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Abstract

Health equality is an important objective in public healthcare systems, and still, we see substantial socio-economic differences. Using high-quality administrative data from Upper Austria, we analyze the socio-economic gradient in mortality and healthcare utilization following a cancer diagnosis. High-SES patients are less likely to die after a cancer hospitalization even when accounting for a comprehensive set of controls, including detailed pre-shock healthcare use. After hospital discharge, patients navigate the healthcare system differently depending on their socio-economic status. We explore potential explanations for the observed SES gradient. Our findings suggest that low-SES cancer patients go to the hospital at a later stage of the disease. Peer groups also matter in explaining SES differences, while healthcare providers do not appear to contribute significantly to the gap. Targeted policies that take into account disease heterogeneity, health awareness, and prevention behavior have the potential to reduce health inequalities.

JEL Classification: I14, I12
Keywords: Health Inequality, SES, Mortality, Health Behavior, Cancer.

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1 Introduction

Understanding how socio-economic status shapes patients' health outcomes is crucial for addressing inequalities in healthcare systems. Many countries with various healthcare systems exhibit significant socio-economic inequalities in mortality and health outcomes (e.g., Devaux, 2015; Terraneo, 2015; Giatti and Barreto, 2006; Kruger and Tennant, 2016; Yong and Yang, 2021), healthcare utilization (e.g., Fiebig et al., 2021; Devaux, 2015; Doorslaer and Koolman, 2004) or health behaviors (Cutler and Lleras-Muney, 2010). A causal link of higher socio-economic status is challenging to establish. The definition of socio-economic status per se is complex because it often affects numerous aspects of individual lives, and is therefore only proxied by characteristics such as income or educational attainment. Hence, studies aiming at a causal effect can typically only focus on a very specific aspect of socio-economic status. In this context, most causal studies focus on educational attainment and show lower mortality and more beneficial health status and behavior (e.g., Lleras-Muney, 2005; Brunello et al., 2016; Buckles et al., 2016; Meghir et al., 2018; Masuda and Shigeoka, 2023; Barcellos et al., 2023; Gensowski and Gørtz, 2024).[1] These inequalities are not limited to health but also have long-term consequences on the labor market (Heinesen and Kolodziejczyk, 2013; Heinesen et al., 2018).[2] Hence, health equity is an important objective in public healthcare systems, and quantifying these inequalities and, in particular, understanding their determinants is therefore critical for improving health equity in our societies since not all inequalities are related to patient characteristics or healthcare providers (Bosque-Mercader et al., 2023).

This study aims to quantify the socio-economic gradient in mortality and healthcare utilization in a universal healthcare system and provide evidence for potential explanations. We focus primarily on patients' first cancer diagnosis, which (i) is typically unexpected, (ii) requires hospitalization, and (iii) involves an unexpected change in the need for health care. Focusing on negative health events also enables us to account for pre-shock healthcare utilization with a high level of detail. We leverage comprehensive administrative health register data for the population of Upper Austria. This data contains detailed information on (i) hospitalizations, diagnosis, length of stay, treatments within hospitals, and readmissions, and (ii) outpatient physician expenditures, drug expenditures, prescriptions, and screening behavior. This data can be linked to a matched employer-employee database, which provides us with individual characteristics and a high-quality measure of socio-economic status (SES).[3] Despite Austria's comprehensive Bismarckian-style uni-

[1]Eriksen et al. (2023) also provide very recent evidence for an intergenerational dimension of inequality.

[2]In the context of commuting accidents, Halla and Zweimüller (2013) find a negative impact of health shocks on labor market outcomes. The adverse employment effects are stronger for blue-collar workers than for white-collar workers.

[3]We measure an individual's socio-economic status based on the collar status of their employment, with white-collar jobs indicating higher socio-economic status and blue-collar jobs indicating lower socio-economic status. We demonstrate that collar status is highly correlated with both educational attainment

versal healthcare system, we still observe substantial differences in health outcomes and healthcare utilization.[4] As summarized in Figure 1, cancer patients with a high SES have a more than 19 percent lower length of stay at initial hospitalization and approximately 9 percent lower expenditures on healthcare services. Most strikingly, high-SES cancer patients have a 50 percent lower short-term mortality and more than 27 percent fewer drug prescriptions one year after initial diagnosis (conditional on survival). Consequently, we want to analyze and understand the drivers behind these substantial inequalities, occurring even in a rather egalitarian healthcare system, where income should—in principle—play a minimal role.

Conditional on experiencing an unanticipated change in the need for healthcare, we first demonstrate a pronounced SES gradient in the type of cancer diagnoses. High-SES patients are more likely to be diagnosed with cancer types associated with higher survival probabilities. Accounting for the exact cancer types reduces the gap in short-term mortality to 31 percent as compared to 50 percent for the raw difference. We then exploit the richness of our data and the fixing of our comparison around a first unexpected cancer diagnosis to equalize high- and low-SES patients regarding their individual characteristics such as age and gender, pre-shock healthcare utilization, and hospital fixed effects. While this adjustment significantly reduces socio-economic gaps in mortality and healthcare utilization, it cannot fully explain the observed SES gradients. During the patients' first hospitalization for cancer, we find that high-SES patients have a statistically significantly shorter length of stay and incur lower expenditures. However, we do not find differences between high- and low-SES patients in the number of services received, hospital departments visited, intensive care treatments, or specific treatments such as screenings. After hospital discharge, we find that the mortality gap between high- and low-SES patients is particularly pronounced in the short term up to 2 quarters after the initial diagnosis. However, the cumulative mortality gap between socio-economic groups remains relatively stable in the long run. Furthermore, patients navigate the healthcare system differently depending on their socio-economic status and reinforce their pre-shock behavioral patterns, which do not necessarily lead to worse health outcomes, as suggested by the stable long-term cumulative mortality gap. We then provide suggestive evidence for potential explanations that should help us to understand the observed SES differences. Our findings suggest that inequalities are particularly driven by behavioral differences, that is, low-SES cancer patients tend to seek hospital care at a later stage of the disease. Peer groups seem to matter in explaining SES differences as well, while we find no evidence that healthcare providers contribute significantly to socio-economic inequalities.

This study contributes to several strands of the literature. First, we contribute to the

and lifetime income, making it a good representation of a person's socio-economic status.

[4] Sortsø et al. (2017) also show significant differences in diabetes patients' healthcare utilization patterns by their socio-economic status within the Danish universal healthcare system. These differences are particularly pronounced for outpatient services, rehabilitation, and specialists in primary care.

body of research on socio-economic inequality in healthcare utilization and health behaviors. Several studies document socio-economic differences in inpatient care. For example, Moscelli et al. (2018) document waiting times differences in English hospitals between patients with different socio-economic statuses with inequalities increasing when average waiting times are high. Turner et al. (2022) investigate waiting times in emergency departments (EDs) and find that inequalities in waiting time are low, but that disadvantaged individuals receive less complex care, are admitted less frequently to inpatient care, and have a higher probability of re-attendance or mortality. Kruger and Tennant (2016) show that disadvantaged individuals are being hospitalized at significantly higher rates than other groups, staying in hospital for longer and at higher costs. Similarly Yong and Yang (2021) demonstrate that, among chronic disease patients in Australia, low-SES patients tend to have higher hospital spending and longer utilization by approximately 20 percent and higher incidence of in-hospital adverse outcomes by up to 80 percent compared to non-disadvantaged patients.

For the outpatient sector, Brekke et al. (2018) find that diabetes patients with low socio-economic status receive shorter consultations but visit their GP more frequently throughout the year, using administrative patient-level data from Norway. Nordin et al. (2013) find a positive education gradient in drug utilization, with highly educated individuals taking a larger number of drugs, where the gradient is stronger for more expensive drugs. Closely related to our empirical approach is Fiebig et al. (2021), who consider the response to a change in healthcare needs due to diabetes and heart disease. They show that utilization of primary care, specialist care, and emergency care responds to a change in healthcare needs. Low and high-income patients navigate the healthcare system differently following a diagnosis. Crego et al. (2022) estimate the causal effect of health shocks on medical expenses, mortality, and labor market outcomes and show substantial heterogeneity by socio-economic status in how individuals respond to the same type of health shock.

Second, more specifically we contribute to the literature documenting worse health outcomes and higher mortality for low-SES cancer patients. These inequalities appear to be consistent across countries and healthcare systems. Byers et al. (2008) use medical records data from the US and find that low socio-economic status is a risk factor for all-cause mortality following a cancer diagnosis, which can be attributed to a later stage at diagnosis and less aggressive treatments. Kumachev et al. (2016) show that higher socio-economic status is associated with more screening and treatments and with overall better survival once accounting for screening, cancer stage at diagnosis, and treatments. Thielen et al. (2015) document a significant association between education and breast cancer, which remains after controlling for cancer stage and comorbidities. Using Danish register data, Heinesen and Kolodziejczyk (2013) show long-run impacts of cancer and estimate the causal effects of breast and colorectal cancer on labor market outcomes 13 years after diagnosis, finding worse labor market outcomes, particularly for lower educated patients. This negative impact of cancer on employment is greater if the pre-cancer occupation requires a high level of manual skills or a low level of cognitive abilities (Heinesen et al., 2018). Consistently, Ahammer et al. (2024) also estimate a wage penalty for breast cancer patients in Austria, which is more pronounced for women at the tail of the wage distribution.

Finally, we extend the literature on potential explanations behind socio-economic inequality in healthcare utilization. Researchers have provided evidence on several aspects that seem to be relevant for driving inequality. Several studies point out that regional differences in access to healthcare services as well as neighborhood disadvantages matter (Atalay et al., 2023; Godøy and Huitfeldt, 2020; Hermes et al., 2022; Spitzer et al., 2022; Perelman and Closon, 2011; Quan et al., 2021; Elek et al., 2023; Hasager and Jørgensen, 2024). Additionally, (access to) information about provider quality (Brown et al., 2023), networking skills or consciousness of patient rights (Moscelli et al., 2018), exposure to health-related expertise, e.g., within the family (Chen et al., 2022), or socio-economic status concordance between doctors and patients (Kristiansen and Sheng, 2022) can significantly contribute to socio-economic inequalities, as well as healthcare providers and prescription behavior of physicians (Currie et al., 2024; Nordin et al., 2013; Badinski et al., 2023; Angerer et al., 2019).

We contribute to these lines of research by extending the evidence on socio-economic inequality in healthcare utilization across several dimensions. Specifically, we study socio-economic inequality in response to an unexpected change in healthcare demand, focusing on cancer patients. In this context, we offer additional insights from a country with universal healthcare, where income should theoretically play no role, as cancer treatments are fully covered by social insurance regardless of income. Most importantly, our comprehensive administrative data allow us to analyze socio-economic inequalities in both the inpatient and outpatient sectors for the identical population, allowing us to track patients for many years after the health shock while extensively controlling for pre-shock utilization patterns. Focusing on cancer patients where health behavior is of particular importance, we extend the literature by combining suggestive evidence on the role of patient selection and hospitals. To the best of our knowledge, we are among the first to discuss the role of peers in the workplace as a contributing factor to these inequalities.

The remainder of this paper is organized as follows. Section 2 provides important background information on the institutional setting and the data used in this study. Section 3 summarizes our empirical strategy and provides descriptive statistics of our sample. Section 4 presents our main findings, Section 5 summarizes findings on potential explanations behind inequality, while Section 6 concludes.

