SUPPLEMENTARY INFORMATION

Survival improvement by decade of patients aged 0-14 years with acute lymphoblastic leukemia: a SEER analysis

Haiqing Ma[1], Huanhuan Sun[2], and Xiaoping Sun[1]

[1]Department of Laboratory Medicine and the Center for Stem Cell and Developmental Biology, The University of Texas MD Anderson Cancer Center, Houston, TX 77030, United States;

[2]Department of Pathology & Immunology, Baylor College of Medicine, Houston, TX 77030, United States.

Correspondence: Xiaoping Sun, Department of Laboratory Medicine, The University of Texas MD Anderson Cancer Center, 1515 Holcombe Boulevard, Unit 0037, Houston, TX 77030. E-mail: xsun@mdanderson.org, Telephone: 713-745-2000
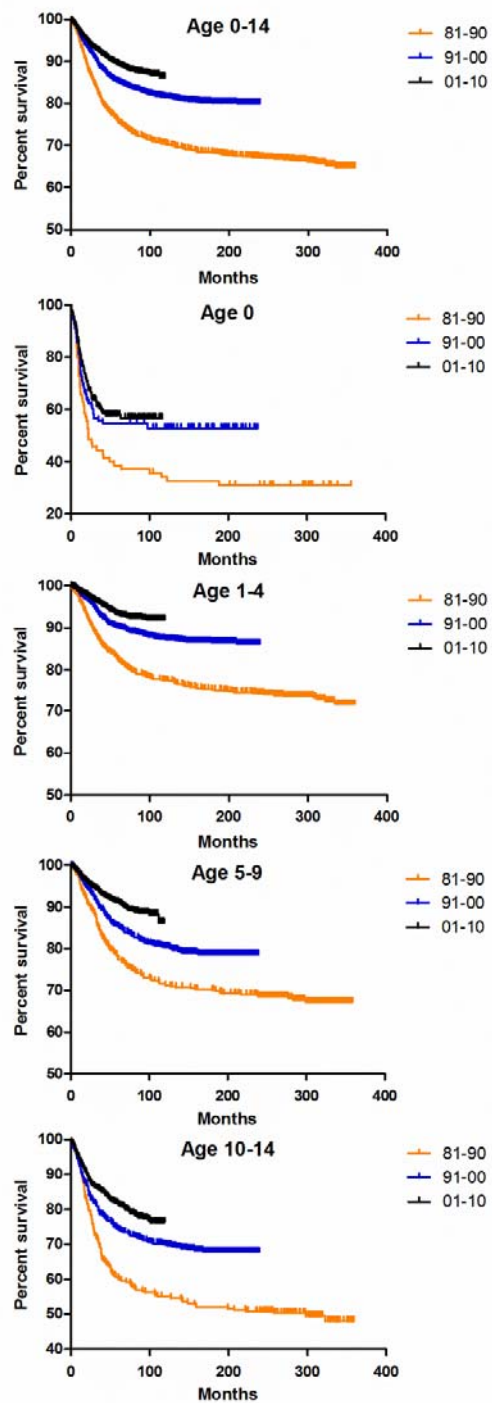
• 4 Supplementary Figures

