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Outcome disparities by insurance type for patients with acute myeloblastic leukemia☆

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ABSTRACT

Survival for patients with acute myeloblastic leukemia (AML) has increased during the past two decades. However, socioeconomic disparities may affect survival for some patient populations. We examine survival by insurance type for patients with AML. Using data from the Surveillance, Epidemiology, and End Results database we estimated survival according to insurance status (no insurance, Medicaid, and other insurance) for patients diagnosed with AML in the United States in 2007–2013. One, 3-, and 5-year survival was lower for patients with no insurance and Medicaid than for patients with other insurance. Five-year survival estimates were 24.7%, 25.6%, and 35.7%, respectively, for patients with Medicaid, no insurance, and other insurance. After adjustment, hazard ratios of 1.46 for uninsured and 1.35 for Medicaid compared to other insurance for overall survival and 1.50 for uninsured and 1.30 for Medicaid compared to other insurance for AML-specific survival were observed. Similar results were seen in all ages and both genders. Patients with no insurance or Medicaid have lower survival expectations after diagnosis with AML than patients with other insurance. Further research into reasons for the poor outcomes for Medicaid patients and continued reduction of number of uninsured people are urgently needed to improve population-level outcomes for AML.

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1. Introduction

Acute myeloblastic leukemia (AML) is a life threatening, but potentially curable condition. Cure is only possible with induction chemotherapy at diagnosis and intensive consolidation with chemotherapy or hematopoietic stem cell transplant after remission is induced. Patients who have delays in their treatment or do not receive standard of care treatment have very compromised survival. Overall, survival has improved for patients with AML in the 21st century as compared to earlier time periods [1,2]. However, it is not clear that all patients have benefited equally from advances in care [3,4]. In addition, survival for younger patients with AML in the United States (US) is lower than that observed in a number of other industrialized countries [5–7].

Lack of insurance or suboptimal insurance is a potential risk factor for delays in the diagnosis and treatment of cancer [8,9]. Some prior studies of AML have suggested that being uninsured or having Medicaid only may be a risk factor for poorer survival [10]. However, others have found no difference in survival for patients without insurance or with Medicaid only [11,12].

Prior studies on this issue have been limited to single institutions or to population databases in small areas. Recently, the SEER data set began including insurance type as a collected variable, allowing survival by insurance type to be examined on the population level in the US overall for the first time. Here, we examine survival for patients diagnosed with AML in the US by insurance type.

2. Methods

Data were extracted from the SEER18 database. The SEER18 database includes data from 18 regional cancer registries throughout the US. Registries are chosen for their high quality and epidemiologically significant populations. Together, the SEER registries draw on a base population of about 86 million people (28% of the total US population) [13]. The population within the SEER

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registry is similar to the general US population in most respects, although there is deliberate oversampling of some minority ethnic groups and a higher proportion of foreign-born persons than in the general US population [13]. In addition, it has been suggested that outcomes may be slightly better in the SEER registries than in the general population [14]. Patients with a diagnosis of AML, selected by ICD-O-3 histologic codes as noted in Supplemental Table 1, were included in the analysis. Cases reported by death certificate only (DCO) were not included as survival times could not be estimated for these cases.

Complete analysis was used to determine 1-, 3-, and 5-year survival for patients with AML by insurance status as described below. In addition, the Kaplan-Meier approach was applied to estimate survival curves.

Patients were categorized according to their insurance type including no insurance, Medicaid, other insurance including Medicare and private insurance, and information missing. According to the coding in the SEER database, insurance type was recorded at the time of initial diagnosis or treatment of the condition. Patients without insurance or who were "self-pay" were coded as "no insurance". Patients with Medicaid, Medicaid Health Maintenance Organization, or Indian Health Services insurance were coded as "Medicaid". Patients with private insurance, Medicare, any combination of Medicare plus supplemental insurance, or Veterans Affairs or military insurance was coded as "other insurance." Patients who were coded as "insured-no specifics" were included in the "other insurance" category. Because the majority of patients age 65 and over will be eligible for Medicare and therefore the rate of uninsured patients of the over age 65 is extremely small, survival was evaluated for ages 15–64 only. Survival within up to 5 years from diagnosis was estimated for patients aged 15–64 years diagnosed in 2007–2013 and followed with respect to vital status until the end of 2013. Age specific and age standardized survival was estimated for point estimates of survival. Age standardization was performed according to the International Cancer Survival Standard [15] using three age groups (15–44, 45–54, and 55–64 years).

