Cancer Staging and Registration

Noncommunicable Diseases and Health Promotion
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Western Pacific Region

Cancer

- Karkinos, cancrum, crabs
- Common term for all malignant tumors
- **Carcinoma**: malignant tumor of epithelial cell origin
- **Sarcoma**: malignant tumor of mesenchymal cell origin

Characteristics of cancer

- Abnormal mass of tissue, the growth of which exceeds and is uncoordiated with that of the normal tissues and persists in the same excessive manner after cessation of the stimuli

- Local invasion
- Spread (metastasis)

Outlines

- Factors affect cancer prognosis
- Cancer staging
  - Staging system: General
  - Staging system: site-specific
- Tumor grade
- Why cancer staging
  - Examples: survival rate by stage
- Cancer survivorship

Understanding Cancer Prognosis

- http://www.cancer.gov/about-cancer/diagnosis-staging/prognosis#factors

Many Factors Can Affect Your Prognosis

Some of the factors that affect prognosis include:

- **The type of cancer and where it is in your body**
- **The stage of the cancer, which refers to the size of the cancer and if it has spread to other parts of your body**
- **The cancer's grade, which refers to how abnormal the cancer cells look under a microscope. Grade provides clues about how quickly the cancer is likely to grow and spread.**
- **Certain traits of the cancer cells**
- **Your age and how healthy you were before cancer**
- **How you respond to treatment**

Type of Cancers

More than 260 types of cancer

http://www.cancer.gov/types

Cancer Staging

Stage refers to the extent of your cancer, such as how large the tumor is, and if it has spread. Knowing the stage of your cancer helps your doctor:

- **Understand how serious your cancer is and your changes of survival**
- **Plan the best treatment for you**
- **Identify clinical trials that may be treatment options for you**

Source: http://www.cancer.gov/about-cancer/diagnosis-staging/staging

Why cancer staging ?

- To determine treatment
- To evaluate and compare results
- To estimate prognosis
- To plan and evaluate cancer screening and prevention programs
- To standardize groupings

Staging system (General)

- **AJCC Stage (TNM)**
- **Summary Stage**
- **Collaborative Stage**

TNM Classification
T (tumor), N (node) & M (metastasis)

Primary tumor (T)

TX	**Primary tumor cannot be assessed**
T0	**No evidence of primary tumor**
Tis	**Carcinoma in situ**
T1-T4	**Increasing size and/or local extent (depth of invasion) of tumor**

TNM Classification

Regional lymph nodes (N)

NX Regional LNs cannot be assessed

N0 No regional LN metastasis

N1-N3 Increasing involvement of regional LNs

*** Direct extension of tumor into a LN classified as a LN metastasis**

**** Metastasis in other than regional LN classified as a distant metastasis**

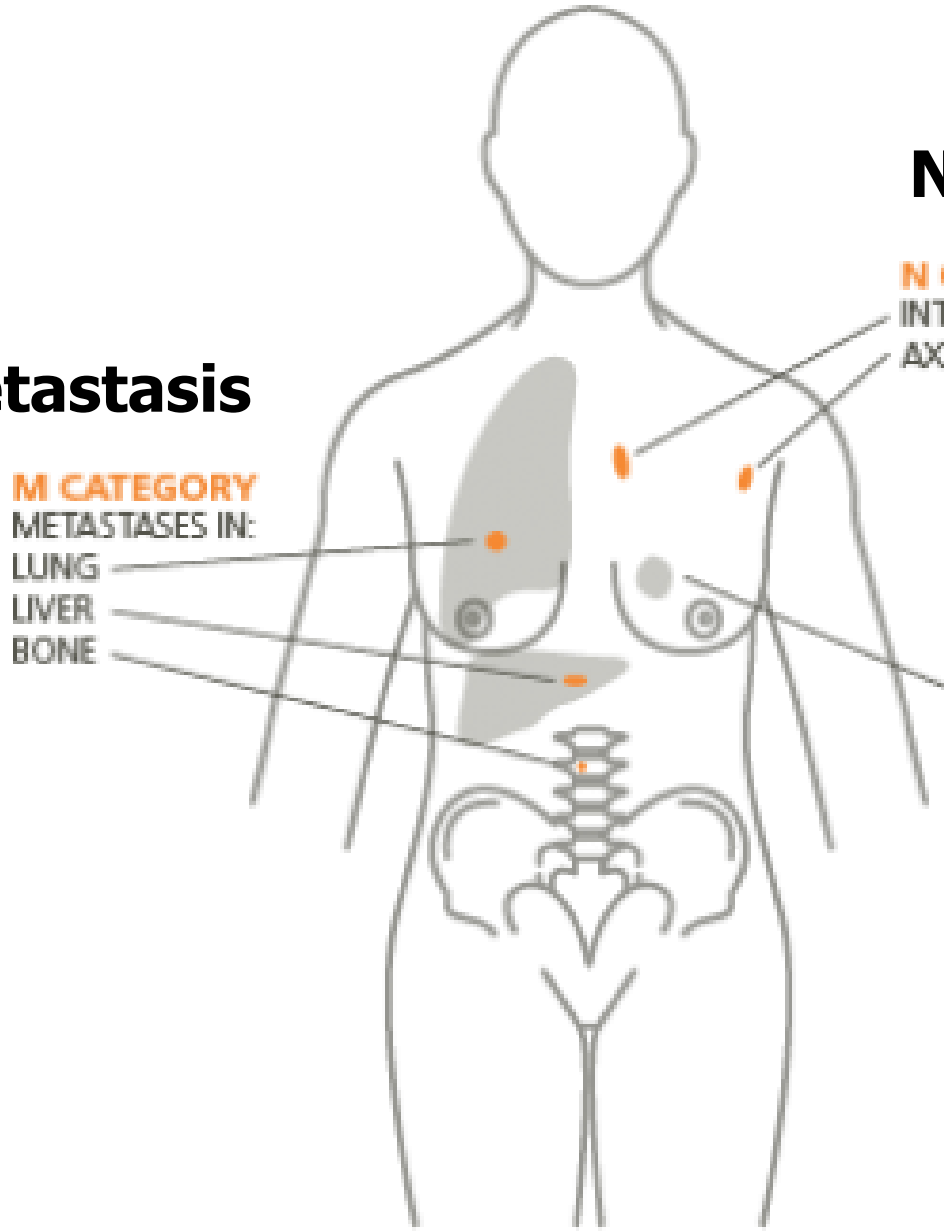
***** Tumor nodule: well defined is classified as N; If tumor nodule is ill defined without evidence of residual LN, classified as T extension**

Distant metastasis (M)

MX Distant metastasis cannot be assessed (No MX)

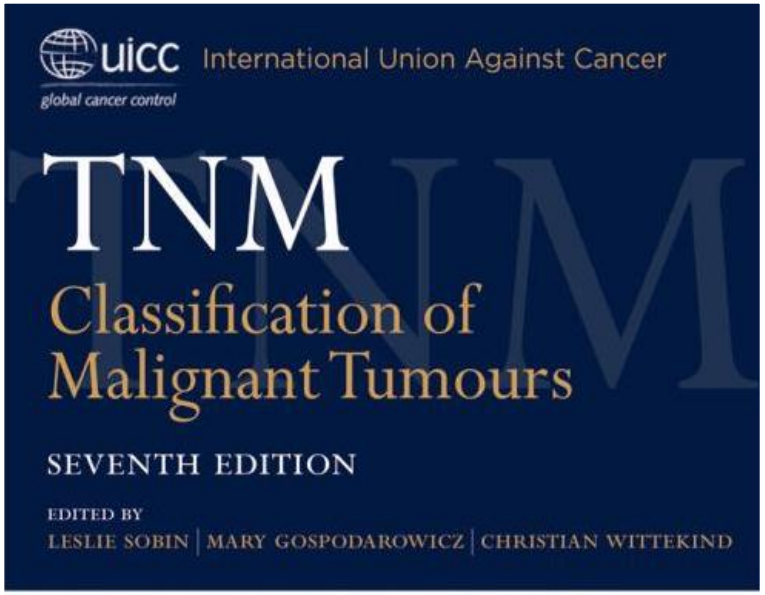
M0 No distant metastasis (no pM0)

M1 Distant metastasis



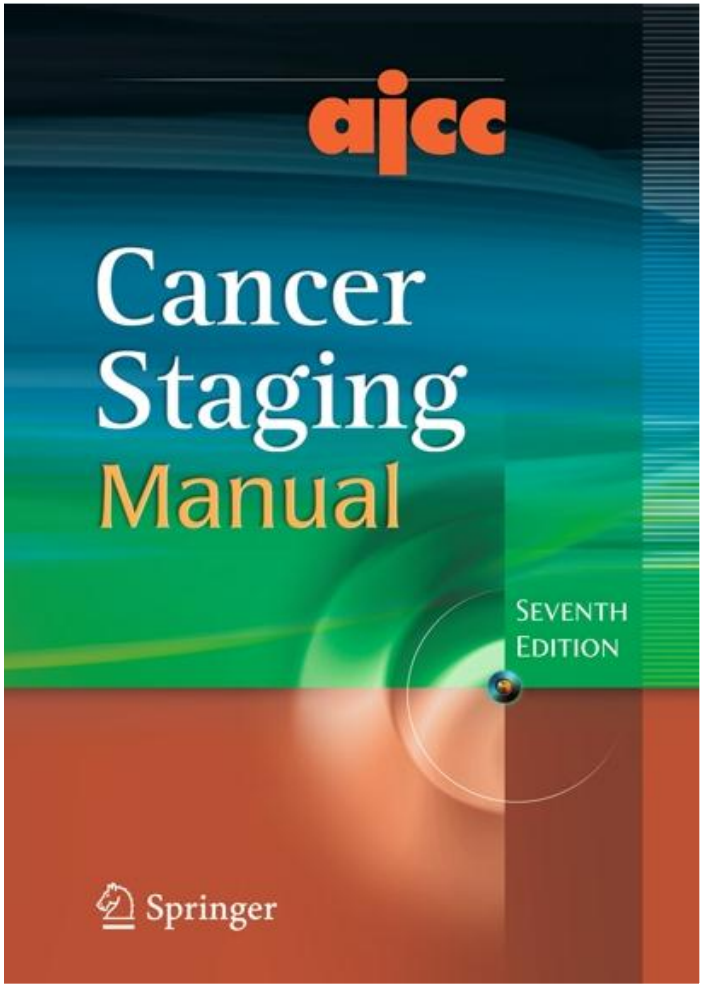
Type of Cancer
Primary Site

- More details
- Narrower categories
- Lots of tedious rules
- Not as easy as summary stage
- More for clinicians than surveillance



