

# Effect of Type of Health Insurance Coverage on Leukemia Survival in Adults in Puerto Rico

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**Objective:** In Puerto Rico, leukemia is among the top 10 cancers in terms of incidence and mortality. The aim of the study described herein was to establish the overall leukemia survival rate in Puerto Rico and determine whether there are differences in leukemia survival by type of health insurance coverage.

**Methods:** Data for adult patients (aged  $\geq 20$  years) diagnosed with leukemia were provided by the Puerto Rico Central Cancer Registry. The relative survival rates (1, 3, and 5 years) were estimated for leukemia patients (diagnosed from 2004 through 2006) by type of health insurance (government health plan [GHP] or non-government health plan [NGHP]). Relative survival is defined as observed survival in the cohort divided by expected survival in the cohort. A Poisson regression model was used to analyze the relative excess risk of death for both the GHP and the NGHP groups.

**Results:** A total of 516 leukemia patients were eligible for analysis. The overall survival rates of leukemia patients in PR for 1, 3, and 5 years after diagnosis were 55.8%, 40.5%, and 34.7%, respectively. Relative survival rates were lower for patients with GHP (1 year = 52.8%; 3 years = 36.4%; 5 years = 32.2%) than they were in people with NGHP (1 year = 57.5%; 3 years = 42.8%; 5 years = 36.1%). Among patients aged 65+ years, those with GHP had a 1.58-fold (95% CI: 1.11-2.27) higher risk of death than did those patients with NGHP.

**Conclusion:** Several factors could explain the disparities observed in leukemia survival rates (as grouped by health insurance status) in PR. Some of them include differences in patterns of healthcare coverage, in delays in treatment, in quality of service, in risk factors, and co-morbidities present in the older population studied. [*PR Health Sci J* 2014;33:132-135]

*Key words:* Healthcare, Leukemia, Survival, Cancer, Disparities

Leukemias are a heterogeneous group of hematologic malignancies characterized by abnormal blood counts and increased tendencies for bleeding and developing infection. The most common types of leukemia are acute lymphocytic leukemia, acute myeloid leukemia, chronic lymphocytic leukemia, and chronic myeloid leukemia (1). Leukemia is among the top 10 cancers in incidence and mortality in Puerto Rico (PR) (2). Worldwide, leukemia is the 11th most common cause of cancer, with 352,000 new cases diagnosed globally in 2012 (3).

Studies have documented a relationship between cancer survival and socioeconomic status, stage of disease at diagnosis, and access to optimal treatment (4, 5). Another study concluded that access to health insurance influences the amount and quality of healthcare received and that the survival rates of multiple cancers were greater for those who were privately insured than they were for uninsured patients, a disparity that can possibly be attributed to the likelihood that uninsured patients receive less screening and/or therapy than insured patients do (6). These studies evidence disparities in cancer care and confirm the necessity of making quality care accessible to everyone.

In the 90s, the government of PR implemented a healthcare reform (HCR) through the privatization of the public health system (7). The government healthcare program (GHP) of PR, available for medically indigent citizens, covers approximately 40% of the Puerto Rican population (8). The goals of the HCR were to ensure access to healthcare services, eliminate disparities for medically indigent citizens, and provide special coverage for high-risk conditions, such as cancer. Thus, an evaluation of

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*The authors have no conflicts of interest to disclose.*

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the effect of the disparities in healthcare access between GHP and non-GHP (NGHP) populations on cancer survival in PR is needed.

This study aimed to describe the overall leukemia survival rate of adult leukemia patients in PR and determine the differences in leukemia cancer survival between adults with GHP and those with NGHP.

### Materials and Methods

The study population included adult leukemia patients (aged ≥20 years) living in PR who were diagnosed from 2004 through 2006; the data are from the Puerto Rico Central Cancer Registry (PRCCR). Variables analyzed included age at diagnosis, sex, type of leukemia (acute myeloid, acute lymphoblastic, chronic myeloid, chronic lymphoblastic, other), and type of health insurance (GHP or NGHP). A Chi-squared test (p-value<0.05) was used to assess associations between categorical variables of interest and type of health insurance.

