A comparison of cause-specific survival with relative-survival for the most common cancers in Taiwan

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ABSTRACT

Age group- and socioeconomic status (SES)-specific relative survival (RS) and cause-specific survival (CSS) estimates of 5-year net cancer survival for each of the 20 most common cancers in Taiwan were computed based on the Taiwan Cancer Registry (TCR), the Taiwan Cause of Death Database (TCOD), and Taiwan's National Health Insurance Research Database (NHIRD). The CSS estimates made use of the SEER (Surveillance, Epidemiology and End Results Program) cause-specific death classification variable (SEERDCV). Age group- and SES-specific RS and CSS estimates were in good agreement with each other except for a few old people group. When discrepancy did appear in certain old people group, it was RS that had higher value. This good agreement may be partly caused by Taiwan's National Health Insurance Program, which provides universal health coverage and thereby reduces the financial barriers to health care services and makes life tables similar across different SES groups. The discrepancy between RS and CSS estimates in old high SES group may be the result of the underestimation by CSS caused by comorbidity. From the period 1992-2004 to the period 2005-2010, improvements in net survival were seen for oral, breast, liver, colorectal, and lung cancers, all-site cancer, leukemia, and non-Hodgkin lymphoma; net survivals in these two periods were similar for the remaining cancers except for pancreatic cancer. More improvements were seen in young people.

KEYWORDS

Cancer Survival, Cause Specific Survival, Relative Survival, SEER Cause-Specific Death Classification Variable, Socioeconomic Status

INTRODUCTION

Cause-specific survival (CSS), which needs accurate cause of death information, and relative survival (RS) are the two basic approaches to net survival, which provides a measure for comparing cancer survival in different populations and different period of times. Using SEER cause-specific death classification variable (SEERDCV), it has been shown that CSS and RS are similar for most of the common cancers in US.(1) Since there are situations that one of the methods performs than the other, SEERDCV helps the study of net cancer survival. SEERDCV has also been shown to facilitate the study of net non-cancer survival (2).

AIMS

To compute and compare RS and CSS estimates of 5-year net survival for the 20 most common cancer sites by taking age and year at diagnosis and SES into account so as to examine if Taiwan's National Health Insurance Program has any impact on the biasedness of RS, which usually suffers underestimation in low socioeconomic (SES) group and overestimation in high SES group.

METHODS

We collected the data of cancer patients diagnosed at age 15 or more in the period 1992-2010 from TCR, which was launched in 1979. TCR was linked with TCOD, which adopted National Identification Number Card in 1985 and Taiwan NHIRD, which was launched in 1995 and whose data are more reliable after 2000. SES was provided by NHIRD and was defined by the insurable monthly income in the National Health Insurance registry archived at the diagnosis year or month. We used both Ederer II and the Pohar-Perme estimator (PPE) to obtain RS. The Taiwan life tables were obtain from Human Mortality Database Website. CSS was calculated using the actuarial method and the SEERDCV. Survival times were calculated in months and censored either at the date of death when the underlying cause was not the cancer under study or at the end of follow-up on Dec. 31, 2011.

RESULTS

Age-and SES-specific net survival

A total of 1,036,754 cancer patients diagnosed between 15 and 94 years of age in the period 1992-2010 were included in our study. Figure 1 gives the plots of CSS against RS, with Figure 1A for the period 2000-2004 and Figure 1B for the period 2005-2010. Each of the two figures has one plot for each of the three SES groups and one plot for all SES groups combined. Within one plot, the horizontal and vertical coordinates of each symbol are the RS and CSS estimates of the 5-year age group- and cancer-specific net survival. Figure 1 shows that age group- and SES-specific RS and CSS estimates were in very good agreement for all the 20 most common cancers in Taiwan. No significant differences, as indicated by red symbols, were seen between RS and CSS estimate, except for a few older age groups. RS and CSS were most consistent for high SES group, followed by medium and low SES groups, and then by the group of all cancer patients. RS and CSS were more consistent in the period 2005-2010 than 2000-2004.