AJCC staging system is widely used and more complex

- Use TNM system
- cTNM, pTNM, rTNM, aTNM
- T (The extent of primary tumor with size)
- N (+/- & extent of regional LN metastasis)
- M (+/- of distant metastasis)
- Stage grouping
- Some cancer site: G(grade), tumor marker



American Joint Committee on Cancer Staging

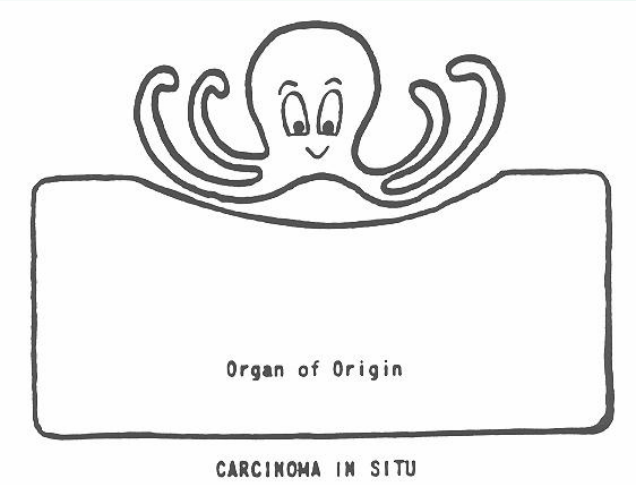
SEER Summary Staging

- 0 In situ
- 1 Localize only
- 2 Regional by direct extension only
- 3 Regional LN involved only
- 4 Regional by both direct extension & LN involvement
- 5 Regional, NOS
- 7 Distant site(s)/ node(s) involved
- 9 Unknown if extension or metastasis
  Death Certificate only case

Definition

- In Situ: Non invasive in place tumor
- Localized: Limited to the organ of origin (different structure within organ)
- Regional: Tumor extension beyond the limits of the organ of origin
- Regional LN: First group of nodes to drain the primary tumor
- Metastases: Tumor cells that have broken away from the primary tumor, have traveled to other parts of the body and grow

In-Situ carcinoma



- In place tumor
- No stromal invasion
- No penetration of basement membrane
- Not used in sarcoma
- Not used in case of any evidence of invasion of nodal involvement or metastasis
- Must be diagnosed pathologically

In situ synonyms

- Non-invasive
- Non-infiltrating
- Intramucosa
- Intraductal
- Preinvasive
- Intraepithelial

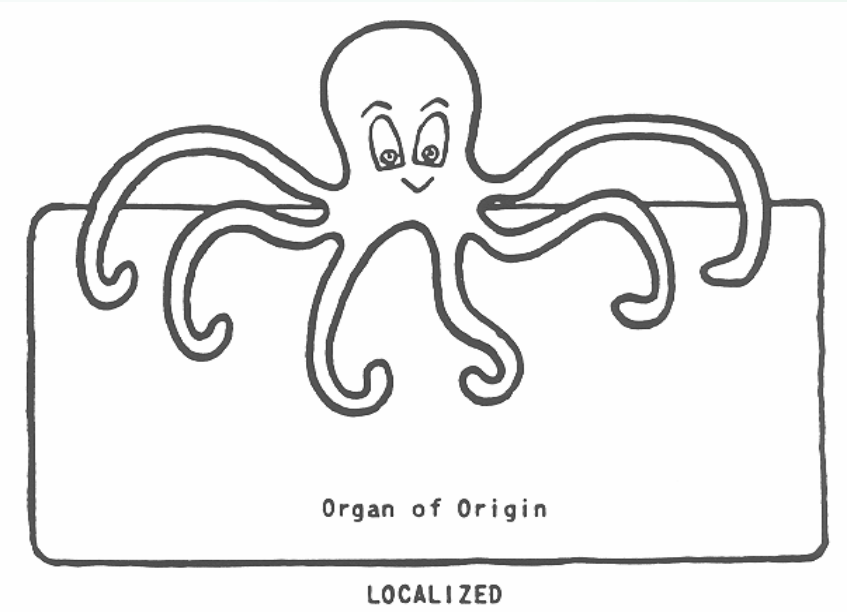
In Situ - Guidelines

- Epithelial tissues only
- Must be diagnose pathologically
- If any evidence of invasion, no longer in situ

Localized

- Confined to the organ of origin
- Must be extend beyond the outer limits or the organ: capsule, serosa
- Vascular invasion within the primary tumor is not a determining factor
- No evidence of metastasis anywhere else
- Can be widely invasive within organ of origin
- Names of anatomic substructure is important

Localized

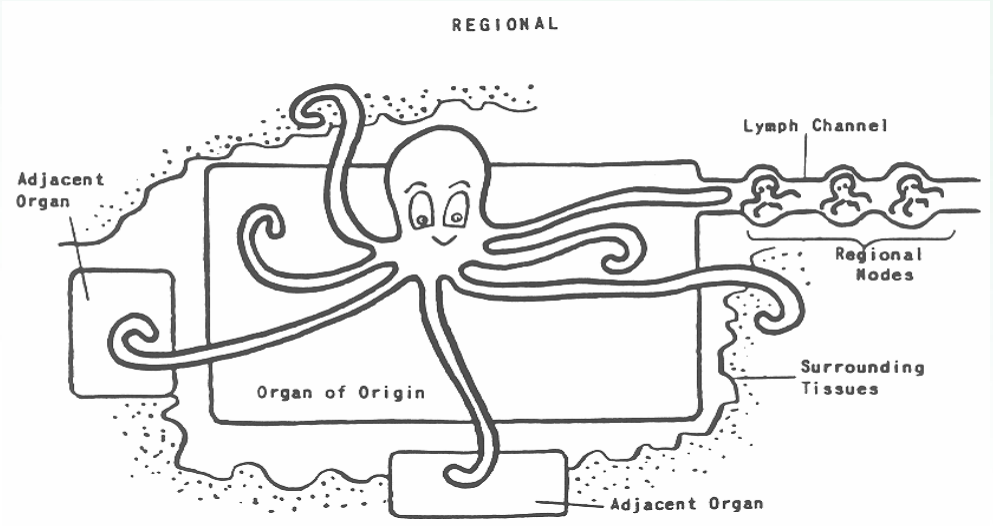


- Microinvasion
- Lymphatic invasion in primary tumor
- Vascular invasion in primary tumor
- Multifocal
- Metastases within organ

Localized - Guidelines

- May require surgical removal of organ
- Review all imaging reports and operative report for evidence of greater spread

Regional



- Tumor beyond limits of organ of origin
- Potential for spread by more than on lymphatic or vascular route
- Rule out in-situ, local and distant categories (difficult to categorize properly)
- Direct extension/ involve LN(1st level)

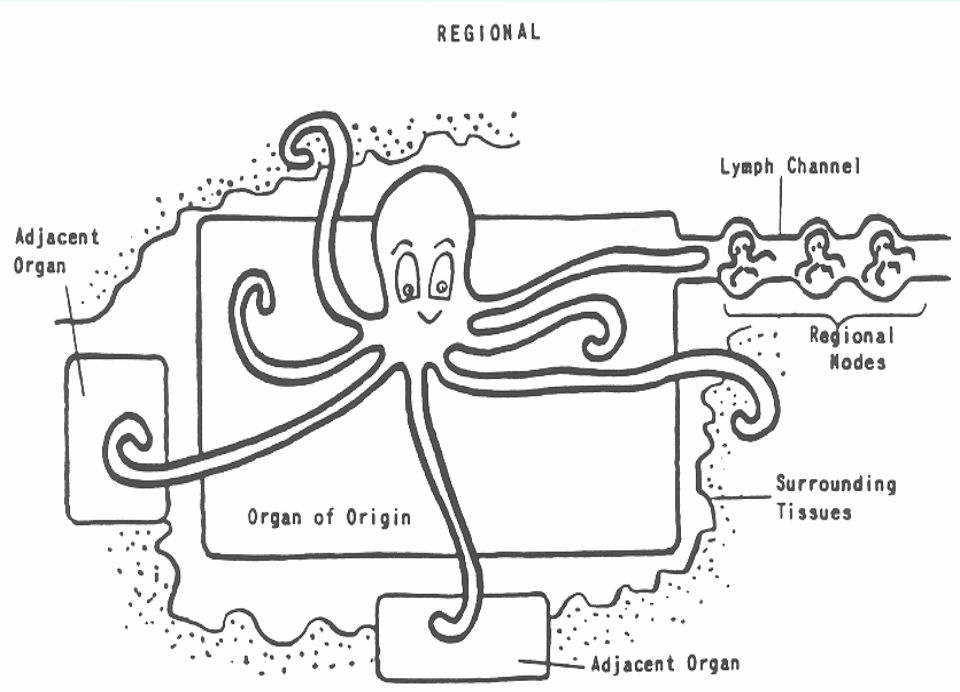
Subcategories of regional

- Regional direct extension: invasion through wall or capsule into adjacent organ/ tissue (2)
- Regional to LNs: 1st level lymph drainage (3)
- Regional direct and nodes (4)
- Regional, NOS: unclear/ not applicable (5)