2 Institutional background and data

2.1 Institutional setting

Austria has a Bismarckian health care system characterized by compulsory health insurance. Employees and their dependents, pensioners, and unemployed are covered by the Austrian Health Insurance Fund.[5] Insured individuals have access to comprehensive public health services financed by wage-based social security contributions from employees and employers, taxes from the national and regional level, and small deductibles.[6] Insurance status and access to universal healthcare services neither change with unemployment nor retirement.

Outpatient care is provided by primary care physicians (GPs and pediatricians) and specialists. As gatekeepers, primary care physicians provide acute and preventive care, such as check-ups, prescribe medications, and refer patients to specialists and hospitals. Patients can also directly consult outpatient hospital departments in case of emergencies or during weekends and at night. These outpatient hospital departments have faced a significant increase in patient visits in recent years due to shortages and long waiting times in the outpatient sectors. Physicians get reimbursed by the social insurance funds dependent on their billed services based on a reimbursement catalog. Alternatively, physicians can provide services without a contract with a public insurance fund. These private physicians can charge for services at higher prices than reimbursed by the insurance fund. Given a restricted number of contracts, the number of these private physicians—mostly specialists—has increased substantially during the last few years.[7] Patients visiting these private physicians must pay for services immediately but are reimbursed by the public insurance fund up to a specified amount. Costs above this limit must be borne by the patients or through additional private insurance. The enormous increase in private physicians and private insurance makes access to high-quality care increasingly income-dependent, somewhat undermining the egalitarian nature of the access to outpatient healthcare services in Austria.

Hospital services are provided by public and private not-for-profit hospitals. Hospital services are reimbursed based on Diagnosis Related Groups (DRGs). Each hospital stay is divided into case groups that consider the severity of the illness and/or the financial

[5]Individuals are assigned to one of the public health insurance providers dependent on the employer and the location of its headquarters. Self-employed individuals, civil servants, workers in the railway and mining industries, and farmers are covered by their special social security institutions.

[6]The most important deductible is the prescription fee of 7.10 euros (in 2024). However, this deductible is capped at a maximum of two percent of the net annual income in total, and certain groups are fully exempted, such as individuals dependent on social benefits or with monthly net income of less than 1,218 euros for singles or 1,920 euros for couples (values for 2024).

[7]In Austria, the number of private specialists increased from 5,116 to 7,065 (38 percent) between 2009 and 2019. The number of private GPs increased from 2,095 to 2,972 (42 percent) over the same period (see Austrian Court of Audit).

burden associated with the diagnosis and the medical treatment required (Bachner et al., 2018).

2.2 Administrative data sources

To investigate socio-economic inequalities in mortality and healthcare utilization after a health shock, we combine the following administrative data sources: First, to obtain patient-level information on healthcare utilization, we use high-quality health register data from the *Upper Austrian Health Insurance Fund* (UAHIF) covering the period from 2005 to 2019. This data provides detailed information on inpatient hospitalizations, outpatient physician visits, and prescribed medications. Covering around 75 percent of the population, UAHIF insures more than one million individuals in Upper Austria, making it the largest statutory health insurance provider in the region.[8] Second, to obtain a credible and accurate indicator of patients' socioeconomic status, we use administrative data from the *Austrian Social Security Database* (ASSD), which is available from 1972 to 2019 (Zweimüller et al., 2009). The ASSD is a matched firm-employee dataset that contains individual-level labor market histories on a daily basis, earnings, collar status, and a range of demographic characteristics including date of death.

2.3 Socio-economic status

While most studies use educational attainment or income as a measure of socio-economic status, we measure a patient's socio-economic status by assessing their labor market position throughout their working life. Utilizing our high-quality labor market data, which spans from 1972 onward, we track each patient's employment history up to two years before their first cancer hospitalization. We define high SES as white-collar employment and low SES as blue-collar employment. White-collar workers are mainly employed in office settings (e.g., programmers, accountants), while blue-collar workers typically perform manual labor in non-office environments (e.g., on a construction site or assembly line). A patient is assigned to a specific socio-economic status based on how much of their working life they have spent in a particular position. If a patient spends the majority of their career in one category, they are assigned to the corresponding socio-economic status. In our context there are several advantages of assigning patients' SES based on collar status: First, we have only partial information on educational attainment and would need to rely on imputed education, particularly for older patients. Second, using collar status is a straightforward approach to classify socio-economic status and is less volatile over time compared to income, for example, due to seasonal work or unemployment episodes. Beyond income levels, collar status also captures aspects such as work environment, job

[8] Upper Austria has around 1.5 million inhabitants and accounts for around 16.7 percent of the Austrian population. It is the third largest of Austria's nine federal states (see Statistics Austria).

stability, access to social capital, and cultural norms influencing lifestyle, health behaviors, or access to resources. Thus, our definition of socio-economic status also reflects non-monetary aspects that extend beyond education or income. However, as a robustness check, we also present results using lifetime income position as an SES indicator in Section 4.

Figure A.1 in the Appendix illustrates various aspects of our socio-economic status calculation. Panel (a) shows the distribution of working years used to determine the SES status, with a mean of 22.53 years, ranging from one year to over 40 years. Panel (b) shows the same distributions by SES status. For patients with high SES, slightly more working years are used in the calculation, as indicated by a shift in the distribution. Since we assign SES based on the majority of work life spent in a particular position, Panel (c) illustrates the variation in the collar status. Approximately 28 percent of patients worked exclusively in white-collar jobs, around 46 percent exclusively in blue-collar jobs, and about 26 percent have worked in both categories over their careers. Panel (d) shows the same separately for our defined SES. It can be seen that patients classified as high-SES are more likely to have experienced both white-collar and blue-collar employment episodes.

To demonstrate that collar status is a good representation of a patient's socio-economic status and is comparable to other studies, Table 1 shows the relationship between our chosen SES measure and the patient's income and education levels. Panel A provides the raw association without any control variables. Panel B adjusts for patient demographics, such as sex, age at hospitalization, quarter-year of hospitalization, citizenship status, and whether the patient resides in an urban area. Column (1) presents the association between our high-SES measure (white collar) and the patients' average yearly income over their working lives. High-SES patients earn 6,034 euros more per year. Adjusting for patient demographics increases this association to 8,173 euros. Compared to the sample average for low-SES patients, this translates into 29 to 39 percent higher yearly income for high-SES patients. Columns (2) to (4) show the association between our high-SES measure and the patient's lifetime income position. To do this, we compute income quartiles for each year, conditional on the patient's sex and age. This measure is then averaged over the patient's working life. After rounding, we obtain the average income quartile (Q1 to Q4), which serves as a proxy for the patient's lifetime income position relative to the population. After adjusting for patient demographics (Panel B), we find that high-SES patients are, on average, in a 0.698 higher income quartile (Column 2), are 31 percentage points more likely to be above the median (Column 3), and are 30 percentage points more likely to be in the fourth (highest) income quartile (Column 4). Relative to the low-SES sample averages, these coefficients translate into increases of 29, 71, and 393 percent, respectively. Columns (5) and (6) show the association between our high-SES measure and the patients' education level. After adjusting for patient demographics (Panel B), high-

SES patients are 31 percentage points (or 69 percent) less likely to have only compulsory schooling as their highest level of education (Column 5), and are 16 percentage points (or 180 percent) more likely to have attained a university degree (Column 6).[9] Overall, our preferred indicator of patients' socio-economic status appears to be convincing, as it is strongly correlated with income, income position, and education.

2.4 Outcome variables

Mortality: We construct the mortality outcomes as indicator variables (0/1) for different time periods to capture the short and long term. In-hospital mortality is defined as having the hospital discharge "death" in the health register data. Mortality outcomes following the initial hospitalization are based on the date of death recorded by the ASSD. We measure longer-term mortality using five cumulative outcomes, namely death in the same quarter as the hospital discharge, within two, four, eight, and 16 quarters.

Initial Hospitalization: Using the health register data, we construct a series of outcome variables for the initial cancer hospitalization. First, we analyze the length of stay in days and the corresponding hospital spending in euros. Second, to get more information about the logistics of the hospital stay, we analyze the number of hospital departments the patient visited and whether the patient received any intensive care during the stay. Third, to evaluate how many and which treatments the patient received, we analyze the total number of individual hospital services and indicator variables for whether the patient received any diagnostics, chemotherapy, radiation therapy, or surgical operations. Individual service codes from the "Leistungsorientierte Krankenanstaltenfinanzierung" were used to classify the individual hospital services in these groups.[10] Fourth, as a proxy for hospital quality, we analyze whether the patient experienced rehospitalization with the same diagnosis within 30 days after discharge.[11]

First Contract with Healthcare System: To analyze the timing and characteristics of patients' first contact with the healthcare system following hospital discharge, we calculate the number of days it takes patients to receive their first medication prescriptions,

[9]It is important to note that the results on education are based on imputed education data and should, therefore be interpreted with caution.

[10]The following codes were used for classification. *Diagnostics*: Chapters 12.01. "Computertomographie," 12.02. "Magnetresonanzdiagnostik," 12.03. "Ergänzende Maßnahmen bei CT/MR Diagnostik," 12.04. "Katheteruntersuchungen," and a hand-selected list of service codes for diagnostic tests. *Chemotherapy*: Chapters 21.02. "Onkologische Therapie," 21.03. "Zussätzliche onk. Therapie," 21.04. "Immunglobine und Immunsuppressiv," 21.06. "Chemotherapieschemata – Kinder," and 21.07. "Chemotherapieschemata - Erwachsene." *Radiation therapy*: Chapters 13.01. "Teletherapie" and 13.02. "Brachytherpie." *Operations*: Chapters one through 11 and a hand-selected list of service codes for operations.

[11]The rehospitalization outcome is analyzed conditional on surviving at least one year after the initial hospitalization.

the associated spending and the number of prescriptions. The same is done for the first outpatient physician visit, including the corresponding spending and an indicator variable for whether the physician is a specialist. Due to data limitations, this analysis is only possible from 2012 onward. Additionally, we calculate the days until the next inpatient hospitalization and include indicator variables if the diagnosis matches that of the first hospitalization. For all these outcomes, we analyze only those patients for whom the next contact with the healthcare system occurs within 60 days of the initial hospital discharge.

Subsequent Healthcare Utilization: To examine the subsequent healthcare utilization in the longer term, we assess several outcomes four and eight quarters after the initial hospital discharge. These outcomes include total spending for outpatient care, for drugs, the number of drug prescriptions, and ambulatory visits[12], spending for inpatient hospital stays, GP visits, outpatient surgeries, outpatient visits for skin-and venereal diseases, and outpatient visits for internal medicine.

3 Research design

3.1 Analysis sample and descriptive statistics

Our sample consists of a cross-section of patients who have a first-time inpatient hospitalization with a main diagnosis of malignant neoplasm *(ICD-10, C00-C97)* in an Upper Austrian hospital between 2010 and 2015. These patients must have been residing in Upper Austria at the time of hospitalization, and insured with the UAHIF during the quarter of the hospitalization and 20, 16, 12, 8, and 4 quarters before so that we can track their pre-shock healthcare utilization pathways. We exclude patients who were hospitalized for non-malignant neoplasms or who were prescribed cancer-related medications before their first inpatient hospitalization for a malignant neoplasm.[13] Further, we exclude patients for whom we do not observe the socio-economic status and those with extremely high utilization during their hospital stay (billed DRG points > 99th percentile).