Net survivals were generally higher for 2005-2010, except for pancreatic cancer.

Age group specific net survival

To compare age group specific 5-year net cancer survival in the US reported in Howlader et al., we report in Table 1 RS and CSS estimates of 5-year net cancer survival for the 20 most common cancers for patients diagnosed at age between 50 and 64 and in the period 1992-2004 in Taiwan. Table 1 shows that only patients diagnosed with myelodysplastic syndromes showed large and significant differences in RS and CSS estimates in 50-64 age group. This indicates a higher level of agreement between RS and CSS estimates in Taiwan.

Table 1 also shows that large increases were seen in net survival for liver cancer in all age groups younger than 85 years and for all-site cancer, non-Hodgkin lymphoma, and oral cancers in all age groups younger than 75 years. Furthermore, large increases were seen in breast, leukemia, and colorectal cancers in age groups younger than 65 years, and a large increase was seen in lung cancer in the 35–65 age group. When cancer subtypes were considered, chronic myelogenous leukemia in the 15–49 age group showed the largest increase, at about 20%. Cancer disparity measures by RS and by CSS were in much better agreement in Taiwan than in the US.(Data not shown)

Figure 1:Five-year cause-specific survival plotted against 5-year relative survival for the 20 most common cancers diagnosed in 2000-2004(1A), and 2005-2010 (1B) stratified by age at diagnosis and socioeconomic status

Figure 1A

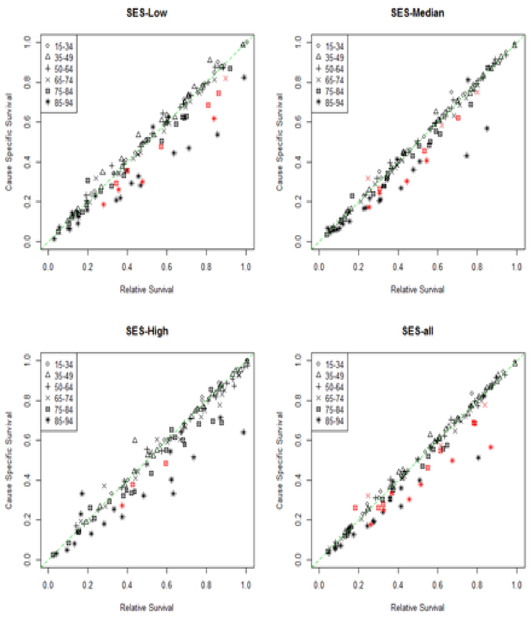

Figure 1B

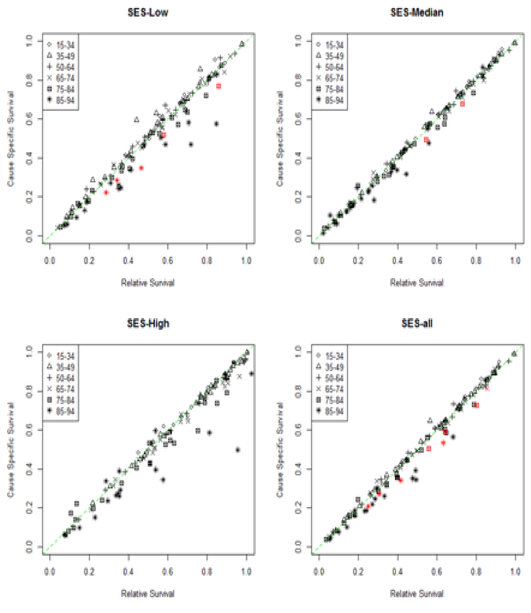

Table 1: Five-year relative survival (RS) and 5-year cause-specific survival (CSS) for selected cancer sites by ages groups, Taiwan

