72
Thyroid	1	0	-	-	-	-	-	-	1.9	-	-	-	-	-	-	-	-	-	-	-	0.2	0.1	0.01	0.01	<b>0.1</b>	C73
Adrenal gland	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C74
Other endocrine	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C75
Hodgkin disease	8	0	-	-	1.4	2.8	-	3.3	1.9	-	-	-	10.7	-	-	-	68.5	-	-	-	1.4	1.0	0.10	0.44	<b>2.7</b>	C81
Non-Hodgkin lymphoma	50	0	7.2	23.7	8.7	2.8	-	1.7	5.8	11.2	8.4	15.0	32.2	-	96.9	-	-	-	-	-	8.9	6.3	1.07	1.07	<b>12.3</b>	C82-85, C96
Immunoproliferative diseases	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C88
Multiple myeloma	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	C90
Lymphoid leukaemia	3	0	-	-	1.4	1.4	-	-	-	-	-	-	-	-	-	39.1	-	-	-	-	0.5	0.4	0.01	0.21	<b>1.4</b>	C91
Myeloid leukaemia	4	0	1.2	2.6	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	0.5	0.03	0.03	<b>0.5</b>	C92-94
Leukaemia unspecified	2	0	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.3	0.02	0.02	<b>0.3</b>	C95
Myeloproliferative disorders	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	MPD
Myelodysplastic syndromes	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.00	0.00	<b>0.0</b>	MDS
Other and unspecified	46	4	-	5.3	1.4	4.2	4.7	3.3	1.9	-	8.4	30.1	53.7	58.4	193.7	78.2	137.1	75.0	188.3	-	8.2	5.8	2.00	3.18	<b>25.9</b>	OUK
All sites	818	26	34.9	59.1	24.6	25.2	66.1	131.4	186.0	269.8	261.8	353.1	526.3	680.9	1380.1	1445.9	4249.5	1350.3	3013.2	2331.0	145.0	20.65	50.07	384.2	<b>ALL</b>	
All sites but C44	798	24	34.9	57.8	24.6	25.2	66.1	131.4	184.1	266.1	253.4	345.6	504.8	661.5	1355.9	1445.9	4043.9	1125.3	2824.9	2097.9	141.4	100.0	20.16	48.46	<b>370.4</b>	ALLXC44