Regional-words to watch

- Name of regional anatomical structure
- Involvement of local LNs
- Lymph node metastasis
- Different names for Lymph node chains
- Potential for spread by more than one lymphatic or vascular supply route

Distant



- Tumor spread to remote area of body
- Four method of spread
  - Direct extension
  - Lymphatic spread
  - Vascular spread
  - Spread through fluid (implantation)

Distant metastases

- Step 1: invasion (penetrate the BM)
- Step 2: transport of cancer cells
- Step 3: adhere, penetrate of vessel wall
- Step 4: growth at the secondary site to form secondary tumor

Common site of distant metastases

- Liver
- Lung
- Bone
- Brain

Distant - Guidelines

- Rule out distant disease first
- Not all distant organs are listed
- Vascular invasion may not be distant
- Liver involvement may not be distant

Unknown stage

- Use this stage sparingly
- Not enough information
- Patient expired
- Patient refused workup
- Contraindications for workup or Tx
- Insufficient workup
- Equivocal workup

How to determine stage

- Identify the primary site
- Look for key words in record
- Match key words to lists in summary staging manual section for that primary site

For determine correct stage

- Where did the cancer start ?
  (Primary site)
- Where did the cancer go?
  (Spread to adjacent organs, distant organs)
- How did the cancer get to the other organ or structure ?
- What are the stage and correct code for this cancer ?

SEER Summary Stage 2000

- Color Edition can be downloaded
- General definitions: p.3-9
- Special rules for lymph nodes: p.7
- General instructions: p.10
- Ambiguous terminology: p.15
- Anatomic detail of head and neck sites: p.16-19

SEER Summary Stage 2000

- Anatomic extension: p.20, p.64
- Anatomic drawings: p22-24
- General layout: p.26-28
- Lymph node synonyms: p.284
- Sites that don’t fit: brain & CNS, lymphoma, myeloma, leukemia, unknown primary site, mycosis fungoides, Kaposi sarcoma, retinoblastoma

Staging Systems (Site specific)

- FIGO (Gyn sites)
- Dukes (colon / rectum)
- Jewett (bladder)
- Clark (melanoma)
- Breslow (melanoma)
- Ann Arbor (lymphoma / NHL)

FIGO staging

- Vulva, Vagina, Uterine cervix, Uterine corpus, Fallopian tube, Ovary, Gestational trophoblastic tumors
- Generally same as TNM
- Contents: Confinement in organ, tumor size, +/- of extension with depth or size, macroscopic or microscopic identity &/or size, peritoneal metastasis (washing cytology)

Clark's level system

- I Intraepidermal (in situ)
- II In the papillary dermis
- III Filling the papillary dermis & stopping at the interphase between papillary and reticular dermis
- IV In the reticular dermis
- V In the subcutaneous fat

Dukes stage
in colorectal carcinomas

- A: Tumor involve the wall of the bowel only (T1, submucosa & T2, proper muscle)
- B: Tumor extend through the wall (T3 & T4)
- C: Tumor have LN metastasis (N1/N2)
- D: Distant metastasis (by others)

SEER Summary Stage

- Widespread use since 1970s
- Applies to solid tumors
- Requires minimal information
- Uses all information in record
- Simple to learn and use
- Good for national surveillance

General guidelines

- Should include all information available through completion of surgery in the 1st course of treatment or within 4 months if diagnosis in the absence of disease progression
- Information after treatment with radio, chemo, hormonal or immunotherapy has begun may be included (within above)
- Site-specific guidelines take precedence over general guidelines

Information using for staging

- Clinical (operative) reports
- Pathologic reports
- Diagnostic imaging reports
- Other investigations: laboratory test

  tumor marker

Operative reports contents

- Name of procedure & surgical approach
- Appearance & involvement of tissue not removed
- Organ removed with appearance & LN No.
- Reconstructive & restorative procedures
- Closure

Pathologic report contents

- Name of procedure & surgical approach
- Appearance & involvement of tissue not removed
- Organ removed with appearance & LN No.
- Reconstructive & restorative procedures
- Closure

Pathologic report: Diagnosis

- Diagnosis with Microscopic description
- Tumor type
- Tumor size, differentiation
- Depth of invasion/penetration
- Involvement of surgical margins
- Vessel(blood & lymphatic)/neural invasion
- No. of (+)LN/ No. of nodes examined
- Status of other organs received

Tumor Grade

- malignant tumors (Arabic no. 1,2,--)

3 Histologic grade (overall proportional)

Z original Broders' grading (4 tier)

Z modified Broders' grading (3 tier)

Z high and low grade (2 tier)

3 Nuclear grade (worst areas)

Z Black NG for breast ca.

Z Fuhrman's NG for renal cell ca.

3 Combined: FIGO grade

Tumor Grade

- **Differentiation**
- **How similar to mother tissue in terms of morphology and function**

➢ **Architecture, polarity**

➢ **Nuclear features**

➢ **Function**

What is "Staging"?

- **A shorthand or notation describing extent of disease**

How far the cancer has spread at time of diagnosis

- **A common medical language**
- **A way of describing or estimating prognosis**

Why cancer staging ?

- To determine treatment
- To evaluate and compare results
- To estimate prognosis
- To plan and evaluate cancer screening and prevention programs
- To standardize groupings

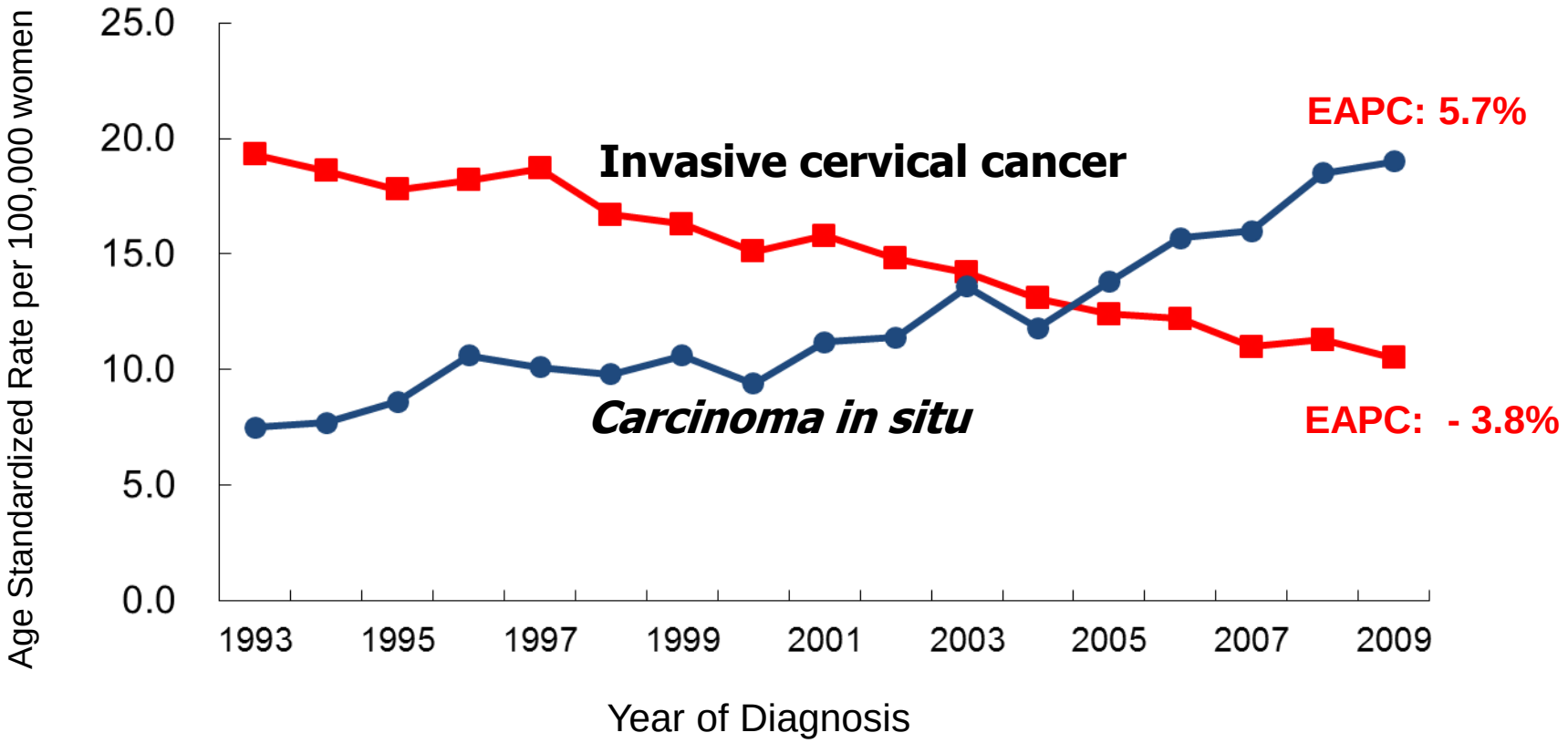
- **Example of importance of staging information to evaluate the cancer screening programme**