Cancer site	1992-2004 50-64 N	RS(CI)	CSS(CI)	2005-2010 50-64 N	RS(CI)	CSS(CI)
All sites combined	175,110	47.86 (47.6, 48.1)	48.38 (48.1, 48.6)	136,699	55.9 (55.6, 56.3)	56.7 (56.4, 57.1)
Oral Cavity and Pharynx	18,314	53.0 (52.2, 53.8)	53.8 (53.0, 54.5)	6,062	59.1 (58.1, 60.0)	60.7 (59.7, 61.6)
Lip	499	69.2 (64.6, 73.5)	70.8 (66.5, 74.6)	459	80.1 (74.1, 85.1)	80.4 (75.1, 84.7)
Tongue	3,350	54.2 (52.4, 56.0)	54.5 (52.8, 56.2)	3,448	62.7 (60.6, 64.8)	63.5 (61.5, 65.5)
hypoprarynx	1,726	29.5 (27.2, 31.7)	31.8 (29.5, 34.0)	1,799	32.1 (29.3, 35.1)	35 (32.1, 37.9)
Esophagus	4,295	16.2 (15.1, 17.4)	16.9 (15.8, 18.1)	3,306	14.5 (13.1, 16.0)	16.1 (14.6, 17.6)
Stomach	9,319	42.0 (41.0, 43.1)	42.0 (41.0, 43.0)	2,627	44.2 (42.5, 45.9)	44.8 (43.1, 46.4)
Colon and Rectum	21,169	61.7 (61.0, 62.4)	60.6 (60.0, 61.3)	5,158	67.59 (66.7, 68.5)	66.97 (66.1, 67.8)
Colon excluding rectum	11,066	61.9 (60.9, 62.9)	61.0 (60.0, 61.9)	10,465	67.1 (65.9, 68.3)	66.5 (65.4, 67.6)
Rectum and rectosigmoid junction	10,103	61.4 (60.4, 62.5)	60.2 (59.3, 61.2)	7,948	68.3 (66.9, 69.7)	67.6 (66.3, 68.9)
Liver and Intrahepatic Bile Duct	31,886	20.9 (20.4, 21.4)	21.3 (20.8, 21.7)	13,669	28.9 (28.1, 29.7)	29.8 (29.0, 30.6)
Liver	30,049	21.6 (21.1, 22.1)	21.9 (21.4, 22.3)	19,601	30.3 (29.5, 31.1)	31.1 (30.2, 31.9)
Intrahepatic bile duct	1,837	9.9 (8.6,1 1.4)	11.3 (9.8, 12.9)	1,431	9.9 (8.0, 12.1)	11.2 (9.1, 13.5)
Pancreas	2,690	10.4 (9.3,1 1.6)	11.7 (10.5, 13.0)	1,945	8.1 (6.8, 9.6)	8.7 (7.3, 10.2)
Larynx	1,618	65.6 (63.0, 68.1)	68.4 (66.0, 70.7)	331	68.3 (64.6, 71.8)	73.6 (70.3, 76.7)
Lung and Bronchus	18,222	15.3 (14.8, 15.9)	15.7 (15.2, 16.2)	9,151	21.7 (20.7, 22.7)	22.0 (21.1, 23.0)
SCC	4,029	17.2 (16.0, 18.4)	17.5 (16.4, 18.8)	1,939	20.8 (18.5, 23.1)	21.2 (19.0, 23.5)
ADC	8,164	15.5 (14.7, 16.3)	15.5 (14.7, 16.3)	8,360	23.7 (22.4, 25.1)	23.8 (22.5, 25.2)
Breast	16,539	79.1 (78.4, 79.8)	78.2 (77.5, 78.8)	2,191	85.7 (84.9, 86.4)	85.3 (84.6, 85.9)
Cervix Uteri	10,393	77.3 (76.4, 78.2)	77.0 (76.2, 77.8)	754	76.5 (74.7, 78.2)	77.4 (75.7, 79.0)
Corpus and Uterus, NOS	2,754	82.2 (80.6, 83.7)	82.0 (80.5, 83.4)	527	84.7 (83.2, 86.2)	85.2 (83.8, 86.5)
Corpus uteri	2,740	82.2 (80.6, 83.7)	82.0 (80.5, 83.4)	3,674	84.8 (83.2, 86.2)	85.2 (83.8, 86.5)
Uterus_NOS	<80	88.9 (55.9, 99.8)	85.7 (53.9, 96.2)	<80	83.8 (63.2, 94.2)	85.3 (65.1, 94.3)