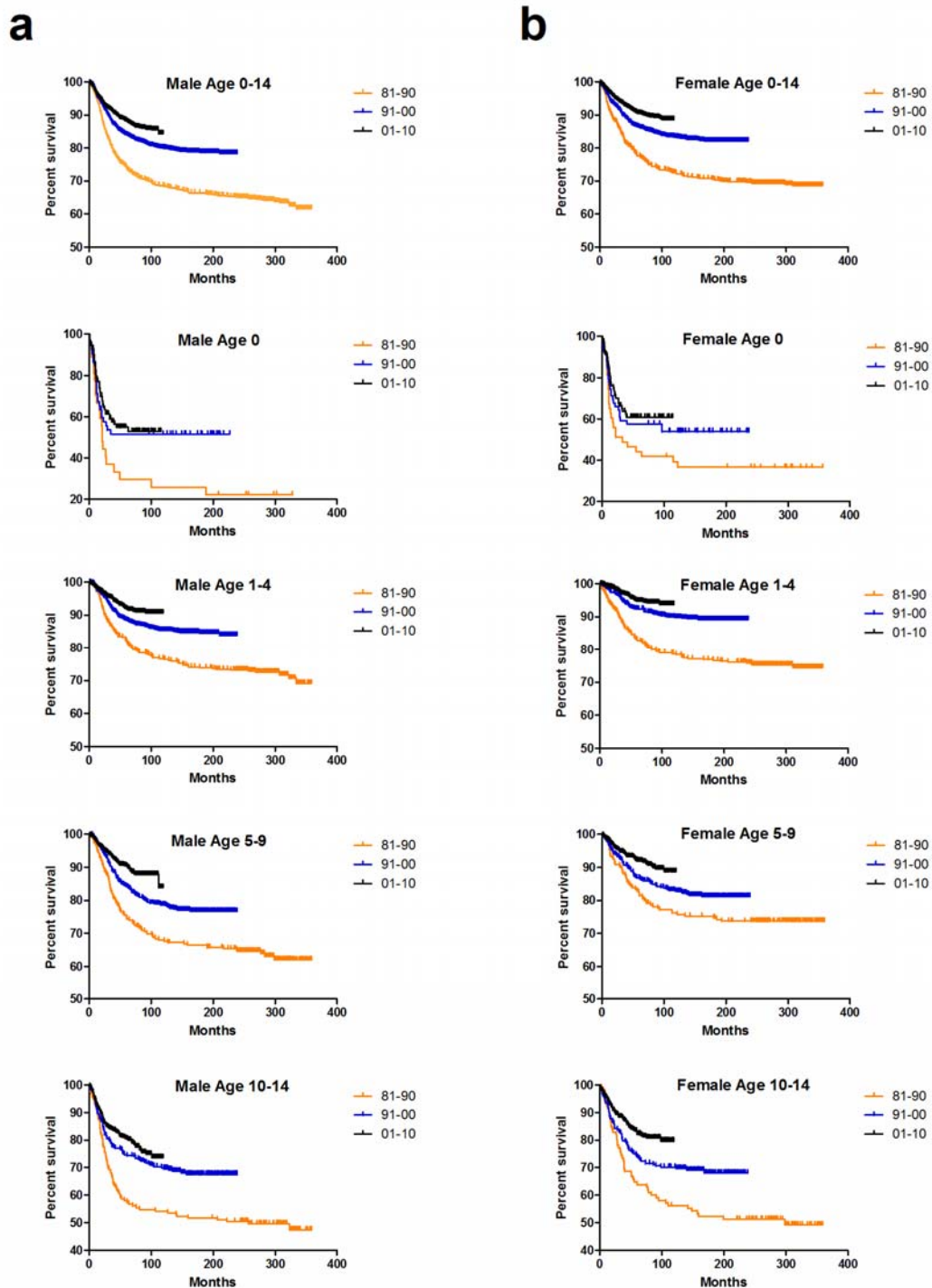• 5 Supplementary Tables

Supplementary Figure S1.
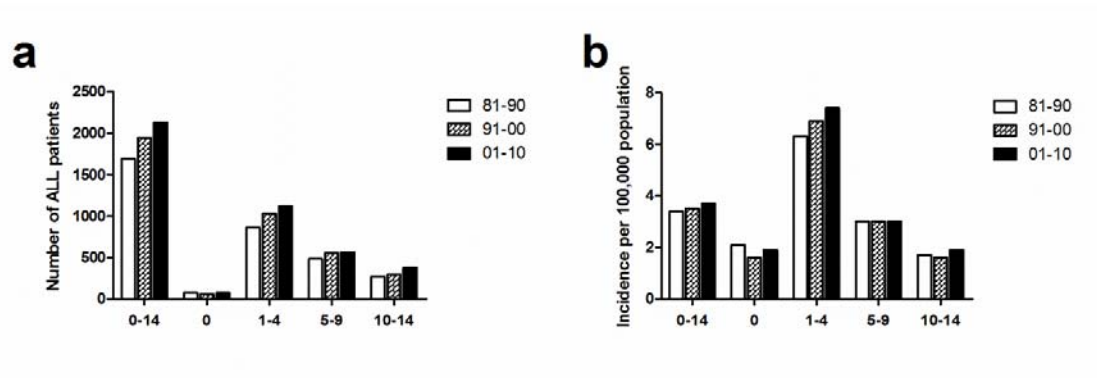
Supplementary Figure S1. Summary data for patients diagnosed with ALL from 1981 to 2010. Data are shown by age group (ages 0-14, 0, 1-4, 5-9, and 10-14 years) and calendar period over the 3 decades. a. Number of patients diagnosed in 9 SEER sites. b. Incidence of ALL in 9 SEER sites.

