# Impact of Chemotherapy and Demographic Factors on Survival in Adult (21-64-Year-Old) with Acute Lymphoblastic Leukemia: A SEER Database 10-Year Cohort Study

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## Background [1-4]

- Acute lymphoblastic leukemia (ALL) is a rare blood and bone marrow cancer characterized by uncontrolled growth of immature lymphoid cells. (1-2)
- Incidence and outcomes vary by age, sex, and race, with higher risks reported in males and White populations. (2)
- Chemotherapy is key treatment, administered in induction, consolidation, and maintenance phases over 2.5–3 years. (3)
- While pediatric patients have a 90% five-year survival rate, adults often experience less favorable outcomes (4).

- **Study Objective:** To assess the 10-year survival probability and examine how chemotherapy, age, sex, and race affect survival in adults with ALL.

## Methodology

- **Study Design:** Prospective cohort study using SEER (2012–2021) and U.S. Mortality data (2000–2021).
- **Population:** Adults aged 21–59 diagnosed with acute lymphoblastic leukemia (ALL).
- **Variables:** Age, sex, race, chemotherapy status, survival time, and all-cause mortality.
- **Exclusion Criteria:** Patients under 20 or aged 60 and above were excluded.
- **Analysis:** Kaplan-Meier survival curves and adjusted Cox regression models using SAS 9.4.

## R E S U L T S

### Table 1: Demographics of U.S. Adults with ALL by Chemotherapy Status

| Characteristics n (%) | Total | Non-Chemo | Chemo | p |
|---|---|---|---|---|
| **Total** | 4256 | 244 (5.73) | 4012 (94.27) | |
| **Age** | - | - | - | 0.000 |
| **20-29** | 1181 (27.75) | 57 (4.83) | 1124 (95.17) | |
| **30-39** | 955(22.44) | 47 (4.92) | 908 (95.08) | |
| **40-49** | 925 (21.73) | 43 (4.65) | 882 (91.35) | |
| **50-59** | 1195 (28.08) | 97 (8.12) | 1098 (91.88) | |
| **Sex** | - | - | - | 0.917 |
| **Female** | 1783 (41.89) | 103 (5.78) | 1680 (94.22) | |
| **Male** | 2473 (58.11) | 141 (5.70) | 2332 (94.30) | |
| **Race** | - | - | - | 0.005 |
| **American Indian** | 72 (1.62) | 6 (8.33) | 66 (91.67) | |
| **Asian/ Pacific Islander** | 420 (9.87) | 23 (5.48) | 397 (94.52) | |
| **Black** | 334 (7.85) | 33 (9.88) | 301 (90.12) | |
| **White** | 3430 (80.59) | 182 (5.31) | 3248 (94.69) | |

### Table 2: All-cause mortality in US adults with ALL from 2012-2021

| Characteristics n (%) | Total | Alive | Dead | p |
|---|---|---|---|---|
| **Total** | 4256 | 4012 (94.27) | 244 (5.73) | |
| **Chemotherapy** | - | - | - | <0.001 |
| **No** | 244 (5.73) | 97 (39.75) | 147 (60.25) | |
| **Yes** | 4012 (94.27) | 2438 (60.77) | 1574 (39.23) | |
| **Age** | - | - | - | <0.001 |
| **20-29** | 1187 (27.75) | 816 (69.09) | 365 (30.91) | |
| **30-39** | 955 (22.44) | 607 (63.56) | 348 (36.44) | |
| **40-49** | 925 (21.73) | 524 (56.65) | 401 (43.35) | |
| **50-59** | 1195 (28.08) | 588 (49.21) | 607 (50.79) | |
| **Sex** | - | - | - | 0.899 |
| **Female** | 1783 (41.89) | 1064 (59.67) | 719 (40.33) | |
| **Male** | 2473 (58.11) | 1471 (59.48) | 1002 (40.52) | |
| **Race** | - | - | - | 0.001 |
| **American Indian** | 72 (1.69) | 41 (56.94) | 31 (43.06) | |
| **Asian/ Pacific Islander** | 420 (9.87) | 279 (66.43) | 141 (33.57) | |
| **Black** | 334 (7.85) | 173 (51.80) | 161 (48.20) | |
| **White** | 3430 (80.59) | 2042 (59.53) | 1388 (40.47) | |

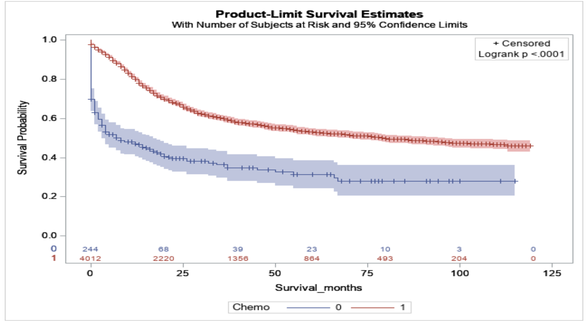
### Table 3: Adjusted Cox Hazard Ratios for Survival by Patient Characteristics

| Characteristics n (%) | Adjusted HR | 95% CI (Profile) | p |
|---|---|---|---|
| **Chemotherapy** | | | |
| **No** | ref | ref | ref |
| **Yes** | 0.383 | (0.323–0.454) | <0.0001 |
| **Age** | | | |
| **20-29** | ref | ref | ref |
| **30-39** | 1.293 | (1.126–1.484) | 0.000 |
| **40-49** | 1.542 | (1.350–1.761) | <0.0001 |
| **50-59** | 1.972 | (1.561–2.276) | <0.0001 |
| **Sex** | | | |
| **Female** | ref | ref | ref |
| **Male** | 1.077 | (0.929–1.252) | 0.134 |
| **Race** | | | |
| **American Indian** | 1.021 | (0.715–1.459) | 0.907 |
| **Asian/ Pacific Islander** | 0.772 | (0.649–0.919) | 0.003 |
| **Black** | 1.133 | (0.961–1.335) | 0.137 |
| **White** | ref | ref | ref |

## Discussion

- **Chemotherapy Effect:** Patients receiving chemotherapy had significantly lower mortality (aHR = 0.383, $p < 0.0001$).
- **Age Impact:** Mortality risk increased with age, highest in the 50–59 group (aHR = 1.972, $p < 0.0001$).
- **Sex Differences:** No significant difference in survival between males and females ($p = 0.134$).
- **Racial Variation:** Asian/Pacific Islanders had better survival (aHR = 0.772, $p = 0.0035$); no difference for Black or AI/AN patients.
- **Conclusion:** Chemotherapy significantly improves survival in adult ALL patients, with age and race influencing outcomes.

### Figure 1: Kaplan-Meier Survival Probability Analysis for Chemotherapy in ALL Patients

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