**Project Title:** Cost-Related Nonadherence and Mortality in Patients with High-Cost Cancers

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**Background:**

In aggregate, cancer is the second leading cause of death in the United States (U.S.), killing nearly 600,000 individuals in 2017,1 and is among the most expensive conditions to treat. In 2013, the U.S. spent over $115 billion in cancer care, approximately one-eighth of which (~$14.4 billion) came from pharmaceutical expenditures.2 As both overall survival and treatment costs have continued to rise, so too have total expenditures, with the U.S. projected to spend nearly $170 billion on cancer care in 2020.3 The five cancers that account for the greatest proportion of these costs are breast, prostate, lung, and colorectal cancer, and lymphoma (note, however, that these figures are a function of both prevalence and individual treatment costs; per capita, bladder cancer is the most expensive to treat).3 Although not all of these costs are borne by patients themselves, individuals undergoing cancer treatment pay a higher proportion of medical expenses out of pocket than do patients with other chronic illnesses, especially if they are uninsured or enrolled in high-deductible health plans.4

While increasing costs can represent therapeutic innovation and, along with it, better long-term prognoses, many patients face significant financial burden in affording essential treatments.5 For instance, cancer survivors are more likely to report high levels of medical debt or personal bankruptcy6 and delaying or not filling prescriptions due to costs (collectively referred to as cost-related nonadherence, CRN)7 than individuals without a cancer diagnosis. Cancer patients who experience financial hardship are more likely to delay or forgo needed medical care than those without financial strain,8 which some have speculated may increase the risk of future complications, disease progression, and mortality.9

**Objectives:**

The objectives of this study are to: 1) determine the prevalence of CRN in patients with lung, breast, colorectal, and prostate cancer or lymphoma 2) determine whether CRN is associated with lower cancer-specific survival for patients with lung, breast, colorectal, and prostate cancer or lymphoma.

**Approach:**

We will use the National Health Interview Survey (NHIS) for all analyses.10 Briefly, the NHIS is an annual, cross-sectional multistage probability sample drawn from all non-institutionalized adults living in the United States. In order to ensure adequate data on specific subpopulations, the NHIS oversamples residents from low-income and predominantly minority neighborhoods. The survey consists of two parts: a core questionnaire, including basic demographics and common health behaviors/risk factors (e.g. smoking, obesity), and supplemental questions, including specific diagnoses and healthcare access. Our analysis will focus on respondents who self-reported a diagnosis of lung, breast, colorectal, or prostate cancer or lymphoma in the past 10 years and were interviewed between 2000 (the first wave to introduce questions about CRN) and 2014 (the last wave for which mortality data is available).

The primary exposure will be CRN, defined as any affirmative response to the following questions: “[You] needed but could not afford prescription medications in the last 12 months?”, “[Due to cost, you] skipped medication doses?”, “[Due to cost, you] delayed taking medication doses?”, or “[Due to cost, you] did not fill prescriptions?” The primary outcome will be time to cancer death. We will also adjust for the potential confounders of sex, age, health insurance (none, Medicare, Medicaid, private, other), race/ethnicity (White, Black, Hispanic, other), and years since diagnosis.

We will first compare the baseline confounders and demographic characteristics between sample participants with and without CRN using design-weighted Chi-square and t-tests. To determine if CRN is associated with cancer mortality, we will use Cox proportional hazards regressions to model time to death as a function of CRN only (unadjusted model) and CRN adjusted for sex, age, race/ethnicity, health insurance, and years since diagnosis. We will run one set of models collapsing across cancer types and a second set stratified by cancer type (for breast-specific stratified models we will restrict analyses to females only because these should represent the vast majority of cases). As in descriptive statistics, Cox models will be weighted for survey design. For reproducibility, one of us (SVA) will obtain the NHIS data from the Institute for Public Use Microsamples (IPUMS) website and store it through the GitHub large file storage in a repository that all group members have access to. Two group members (SVA and EH) will be responsible for conducting all analyses in RStudio, version 1.2.5019,11 and will upload code periodically to a GitHub repository, where other potential users can access and rerun/double check each other’s analyses to ensure that all group members obtain the same results.

**References**

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8. Kent E, Forsythe L, Yabroff K, Weaver K, Rodriguez J, Rowland J. Are survivors who report cancer-related financial problems more likely to forgo or delay medical care? *Cancer*. 2013;119(20):3710-3717.

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11. R Studio Team. *RStudio: Integrated Development for R*. Boston, MA: RStudio, Inc.; 2019. http://www.rstudio.com/.

**Timeline:**

March 25, 2020 – April 5, 2020: Data Cleaning (e.g. downloading data, recoding variables)

April 6, 2020 – April 13, 2020: Analysis (e.g. descriptive statistics, Cox proportional hazards)

April 14, 2020 – April 22, 2020: Create presentation

Ongoing: Uploading code to GitHub, version control

**Roles:** SVA and EH will be responsible for data management, cleaning and analysis, KT and LG will be responsible for reporting results and creation of presentation.