Cervical cancer screening in the Republic of Korea

Cancer Survival Rate: what can CSR tell you/ what can't CSR tell you

Trends in Age-standardized Incidence Rate of Cervical CIS and ICC

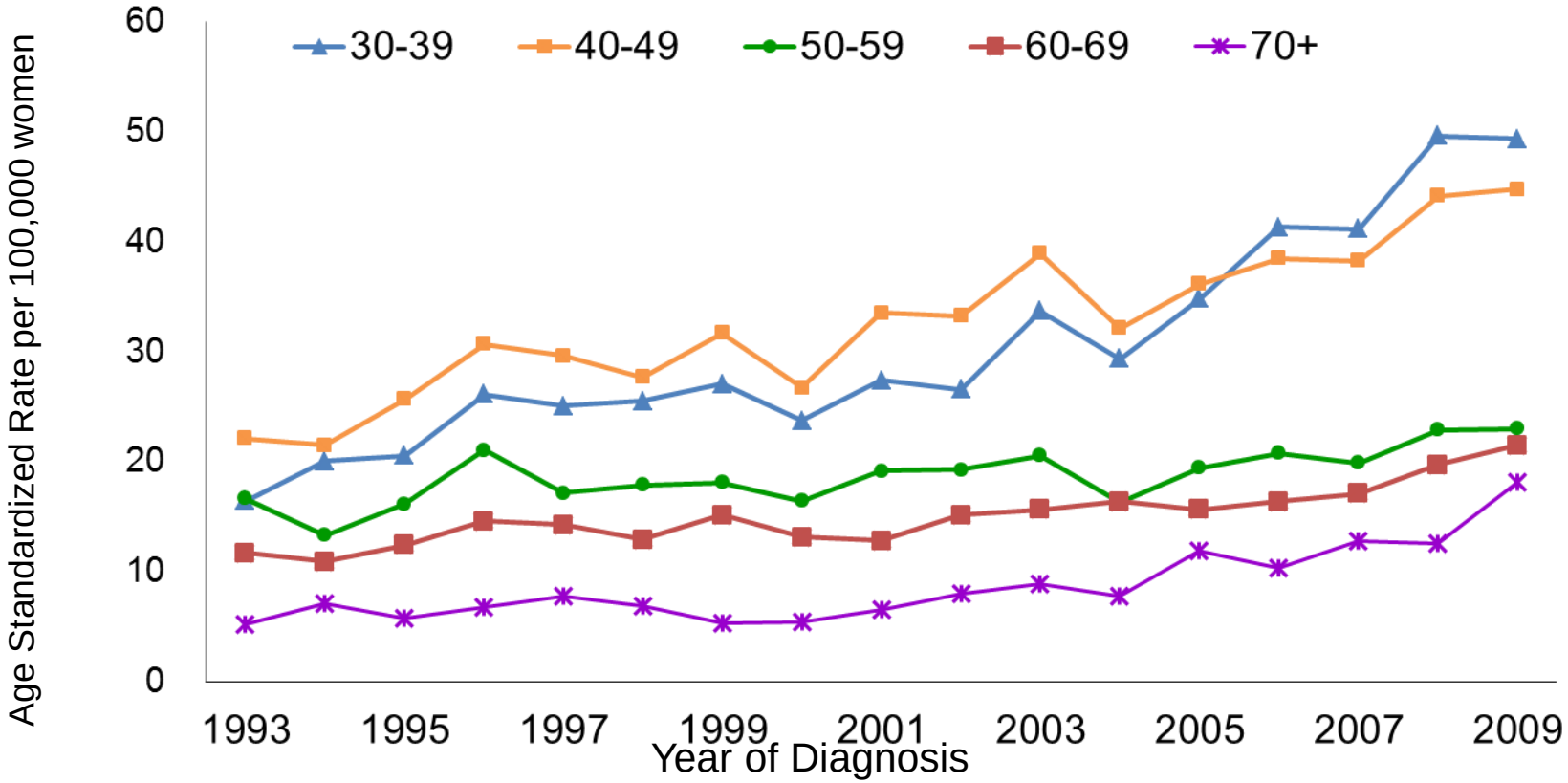
Data source: Korea Central Cancer Registry, ROK



EAPC: Estimated annual % changes

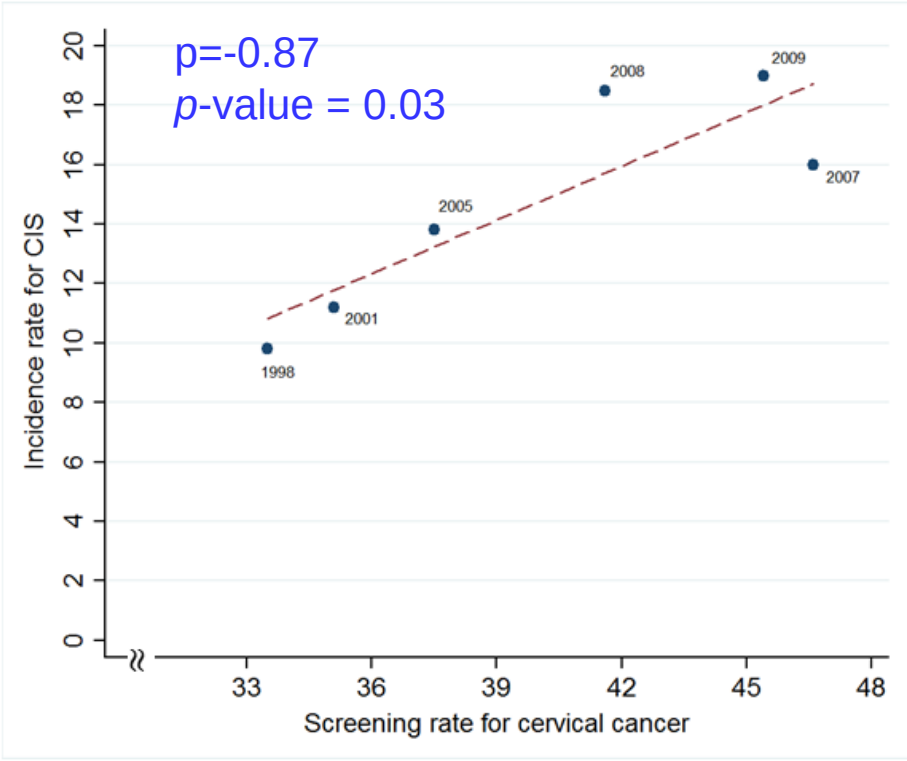
Trends in Age-specific Incidence Rate of Cervical CIS by Age Group

Data source: Korea Central Cancer Registry, ROK



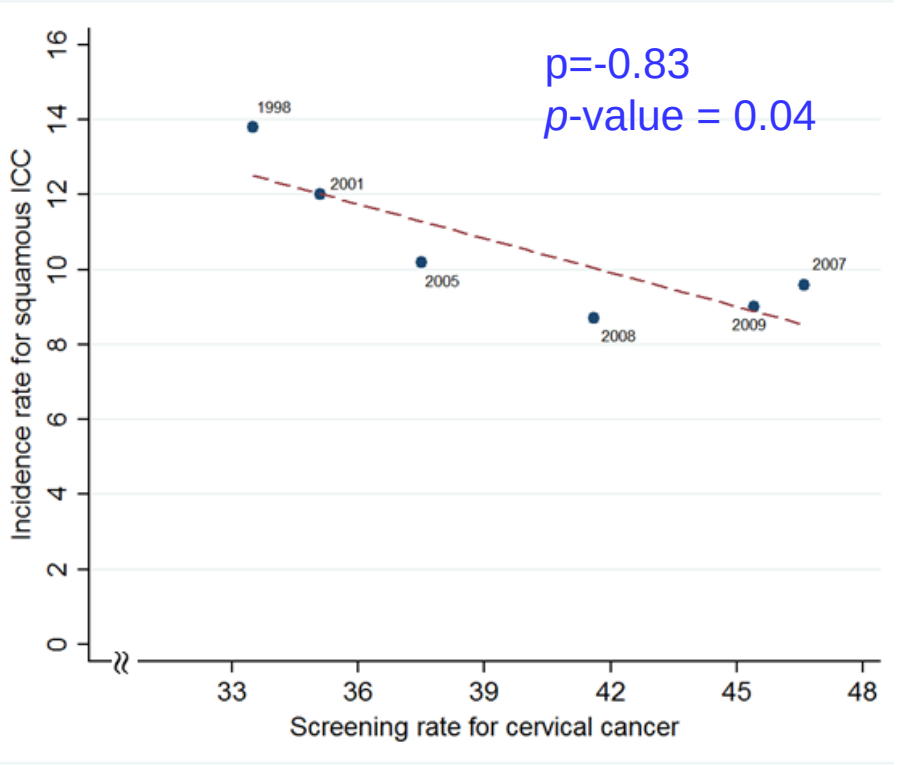
Association between Screening Rate and Incidence Rate