Supplementary Figure S2.

Supplementary Figure S2. Kaplan-Meier survival analysis for patients with ALL from 18 SEER sites from 1981 to 2010. Data are shown by age group (in years) and calendar period over the 3 decades.

Supplementary Figure S3.

Supplementary Figure S3. Kaplan-Meier survival analysis for male (a) and female (b) patients with ALL from 18 SEER sites from 1981 to 2010. Data are shown by age group (in years) and calendar period over the 3 decades.

Supplementary Figure S4.
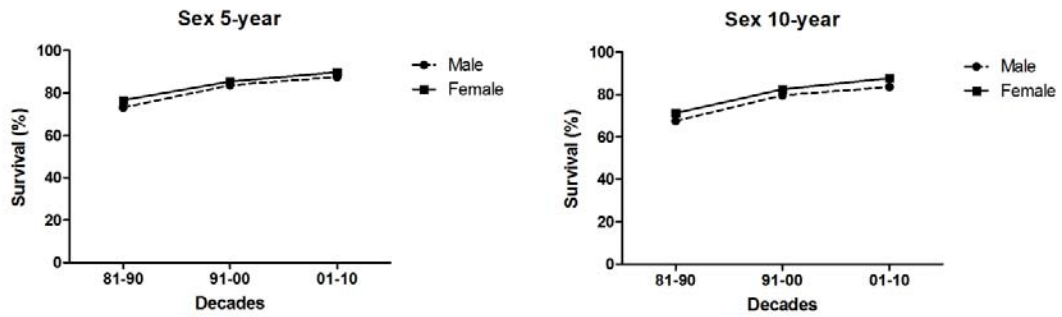
Supplementary Figure S4. 5-year and 10-year relative survival estimates of patients with ALL age 0-14 years according to sex over 3 decades, from 1981 to 2010, at 18 SEER sites.

Supplementary Table S1. Relative survival estimates: Percentages for male ALL patients during the periods 1981 to 1990, 1991 to 2000, and 2001 to 2010. Data are means ± SEM, with number of patients in parentheses.