One-, three-, and five-year maximum relative survival rates were calculated using the cohort method and a maximum-likelihood algorithm in the statistical software Stata/SE version 11.2 (StataCorp LP, College Station, TX). Relative survival rate is the method most commonly used in population-based cancer-survival studies (9). Relative survival rates were estimated as the ratio of the observed to the expected survival rates. Expected survival represents the survival of the general population being of the same age and sex and in the same calendar year (9, 10). We estimated expected survival based on data from the PR population life table, stratified by age, sex, and calendar time (11). A Poisson regression model using the command “strs” in Stata 11.2 was used to analyze the relative excess risks of death in the GHP and NGHP groups (9). IRB approval was obtained for these analyses.

### Results

A total of 516 adults with leukemia were eligible for analysis. The median age of diagnosis for these patients was 65 years. The minimum age at diagnosis was 20 years and the maximum age at diagnosis was 95 years. In the bivariate analysis, differences between GHP and NGHP leukemia cases were observed by age group (p<0.001) and type of leukemia (p<0.05). A marginally significant difference was observed by sex (p = 0.06) (Table 1).

Table 2 shows that the overall survival rates of leukemia patients in PR 1, 3, and 5 years after diagnosis were 55.76%, 40.46%, and 34.67%, respectively. Relative survival rates were lower in GHP patients (1 year = 52.77%; 3 years = 36.40%;

5 years = 32.18%) than they were in NGHP patients (1 year = 57.47%; 3 years = 42.79%; 5 years = 36.06%). Differences in survival rates were also observed when age and type of leukemia were taken into consideration (Table 2). The likelihood-ratio test showed a significant interaction between the main predictor variable (health insurance-coverage type) and the covariate age group at diagnosis (p<0.05). Thus, the Poisson model was stratified by age-group. Results show that the risk of death for patients with GHP was approximately 1.6 times greater than the risk for NGHP patients aged 65+ years, after adjusting for sex and type of leukemia (Figure 1). No significant differences were observed among patients who were under 65 years of age.

### Conclusions

Our study is the first to describe leukemia survival rates for adult patients in PR overall and by health insurance coverage. Results show that the 1-, 3-, and 5-year relative survival rates of leukemia in PR varied specifically by age, type of leukemia, and type of health insurance coverage. The results for age and type of leukemia were expected and were consistent with SEER data for the US, where increased survival is also observed among younger patients and those with one or more types of chronic leukemia (12, 13, 14). Comparisons between patients in PR and those in the US regarding leukemia survival need to be interpreted with caution, given differences in the time periods and in the age groups included for analysis. In a SEER study of acute leukemia that was done in the US (2003-2008), the 5-year survival rate for US patients aged 15 years or older who had been diagnosed with acute myeloid leukemia was 22.5%

**Table 1.** Characteristics of adult leukemia patients living in Puerto Rico, by type of health insurance coverage (2004–2006).

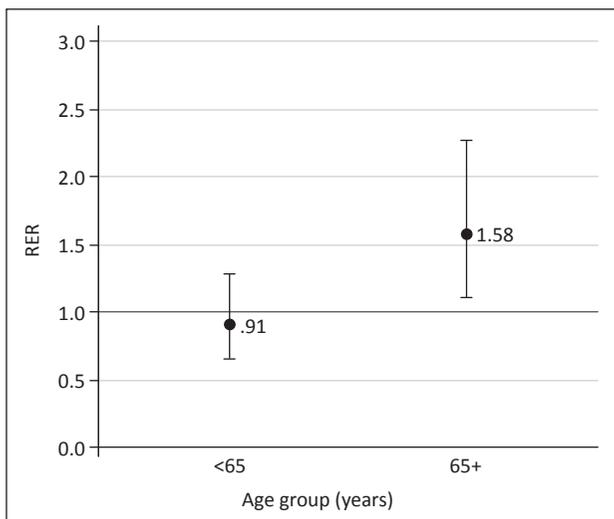
Variable	Government Health Plan, N (%)	Non-Government Health Plan, N (%)	Total, N (%)	p-value
All	186 (36.0)	330 (64.0)	516	
Age at Dx (years)				
20-64	122 (65.6)	136 (41.2)	258 (50.0)	<0.001*
65+	64 (34.4)	194 (58.8)	258 (50.0)	
Gender				
Male	101 (54.3)	207 (62.7)	308 (59.7)	0.061‡
Female	85 (45.7)	123 (37.3)	208 (40.3)	
Type of Leukemia				
Acute Lymphoblastic	20 (10.8)	17 (5.2)	37 (7.2)	0.007*
Chronic Myeloid	24 (12.9)	38 (11.5)	62 (12.0)	
Chronic Lymphoblastic	27 (14.5)	77 (23.3)	104 (20.2)	
Acute Myeloid	67 (36.0)	92 (27.9)	159 (30.8)	
Other	48 (25.8)	106 (32.1)	154 (29.8)	