Table 2 presents descriptive statistics for patients in our analysis sample by socio-economic status. We analyze 22,398 cancer patients, of whom 9,983 (44.57 percent) have high socio-economic status and 12,415 (55.43 percent) have low socio-economic status. Compared to low-SES patients, high-SES patients are more likely to be female (0.497 vs. 0.390), younger at the time of hospitalization (65.96 vs. 67.50), more likely to reside in an urban area (0.33 vs. 0.23) and be Austrian citizens (0.95 vs. 0.91). During the initial

[12]Due to data limitations, ambulatory visits are only available from 2011 and can only be counted once per patient, hospital and quarter. Therefore, multiple ambulatory visits to the same hospital in a quarter are capped at 1.

[13]Non-malignant neoplasms are classified by the ICD-10 diagnoses: D00-D09 "In situ neoplasms", D10-D36 "Benign neoplasms", and D37-D48 "Neoplasms of uncertain or unknown behavior." Cancer-related drugs are classified by ATC codes: L01 "Antineoplastic agents" and L02 "Endocrine therapy."

cancer hospitalization, high-SES patients have, on average, a 1.6-day shorter length of stay, 501 euros lower spending, receive 0.2 fewer individual services, and visit 0.09 fewer hospital departments. They are less likely to receive chemotherapy, radiation therapy, and diagnostic tests but more likely to undergo operations. The probability of receiving intensive care is lower for high-SES patients, however, there is no statistically significant difference in the probability of rehospitalization with the same diagnosis within 30 days after discharge. High-SES patients are, on average, less likely to die following cancer hospitalization in the short and long term. When considering healthcare utilization eight quarters before hospitalization, the following patterns emerge. High-SES patients have lower spending on GPs and higher spending on specialists. They have lower utilization of drugs and hospital visits. However, more utilization of general health screenings and ambulatory visits. The direction of the differences between the groups is also present when considering healthcare utilization four quarters after the initial cancer hospitalization, but the magnitudes are different.

Figure 2 shows the distributions of several variables separately by socio-economic status. Panel (a) shows that high-SES patients experience their first-time cancer hospitalization at an earlier age compared to low-SES patients. The density tends to be higher between the ages of 30 and 60 and lower between the ages of 70 and 90. Panel (b) shows that the distribution of hospitalizations across admission years remains relatively constant from 2010 to 2015, with only slight differences in the density between high- and low-SES patients. Panel (c) depicts the distribution of cancer diagnoses by socio-economic status. High-SES patients are more likely to be diagnosed with malignant neoplasms of the skin, breast, and female genital organs, while low-SES patients are more likely to be diagnosed with malignant neoplasms of digestive organs, respiratory and intrathoracic organs, urinary tract, and lip, oral cavity, and pharynx. This pattern suggests that low-SES patients tend to be admitted with more severe cancer types at their first inpatient hospitalization. Figure 3 shows the relationship between the share of high-SES patients within a particular cancer type and the corresponding average five-year survival probability for that cancer type. There is a positive relationship, indicating that low-SES patients are diagnosed with more lethal cancers than high-SES patients.

3.2 Empirical strategy

This study aims to quantify the socio-economic gradient in mortality and healthcare utilization. We focus on patients' first-time cancer diagnoses which are (i) typically unexpected, (ii) require hospitalization, and (iii) imply an unanticipated change in the health care needs. We take advantage of the richness of our administrative data, which allows us to include an extensive set of detailed control variables. Hence, we can compare patients with high and low socio-economic status who are otherwise very similar across a wide range of aspects. We estimate the following equation within our cross-sectional data structure:

$$Y_i = \beta_1 + \beta_2 \cdot SES_i + \beta_x \cdot \mathbf{X}_i + \beta_{HS} \cdot \mathbf{HS}_i + \beta_{HB} \cdot \mathbf{HB}_i + \Psi + \epsilon_i \quad (1)$$

where Y_i is the outcome of patient i, such as the length of stay during the initial hospitalization, mortality in the quarter of hospitalization, or the number of drug prescriptions four quarters later. SES_i is a binary indicator equal to 1 if patient i has a high socio-economic status. Thus, β_2 is the coefficient of interest, denoting the difference in the outcome between patients with high- and low-SES. $\mathbf{X}_i$ is a vector of individual characteristics, including the patient's sex, citizenship status (Austrian/non-Austrian/missing), and whether the patient resides in an urban area, defined as the three largest cities in Upper Austria.[14] $\mathbf{HS}_i$ is a vector of patient i's healthcare utilization, intended to capture the health status before initial cancer hospitalization. The vector includes the following healthcare categories: (1) inpatient hospital spending, measured separately for each ICD-10 diagnosis chapter (e.g., Chapter X "Diseases of the respiratory system"), (2) the number of drug prescriptions for each ATC main group (e.g., J "Antiinfectives for systemic use"), and (3) the number of secondary diagnoses at the initial hospitalization. All these health status indicators, except for the number of secondary diagnoses, are measured as averages 20, 16, 12, 8, and 4 quarters before the hospitalization. $\mathbf{HB}_i$ is a vector of patient i's healthcare utilization, which should capture the health behavior before initial cancer hospitalization. These indicators are also measured as averages 20, 16, 12, 8, and 4 quarters before the hospitalization and include the following categories: (1) spending for outpatient physician visits by medical specialty (e.g., GP), and (2) the number of general health screening visits. Ψ captures a wide range of different fixed effects, including the diagnosis at initial hospitalization at the three-digit level (e.g., C50), the hospital to which the patient is admitted, the patient's GP one quarter before admission, the quarter-year of hospitalization (e.g., 2010/Q1), the weekday of hospitalization (e.g., Monday), and the age at hospitalization. ϵ_i is the error term and standard errors are robust.

Therefore, essentially, our analysis compares high- and low-SES patients of the same age, sex, nationality, and area of residence who are admitted to the same hospital with the same cancer diagnosis, in the same quarter-year and on the same day of the week, and who share the same GP as well as identical pre-hospitalization utilization in terms of hospital spending, drug prescriptions, physician visits, health screening visits, and diagnosed comorbidities.

[14]These cities are Linz, Wels, and Steyr.

4 Main Results

This section presents the main results of our study. First, we provide evidence of the socio-economic inequality in short- and long-run mortality following a cancer diagnosis. Next, we provide results on patients' utilization of hospital services at the initial hospitalization to examine the role of healthcare providers. Using the same framework, we then follow the patients to the outpatient sector to present findings on their first healthcare contact after hospital discharge and subsequent healthcare utilization. Finally, we show the robustness of our results for an alternative definition of socio-economic status.

Mortality: Table 3 summarizes the difference in short-term mortality by socio-economic status. Column (1) shows that high-SES patients have a 2.1 percentage point lower mortality within the first quarter after the diagnosis, which corresponds to a 50.3 percent lower mortality risk compared to the overall average. This difference reflects the raw mortality gap between high- and low-SES patients without controlling for any individual characteristics. However, as shown before, there is also substantial heterogeneity between high- and low-SES patients in terms of the diagnosed cancer type. Once we account for the exact cancer type (see Column (2)), the raw mortality gap is reduced to 1.3 percentage points (30.7 percent). This reduction aligns with the fact that low-SES patients are more likely to be diagnosed with cancer types of lower survival (see Figure 3). In Column (3), we further enrich our model by incorporating the full set of control variables, including individual characteristics, pre-diagnosis health status, pre-diagnosis health behavior, and hospital and GP fixed effects. This allows us to compare high- and low-SES patients who are identical in terms of age, diagnosed cancer type, gender, region, pre-diagnosis healthcare utilization, comorbidities, GP, and screening behavior, and who are admitted to the same hospital at the same quarter-year. Even with this extensive set of control variables, we still find a statistically significant difference in short-term mortality of 0.6 percentage points or approximately 15 percent.

The mortality gap is particularly pronounced within the first six months after diagnosis. Figure 4 shows the effect of high SES on long-term mortality using the full specification, including all control variables. While there is no mortality gap during the initial hospitalization, we find a statistically significant mortality gap after discharge, which is, however, stabilizing over time. While the mortality gap increases to approximately 1.4 percentage points (or 10.5 percent of average mortality risk) within two quarters after hospital discharge, the cumulative mortality gap amounts to 2.3 percentage points (8.7 percent) after two years and 2.2 percentage points (6.3 percent) after four years.[15] Thus, after surviving the first six months, the additional socio-economic gradient in mortality

[15]Table A.1 in the Appendix shows the effect of high SES on short- and long-term mortality for three different model specifications.

risk becomes less relevant over time.

Initial Hospitalization: Next, we examine whether the short-term mortality gap is also reflected in the outcomes of the initial hospitalization.[16] Table 4 summarizes the effect of high SES on various outcomes of the initial cancer hospitalization adjusting for the full set of control variables. We find that high-SES patients have a 0.58-day shorter length of stay (7 percent of the average length of stay) and slightly lower hospital expenditures amounting to 195.8 euros (3.67 percent). However, we do not observe any significant SES differences in the number of hospital departments involved in care, intensive care probability, readmission, the number of treatments, or the probability of receiving diagnostic tests, chemotherapy, or operations. So there is no indication, that—conditional on the exact diagnosis and hospital—health providers treat patients of different socio-economic statuses differently, and are therefore unlikely to significantly contribute to SES gradient in mortality. We only observe a lower probability for radiation therapy of 0.5 percentage points or approximately 20 percent for high-SES patients. Since radiation therapy is often the only treatment option for cancers diagnosed at later stages, this might be a first indication, that the timing of diagnosis is not the same across socio-economic status, even if pre-diagnosis healthcare utilization patterns are identical.[17]

Subsequent outpatient healthcare utilization: Finally, we follow each cancer patient on their way through the healthcare system and observe their utilization behavior after the initial hospitalization.[18] Table 5 presents the effect of high SES on the first contact with the healthcare system after hospital discharge with the full set of control variables. We find that high-SES patients take up drug prescriptions 0.7 days, or 7.7 percent, later and have 0.12 (approximately 5 percent) fewer prescriptions than low-SES patients. There is no such gap in terms of drug expenditures. Similarly, high-SES patients visit outpatient physicians slightly later by on average 1.2 days (11.7 percent) and are more likely to visit a specialist (3.4 percentage points or 23 percent of average attendance probability). Although we observe substantial mortality differences in the first six months after the first cancer diagnosis, there is no such SES gap in hospital readmission for the same diagnosis (see Columns (7) and (8)). These findings are consistent with a flattening mortality effect over time, that is, after approximately six months the mortality gap remains constant. One important implication consistent with these findings is that the socio-economic gradient in mortality is most likely driven by unobserved differences in health status at diagnosis resulting in a mortality gap in the short run.

Even if the cumulative mortality gap stabilizes over time, patients from different

[16]Initial hospitalization refers to the first hospitalization due to the cancer diagnosis.

[17]Unfortunately, our data do not allow us to directly observe the cancer stage.