Screening rate and Incidence rate for CIS



*CIS: carcinoma in situ

Screening rate and Incidence rate for ICC

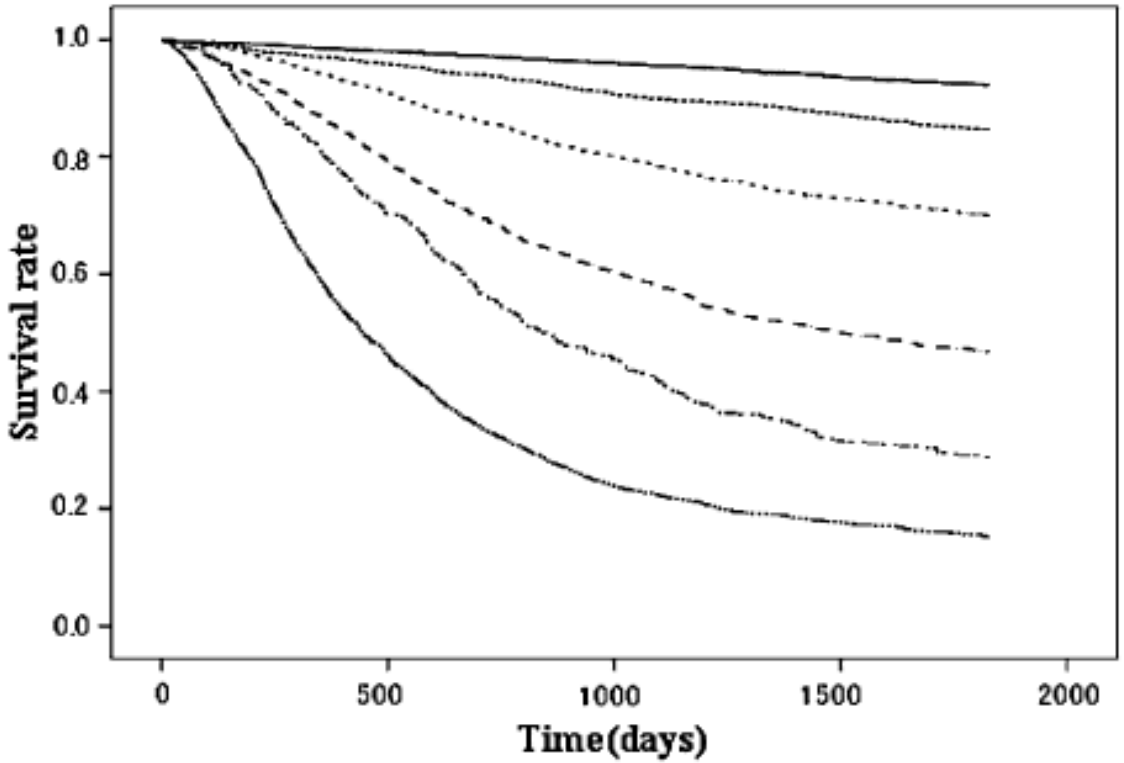


*ICC: invasive cervical carcinoma

Oncologist Anthony L. Back, M.D., a national expert on doctor-patient communications, talks with one of his patients about what she'd like to know of her prognosis.
Credit: National Cancer Institute

http://www.cancer.gov/about-cancer/diagnosis-staging/prognosis#video-series

5 year Survival Rate of Gastric Cancer in Japan, 2002



Stage Ⅰ A: 5YSR, 92.3% (n=5564)

Stage Ⅰ B: 5YSR, 84.7% (n=1950)

Stage Ⅱ: 5YSR, 70.0% (n=1614)

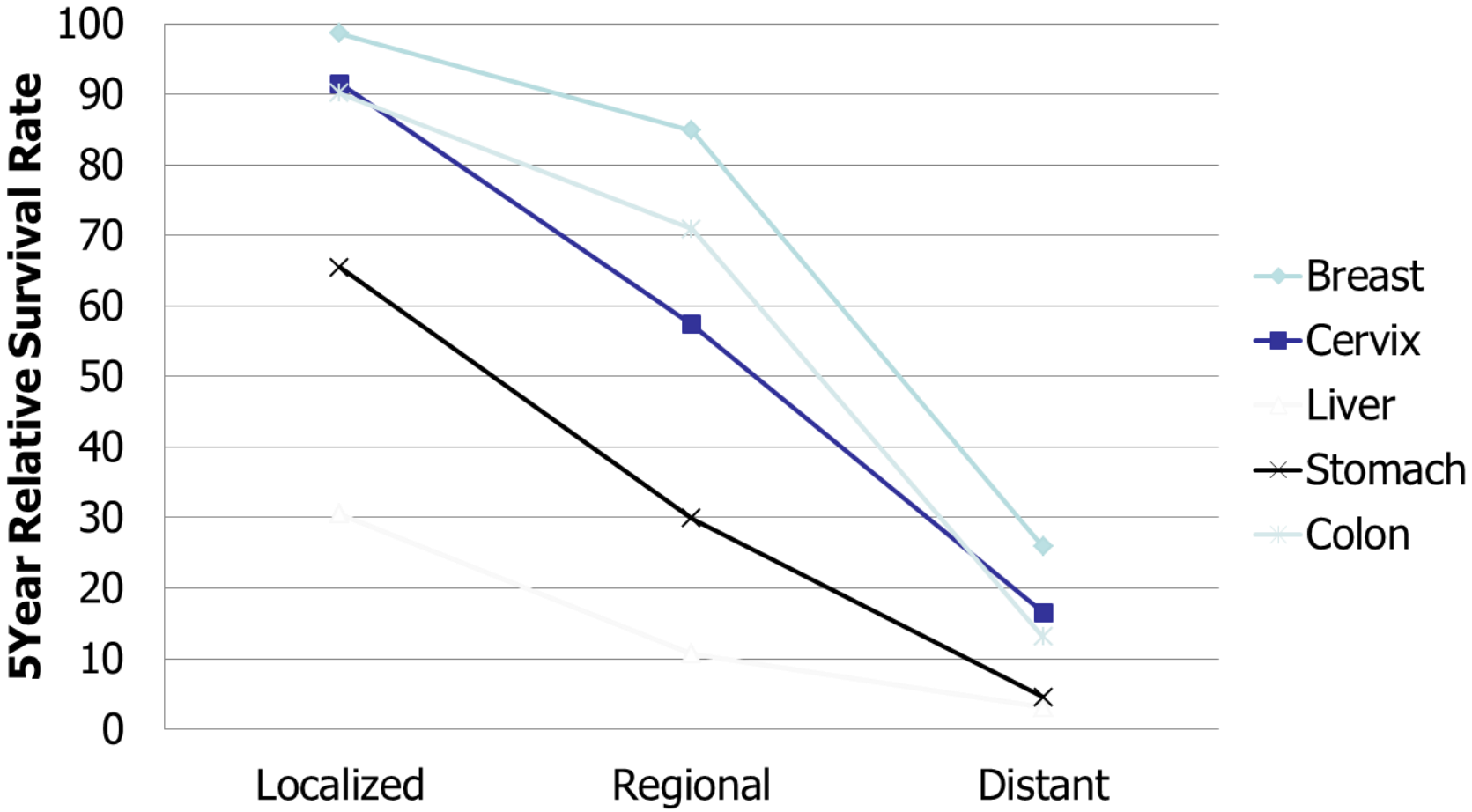
StageⅢA: 5YSR, 46.8% (n=1048)

StageⅢB: 5YSR, 28.8% (n=477)

StageⅣ: 5YSR, 15.2% (n=1924)