\*χ<sup>2</sup> Test significant at p<0.05; ‡Marginally significant

**Table 2.** Relative survival (1, 3, and 5 years)\* of adult leukemia patients in Puerto Rico (2004–2006).

Variable	1-year survival (95% CI)	3-year survival (95% CI)	5-year survival (95% CI)
Overall	55.76 (51.22, 60.08)	40.46 (35.93, 44.98)	34.67 (30.18, 39.25)
<i>Health Insurance</i>			
Government Health Plan	52.77 (45.20, 59.83)	36.40 (29.27, 43.63)	32.18 (25.23, 39.41)
Non-Government Health Plan	57.47 (51.74, 62.83)	42.79 (36.98, 48.55)	36.06 (30.29, 41.97)
<i>Sex</i>			
Male	54.34 (48.39, 59.96)	38.70 (32.83, 44.63)	33.82 (27.93, 39.92)
Female	57.83 (50.68, 64.37)	42.96 (35.90, 49.88)	35.92 (29.09, 42.87)
<i>Age at Dx (years)</i>			
20-64	62.40 (56.14, 68.04)	47.81 (41.50, 53.87)	41.72 (35.51, 47.85)
65+	48.79 (42.25, 55.08)	32.50 (26.24, 39.05)	26.89 (20.69, 33.69)
<i>Type of Leukemia</i>			
Acute Lymphoblastic	43.78 (27.53, 59.01)	19.70 (8.67, 34.14)	20.48 (9.02, 35.49)
Chronic Myeloid	76.51 (63.30, 85.92)	63.32 (48.89, 75.44)	52.21 (37.63, 65.84)
Chronic Lymphoblastic	91.19 (82.80, 96.44)	75.86 (64.69, 84.99)	63.39 (51.19, 74.47)
Acute Myeloid	41.26 (33.43, 48.95)	24.51 (17.95, 31.68)	21.61 (15.35, 28.63)
Other	41.68 (3.64, 49.57)	29.49 (22.17, 37.26)	25.53 (18.50, 33.25)

\*Relative survival and 95% confidence intervals are given as percentages.



**Figure 1.** Relative excess risk (RER) of death for adult leukemia patients with GHP compared to NGHP in Puerto Rico from 2004 to 2006. RER was estimated by Poisson regression. Patients were followed until December 31, 2011; model was adjusted by sex, length of follow up, and type of leukemia.

(12). While, our study showed that the 5-year survival rate for PR patients who had been diagnosed with acute myeloid leukemia was 21.61%. Nonetheless, for acute lymphoblastic leukemia, a 5-year survival rate of 39.0% was observed in the US, which contrasts with the lower 20.48% that was found in PR during the period evaluated (2004-2006) (12). Furthermore, according to the SEER data (2003-2009), the 5-year survival rate for leukemia patients aged 65+ years was 43.1% in the US (13), which is much higher than that of leukemia patients in PR (26.9%) during the study period (2004-2006). Given that US data have shown disparities between NHW and

other racial/ethnic minorities in terms of leukemia survival rates (12, 13), future studies should further evaluate the potential disparities in leukemia survival rates between patients in PR and those in the US.