[18]Note that outpatient healthcare utilization outcomes can only be interpreted conditional on survival.

socio-economic backgrounds may still change their utilization patterns differently after diagnosis. As shown before, high and low-SES patients navigate through the outpatient healthcare system systematically differently, with high-SES patients more likely to visit specialists directly rather than limiting themselves to GPs.[19] Figure 5 illustrates the effect of high SES on subsequent healthcare utilization 4 and 8 quarters after hospital discharge with all control variables in percent relative to the outcome mean.[20] First, we find that, except for outpatient visits for surgery, the patterns remain stable over time, both qualitatively and quantitatively. Second, differences in expenditures for overall outpatient care are relatively small, with high-SES patients having 1.8 percent higher expenditures 4 quarters after hospital discharge (however, not statistically significant) and 5 percent after eight quarters. Similarly, for high-SES patients, the probability of ambulatory visits is about 3 percentage points or 4.5 percent higher. However, high-SES patients have fewer drug prescriptions and lower expenditures, with reductions ranging from 6 to 9 percent. Most notably, post-diagnosis healthcare utilization seems to reinforce pre-diagnosis patterns.[21] Four quarters after the hospital discharge, high-SES patients are less likely to visit GPs (5 percent), but much more likely to visit outpatient specialists, including surgeons (31.4 percent, but not statistically significant), dermatologists (29 percent), and internists (18 percent). These gaps narrow somewhat after eight quarters. However, given the stabilization of long-run mortality and no difference in readmissions, the considerable differences in outpatient healthcare use after a health shock by diverging navigation through the healthcare system does not seem to translate into worsening health outcomes and therefore necessarily lead to greater inequality in mortality and health status.

Alternative SES definition: As a robustness check, we repeated our analysis using an alternative definition of socio-economic status, based on lifetime wage position rather than the collar status. Table 6 summarizes our main findings across different SES definitions for several outcome variables. Panel (A) replicates our main findings based on the collar definition, while Panel B shows the equivalent results based on the wage quartile of the patient.[22] Relative to the lowest wage quartile, we find that patients from higher wage quartiles have lower short-run mortality, with a mortality gap of 30 percent for the fourth quartile and 11 percent one year after diagnosis. Similarly, for outcomes related to the initial hospital stay and post-diagnosis outpatient healthcare utilization, we find results

[19]GPs are often regarded as gatekeepers in the system who refer patients to specialists in case of further examinations, but patients can also directly seek medical advice from specialists even without referrals from GPs.

[20]Table A.2 in the Appendix summarizes the estimate on the socio-economic status for subsequent healthcare utilization 4 and 8 quarters after hospital discharge with all control variables. The percentage effect sizes are equivalent to those presented in Figure 5.

[21]Note that we control for pre-diagnosis healthcare utilization, that is, patients are identical in their pre-shock medical attendance for GPs and specialists. However, we cannot distinguish whether specialist visits are based on GP referrals or direct visits.

[22]See also our discussion in Section 2.3.

that are consistent with our main specification and are also quantitatively very comparable. We are therefore confident, that our results are not driven by a specific definition of socio-economic status.

5 Potential Explanations

Thus far, we have shown a significant socio-economic gradient in short-run mortality, which tends to stabilize after approximately 6 months, with no difference in hospital readmissions. While patients tend to reinforce their pre-diagnosis healthcare behavior, this does not widen the gap in severe health outcomes. However, we still lack a clear understanding of the factors driving the substantial mortality gap after a first-time cancer diagnosis. The evidence we have seen so far suggests a significant unobserved difference in patients' health status at diagnosis that cannot be explained by pre-diagnosis healthcare utilization in both the inpatient and outpatient sectors. This section provides additional suggestive evidence on potential explanations behind the remaining unexplained inequality, as summarized in Table 7.

Timing of diagnosis: One possible explanation for the mortality gap is unobserved differences in health status at diagnosis. The lower short-term mortality risk for high-SES patients may imply that a fraction of low-SES patients are diagnosed at a later stage of the disease, even when accounting for their pre-diagnosis healthcare utilization. This means that we are comparing a low-SES patient with a high-SES patient with identical medical attendance and prescription patterns before diagnosis but for some patients this does not equalize health status. Therefore, we might wrongly compare healthier high-SES patients with sicker low-SES patients of identical utilization patterns.

We have already shown that low-SES patients are more likely to receive radiation therapy for the same type of cancer diagnosis (Table 4, Column (9)). Since surgeries or chemical therapies are no longer feasible for later-stage cancers, a higher incidence of radiation therapy may indicate a higher proportion of later-stage cancers among low-SES patients. Unfortunately, we cannot directly observe patients' cancer stages in our data. Therefore, we provide three additional pieces of evidence supporting the hypothesis that the differential timing of the diagnosis is an important explanation for the socio-economic gradient.

First, Column (1) of Table 7 shows the socio-economic gradient for patients experiencing a first-time myocardial infarction. This comparison is relevant because, unlike cancer diagnoses, the exact timing of a myocardial infarction is much less dependent on individual behavior. Hence, patients from different socio-economic backgrounds should be more similar in terms of disease stage than cancer patients.[23] Consistent with this expectation,

[23]Table A.3 provides summary statistics for heart disease patients by socio-economic status.

we do not observe a significant socio-economic gradient in short-run mortality (Panel A), length of stay (Panel B) and hospital spending (Panel C) at the initial hospitalization.

Second, we differentiate cancer types by severity.[24] Less severe cancer types particularly differ from more severe cancer types in the availability of effective screening devices. Mammographies, colonoscopies, or PSA tests for prostate cancer are widely available at any GP and are covered by health insurance annually. Since high-SES individuals are more likely to undergo regular cancer screenings, their probability of early detection has to be greater. As Column (2) of Table 7 shows, there is no significant SES mortality gap for less severe cancer types. However, hospital spending and the number of treatments performed at initial hospitalization are significantly lower for high-SES patients. Low-SES patients may require more diagnostics and treatments at hospitalization and therefore have a longer length of stay and higher costs. This picture is different when looking at severe cancer types with lower survival probabilities (see Column (3) of Table 7). These are cancer types with worse detection tools and are often diagnosed when already clear symptoms occur. For these cancer types, we do not observe significant differences in hospital spending by socio-economic status. Still, the mortality of high-SES patients is substantially lower by more than 20 percent.

Finally, we separate our analysis by hospital occupancy.[25] If hospitals are crowded, they might be forced to focus on necessary treatments and postpone elective treatments to times with lower occupancy. This implies that in times of high occupancy, patients should be on average more similar concerning the severity of their diseases. Hence, we expect a sample of cancer patients in a hospital at a crowded time to be more similar in terms of health status and cancer stages. Column (4) of Table 7 presents the results for admission days where hospitals have high occupancy. We find no significant socio-economic differences in mortality and hospital expenditures. When analyzing admissions during low occupancy days (Column (5)), we find lower mortality, a shorter length of stay, and lower expenditures for high-SES patients. To summarize, we interpret this set of findings to be consistent with the hypothesis that the timing of diagnosis is a relevant and important explanation for socio-economic inequalities in our analysis.

Peer effects: Studies have documented significant spillover effects of health behaviors among family members (e.g., Fadlon and Nielsen, 2019) or colleagues at the workplace (e.g., Pruckner et al., 2020). Moreover, there is growing evidence on the role of neighborhood effects on inequalities in health (Kabir et al., 2022; Atalay et al., 2023; Hasager

[24]The assessment of cancer severity is based on the 5-year survival rates provided by Statistics Austria. We define cancer type as severe if its survival rate is below 50 percent (e.g., lung, pancreas, liver, or stomach) and as less severe otherwise (e.g., breast, prostate, colon, or bladder). See also Figure (a) of Appendix Figure A.2.

[25]We measure hospital occupancy by the number of patients relative to the maximum capacity in each hospital. A hospital is considered as crowded if occupancy is above the median conditional on the hospital and day of the week. See also Figure (b) of Appendix Figure A.2.

and Jørgensen, 2024). This may also extend to healthcare utilization. To address this potential explanation, we consider the socio-economic status of the patient's peers at work as a factor.[26] More precisely, we distinguish between patients working in firms with a high and low share of peers of lower socio-economic status. Column (6) of Table 7 shows that there is no statistically significant socio-economic gradient in mortality or hospital expenditures for high-SES patients who are predominantly exposed to a low-SES working environment. However, when these patients worked in high-SES environments (see Column (7)), we again find a significant mortality gap of 23.7 percent, as well as lower hospital expenditures of around 5 percent. This suggests that if a high-SES patient is surrounded by peers of different status, they lose their mortality advantage. These findings corroborate the evidence that spillover effects of peers matter for the inequality in health and healthcare utilization beyond neighborhoods, and may also extend to workplaces.

Health providers: Finally, another possible explanation could be that health providers treat patients with different socio-economic statuses differently (Moscelli et al., 2018). However, we do not find statistically significant socio-economic differences in the number of treatments or hospital departments involved at first hospitalization conditional on cancer type. Moreover, hospitals do not treat patients differently under high occupancy (see Column (4) of Table 7). This suggests that healthcare providers do not differentiate by socio-economic status in their treatment behavior and do not contribute significantly to socio-economic inequalities.

6 Conclusions

Health equality is an important objective in public healthcare systems, and still, we see substantial socio-economic differences. This study analyzes the socio-economic gradient in mortality and healthcare utilization after patients are diagnosed with cancer. We investigate this important topic within a Bismarckian type universal healthcare system, where income differences should not be a relevant predictor of inequalities. Exploiting an unexpected change in the need for healthcare allows us to account for pre-diagnosis healthcare utilization in a detailed way to improve our understanding of the explanations and selection determining socio-economic inequality. We find that high-SES patients are less likely to die after a cancer hospitalization even when accounting for a comprehensive set of controls, including detailed pre-shock healthcare use. This mortality gap is particularly pronounced in the short term, up to 2 quarters after the initial diagnosis. Conditional on survival, the cumulative mortality gap between socio-economic groups re-

[26]We define a patient to be exposed to a high share of low-SES peers if the share of blue-collar workers in the patient's workplace is above the median share of blue collar working peers in firms worked, averaged over the patients' working career from 1972 to 2005. See also Figure (c) of Appendix Figure A.2.

mains relatively stable in the long run. After hospital discharge, patients navigate the healthcare system differently depending on their socio-economic status and reinforce their pre-shock behavioral patterns. However, these differences do not necessarily lead to worse health outcomes, as suggested by the stable long-term cumulative mortality gap. We then provide suggestive evidence for potential explanations that should help us understand the observed SES differences. Our findings suggest that inequalities are particularly driven by behavioral differences, that is, low-SES cancer patients go to the hospital at a later stage of the disease. Peer groups seem to matter in explaining SES differences as well, while we find no evidence that healthcare providers contribute significantly to socio-economic inequalities. Overall, our findings suggest that universal healthcare systems are on average rather successful in providing systematic healthcare in a non-discriminatory way but cannot rule out unfavorable health behaviors among low-SES patients. Consequently, if governments aim to reduce health inequalities within a universal healthcare system, our findings highlight the need for targeted policies that address the specific needs of different socio-economic groups. These policies should account for heterogeneity in diseases as well as patients' overall health awareness and prevention behavior.