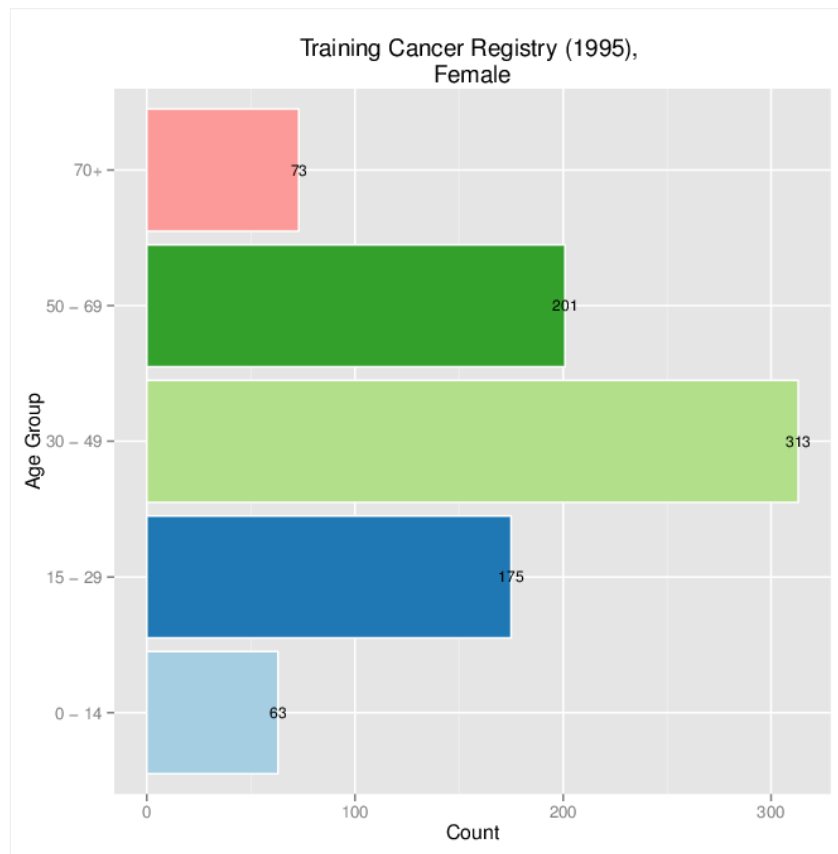
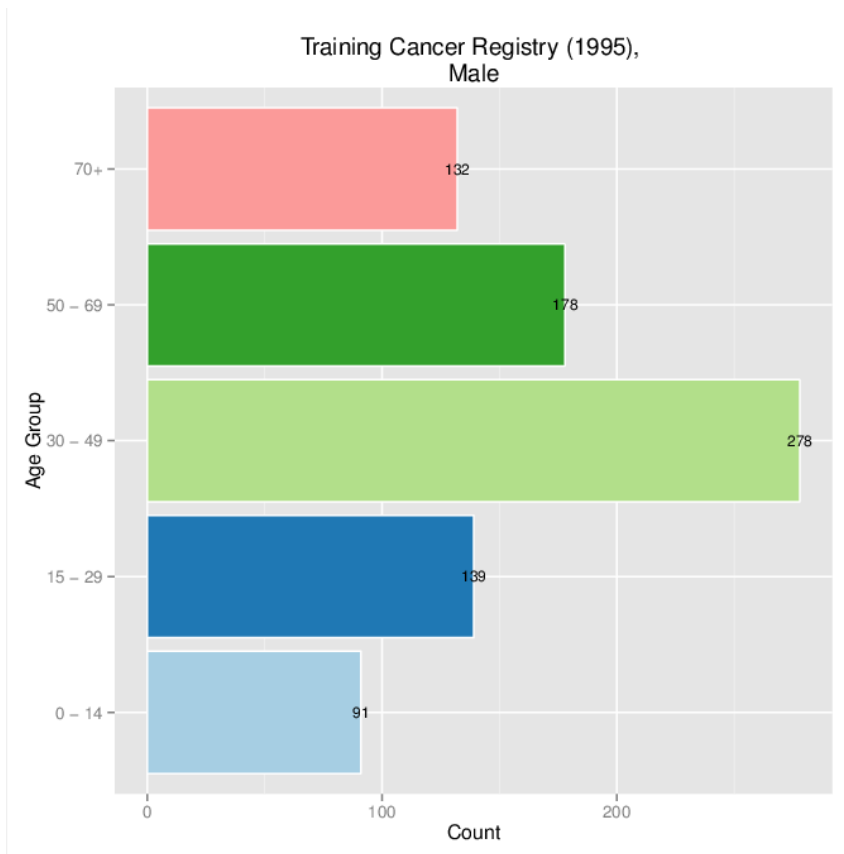
# Age-specific rates for major cancers