Age Group	1981-1990	1991-2000	2001-2010
12-Mo RS			
0-14	93.8 ± 0.8 (920)	96.0 ± 0.5 (1904)	96.1 ± 0.3 (3905)
0	66.2 ± 8.9 (29)	73.5 ± 6.0 (56)	76.8 ± 4.0 (119)
1-4	95.7 ± 1.0 (455)	97.9 ± 0.5 (1013)	98.0 ± 0.3 (1989)
5-9	95.3 ± 1.3 (273)	97.6 ± 0.7 (528)	97.2 ± 0.5 (1061)
10-14	90.8 ± 2.3 (163)	91.2 ± 1.6 (307)	92.6 ± 1.0 (736)
24-Mo RS			
0-14	85.6 ± 1.2	91.8 ± 0.6***	92.8 ± 0.4
0	41.9 ± 9.3	55.0 ± 6.8	62.8 ± 4.7
1-4	90.0 ± 1.4	95.4 ± 0.7**	96.1 ± 0.5
5-9	88.7 ± 1.9	93.8 ± 1.1	95.0 ± 0.7
10-14	76.1 ± 3.3	83.1 ± 2.1	85.7 ± 1.4
36-Mo RS			
0-14	79.5 ± 1.3	87.9 ± 0.8***	90.9 ± 0.5*
0	34.9 ± 8.9	49.3 ± 6.8	57.3 ± 4.9
1-4	85.4 ± 1.7	92.0 ± 0.9**	94.8 ± 0.5*
5-9	81.7 ± 2.3	89.8 ± 1.3*	93.1 ± 0.9
10-14	66.9 ± 3.7	78.3 ± 2.4*	82.8 ± 1.5
48-Mo RS			
0-14	75.2 ± 1.4	85.0 ± 0.8***	89.0 ± 0.6***
0	31.4 ± 8.7	49.3 ± 6.8	53.4 ± 5.1
1-4	82.1 ± 1.8	89.4 ± 1.0**	93.1 ± 0.7*
5-9	77.4 ± 2.5	85.4 ± 1.5*	90.7 ± 1.0*
10-14	60.1 ± 3.9	76.3 ± 2.4**	81.4 ± 1.6
60-Mo RS			
0-14	73.2 ± 1.5	83.7 ± 0.9***	87.6 ± 0.6**
0	28.0 ± 8.4	49.3 ± 6.8	53.4 ± 5.1
1-4	81.0 ± 1.8	88.3 ± 1.0**	91.6 ± 0.7*
5-9	74.4 ± 2.6	83.9 ± 1.6*	90.0 ± 1.1*
10-14	57.1 ± 3.9	74.1 ± 2.5**	79.5 ± 1.7
72-Mo RS			
0-14	70.9 ± 1.5	82.5 ± 0.9***	86.3 ± 0.7*
0	28.0 ± 8.4	49.3 ± 6.8	51.4 ± 5.3
1-4	78.4 ± 1.9	87.3 ± 1.1***	90.7 ± 0.8
5-9	72.3 ± 2.7	81.8 ± 1.7*	87.8 ± 1.3*
10-14	55.3 ± 3.9	73.8 ± 2.5***	77.9 ± 1.8
84-Mo RS			
0-14	69.6 ± 1.5	81.6 ± 0.9***	85.5 ± 0.7*
0	28.0 ± 8.4	49.3 ± 6.8	51.4 ± 5.3

1-4	77.3 ± 2.0	86.7 ± 1.1***	90.5 ± 0.8*
5-9	70.4 ± 2.8	80.4 ± 1.7*	87.3 ± 1.3*
10-14	54.1 ± 3.9	72.3 ± 2.6***	75.5 ± 2.0
96-Mo RS			
0-14	69.0 ± 1.5	80.7 ± 0.9***	85.0 ± 0.8*
0	28.0 ± 8.4	49.3 ± 6.8	51.4 ± 5.3
1-4	76.8 ± 2.0	86.1 ± 1.1***	90.3 ± 0.9*
5-9	69.0 ± 2.8	78.9 ± 1.8*	87.3 ± 1.3**
10-14	54.1 ± 3.9	71.3 ± 2.6**	73.8 ± 2.2
108-Mo RS			
0-14	67.8 ± 1.6	80.1 ± 0.9***	84.8 ± 0.8**
0	24.5 ± 8.1	49.3 ± 6.8	51.4 ± 5.3
1-4	75.7 ± 2.0	85.6 ± 1.1***	90.3 ± 0.9*
5-9	67.6 ± 2.8	78.6 ± 1.8**	87.3 ± 1.3**
10-14	53.6 ± 4.0	70.1 ± 2.6**	72.8 ± 2.5
120-Mo RS			
0-14	67.6 ± 1.6	79.7 ± 0.9***	83.6 ± 1.2
0	24.5 ± 8.1	49.3 ± 6.8	51.4 ± 5.3
1-4	75.5 ± 2.0	85.2 ± 1.1***	90.3 ± 0.9**
5-9	67.2 ± 2.9	78.2 ± 1.8**	83.2 ± 3.1
10-14	53.6 ± 4.0	69.8 ± 2.7**	72.8 ± 2.5

Abbreviations: Mo, month; RS, relative survival; SEM, standard error of the mean.
*$p < 0.01$, **$p < 0.001$, and ***$p < 0.0001$ for comparisons with the preceding decade.

Supplementary Table S2. Relative survival estimates: Percentages for female ALL patients during the periods 1981 to 1990, 1991 to 2000, and 2001 to 2010. Data are means ± SEM, with number of patients in parentheses.