Because age, race, marital status, income, and gender can affect the prognosis in patients with AML, a hazards analysis was used to estimate the effect of insurance on overall and AML-specific survival after correcting for these variables. Individual income is not available in the SEER database, so income was estimated using county level income, using the US Census Fact Finder tool [16], and income quintiles were derived. A shared frailty model with log-normal distributed frailty was used rather than the standard Cox proportional hazard model in order to account for the possibility of clustering. In AML-specific survival, death from AML was counted as an event, while death from any other cause was counted as censoring.

Certain subtypes of AML have a specific known prognosis which is different from that of the standard patient. For example, patients with acute promyelocytic leukemia (APL) have both a better prognosis and different treatment options as compared to patients with other forms of AML [17]. Conversely, patients with myelodysplastic syndrome prior to the diagnosis of AML have a worse prognosis than patients with de novo AML. Because of this, a sensitivity analysis in which specific subtypes of AML with known better or worse prognoses were excluded, leaving, as far as possible, only "average prognosis" AML was performed to reduce the risk that any observed differences in survival were due to differences in AML subtype. Specifically, patients with APL, 11q23, multilineage dysplasia, Down syndrome related AML, and therapy related were excluded from the analysis and all other AML subtypes were included in the analysis (Supplementary Table 1).

Initial survival of patients with AML will be strongly affected by the receipt of appropriate induction and consolidation treatment, whereas longer term survival in patients who survive the first year after diagnosis may be influenced more by appropriate treatment to prevent relapse (i.e. hematopoietic stem cell transplant for appropriate subtypes of AML), late complications of treatment, effective treatment of relapse, and comorbid conditions. Therefore, we performed a conditional analysis in which 5-year survival conditional on survival for at least one year after diagnosis was evaluated.

All calculations were carried out using SAS software (version 9.4, Carey, North Carolina, USA). Macros developed for population-based survival analysis [18] were used to estimate survival at one to five years after diagnosis. Cox proportional hazard models were estimated using standard SAS procedures. Statistical significance was tested two-sided with $\alpha = 0.05$ and no multiple comparison corrections. Differences in survival between patients with different insurance types were tested for statistical significance using model-based period analysis [19]. In model-based period analysis, numbers of deaths were modeled as a function of period of follow-up, age group, and country by Poisson regression with the logarithm of person-months at risk.

3. Results

A total of 10,690 patients diagnosed with AML at age 15–64 were identified for analysis. Of these, 619 (6.0%) were uninsured and 2033 (19.6%) were insured with Medicaid only. Insurance information was missing for 317 patients (3.0%). Younger patients (15–44) were more likely to be uninsured or insured with Medicaid only. There were slightly fewer women than men diagnosed and men were slightly more likely to be uninsured (6.7% for men versus 5.2% for women). Conversely, women were slightly more likely to be insured with Medicaid, at 18.8% for men, 20.5% for women (Table 1).

Overall, patients with AML with Medicaid or without insurance had lower 1-, 3-, and 5-year survival expectations than those with other insurance (Table 2). Age adjusted survival estimates for 1-year survival were 48.7% for Medicaid, 46.0% for uninsured patients, and 58.9% for patients with other insurance. Similar trends were observed for longer term survival, with 5-year survival estimates of 24.7% for Medicaid, 25.6% for uninsured, and 35.7% for other insurance. When survival was examined by gender, women had slightly higher survival estimates compared to men and the differences in survival between insurance types were most often greater for men. For example, the difference in 5-year survival between Medicaid and uninsured versus other insurance was +8.7% units and +9.2% units, respectively, for women and +13.6% units and +9.8% units, respectively, for men.

In order to examine the effects of later mortality on survival, 5-year survival conditional on survival for 1-year after diagnosis was examined. Point estimates of 5-year conditional survival were higher for patients with insurance other than Medicaid for all ages and both genders. However, the differences were significant only for Medicaid versus other insurance and neither difference was significant for women (Table 2).

Because racial and ethnic minorities are more likely to be uninsured or have Medicaid only as insurance, an analysis was performed examining survival for non-Hispanic white patients only. Case numbers were too small to permit examination of survival for any other racial or ethnic group individually. When survival for only non-Hispanic white patients was examined, a similar pattern was observed to the overall survival (Supplementary Table 2), although the point estimates were slightly higher and the differences between Medicaid or uninsured patients and patients with other insurance were, in general, greater. Because case numbers were smaller, some differences were no longer statistically significant.

Kaplan-Meier curves for absolute survival for up to 60 months after diagnosis showed similar results with survival being markedly