## Age Specific Rates (Top Cancer Sites)



# Bar Chart

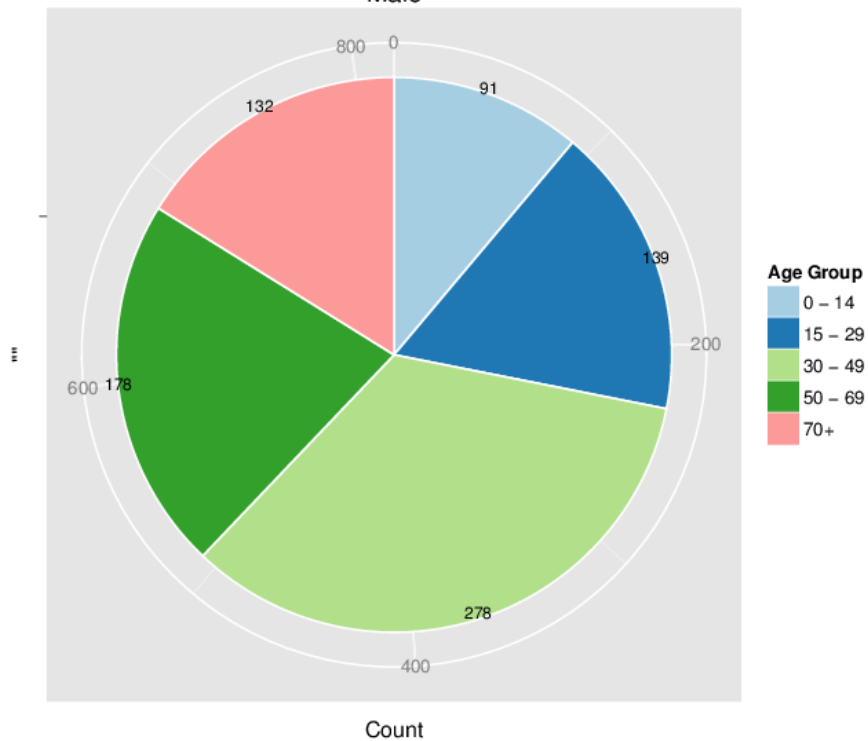
## Barchart of cases by age group by sex