Our results also showed that leukemia patients, aged 65+ years and with GHP, had a higher risk of death than did patients with NGHP and who were in the same age group. This result highlights the presence of a cancer disparity by type of health insurance coverage in this age group, which warrants further research. Several factors could

explain this disparity, including differences in healthcare coverage; delays in treatment; quality of service; risk factors, and co-morbidities, which are present in these older populations. These results support McDavid's report that some disparities exist with relation to cancer survival and type of health insurance (6).

Nonetheless, this study has several limitations, as variables of interest, such as socioeconomic status, biomarkers (cytogenetics), treatment type, co-morbidities, and other prognostic factors, which may affect leukemia survival, could not be accessed and should be evaluated in future studies. Moreover, we were unable to determine the proportion of the NGHP group without insurance. This could lead to an underestimation of the survival rates for the NGHP patients. Future studies, including those looking at cytogenetic profiles, biomarkers, and types of treatment, should be implemented in order to further evaluate the observed association between type of health insurance and survival in the members of this age-group and try to elucidate why this pattern was not observed in the members of the younger cohorts. Despite these limitations, this study is a first step in evaluating both the disparities in leukemia survival in PR and the interplay of the barriers that affect the health outcomes of the population. In addition to clinical factors, it is evident that health insurance coverage and other socioeconomic factors, as well as the structure of the healthcare system, play an important role in the survival of leukemia patients, mainly in those who are 65 years of age and older. Although GHP cancer patients have special coverage that facilitates the effective management of their cancer, the poor coordination and fragmentation of the services could be impacting the survival of these patients. In addition, older GHP patients may have be affected by other factors (e.g., co-morbidities, geographical challenges)

that limit their access to healthcare services. Thus, future research studies and interventions should further evaluate these barriers in order to have an impact on the survival of this population and decrease disparities.

## Resumen

**Objetivo:** La leucemia es uno de los principales diez tipos de cáncer más comunes en incidencia y mortalidad en Puerto Rico. Este estudio tuvo como objetivo estimar la tasa de supervivencia de leucemia en Puerto Rico y determinar si existe una diferencia entre la supervivencia de leucemia por tipo de seguro médico. **Métodos:** Los datos de los pacientes adultos ( $\geq 20$  años de edad) diagnosticados con leucemia fueron provistos por el Registro Central de Cáncer de Puerto Rico. La tasa relativa de supervivencia (1, 3 y 5 años) fue estimada para adultos con leucemia (diagnosticados entre 2004 y 2006), por tipo de seguro médico (pacientes con el plan médico gubernamental y pacientes que podrían tener otro tipo de cubierta). La tasa de supervivencia relativa es definida como la supervivencia observada en el cohorte dividida por la supervivencia esperada en el cohorte. Se utilizó una regresión Poisson para analizar si existía un exceso en el riesgo relativo entre las muertes de las personas en plan médico gubernamental y las del plan médico no gubernamental. **Resultados:** Un total de 516 pacientes de leucemia fueron elegibles para el estudio. La supervivencia general para los pacientes de leucemia en Puerto Rico, luego de 1, 3 y 5 años de diagnóstico, fue de 55.8%, 40.5% y 34.7% respectivamente. La supervivencia relativa fue menor en los pacientes de leucemia que tenían el plan médico gubernamental (1 año = 52.8%; 3 años = 36.4%; 5 años = 32.2%) que en los pacientes del plan médico no gubernamental (1 año = 57.5%; 3 años = 42.8%; 5 años = 36.1%). Entre los pacientes mayores de 65 años, aquellos con el plan médico gubernamental tuvieron un riesgo de hasta 1.58 (IC 95%: 1.11-2.27) veces más alto comparado con los pacientes sin esta cubierta. **Conclusión:** Varios factores pudieran explicar esta inequidad observada por tipo de seguro médico en PR, incluyendo las diferencias en el patrón de cobertura de los planes médicos a través de Puerto Rico, al igual que las diferencias en el momento que el paciente recibe el tratamiento, en la calidad de los servicios, en los factores de riesgos y las co-morbilidades en esta población.

## Acknowledgments

This study was funded by the National Program of Cancer Registries of the Center for Disease Control and Prevention (CDC) (Grant #5U58DP003863-02).

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