Ovary	2,337	54.5 (52.4, 56.5)	54.8 (52.8, 56.8)	631	63.8 (61.0, 66.4)	64 (61.3, 66.6)
Prostate	2,352	75.3 (73.3, 77.3)	72.9 (71.0, 74.7)	405	85 (82.6, 87.1)	83 (80.9, 84.8)
Urinary Bladder	4,544	76.5 (75.1, 77.9)	77.4 (76.1, 78.6)	529	81.2 (79.1, 83.1)	81.7 (79.9, 83.3)
Kidney and Renal Pelvis	3,138	65.51 (63.7, 67.3)	66.1 (64.4, 67.7)	674	72.49 (70.2, 74.7)	73.06 (71.0, 75.0)
Thyroid	2,944	92.5 (91.2, 93.6)	91.5 (90.4, 92.5)	183	96.4 (95.3, 97.4)	95.4 (94.5, 96.1)
Non-Hodgkin Lymphoma	2,798	55.7 (53.7, 57.6)	56.8 (54.9, 58.6)	955	64.5 (62.2, 66.7)	65.4 (63.2, 67.4)
Leukemia	2,044	31.66 (29.6, 33.8)	35.74 (33.6, 37.9)	947	45.98 (43.2, 48.7)	49.07 (46.4, 51.7)
Acute lymphocytic leukemia	189	12.8 (8.4, 18.1)	13.3 (8.8, 18.7)	NA	NA	NA
Chronic lymphocytic leukemia	212	65.8 (58.4, 72.3)	68.0 (61.0, 73.9)	193	78.1 (67.5,86.1)	78.8 (69.4,85.6)
Acute myeloid leukemia	1,047	19.4 (17.0, 21.9)	21.8 (19.2, 24.5)	824	23 (19.6,26.5)	23.7 (20.3,27.3)
CML	318	45 (39.2, 50.6)	51.2 (45.3, 56.8)	254	76.4 (69.0,82.5)	76.7 (69.7,82.4)
Myelodysplastic syndromes	131	32.9 (24.8, 41.3)	53.7 (43.3, 62.9) #	204	31.4 (23.8,39.4)	45 (35.6,53.9)
Myeloproliferative neoplasms	94	87.3 (77.6, 93.8)	89.0 (80.5, 93.9)	277	87.7 (80.9,92.6)	92 (86.9,95.2)
Other Biliary	1,245	29.1 (26.5, 31.7)	31.0 (28.3, 33.6)	530	31.4 (27.5,35.3)	34.7 (30.7,38.7)
Other Non-Epithelial Skin	3,859	87.7 (86.4, 88.9)	89.5 (88.4, 90.4)	307	91.3 (89.7,92.7)	92.9 (91.7,93.9)

CONCLUSION

For the 20 most common cancers in Taiwan, age group- and SES specific- RS and CSS estimates were consistent with each other except for a few old people group. Taiwan's National Health Insurance Program has reduced the financial barrier to health care services and the inequality between high and low income in the distribution of access. This makes life tables similar among different SES groups and hence reduces the underestimation of RS in low SES group and the overestimation of RS in high SES group. The improvement in net survival for certain cancers in the period 2005-2010 over the period of 2000-2004 seemed to reflect recent advances in cancer therapies. Since CSS and RS are in good agreement, suggesting that the SEER cause-specific death classification variable is applicable in Taiwan cancer patients.

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