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7 Figures (to be placed in the article)

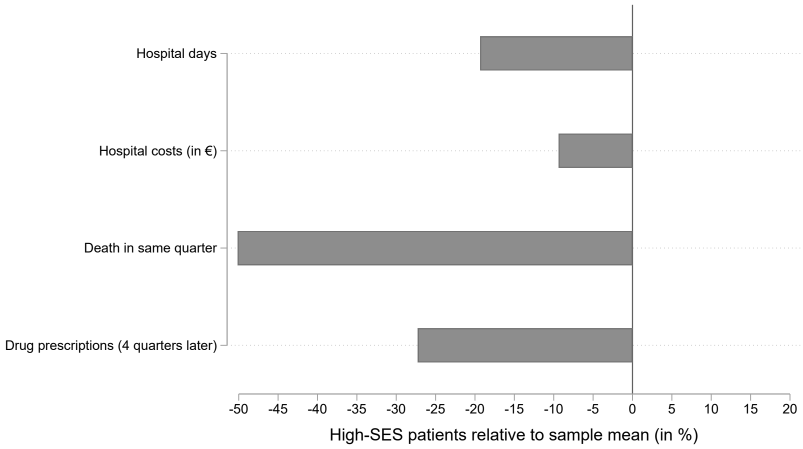

Figure 1: Examples of Raw SES Gaps of Cancer Hospitalizations

Note — This figure shows the raw average differences between patients from high and low socio-economic status, expressed as a percentage of the sample mean, for four different variables. Our sample is a cross-section of patients who have a first-time inpatient hospitalization with a main diagnosis of malignant neoplasm. For a more detailed overview of the sample structure, refer to Section 3.1. The displayed variables are the number of hospital days during the initial hospitalization, the spending at the initial hospitalization, an indicator variable if the patient dies in the same quarter as the hospitalization, and the number of drug prescriptions four quarters after the hospital discharge.

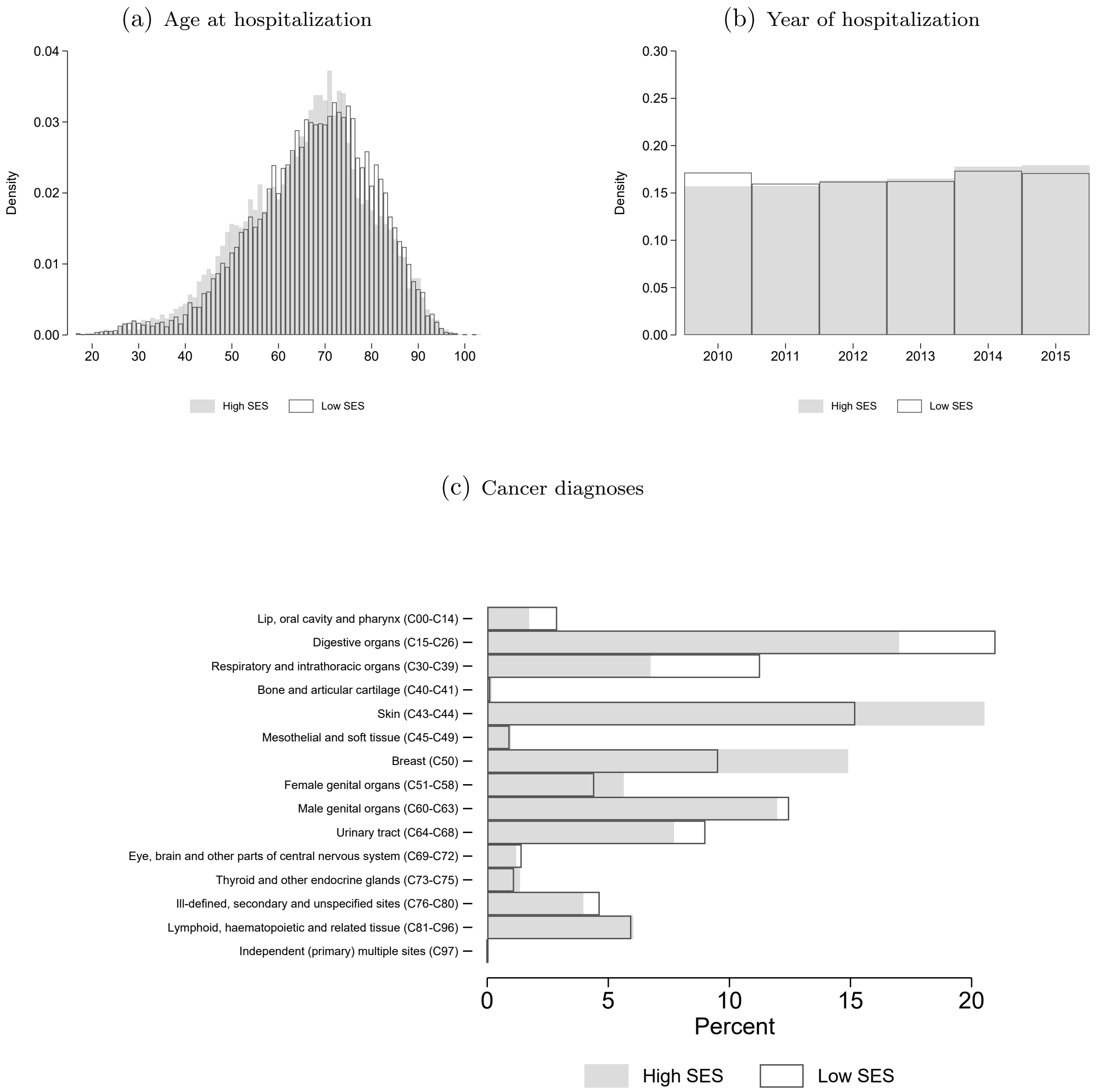

Figure 2: Distributions by SES

Note — This figure shows the distributions of several variables by socio-economic status for patients in our estimation sample. Gray bars correspond to patients with high SES and hollow black bars correspond to patients with low SES. For a more detailed overview of the sample structure, refer to Section 3.1. Panel (a) shows the distribution of patients' ages at their first-time cancer hospitalization. Panel (b) shows the distribution of hospitalizations across admission years. Panel (c) shows the distribution of cancer diagnoses.

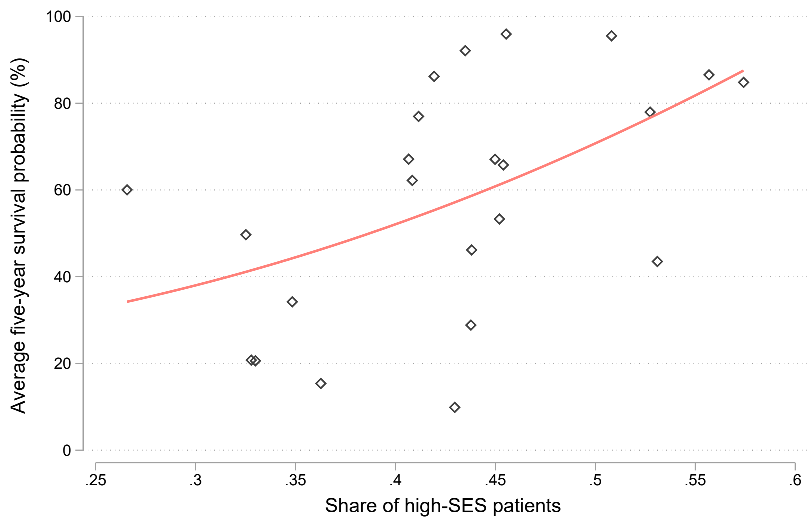

Figure 3: Relationship Between Cancer Severity and Socio-Economic-Status

Note — The figure shows the relationship between the share of high-SES patients within a particular cancer type and the corresponding average five-year survival probability (in percent) for that cancer type. Each scatter represents a different cancer type and the pink line shows the predicted quadratic relationship between the two variables. Information on cancer survival rates is obtained from *Statistics Austria*. For each cancer type, survival rates are available by year and patient's sex. To calculate the survival rate and the share of high-SES patients for each cancer type, we first use our analysis sample (see Section 3.1) and match the cancer survival rates on the patient's cancer type, year of hospitalization, and sex. We then compute the average five-year survival probability and the average share of high-SES patients for each cancer type. Cancer survival rates from *Statistics Austria* are available for 77.5 percent of the hospitalizations in our sample. The cancer types for which we do not have a match tend to be less common, except for the diagnosis "C44 - Other malignant neoplasms of the skin".

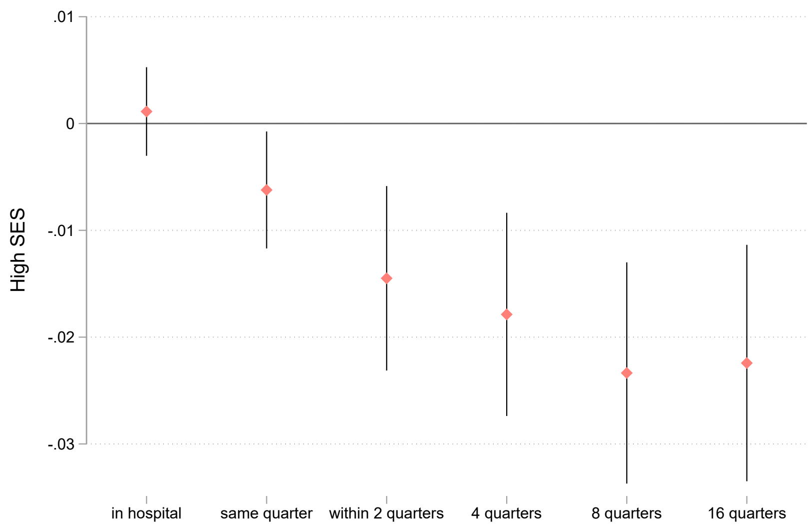

Figure 4: Effect of High-SES on Long-Term Mortality

Note — The figure shows the estimated coefficients and the corresponding 95 percent confidence intervals for the effect of high socio-economic status on six different mortality outcomes. The coefficients are estimated using Equation (1) using the full set of control variables. Standard errors are robust. All mortality outcomes are constructed as indicator variables (0/1). In-hospital mortality is defined as having the hospital discharge "death". Longer-term mortality is measured cumulatively, that is, death in the same quarter as the hospital discharge, within 2, 4, 8, and 16 quarters.