Age Group	1981-1990	1991-2000	2001-2010
12-Mo RS			
0-14	92.2 ± 1.0 (771)	95.3 ± 0.5 (1513)*	96.7 ± 0.3 (3083)
0	62.3 ± 7.2 (47)	74.7 ± 5.6 (62)	81.4 ± 3.9 (112)
1-4	94.1 ± 1.2 (405)	98.0 ± 0.5 (776)**	98.4 ± 0.3 (1569)
5-9	96.2 ± 1.3 (211)	95.5 ± 1.0 (442)	97.6 ± 0.5 (866)
10-14	89.8 ± 2.9 (108)	91.4 ± 1.8 (233)	93.8 ± 1.1 (536)
24-Mo RS			
0-14	86.6 ± 1.2	91.9 ± 0.7***	94.4 ± 0.4**
0	47.3 ± 7.3	63.3 ± 6.2	67.3 ± 4.8
1-4	90.6 ± 1.5	96.7 ± 0.6***	97.8 ± 0.4
5-9	90.6 ± 2.0	92.5 ± 1.3	95.1 ± 0.8
10-14	80.6 ± 3.8	82.4 ± 2.5	88.8 ± 1.4
36-Mo RS			
0-14	82.5 ± 1.4	89.1 ± 0.8***	92.6 ± 0.5**
0	45.1 ± 7.3	56.8 ± 6.3	61.0 ± 5.1
1-4	86.9 ± 1.7	94.5 ± 0.8***	96.3 ± 0.5
5-9	87.7 ± 2.3	89.6 ± 1.5	93.8 ± 0.9
10-14	72.3 ± 4.3	79.0 ± 2.7	86.8 ± 1.6*
48-Mo RS			
0-14	79.0 ± 1.5	86.9 ± 0.9***	91.1 ± 0.6***
0	43.0 ± 7.3	55.2 ± 6.4	58.3 ± 5.2
1-4	83.9 ± 1.8	92.6 ± 0.9***	95.4 ± 0.6*
5-9	83.9 ± 2.5	87.7 ± 1.6	92.7 ± 1.0*
10-14	66.7 ± 4.5	74.7 ± 2.9	83.3 ± 1.8
60-Mo RS			
0-14	76.7 ± 1.5	85.5 ± 0.9***	89.9 ± 0.6***
0	40.9 ± 7.2	55.2 ± 6.4	58.3 ± 5.2
1-4	81.7 ± 1.9	91.8 ± 1.0***	94.1 ± 0.7
5-9	82.1 ± 2.6	85.7 ± 1.7	91.4 ± 1.1*
10-14	63.0 ± 4.7	72.6 ± 2.9	81.9 ± 1.9*
72-Mo RS			
0-14	75.1 ± 1.6	84.7 ± 0.9***	89.1 ± 0.7**
0	38.7 ± 7.2	55.2 ± 6.4	58.3 ± 5.2
1-4	80.7 ± 2.0	91.1 ± 1.0***	93.7 ± 0.8
5-9	79.2 ± 2.8	84.8 ± 1.7	90.5 ± 1.2*
10-14	62.1 ± 4.7	70.9 ± 3.0	79.9 ± 2.1
84-Mo RS			
0-14	73.2 ± 1.6	84.1 ± 0.9***	88.5 ± 0.7**
0	38.7 ± 7.2	55.2 ± 6.4	58.3 ± 5.2
1-4	78.7 ± 2.0	90.7 ± 1.1***	93.5 ± 0.8
5-9	77.8 ± 2.9	83.9 ± 1.8	89.5 ± 1.4