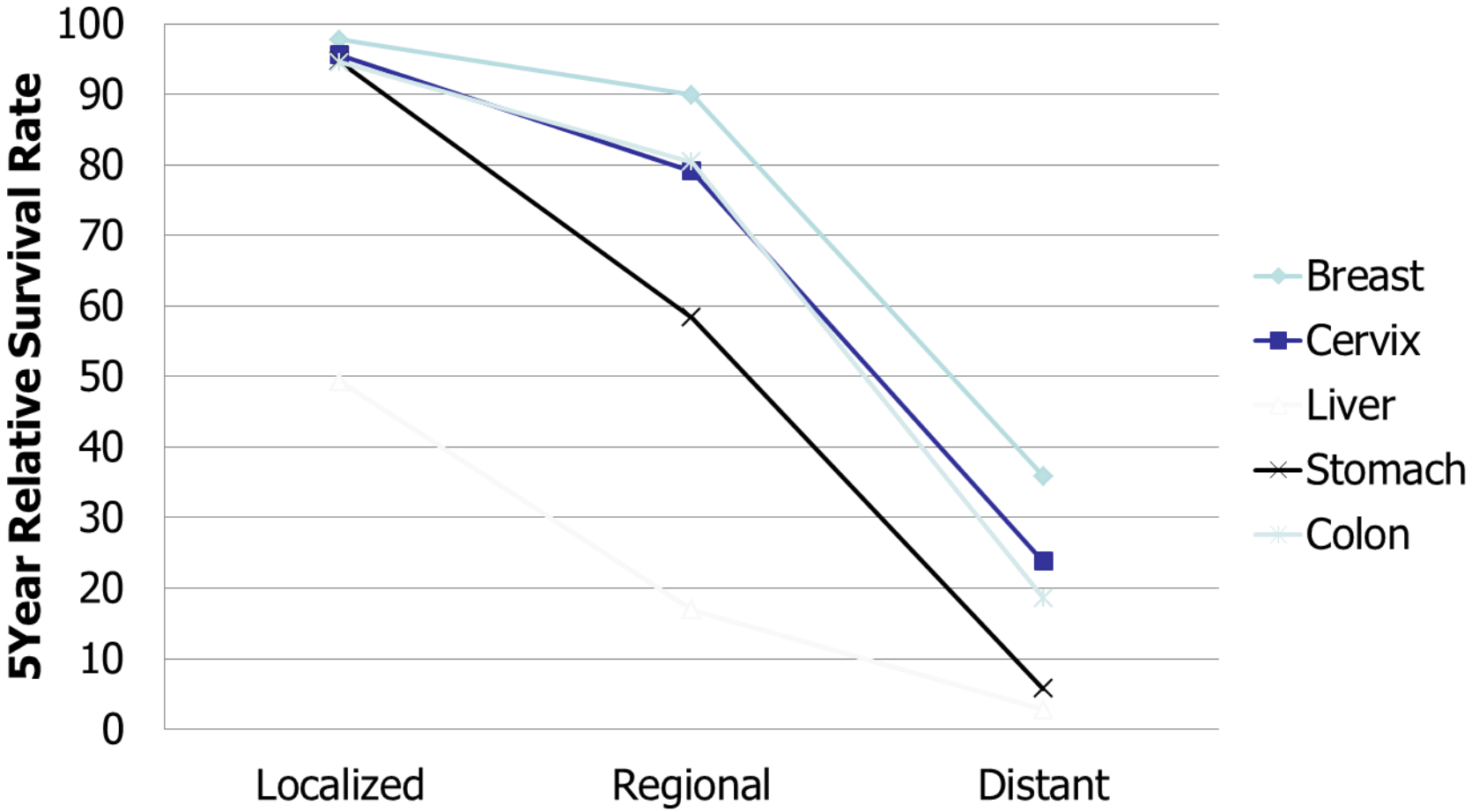
Gastric Cancer, .2013;16:1–27

5-Year Relative Survival of Cancers in America, 2005-2011



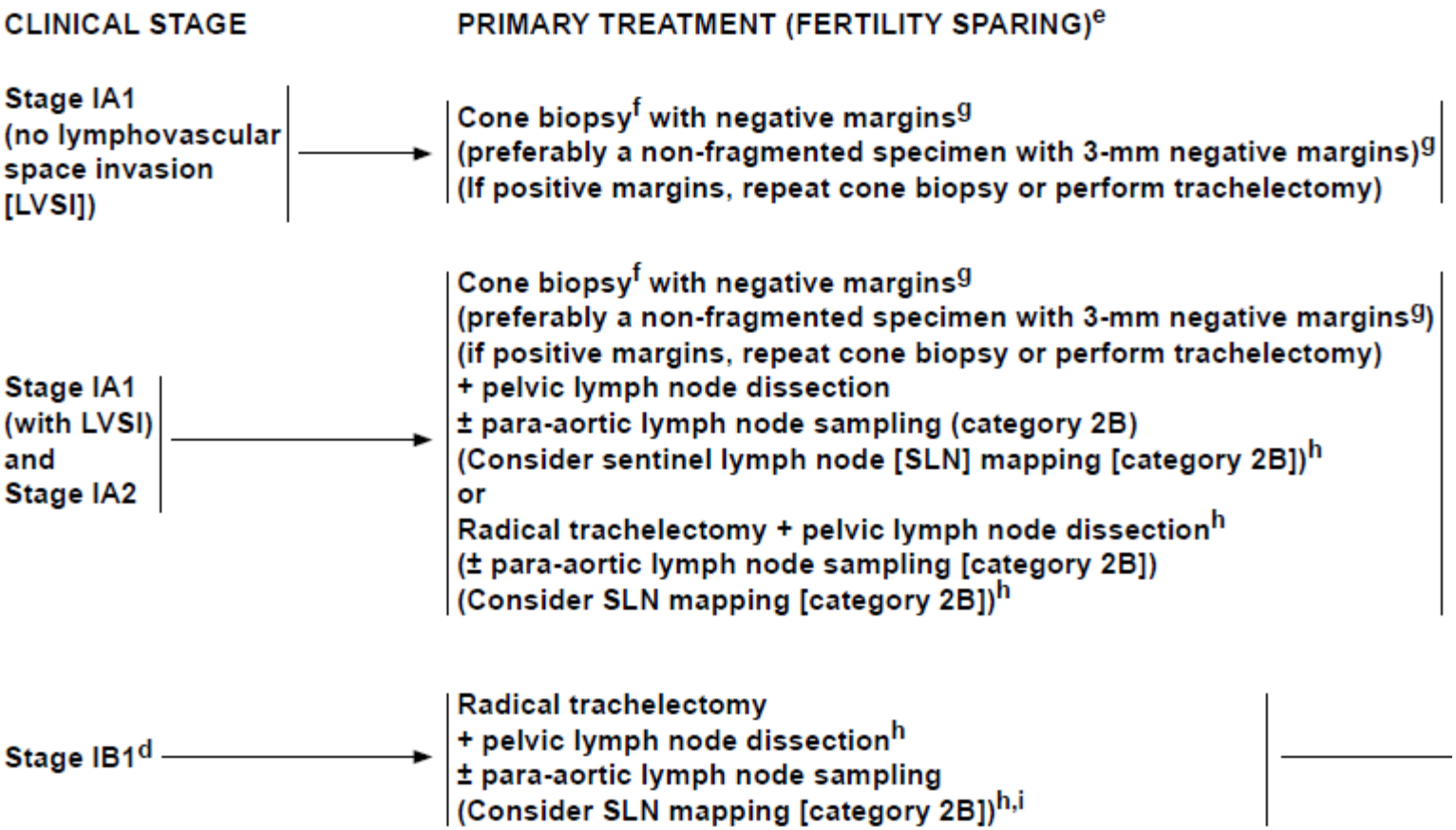
National Cancer Institute, SEER Cancer Statistics Review 1975-2012

5-Year Relative Survival of Cancers in Korea, 2008-2012



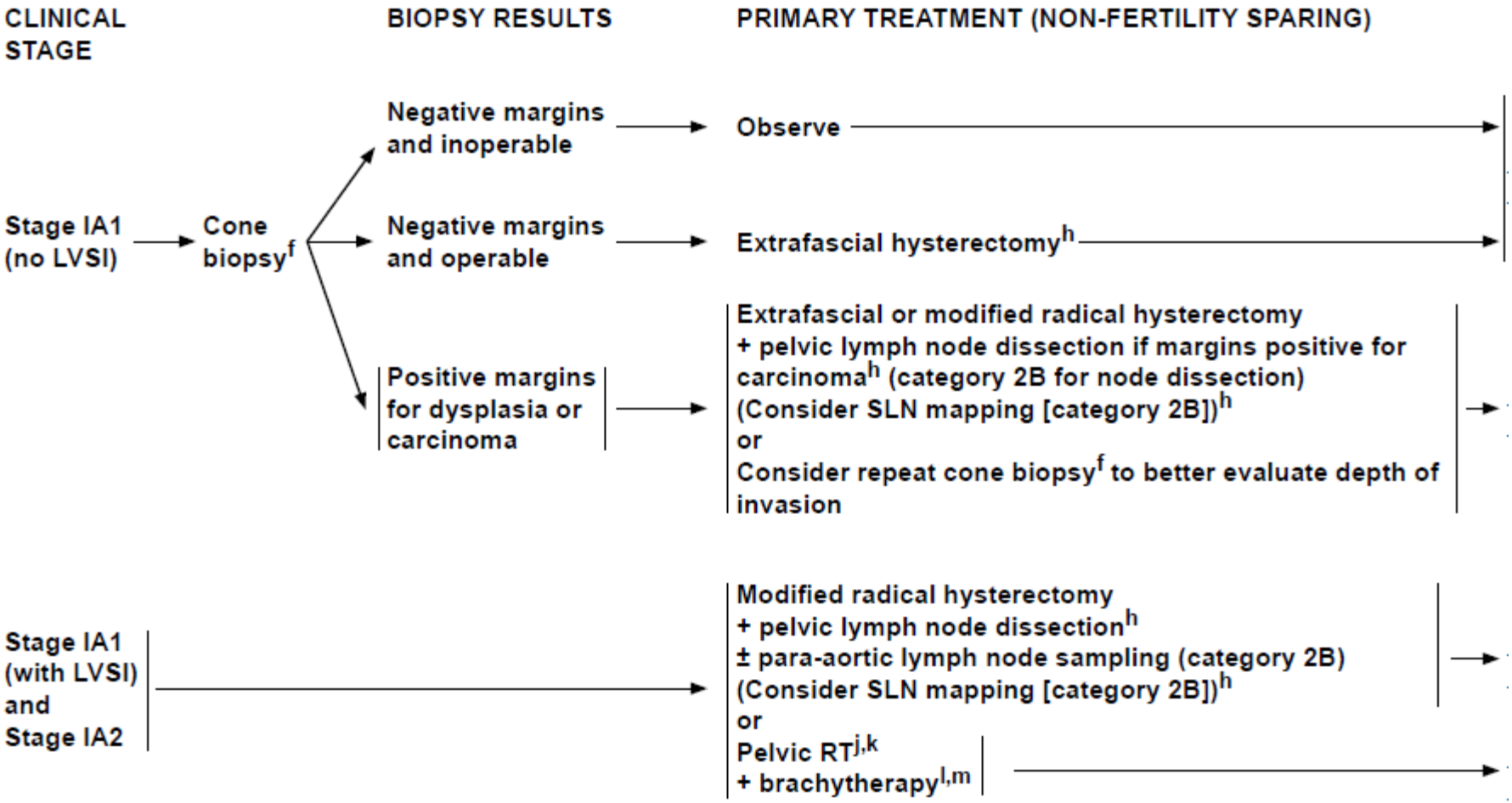
Korean Central Cancer Registry, Annual report of cancer statistics in Korea in 2012

Cervical cancer treatment by stage



National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology, 2016

Cervical cancer treatment by stage



National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology, 2016

Cancer Survivors

- **Lost in Transition**
- **Survivors and doctors are only interested in cancer surveillance**
  - **Insufficient NCD management**
  - **Insufficient preventive care including disease screening**

Institute of Medicine and National Research Council, *From cancer patient to cancer survivor: lost in transition, 2006.*

Cancer Survivors: Healthy lifestyle

Table 2. Relationship Between Body Mass Index, Alcohol Consumption, and Smoking and Risk of Contralateral Breast Cancer