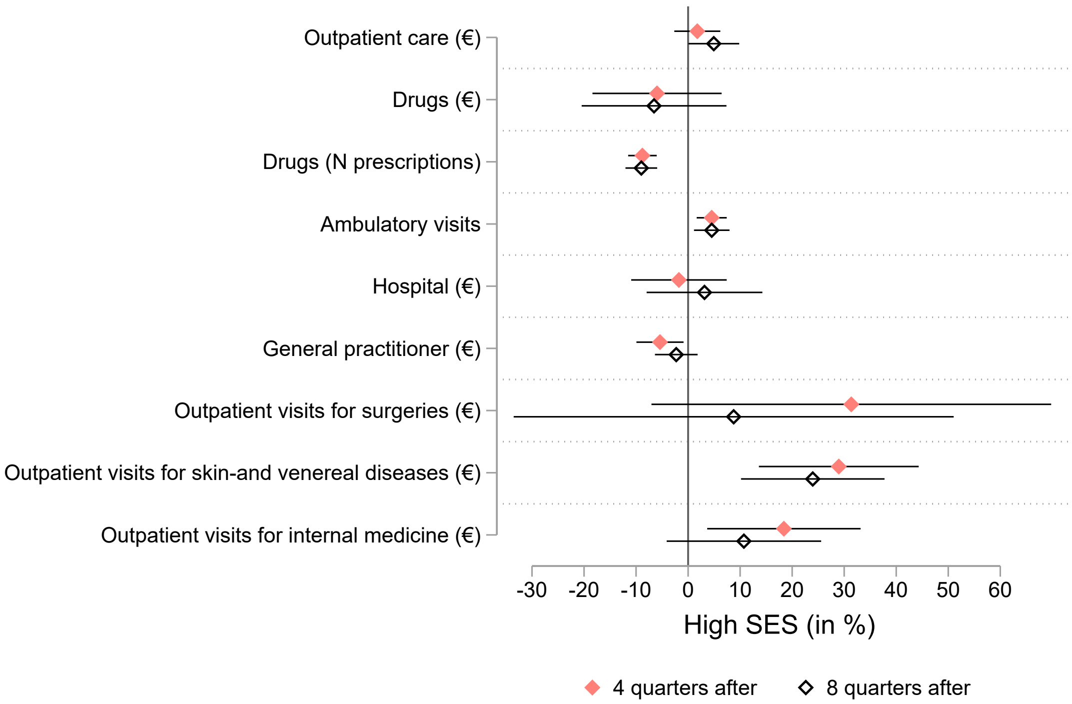

Figure 5: Effect of High-SES on Subsequent Healthcare Utilization

Note — The figure shows the point estimates and the corresponding 95 percent confidence intervals for the effect of high socio-economic status on various outcomes measuring subsequent healthcare utilization. All outcomes are measured in 4 quarters (pink diamonds) and 8 quarters (black hollow diamonds) after the initial hospitalization. To facilitate interpretation, all coefficients are transformed to be expressed as a percentage of the sample mean. The coefficients are estimated with Equation (1) using the full set of control variables. Standard errors are robust.

8 Tables (to be placed in the article)

Table 1: Relationship Between the Baseline SES Indicator, Income and Education

		Lifetime income position (Q1-Q4)			Highest completed education	
	Yearly income (Ø lifetime)	Ø	**P**(>Q2)	**P**(Q4)	**P**(Compulsory school)	**P**(University)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: No controls						
High SES	6,033.763***	0.668***	0.295***	0.286***	-0.303***	0.145***
	(174.069)	(0.012)	(0.007)	(0.006)	(0.006)	(0.005)
Difference to low SES (%)	29.00	28.03	67.82	373.85	-67.81	163.43
Outcome Mean	23,584.356	2.691	0.571	0.209	0.310	0.154
N	19,139	19,139	19,139	19,139	19,638	19,638
Panel B: With controls						
High SES	8,172.503***	0.698***	0.309***	0.301***	-0.308***	0.159***
	(130.254)	(0.012)	(0.007)	(0.006)	(0.006)	(0.005)
Difference to low SES (%)	39.28	29.31	71.05	392.93	-68.92	180.09
Outcome Mean	23,584.356	2.691	0.571	0.209	0.310	0.154
N	19,139	19,139	19,139	19,139	19,638	19,638

Note — The table reports the estimated coefficients for the effect of our preferred measure of patients' socio-economic status and patients' income and education levels. For our preferred measure, we define high socio-economic status as white-collar employment and low socio-economic status as blue-collar employment. For a more detailed discussion of the SES indicators, refer to Section 2.3. Panel A presents the raw association without any control variables and Panel B adjusts for patient demographics, such as sex, age at hospitalization, quarter-year of hospitalization, citizenship status, and whether the patient lives in an urban area. Column (1) shows the patient's average yearly income over the career. Columns (2) to (4) display the lifetime income position of the patient: The average income position (2), the probability of being above the median (3), and the probability of being in the fourth (highest) income quartile (4). Columns (5) and (6) show the education of the patients: The probability of having compulsory schooling as the highest level of education (5), and the probability of having a university degree as the highest level of education (6). The lifetime income position is based on computed income quartiles for each year, conditional on the patient's sex and age. This measure is then averaged over the patients' working lives from 1972 to 2005. After rounding, we obtain the average income quartile (Q1 to Q4), which is a proxy for the patient's lifetime income position relative to the population. The analysis involving the patient's income and lifetime income position is conducted for individuals who have Austrian citizenship and have worked at least five years in an Upper Austrian firm. It is important to note that the results on education are based on imputed education data and should therefore be interpreted with caution. The effect size relative to the outcome mean of low-SES patients in percent, the mean of the outcome variable, and the number of observations are reported at the bottom of the panels. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Characteristics of Patients by Socio-Economic Status

	(1) Ø Full Sample	(2) Ø High SES	(3) Ø Low SES	(4) Diff.	(5) Sign.	(6) N
Demographics						
Female	0.4379	0.4969	0.3903	0.1066	***	22,398
Age at hospitalization	66.8132	65.9573	67.5015	-1.5442	***	22,398
Urban residence	0.2753	0.3296	0.2317	0.0978	***	22,398
Austrian citizen	0.9238	0.9452	0.9066	0.0386	***	22,398
Initial hospital stay						
Length of stay	8.3569	7.4615	9.0769	-1.6154	***	22,398
Hospital spending	5,349.5077	5,071.6511	5,572.9343	-501.2832	***	22,398
N individual services	3.1701	3.0577	3.2605	-0.2028	***	22,394
N hospital departments	1.3826	1.3332	1.4224	-0.0892	***	22,395
Any services for chemotherapy (0/1)	0.0593	0.0558	0.0621	-0.0063	**	22,398
Any services for radiation therapy (0/1)	0.0244	0.0216	0.0266	-0.0049	**	22,398
Any operations (0/1)	0.5544	0.5898	0.5260	0.0638	***	22,398
Any services for diagnostics (0/1)	0.6091	0.5826	0.6304	-0.0479	***	22,398
Intensive care (0/1)	0.0983	0.0901	0.1049	-0.0148	***	22,398
Rehospitalization within 30 days	0.3639	0.3582	0.3690	-0.0107		18,261
Mortality						
Death in hospital	0.0228	0.0177	0.0268	-0.0091	***	22,398
Death in quarter of stay	0.0429	0.0310	0.0524	-0.0215	***	22,398
Death within 1 quarter	0.0991	0.0734	0.1197	-0.0463	***	22,398
Death within 2 quarters	0.1375	0.1029	0.1654	-0.0625	***	22,398
Death within 4 quarters	0.1947	0.1505	0.2303	-0.0798	***	22,398
Death within 8 quarters	0.2683	0.2147	0.3114	-0.0967	***	22,398
Death within 16 quarters	0.3543	0.2943	0.4026	-0.1083	***	22,398
Healthcare (8 quarters before)						
Outpatient care (€)	135.0254	141.7197	129.6425	12.0772	***	22,398
General practitioner (€)	41.1944	37.7039	44.0012	-6.2974	***	22,398
Specialist (€)	78.6430	85.9974	72.7293	13.2681	***	22,398
General health screenings (N visits)	0.0442	0.0488	0.0406	0.0082	***	22,398
Drugs (€)	124.3210	114.6407	132.1050	-17.4643	***	22,398
Drugs (N prescriptions)	6.4201	5.5798	7.0959	-1.5161	***	22,398
Hospital (€)	395.8117	326.3036	451.7037	-125.4001	***	22,398
Ambulatory visits	0.2787	0.3071	0.2552	0.0519	***	11,505
Healthcare (4 quarters after)						
Outpatient care (€)	185.3934	188.7550	182.4452	6.3098		18,436
General practitioner (€)	63.3683	57.1536	68.8187	-11.6650	***	18,436
Specialist (€)	99.4036	106.6952	93.0088	13.6864	***	18,436
General health screenings (N visits)	0.0406	0.0421	0.0392	0.0029		18,436
Drugs (€)	438.5210	393.1181	478.3399	-85.2218	***	18,436
Drugs (N prescriptions)	8.7462	7.4769	9.8594	-2.3825	***	18,436
Hospital (€)	2,271.7120	2,139.0620	2,388.0475	-248.9855	***	18,436
Ambulatory visits	0.7346	0.7612	0.7113	0.0499	***	18,436
N	22,398	9,983	12,415			

Note — The table presents descriptive statistics for demographic characteristics, initial hospital stay, mortality, and healthcare use for patients included in the main analysis sample. A more detailed discussion of the SES indicators and sample structure can be found in Section 2.3 and Section 3.1. Column (1) shows the average for the full sample, Column (2) for patients with high socio-economic status, and Column (3) for patients with low socio-economic status. Column (4) shows the difference between high- and low-SES patients, while Column (5) indicates the statistical significance of these differences. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Column (6) provides the number of observations.

Table 3: Effect of High-SES on Short-Term Mortality

	(1) Raw	(2) Diagnosis	(3) Full controls
High SES	-0.021***	-0.013***	-0.006**
	(0.003)	(0.003)	(0.003)
Effect Size (%)	-50.33	-30.73	-14.59
Outcome Mean	0.043	0.043	0.043
N	22,153	22,153	22,153
ICD diagnosis (3 digits)	✗	✓	✓
Individual characteristics	✗	✗	✓
Health status (pre)	✗	✗	✓
Health behavior (pre)	✗	✗	✓
Hospital & GP	✗	✗	✓

Note — The table presents the estimated coefficients for the effect of high socio-economic status on the probability of dying within the same quarter as the initial cancer hospitalization. The coefficients are based on Equation (1). Column (1) shows the effect without control variables, Column (2) controls for diagnosis fixed effects only, and Column (3) includes the full set of control variables as detailed in Section 3.2. The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the table. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effect of High-SES on Outcomes of the Initial Hospitalization

	(1) LoS	(2) Spending	(3) N departments	(4) **P**(Intensive)	(5) **P**(Rehosp.)	(6) N services	(7) **P**(Diagnostics)	(8) **P**(Chemotherapy)	(9) **P**(Radiation)	(10) **P**(Operation)
High SES	-0.583***	-195.847**	-0.018	-0.002	-0.004	-0.073	-0.009	0.003	-0.005**	0.003
	(0.113)	(76.838)	(0.012)	(0.004)	(0.007)	(0.047)	(0.006)	(0.003)	(0.002)	(0.006)
Effect Size (%)	-6.99	-3.67	-1.32	-1.74	-0.98	-2.30	-1.41	4.36	-19.71	0.59
Outcome Mean	8.346	5,342.752	1.383	0.098	0.364	3.165	0.608	0.059	0.024	0.554
N	22,153	22,153	22,150	22,153	18,078	22,149	22,153	22,153	22,153	22,153
ICD diagnosis (3 digits)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Individual characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health status (pre)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health behavior (pre)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hospital & GP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note — The table reports the estimated coefficients for the effect of high socio-economic status on several outcomes of the initial cancer hospitalization. The coefficients are estimated with Equation (1) using the full set of control variables. Column (1) shows the length of stay in days, Column (2) the hospital spending in euros, Column (3) the number of hospital departments the patient visited, Column (4) whether the patient received any intensive care during the stay, Column (5) whether the patient had a rehospitalization with the same diagnosis within 30 days after discharge, and Column (6) the number of individual hospital services. Further, we analyze whether the patient received any diagnostics (Column (7)), chemotherapy (Column (8)), radiation therapy (Column (9)), or operations (Column (10)). The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the table. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effect of High-SES on the First Contact with the Healthcare System After Hospital Discharge