10-14	58.5 ± 4.8	70.1 ± 3.0	79.4 ± 2.1
96-Mo RS			
0-14	72.3 ± 1.6	83.3 ± 1.0***	88.4 ± 0.7***
0	38.7 ± 7.2	55.2 ± 6.4	58.3 ± 5.2
1-4	78.0 ± 2.1	90.1 ± 1.1***	93.5 ± 0.8
5-9	76.9 ± 2.9	82.9 ± 1.8	89.0 ± 1.4*
10-14	56.6 ± 4.8	69.2 ± 3.0	79.4 ± 2.1*
108-Mo RS			
0-14	72.0 ± 1.6	82.7 ± 1.0***	87.8 ± 0.8**
0	38.7 ± 7.2	51.7 ± 6.4	58.3 ± 5.2
1-4	77.7 ± 2.1	89.6 ± 1.1***	93.1 ± 0.9
5-9	76.9 ± 2.9	82.3 ± 1.8	88.2 ± 1.6
10-14	55.7 ± 4.8	68.8 ± 3.0	78.4 ± 2.3
120-Mo RS			
0-14	71.4 ± 1.6	82.5 ± 1.0***	87.8 ± 0.8***
0	36.3 ± 7.1	51.7 ± 6.4	58.3 ± 5.2
1-4	77.5 ± 2.1	89.5 ± 1.1***	93.1 ± 0.9
5-9	76.0 ± 3.0	81.8 ± 1.9	88.2 ± 1.6
10-14	54.8 ± 4.8	68.8 ± 3.0	78.4 ± 2.3

Abbreviations: Mo, month; RS, relative survival; SEM, standard error of the mean.
*$p < 0.01$, **$p < 0.001$, and ***$p < 0.0001$ for comparisons with the preceding decade.

Supplementary Table S3. 5-year and 10-year relative survival estimates of ALL according to sex, age group, and calendar period over 3 decades, from 1981 to 2010, at 18 SEER sites. Data are means ± SEM, with number of patients in parentheses.

Decade	Age Group	Male	Female
81-90	60-Mo RS		
	0-14	73.2 ± 1.5 (920)	76.7 ± 1.5 (771)
	0	28.0 ± 8.4 (29)	40.9 ± 7.2 (47)
	1-4	81.0 ± 1.8 (455)	81.7 ± 1.9 (405)
	5-9	74.4 ± 2.6 (273)	82.1 ± 2.6 (211)
	10-14	57.1 ± 3.9 (163)	63.0 ± 4.7 (108)
	120-Mo RS		
	0-14	67.6 ± 1.6	71.4 ± 1.6
	0	24.5 ± 8.1	36.3 ± 7.1
	1-4	75.5 ± 2.0	77.5 ± 2.1
	5-9	67.2 ± 2.9	76.0 ± 3.0
	10-14	53.6 ± 4.0	54.8 ± 4.8
91-00	60-Mo RS		
	0-14	83.7 ± 0.9 (1904)	85.5 ± 0.9 (1513)
	0	49.3 ± 6.8 (56)	55.2 ± 6.4 (62)
	1-4	88.3 ± 1.0 (1013)	91.8 ± 1.0 (776)
	5-9	83.9 ± 1.6 (528)	85.7 ± 1.7 (442)
	10-14	74.1 ± 2.5 (307)	72.6 ± 2.9 (233)
	120-Mo RS		
	0-14	79.7 ± 0.9	82.5 ± 1.0
	0	49.3 ± 6.8	51.7 ± 6.4
	1-4	85.2 ± 1.1	89.5 ± 1.1*
	5-9	78.2 ± 1.8	81.8 ± 1.9
	10-14	69.8 ± 2.7	68.8 ± 3.0
01-10	60-Mo RS		
	0-14	87.6 ± 0.6 (3905)	89.9 ± 0.6 (3083)*
	0	53.4 ± 5.1 (119)	58.3 ± 5.2 (112)
	1-4	91.6 ± 0.7 (1989)	94.1 ± 0.7 (1569)
	5-9	90.0 ± 1.1 (1061)	91.4 ± 1.1 (866)
	10-14	79.5 ± 1.7 (736)	81.9 ± 1.9 (536)
	120-Mo RS		
	0-14	83.6 ± 1.2	87.8 ± 0.8*
	0	51.4 ± 5.3	58.3 ± 5.2
	1-4	90.3 ± 0.9	93.1 ± 0.9
	5-9	83.2 ± 3.1	88.2 ± 1.6
	10-14	72.8 ± 2.5	78.4 ± 2.3

Abbreviations: Mo, month; RS, relative survival; SEM, standard error of the mean.
*$p < 0.01$, **$p < 0.001$, and ***$p < 0.0001$ for comparisons with the Male group.