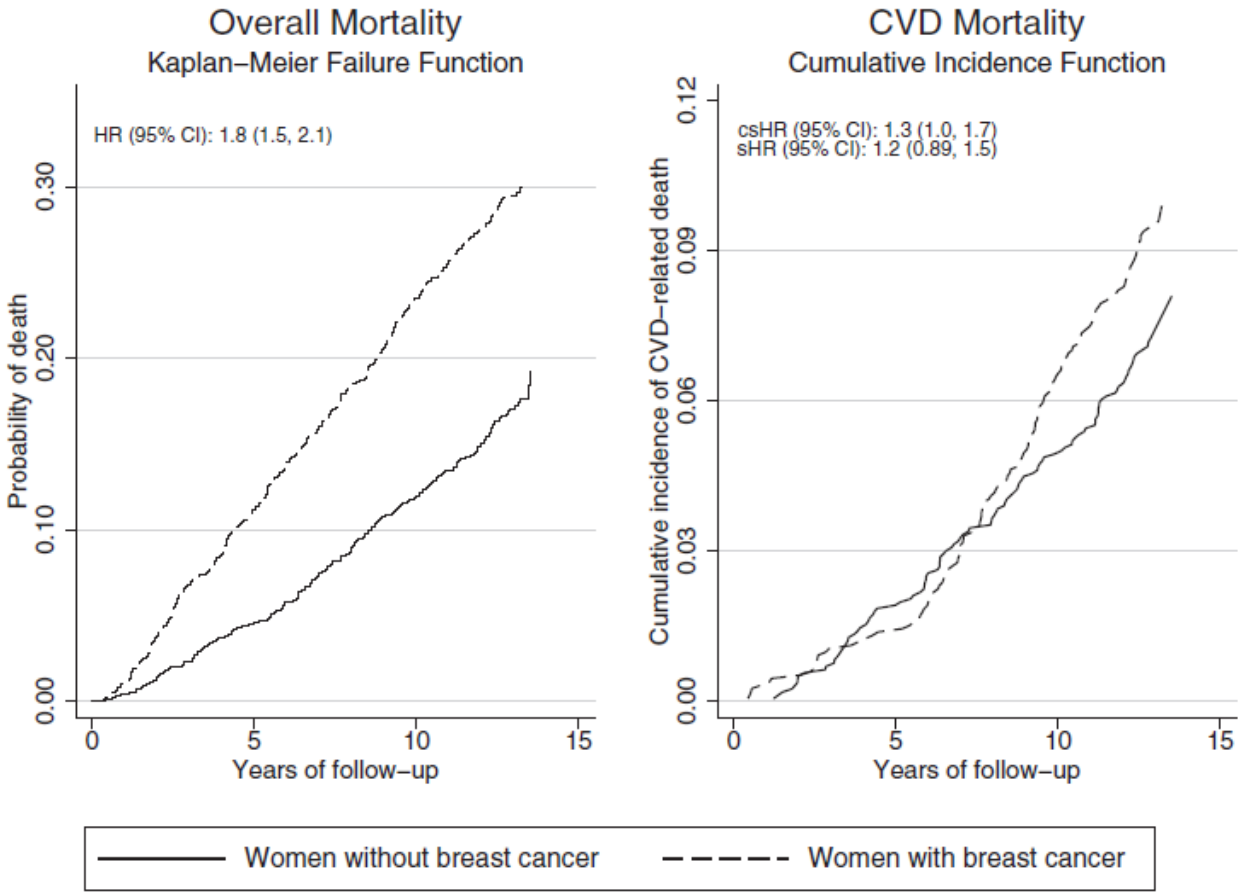
Characteristic	Controls (n = 712)		Patients With Contralateral Breast Cancer (n = 355)		OR*	95% CI
	No.	%	No.	%		
Body mass index at first breast cancer diagnosis, kg/m^2						
< 25	317	44.5	133	37.5	1.0	Reference
25-29.9	213	29.9	114	32.1	1.3	0.9 to 1.8
≥ 30	182	25.6	108	30.4	1.5	1.0 to 2.1†
Body mass index at reference date, kg/m^2						
< 25	254	39.3	110	35.6	1.0	Reference
25-29.9	222	34.0	93	30.1	1.0	0.7 to 1.5
≥ 30	173	26.7	106	34.3	1.4	1.0 to 2.1
Average alcohol consumption at first breast cancer diagnosis, drinks/week						
None	280	49.4	121	46.0	1.0	Reference
< 3	144	25.4	70	26.6	1.6	1.0 to 2.5†
3-6.9	62	10.9	29	11.0	1.4	0.7 to 2.5
≥ 7	81	14.3	43	16.4	1.7	1.0 to 2.9†
Average alcohol consumption between first breast cancer diagnosis and reference date, drinks/week						
None	270	47.6	119	45.3	1.0	Reference
< 3	149	26.3	75	28.5	1.6	1.0 to 2.4
3-6.9	75	13.2	26	9.9	1.0	0.5 to 1.8
≥ 7	73	12.9	43	16.4	1.9	1.1 to 3.2†
Smoking status at first breast cancer diagnosis						
Never smoker	298	52.2	126	47.6	1.0	Reference
Former smoker	186	32.6	88	33.2	1.2	0.8 to 1.7
Current smoker	87	15.2	51	19.3	1.8	1.1 to 3.2†
Smoking status at reference date						
Never smoker	298	52.2	126	47.6	1.0	Reference
Former smoker	215	37.7	102	38.5	1.2	0.8 to 1.7
Current smoker	58	10.2	37	14.0	2.2	1.2 to 4.0†

Abbreviation: OR, odds ratio.
*ORs and 95% CIs were estimated using conditional logistic regression and are implicitly adjusted for each of the matching variables (age and year of first breast cancer diagnosis, county, race/ethnicity, stage, and survival time). In addition, all ORs are adjusted for adjuvant hormonal therapy and chemotherapy. ORs for body mass index are also adjusted for use of menopausal hormone therapy at first breast cancer diagnosis. ORs for alcohol use are also adjusted for body mass index at reference date. ORs for smoking are also adjusted for first degree family history of breast cancer.
†$P < .05$.

- **USA**
- 369 women with diagnosed with a first primary invasive, stage I to IIIB, ER (+) **breast cancer**, and 726 matched controls at age 40 to 79 years
- Followed up from 1990.1.1 to 2005.9.30

J Clin Oncol 2009; 27:5312-5318.

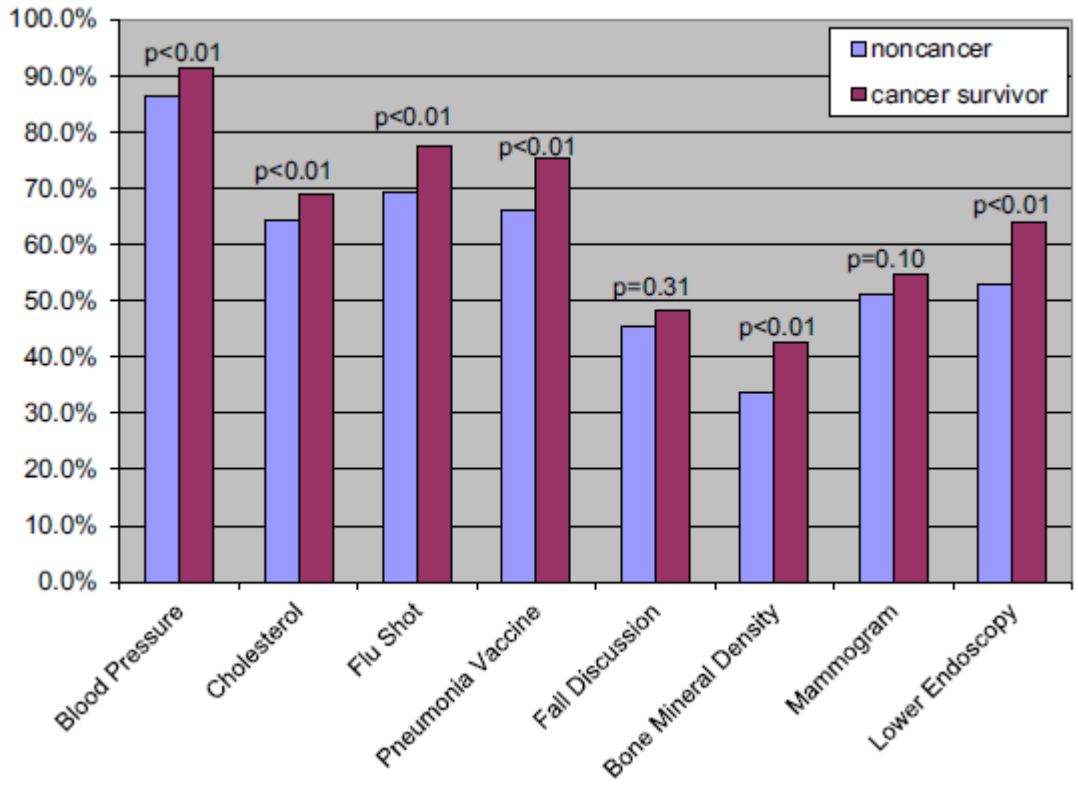
Cancer Survivors: Higher CVD risk



- **USA**
- population-based sample of 1,413 women with **breast cancer** diagnosed in 1996–1997 and 1,411 age-matched women without breast cancer
- Followed up through to 2009.12.31

Epidemiology 2016;27: 6–13

Cancer Survivors: Preventive care



- **USA**
- nationally representative sample
- 12,016 older adults from the 2003 Medicare Current Beneficiary Survey

The overall receipt of preventive care services was greater in cancer survivors, the percentage of patients receiving these services was not ideal.

J Geriatric Oncol. 2014;6:85-92.