	First medication prescription			First outpatient physician visit			First inpatient hospitalization	
	N days	Spending	N prescriptions	Days	Spending	**P**(Specialist)	Days	**P**(Same diagnosis)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
High SES	0.714***	-1.163	-0.116***	1.163***	0.970	0.034***	0.066	0.010
	(0.195)	(6.841)	(0.037)	(0.230)	(1.366)	(0.007)	(0.256)	(0.008)
Effect Size (%)	7.69	-1.13	-4.92	11.65	3.99	22.92	0.38	1.42
Outcome Mean	9.292	102.596	2.360	9.979	24.318	0.150	17.430	0.703
N	19,861	19,861	19,861	14,025	14,025	14,025	13,519	13,519
ICD diagnosis (3 digits)	✓	✓	✓	✓	✓	✓	✓	✓
Individual characteristics	✓	✓	✓	✓	✓	✓	✓	✓
Health status (pre)	✓	✓	✓	✓	✓	✓	✓	✓
Health behavior (pre)	✓	✓	✓	✓	✓	✓	✓	✓
Hospital & GP	✓	✓	✓	✓	✓	✓	✓	✓

Note — The table presents the estimated coefficients for the effect of high socio-economic status on several outcomes of the first contact with the healthcare system after hospital discharge. The coefficients are estimated with Equation (1) using the full set of control variables. Column (1) shows the number of days it takes patients to receive their first medication prescriptions, Column (2) the corresponding spending, and Column (3) the corresponding number of prescriptions. Column (4) shows the number of days to the first outpatient physician visit, Column (5) the corresponding spending, and Column (6) is an indicator variable for whether the physician is a specialist. Column (7) shows the number of days until the next inpatient hospitalization and Column (8) is an indicator variable for whether the diagnosis is the same as the diagnosis of the initial hospitalization. For all these outcomes, we analyze only those patients for whom the next contact with the healthcare system occurs within 60 days of the initial hospital discharge. Due to data limitations, the analysis of the first outpatient physician visit is only possible from 2012 onward. The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the table. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Alternative Definition of Socio-Economic Status

	Mortality		Initial hospitalization		First healthcare contact		Healthcare 4 quarters after		
	Same quarter	Within 4 quarters	LoS	Spending	N prescriptions	**P**(Specialist)	N prescriptions	Ambulatory visits	GP (€)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Collar (main specification)									
High SES	-0.006**	-0.018***	-0.583***	-195.847**	-0.116***	0.034***	-0.772***	0.033***	-3.448**
	(0.003)	(0.005)	(0.113)	(76.838)	(0.037)	(0.007)	(0.123)	(0.011)	(1.475)
Effect Size (%)	-14.59	-9.21	-6.99	-3.67	-4.92	22.92	-8.78	4.54	-5.40
Outcome Mean	0.043	0.194	8.346	5,342.752	2.360	0.150	8.790	0.735	63.816
N	22,153	22,153	22,153	22,153	19,861	14,025	18,249	18,249	18,249
Panel B: Lifetime position (base Q1)									
Q2	-0.002	-0.008	-0.299	-148.235	-0.215**	-0.021*	-0.941***	0.035*	-2.415
	(0.006)	(0.010)	(0.234)	(151.278)	(0.090)	(0.012)	(0.302)	(0.021)	(2.999)
Q3	-0.011*	-0.021**	-0.396*	-47.966	-0.264***	-0.002	-1.357***	0.043**	-2.554
	(0.006)	(0.010)	(0.234)	(151.552)	(0.078)	(0.012)	(0.294)	(0.021)	(2.944)
Q4	-0.013*	-0.021*	-0.480*	-88.019	-0.322***	0.024*	-1.836***	0.044*	-5.892*
	(0.007)	(0.011)	(0.246)	(161.545)	(0.081)	(0.014)	(0.302)	(0.023)	(3.045)
Effect Size of 4. Quartile (%)	-29.52	-10.91	-5.79	-1.65	-13.69	15.69	-21.24	5.99	-9.35
Outcome Mean	0.043	0.195	8.282	5,335.504	2.348	0.153	8.645	0.737	63.038
N	18,941	18,941	18,941	18,941	16,965	12,000	15,642	15,642	15,642
ICD diagnosis (3 digits)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Individual characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health status (pre)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health behavior (pre)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hospital & GP	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note — The table reports the estimated coefficients for the effect of high socio-economic status on several outcomes for different definitions of SES. The coefficients are estimated with Equation (1) using the full set of control variables. Panel A shows the effects using our baseline SES indicator, defining high socio-economic status as white-collar employment and low socio-economic status as blue-collar employment. Panel B shows the effects of an alternative SES indicator, namely the lifetime income position of the patient. This indicator is based on computed income quartiles for each year, conditional on the patient's sex and age. This measure is then averaged over the patients' careers from 1972 to 2005. After rounding, we obtain the average income quartile (Q1 to Q4), which is a proxy for the patient's lifetime income position relative to the population. The analysis involving the patient's lifetime income position is conducted for individuals who have Austrian citizenship and have worked at least five years in an Upper Austrian firm. Column (1) shows the probability of dying within the same quarter as the initial cancer hospitalization, Column (2) the probability of dying within four quarters, Column (3) the length of stay at the initial hospitalization in days, Column (4) the hospital spending at the initial hospitalization in euros, Column (5) the number of drug prescriptions at the first prescription after hospital discharge, Column (6) is an indicator variable for whether the first visited physician after hospital discharge is a specialist, Column (7) the number of drug prescriptions four quarters after hospitalization, Column (8) the number of ambulatory visits four quarters after hospitalization, and Column (8) spending for GPs in euros four quarters after hospitalization. The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the panels. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Potential Explanations

	Heart disease	Cancer survival rate		Hospital occupancy		Share low SES peers	
		High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Death in same quarter							
High SES	-0.001	0.003	-0.021**	-0.004	-0.009**	-0.006	-0.008*
	(0.007)	(0.003)	(0.010)	(0.004)	(0.004)	(0.005)	(0.004)
Effect Size (%)	-1.15	18.41	-20.44	-9.06	-20.01	-12.01	-23.70
Outcome Mean	0.127	0.019	0.104	0.041	0.044	0.051	0.034
N	12,910	12,258	4,916	10,407	11,743	11,028	10,970
Panel B: Length of stay at the initial hospitalization							
High SES	0.084	-0.555***	-0.721**	-0.532***	-0.591***	-0.675***	-0.457***
	(0.125)	(0.142)	(0.347)	(0.172)	(0.159)	(0.209)	(0.170)
Effect Size (%)	1.02	-7.21	-6.07	-6.44	-7.02	-7.50	-5.92
Outcome Mean	8.235	7.700	11.877	8.260	8.416	9.000	7.725
N	12,910	12,258	4,916	10,407	11,743	11,028	10,970
Panel C: Hospital spending at the initial hospitalization							
High SES	-40.145	-304.764***	-36.008	-95.788	-250.131**	-153.372	-242.101**
	(84.540)	(98.258)	(243.407)	(115.925)	(108.252)	(140.480)	(120.943)
Effect Size (%)	-0.68	-5.81	-0.51	-1.81	-4.64	-2.80	-4.64
Outcome Mean	5,914.319	5,243.528	7,006.994	5,285.504	5,391.803	5,486.814	5,213.557
N	12,910	12,258	4,916	10,407	11,743	11,028	10,970
ICD diagnosis (3 digits)	✓	✓	✓	✓	✓	✓	✓
Individual characteristics	✓	✓	✓	✓	✓	✓	✓
Health status (pre)	✓	✓	✓	✓	✓	✓	✓
Health behavior (pre)	✓	✓	✓	✓	✓	✓	✓
Hospital & GP	✓	✓	✓	✓	✓	✓	✓

Note — The table presents the estimated coefficients for the effect of high socio-economic status on several outcomes for different sub-samples. The coefficients are estimated with Equation (1) using the full set of control variables. Panel A shows the effect of high SES on the probability of dying within the same quarter as the initial cancer hospitalization, Panel B on the length of stay at the initial hospitalization in days, and Panel C on the hospital spending at the initial hospitalization in euros. The columns correspond to different sub-samples. Column (1) analyzes patients with a first-time hospitalization for heart disease. Columns (2) and (3) analyze patients with cancer types of high five-year survival rates ($\geq$50 percent) and low survival rates (<50 percent). Information on cancer survival rates is obtained from *Statistics Austria*. For each cancer type, survival rates are available by year and patient's sex. To calculate the survival rate for each cancer type, we first use our analysis sample (see Section 3.1) and match the cancer survival rates on the patient's cancer type, year of hospitalization, and sex. We then compute the average five-year survival probability for each cancer type. Cancer survival rates are available for 77.5 percent of the hospitalizations in our sample. The cancer types for which we do not have a match tend to be less common, except for the diagnosis "C44 - Other malignant neoplasms of skin". Columns (4) and (5) analyze patients with high and low hospital occupancy at the initial cancer hospitalization. Occupancy is defined as the share of patients hospitalized with cancer on a given day relative to the daily maximum number of patients the hospital admitted with cancer between 2010 and 2015. High or low occupancy is then defined as above or below the median in the occupancy measure conditional on the hospital and day of the week. Columns (6) and (7) analyze patients with a high and low share of low-SES peers. High and low share of low-SES peers is defined as above or below the median share of blue collar working peers in firms worked, averaged over the patients' career from 1972 to 2005. The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the panels. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Web Appendix

This Web Appendix provides additional material discussed in the unpublished manuscript "Socio-Economic Inequality in Mortality and Healthcare Utilization: Evidence from Cancer Patients" by Wolfgang Frimmel, and Felix Glaser.