Supplementary Table S4. 5-year and 10-year relative survival estimates of ALL according to socioeconomic status/county level poverty rates, age group, and calendar period over 3 decades, from 1981 to 2010, at 18 SEER sites. Data are means ± SEM, with number of patients in parentheses.

Decade	Age Group	Low Poverty	Medium Poverty	High Poverty
81-90	60-Mo RS			
	0-14	76.2 ± 1.4 (926)	74.5 ± 1.6 (717)	51.1 ± 7.3 (47) **
	0	39.5 ± 7.7 (41)	37.1 ± 8.9 (30)	0.0 ± 0.0 (5)
	1-4	82.6 ± 1.8 (470)	80.8 ± 2.1 (362)	66.8 ± 9.1 (27)
	5-9	77.9 ± 2.5 (271)	78.6 ± 2.9 (205)	50.0 ± 17.7 (8)
	10-14	62.5 ± 4.1 (144)	57.6 ± 4.5 (120)	28.6 ± 17.1 (7)
	120-Mo RS			
	0-14	70.7 ± 1.5	68.8 ± 1.7	49.0 ± 7.3*
	0	34.2 ± 7.5	33.7 ± 8.7	0.0 ± 0.0
	1-4	77.2 ± 2.0	76.1 ± 2.3	66.8 ± 9.1
	5-9	72.5 ± 2.7	70.4 ± 3.2	37.5 ± 17.1
	10-14	56.4 ± 4.2	52.9 ± 4.6	28.6 ± 17.1
91-00	60-Mo RS			
	0-14	87.3 ± 0.9 (1391)	82.9 ± 0.9 (1903) **	78.0 ± 3.8 (123) *
	0	45.8 ± 7.6 (44)	56.8 ± 6.0 (70)	50.4 ± 25.2 (4)
	1-4	92.4 ± 1.0 (746)	88.3 ± 1.0 (997) *	82.3 ± 5.7 (46)
	5-9	85.6 ± 1.8 (371)	84.3 ± 1.6 (548)	82.4 ± 5.3 (51)
	10-14	81.4 ± 2.6 (230)	67.8 ± 2.8 (288) **	63.8 ± 10.3 (22)
	120-Mo RS			
	0-14	83.8 ± 1.0	79.3 ± 0.9**	74.3 ± 4.0*
	0	45.8 ± 7.6	53.7 ± 6.1	50.4 ± 25.2
	1-4	89.1 ± 1.2	86.1 ± 1.1	72.8 ± 7.2*
	5-9	81.6 ± 2.0	78.4 ± 1.8	82.4 ± 5.3
	10-14	77.3 ± 2.8	63.8 ± 2.9*	59.3 ± 10.5
01-10	60-Mo RS			
	0-14	91.7 ± 0.7 (2343)	87.1 ± 0.6 (4050) ***	86.4 ± 1.7 (592) *
	0	65.1 ± 5.8 (78)	51.2 ± 5.1 (124)	50.7 ± 10.6 (29)
	1-4	95.3 ± 0.7 (1230)	91.6 ± 0.7 (2033) **	89.1 ± 2.4 (292) **
	5-9	93.5 ± 1.2 (621)	89.0 ± 1.1 (1141) *	90.7 ± 2.6 (165)
	10-14	84.2 ± 2.0 (414)	78.5 ± 1.7 (752)	81.0 ± 4.3 (106)
	120-Mo RS			
	0-14	89.5 ± 0.9	83.7 ± 1.0***	81.4 ± 4.4*
	0	65.1 ± 5.8	49.0 ± 5.3	50.7 ± 10.6
	1-4	94.3 ± 0.9	90.2 ± 0.9*	89.1 ± 2.4
	5-9	90.5 ± 2.0	84.2 ± 2.2	79.5 ± 9.7
	10-14	79.8 ± 2.8	72.3 ± 2.3	78.5 ± 4.9

Abbreviations: Mo, month; RS, relative survival; SEM, standard error of the mean.
*$p < 0.01$, **$p < 0.001$, and ***$p < 0.0001$ for comparisons with the Low Poverty group.