Table 4. Observed numbers and standardized incidence ratios of second primary cancer according to the site of first and second primary cancer, 1985–2004, in both sexes

First cancer site	Second cancer site	No. second primary cancers	Person-years	SIR	95% CI
Mouth/pharynx	Esophagus	137	32 483	13.62	11.34–15.90
Mouth/pharynx	Stomach	81	32 571	1.38	1.08–1.68
Mouth/pharynx	Colorectum	53	32 558	1.35	0.99–1.71
Mouth/pharynx	Liver	66	32 599	1.49	1.13–1.85
Mouth/pharynx	Gallbladder	11	32 684	1.52	0.62–2.41
Mouth/pharynx	Pancreas	17	32 684	1.57	0.82–2.31
Mouth/pharynx	Larynx	12	32 674	4.35	1.89–6.81
Mouth/pharynx	Lung	113	32 562	2.45	2.00–2.90
Mouth/pharynx	Prostate	18	32 657	1.73	0.93–2.53
Mouth/pharynx	Kidney/urinary tract/bladder	16	32 656	1.30	0.66–1.94
Mouth/pharynx	Blood	28	32 661	2.39	1.50–3.27
Esophagus	Mouth/pharynx	94	19 043	21.63	17.26–26.00
Esophagus	Stomach	58	19 128	1.32	0.98–1.66
Esophagus	Colorectum	33	19 117	1.15	0.76–1.54
Esophagus	Liver	40	19 154	1.21	0.83–1.58
Esophagus	Pancreas	16	19 193	2.00	1.02–2.97
Esophagus	Larynx	14	19 181	6.38	3.04–9.72
Esophagus	Lung	62	19 129	1.71	1.29–2.14
Esophagus	Prostate	14	19 181	1.51	0.72–2.30
Esophagus	Kidney/urinary tract/bladder	19	19 173	2.00	1.10–2.90
Esophagus	Blood	16	19 174	1.89	0.97–2.82
Stomach	Mouth/pharynx	89	294 635	1.54	1.22–1.86
Stomach	Esophagus	171	294 528	1.68	1.42–1.93
Stomach	Colorectum	563	293 399	1.40	1.28–1.51
Stomach	Liver	486	293 978	1.07	0.97–1.16
Stomach	Gallbladder	91	294 693	1.17	0.93–1.41
Stomach	Pancreas	134	294 709	1.18	0.98–1.38
Stomach	Larynx	39	294 685	1.36	0.94–1.79
Stomach	Lung	632	294 047	1.26	1.16–1.36
Stomach	Breast (female)	126	294 397	1.63	1.34–1.91
Stomach	Uterus	35	294 742	1.09	0.73–1.45
Stomach	Ovary	15	294 779	1.04	0.51–1.56
Stomach	Prostate	157	294 497	1.36	1.15–1.57
Stomach	Kidney/urinary tract/bladder	163	294 433	1.26	1.07–1.45
Stomach	Thyroid	31	294 695	1.86	1.20–2.51
Stomach	Blood	137	294 653	1.14	0.95–1.33
Colorectum	Mouth/pharynx	47	222 016	1.13	0.81–1.45
Colorectum	Esophagus	95	221 949	1.31	1.05–1.57
Colorectum	Stomach	558	220 824	1.28	1.17–1.39
Colorectum	Liver	352	221 454	1.07	0.96–1.19
Colorectum	Gallbladder	58	222 035	0.97	0.72–1.22
Colorectum	Pancreas	109	222 020	1.28	1.04–1.52
Colorectum	Larynx	29	222 010	1.50	0.96–2.05
Colorectum	Lung	410	221 554	1.14	1.03–1.25
Colorectum	Breast (female)	91	221 774	1.22	0.97–1.47
Colorectum	Uterus	50	221 961	1.64	1.19–2.10
Colorectum	Ovary	34	222 048	2.43	1.61–3.24
Colorectum	Prostate	107	221 886	1.31	1.06–1.56
Colorectum	Kidney/urinary tract/bladder	120	221 805	1.30	1.07–1.53
Colorectum	Thyroid	42	221 956	3.00	2.09–3.91
Colorectum	Blood	108	221 970	1.20	0.97–1.43
Liver	Mouth/pharynx	31	91 628	1.51	0.98–2.04
Liver	Esophagus	58	91 598	1.56	1.16–1.96
Liver	Stomach	264	91 223	1.22	1.08–1.37
Liver	Colorectum	170	91 367	1.19	1.01–1.37
Liver	Gallbladder	22	91 655	0.82	0.48–1.17
Liver	Pancreas	34	91 647	0.85	0.57–1.14
Liver	Lung	146	91 519	0.82	0.69–0.95
Liver	Breast (female)	24	91 633	1.26	0.75–1.76
Liver	Ovary	12	91 658	3.23	1.40–5.06

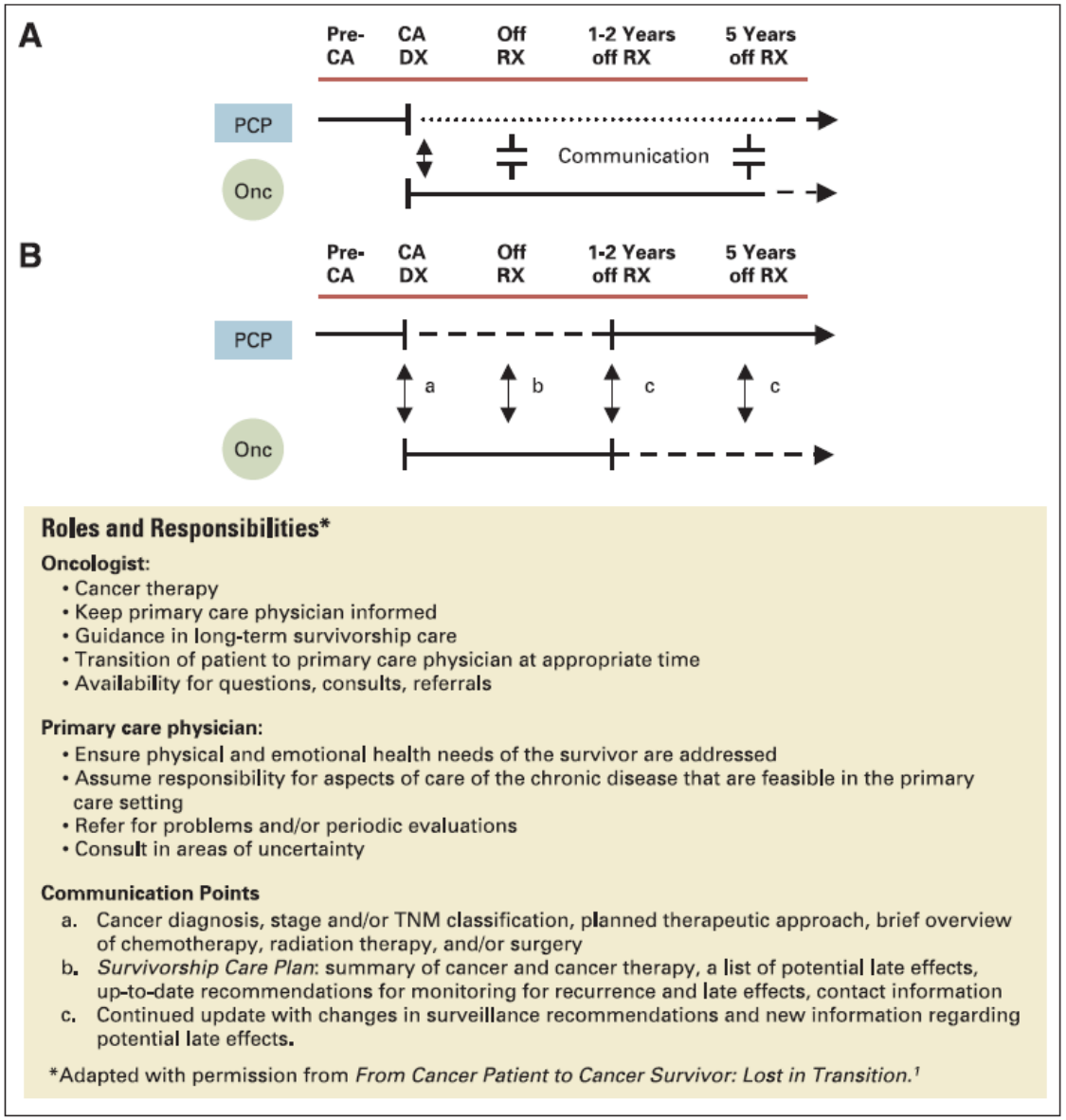
Cancer Survivors: Second primary cancers

- **Japan**
- patients aged 0–79 years who were first diagnosed with cancer between 1985 and 2004 in Osaka
- Followed up through to 2005.12.31

Cancer survivors are at higher risk of second primary cancer compared with the general population

Cancer Science. 2011;103(6); 349-7006

Shared care model for cancer survivors



Roles and Responsibilities*

Oncologist:
- Cancer therapy
- Keep primary care physician informed
- Guidance in long-term survivorship care
- Transition of patient to primary care physician at appropriate time
- Availability for questions, consults, referrals

Primary care physician:
- Ensure physical and emotional health needs of the survivor are addressed
- Assume responsibility for aspects of care of the chronic disease that are feasible in the primary care setting
- Refer for problems and/or periodic evaluations
- Consult in areas of uncertainty

Communication Points

a. Cancer diagnosis, stage and/or TNM classification, planned therapeutic approach, brief overview of chemotherapy, radiation therapy, and/or surgery
b. *Survivorship Care Plan*: summary of cancer and cancer therapy, a list of potential late effects, up-to-date recommendations for monitoring for recurrence and late effects, contact information
c. Continued update with changes in surveillance recommendations and new information regarding potential late effects.

*Adapted with permission from *From Cancer Patient to Cancer Survivor: Lost in Transition.*[1]

Institute of Medicine (IOM) and National Research Council (NRC) suggested in their report, 2006

Shared-Care model is developed for improving patient outcomes and enhancing the management of patients. Strategies to enhance the model need to be developed. Collaboration of oncologist and primary care physician societies is one of the key strategies.

J Clin Oncol. 2006;24:5117-5124
Institute of Medicine and National Research Council, *From cancer patient to cancer survivor: lost in transition, 2006.*

Cancer survivorship

- **Care of cancer survivorship should include**
  - **Prevention of new and recurrent cancer and other late effects**
  - **Surveillance for cancer spread, recurrence, or second cancer**
  - **Assessment of late psychological and physical effects**
  - **Intervention for consequences of cancer and treatment**
  - **Coordination of care between primary care provider and specialists to ensure that all of survivor's health needs are met**

National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology, 2016

Cancer Control and Registration

Thank you very much for your attention

Noncommunicable Diseases and Health Promotion (NCD), Western Pacific Regional Office, WHO

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