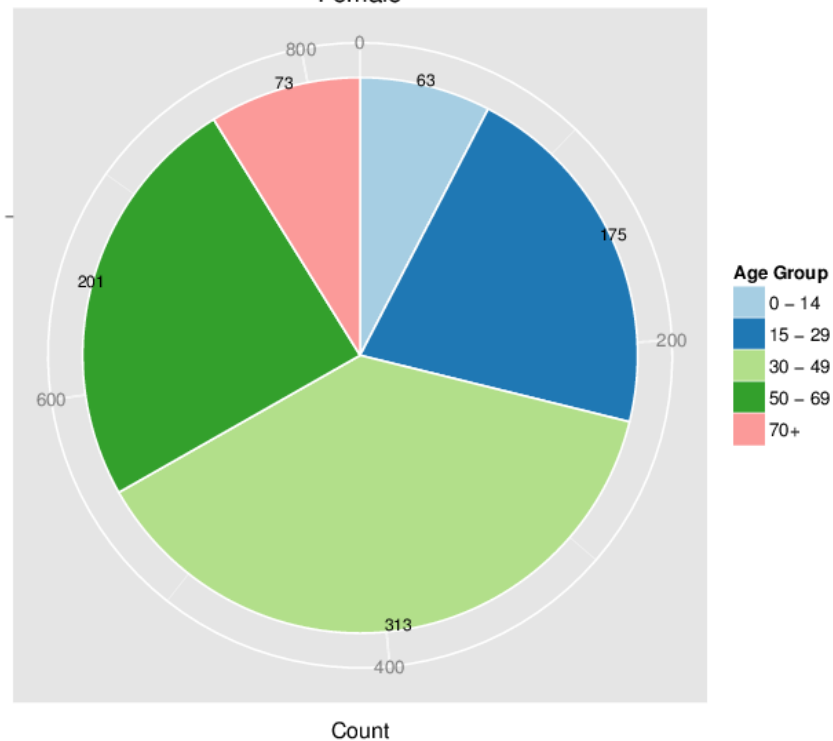
# Pie chart

## Piechart of cases by age group by sex

Training Cancer Registry (1995),  
Male



Training Cancer Registry (1995),  
Female

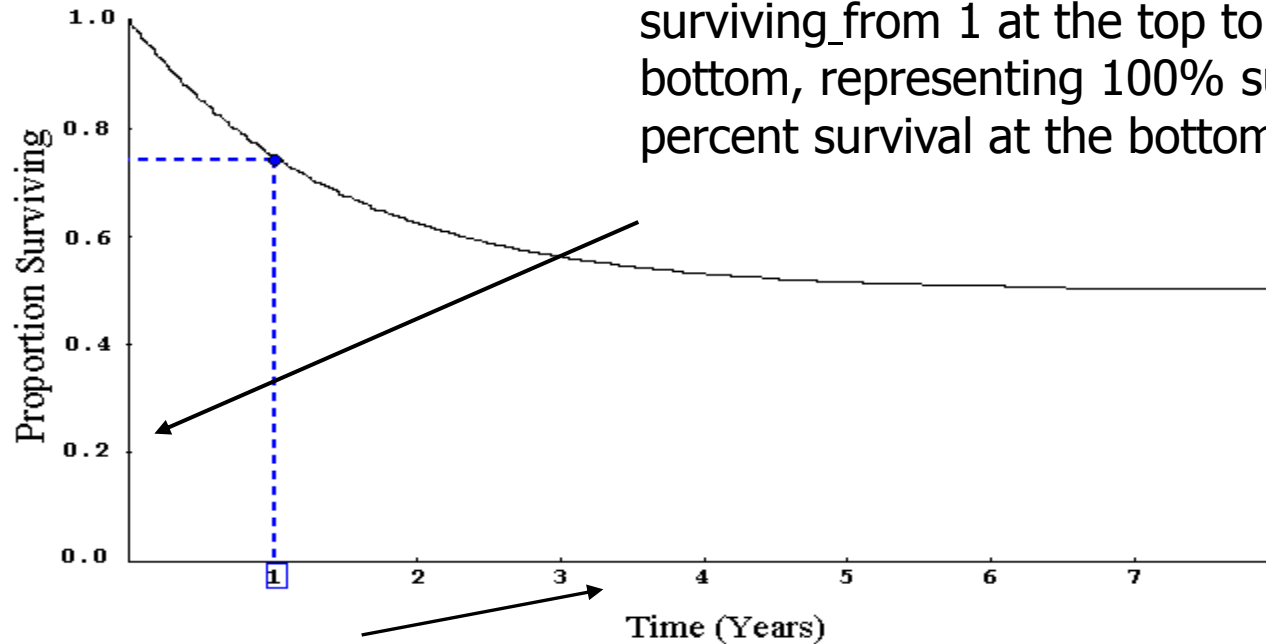


# Population-based survival

## Survival Curves

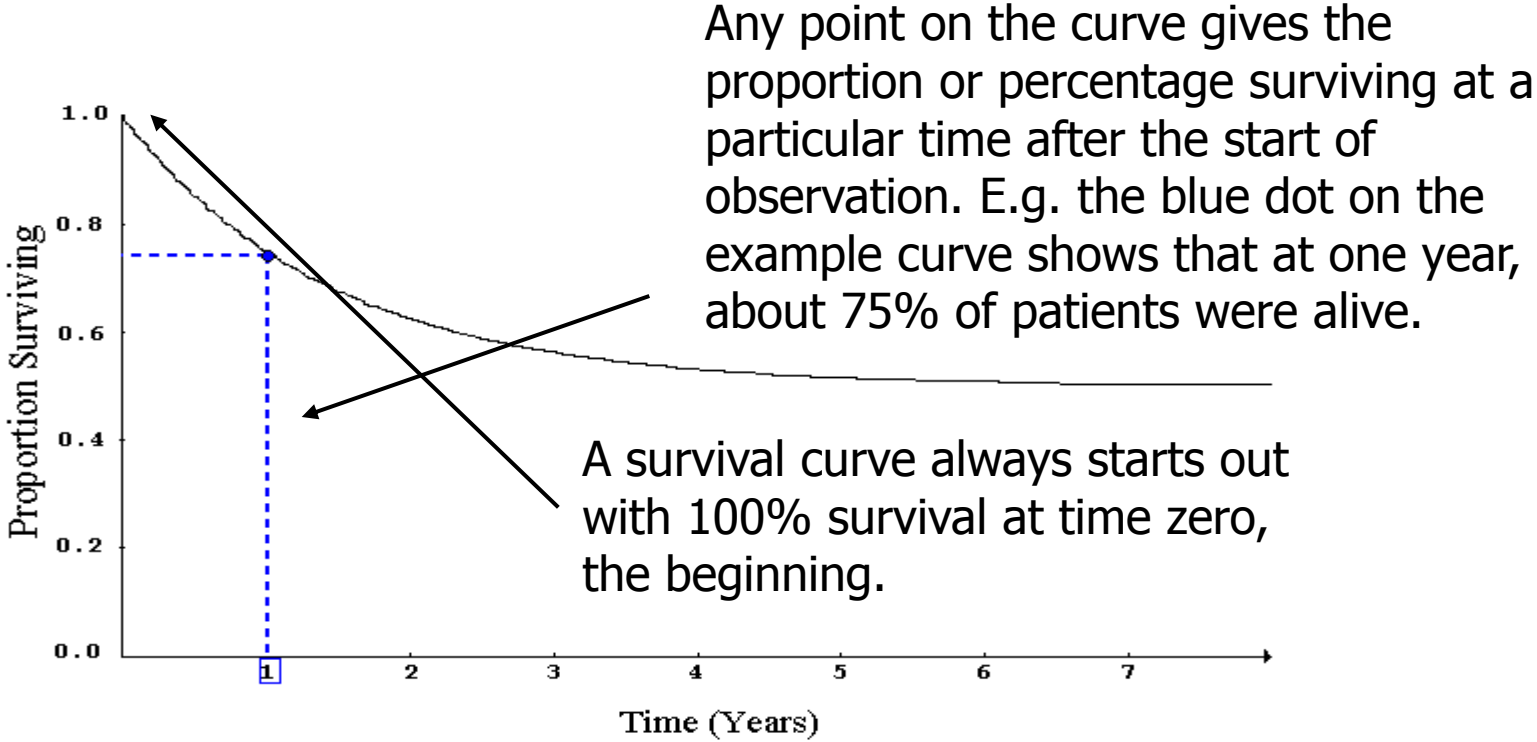
A survival curve is a statistical picture of the survival experience of a group of patients in the form of a graph showing the percentage surviving versus time.