Supplementary Table S5. 5-year and 10-year relative survival estimates of ALL according to race, age group, and calendar period over 3 decades, from 1981 to 2010, at 18 SEER sites. Data are means ± SEM, with number of patients in parentheses.

Decade	Age Group	White	Black	Other
81-90	60-Mo RS			
	0-14	76.3 ± 1.1 (1394)	56.6 ± 4.4 (126) ***	75.9 ± 3.3 (165)
	0	33.2 ± 5.9 (64)	25.5 ± 15.6 (8)	100.0 ± 0.0 (3)
	1-4	82.8 ± 1.4 (709)	65.7 ± 6.1 (61) **	79.9 ± 4.3 (89)
	5-9	79.9 ± 2.0 (392)	58.1 ± 8.9 (31) *	72.5 ± 5.9 (58)
	10-14	61.6 ± 3.2 (229)	42.5 ± 9.7 (26)	60.1 ± 12.7 (15)
	120-Mo RS			
	0-14	71.0 ± 1.2	50.3 ± 4.5***	69.8 ± 3.6
	0	29.8 ± 5.8	25.5 ± 15.6	67.3 ± 27.5
	1-4	78.2 ± 1.6	57.6 ± 6.4**	76.5 ± 4.5
	5-9	73.4 ± 2.2	51.8 ± 9.0*	63.8 ± 6.3
	10-14	56.1 ± 3.3	39.0 ± 9.7	53.5 ± 12.9
91-00	60-Mo RS			
	0-14	85.0 ± 0.7 (2850)	77.1 ± 2.8 (226) *	84.8 ± 2.0 (323)
	0	50.8 ± 5.2 (96)	38.1 ± 17.4 (8)	69.6 ± 12.9 (13)
	1-4	90.1 ± 0.8 (1497)	77.4 ± 4.5 (88) **	93.1 ± 1.9 (190)
	5-9	86.0 ± 1.2 (804)	82.8 ± 4.2 (81)	73.2 ± 4.9 (82) *
	10-14	73.4 ± 2.1 (453)	73.6 ± 6.3 (49)	73.8 ± 7.2 (38)
	120-Mo RS			
	0-14	81.4 ± 0.7	71.9 ± 3.0**	82.5 ± 2.1
	0	49.7 ± 5.2	38.1 ± 17.4	61.0 ± 13.9
	1-4	87.2 ± 0.9	75.2 ± 4.6*	90.8 ± 2.2
	5-9	81.1 ± 1.4	75.3 ± 4.8	70.8 ± 5.0
	10-14	69.4 ± 2.2	65.6 ± 6.9	73.8 ± 7.2
01-10	60-Mo RS			
	0-14	88.9 ± 0.5 (5777)	86.1 ± 1.7 (527)	87.9 ± 1.5 (616)
	0	57.1 ± 4.2 (178)	44.6 ± 10.9 (26)	55.2 ± 10.9 (25)
	1-4	92.7 ± 0.6 (2985)	90.4 ± 2.2 (226)	93.5 ± 1.7 (307)
	5-9	91.0 ± 0.8 (1583)	91.6 ± 2.6 (146)	87.4 ± 2.9 (180)
	10-14	80.3 ± 1.4 (1031)	80.7 ± 4.2 (129)	80.8 ± 4.5 (104)
	120-Mo RS			
	0-14	85.7 ± 0.8	85.1 ± 1.9	82.9 ± 2.3
	0	55.7 ± 4.3	44.6 ± 10.9	55.2 ± 10.9
	1-4	91.6 ± 0.7	89.1 ± 2.6	91.4 ± 2.7
	5-9	86.1 ± 1.9	91.6 ± 2.6	80.1 ± 4.8
	10-14	75.0 ± 1.9	78.9 ± 4.5	71.5 ± 6.0

Abbreviations: Mo, month; RS, relative survival; SEM, standard error of the mean.
*$p < 0.01$, **$p < 0.001$, and ***$p < 0.0001$ for comparisons with the White group.