Y axis, gives the proportion of people surviving from 1 at the top to zero at the bottom, representing 100% survival to zero percent survival at the bottom.



The X axis, gives the time after diagnosis

# Survival Curves



# Questions in survival analyses

## Which Survival?

- **Observed (or crude) survival**
- **Cause-specific survival**
- **Relative survival**

# Observed (crude) survival

**Observed survival =**  
**number surviving the interval**  
**number alive at the start of the interval**



# Observed (crude) survival

Often the length of follow-up is not the same for all patients and some became “censored” during the interval. Usually we assume that each “censored” patient was at risk for only half of the interval, so :

$$= \text{ number surviving the interval } \\ \text{ number alive at start of interval } - \\ \text{ (0.5 * number censored)}$$

# Observed (crude) survival

- **“Real” survival of the patients**
- **survival from disease of interest and all causes of death combined**
- **Intuitive; easy to explain**
- **Easily computed in wide variety of statistical software**

# Cause-specific Survival

**The analysis is exactly the same as for observed survival (actuarial or Kaplan-meier) but those dying from other causes are counted as censored at their time of death**

# Cause-specific Survival

**Cause of death from the death certificate is used to attribute the death to**

- the disease of interest
- other causes

**BUT.....**

**Which deaths should be considered attributable to the disease of interest?**

**Are the death certificates available and accurate?**

# Relative Survival

$$\text{Relative survival} = \frac{\text{observed survival}}{\text{expected survival}}$$

where :

**Expected survival = survival that would have been expected if the patients had been subject only to the mortality rates of the general population.**

**It can be interpreted as the proportion of patients alive after i years of follow-up in the hypothetical situation where the disease in question is the only possible cause of death.**

# Calculating the expected survival

## Life tables

**Tables of the mortality rates of the general population from Life table, by**

- **age (single year of age at death, 0-99)**
- **Sex, calendar period of death**

**And by other important factors such as**

- **Geographical area**
- **deprivation category**

# Relative Survival

- **separates risk from disease of interest and background risk (everyone)**
  - *all* deaths in study period are included
  - uses vital statistics to account for background risk
  - **does not require information on cause of death**
  - **Standard method in cancer survival**

# To calculate relative survival, you need..

- ***Variables***

*Date of incidence, Date of follow-up, Status*

- ***Expected survival of general population (Life table from Statistical office)***

- **Statistical Program**

- **SAS, STATA, R**
- **SEER\*Stat**



**Thank you for your attention**