A Additional Figures and Tables

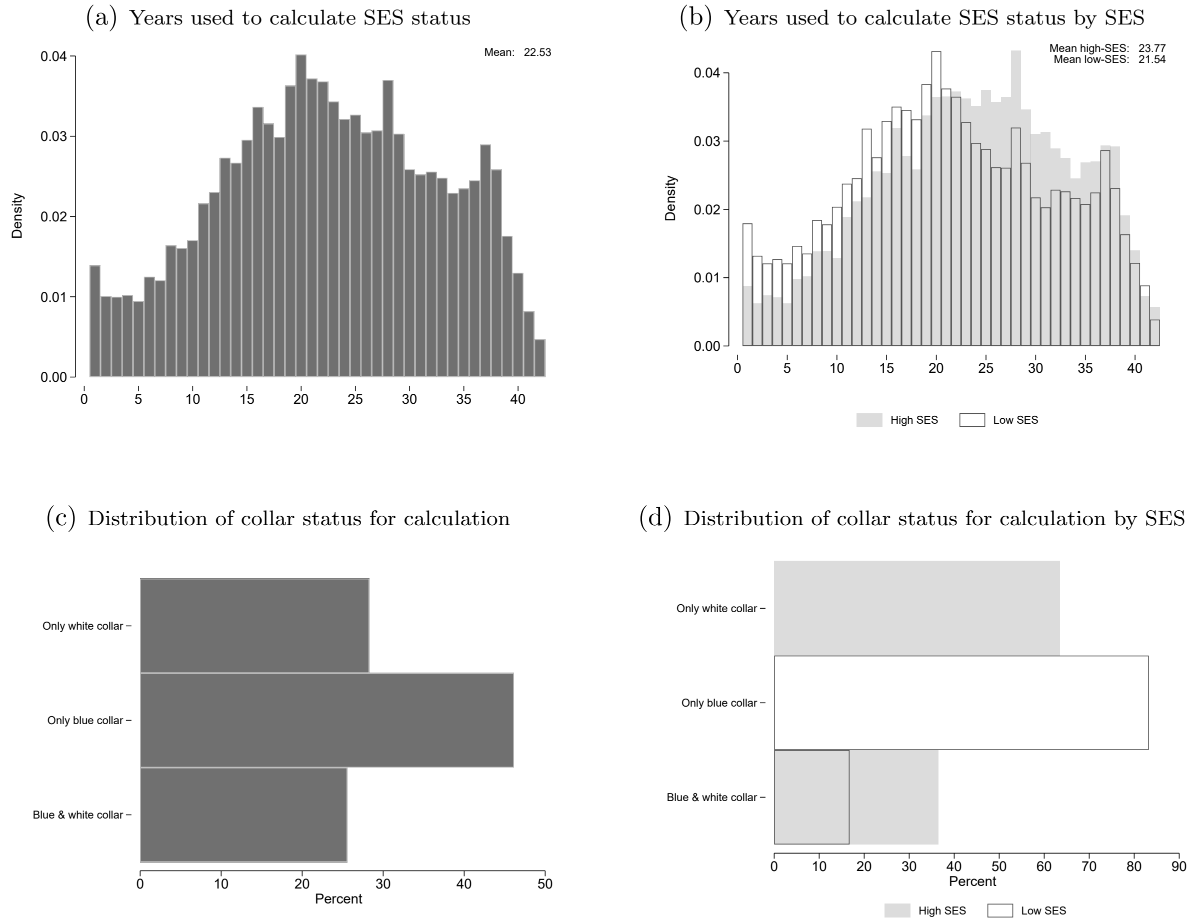

Figure A.1: Characteristics of the Calculation of the SES Status

Note — This figure shows the distributions of several variables for patients in our estimation sample. In Panels (b) and (d), gray bars correspond to patients with high SES and hollow black bars correspond to patients with low SES. Panel (a) shows the distribution of the working years used to determine the SES status, and Panel (b) shows the same distributions by SES status. Panel (c) shows the variation in the collar status, and Panel (d) shows the same separately for our defined SES status.

Table A.1: Effect of High-SES on Mortality

	(1) Raw	(2) Diagnosis	(3) Full controls
Panel A: Death in hospital			
High SES	-0.009***	-0.004**	0.001
	(0.002)	(0.002)	(0.002)
Effect Size (%)	-40.55	-18.58	5.01
Outcome Mean	0.022	0.022	0.022
N	22,153	22,153	22,153
Panel B: Death in same quarter			
High SES	-0.021***	-0.013***	-0.006**
	(0.003)	(0.003)	(0.003)
Effect Size (%)	-50.33	-30.73	-14.59
Outcome Mean	0.043	0.043	0.043
N	22,153	22,153	22,153
Panel C: Death within 2 quarters			
High SES	-0.063***	-0.035***	-0.014***
	(0.005)	(0.004)	(0.004)
Effect Size (%)	-45.61	-25.81	-10.56
Outcome Mean	0.137	0.137	0.137
N	22,153	22,153	22,153
Panel D: Death within 4 quarters			
High SES	-0.080***	-0.042***	-0.018***
	(0.005)	(0.005)	(0.005)
Effect Size (%)	-41.04	-21.58	-9.21
Outcome Mean	0.194	0.194	0.194
N	22,153	22,153	22,153
Panel E: Death within 8 quarters			
High SES	-0.097***	-0.050***	-0.023***
	(0.006)	(0.005)	(0.005)
Effect Size (%)	-36.17	-18.85	-8.73
Outcome Mean	0.267	0.267	0.267
N	22,153	22,153	22,153
Panel F: Death within 16 quarters			
High SES	-0.108***	-0.058***	-0.022***
	(0.006)	(0.006)	(0.006)
Effect Size (%)	-30.62	-16.31	-6.34
Outcome Mean	0.353	0.353	0.353
N	22,153	22,153	22,153
ICD diagnosis (3 digits)	✗	✓	✓
Individual characteristics	✗	✗	✓
Health status (pre)	✗	✗	✓
Health behavior (pre)	✗	✗	✓
Hospital & GP	✗	✗	✓

Note — The table presents the estimated coefficients for the effect of high socio-economic status on six mortality outcomes. The coefficients are based on Equation (1). Column (1) shows the effect without control variables, Column (2) controls for diagnosis fixed effects only, and Column (3) includes the full set of control variables as detailed in Section 3.2. All mortality outcomes are constructed as indicator variables (0/1). In-hospital mortality is defined as having the hospital discharge "death" (Panel A). Longer-term mortality is measured cumulatively, that is, death in the same quarter as the hospital discharge (Panel B), within 2 quarters (Panel C), 4 (Panel D), 8 (Panel E), and 16 quarters (Panel F). The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the panels. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2: Effect of High-SES on Subsequent Healthcare Utilization

	(1) 4 quarters after discharge	(2) 8 quarters after discharge
Panel A: Outpatient care (€)		
High SES	3.297	9.502**
	(4.205)	(4.796)
Effect Size (%)	1.77	4.94
Outcome Mean	186.362	192.297
N	18,249	16,378
Panel B: Drugs (€)		
High SES	-26.283	-27.166
	(27.869)	(29.465)
Effect Size (%)	-5.97	-6.55
Outcome Mean	440.180	415.040
N	18,249	16,378
Panel C: Drugs (N prescriptions)		
High SES	-0.772***	-0.747***
	(0.123)	(0.129)
Effect Size (%)	-8.78	-8.99
Outcome Mean	8.790	8.306
N	18,249	16,378
Panel D: Ambulatory visits		
High SES	0.033***	0.030***
	(0.011)	(0.012)
Effect Size (%)	4.54	4.55
Outcome Mean	0.735	0.661
N	18,249	16,378
Panel E: Hospital (€)		
High SES	-40.032	51.276
	(106.372)	(92.288)
Effect Size (%)	-1.76	3.15
Outcome Mean	2,271.420	1,625.819
N	18,249	16,378
Panel F: General practitioner (€)		
High SES	-3.448**	-1.381
	(1.475)	(1.269)
Effect Size (%)	-5.40	-2.28
Outcome Mean	63.816	60.706
N	18,249	16,378
Panel G: Outpatient visits for surgeries (€)		
High SES	0.516	0.152
	(0.322)	(0.375)
Effect Size (%)	31.37	8.76
Outcome Mean	1.645	1.739
N	18,249	16,378
Panel H: Outpatient visits for skin-and venereal diseases (€)		
High SES	1.307***	1.171***
	(0.353)	(0.344)
Effect Size (%)	28.97	23.96
Outcome Mean	4.511	4.888
N	18,249	16,378
Panel I: Outpatient visits for internal medicine (€)		
High SES	1.295**	0.877
	(0.529)	(0.620)
Effect Size (%)	18.41	10.73
Outcome Mean	7.031	8.179
N	18,249	16,378
ICD diagnosis (3 digits)	✓	✓
Individual characteristics	✓	✓
Health status (pre)	✓	✓
Health behavior (pre)	✓	✓
Hospital & GP	✓	✓

Note — The table presents the estimated coefficients for the effect of high socio-economic status on various outcomes measuring subsequent healthcare utilization. The coefficients are estimated with Equation (1) using the full set of control variables. All outcomes are measured in both 4 quarters (Column (1)) and 8 quarters (Column (2)) after the initial hospitalization. The effect size as a percentage of the outcome mean, the mean of the outcome variable, and the number of observations are provided at the bottom of the panels. Standard errors are robust and reported in parentheses below the coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3: Characteristics of Heart Disease Patients by Socio-Economic Status

	(1) Ø Full Sample	(2) Ø High SES	(3) Ø Low SES	(4) Diff.	(5) Sign.	(6) N
Demographics						
Female	0.3781	0.3737	0.3805	-0.0068		13,016
Age at hospitalization	73.4955	74.2778	73.0680	1.2099	***	13,016
Urban residence	0.2676	0.3348	0.2309	0.1039	***	13,016
Austrian citizen	0.9278	0.9511	0.9150	0.0360	***	13,016
Initial hospital stay						
Length of stay	8.2315	8.2196	8.2380	-0.0184		13,016
Hospital spending	5,914.8246	6,008.2736	5,863.7475	144.5261		13,016
N individual services	1.9206	2.0726	1.8375	0.2352	***	13,016
N hospital departments	1.6262	1.6301	1.6241	0.0060		13,011
Intensive care (0/1)	0.3281	0.3317	0.3260	0.0057		13,016
Rehospitalization within 30 days	0.0473	0.0422	0.0501	-0.0079	*	9,858
Mortality						
Death in hospital	0.1036	0.1037	0.1035	0.0002		13,016
Death in quarter of stay	0.1269	0.1283	0.1262	0.0021		13,016
Death within 1 quarter	0.1796	0.1804	0.1792	0.0013		13,016
Death within 2 quarters	0.2076	0.2067	0.2081	-0.0013		13,016
Death within 4 quarters	0.2553	0.2520	0.2571	-0.0052		13,016
Death within 8 quarters	0.3320	0.3248	0.3359	-0.0111		13,016
Death within 16 quarters	0.4561	0.4400	0.4648	-0.0248	***	13,016
Healthcare (8 quarters before)						
Outpatient care (€)	152.3803	170.1801	142.6513	27.5287	***	13,016
General practitioner (€)	60.6552	57.4072	62.4304	-5.0232	***	13,016
Specialist (€)	75.3723	90.2147	67.2597	22.9550	***	13,016
General health screenings (N visits)	0.0369	0.0380	0.0362	0.0018		13,016
Drugs (€)	231.8978	248.9391	222.5834	26.3558	*	13,016
Drugs (N prescriptions)	10.8404	9.7396	11.4421	-1.7026	***	13,016
Hospital (€)	837.1939	848.2958	831.1258	17.1701		13,016
Ambulatory visits	0.3495	0.3982	0.3222	0.0761	***	6,667
Healthcare (4 quarters after)						
Outpatient care (€)	220.2613	235.2401	212.0316	23.2085	***	9,921
General practitioner (€)	92.4425	84.1884	96.9775	-12.7892	***	9,921
Specialist (€)	97.7542	113.1107	89.3169	23.7938	***	9,921
General health screenings (N visits)	0.0367	0.0347	0.0378	-0.0031		9,921
Drugs (€)	391.4347	385.7263	394.5710	-8.8448		9,921
Drugs (N prescriptions)	14.1364	12.1561	15.2244	-3.0684	***	9,921
Hospital (€)	1,784.2887	1,809.6081	1,770.3775	39.2306		9,921
Ambulatory visits	0.4485	0.4784	0.4321	0.0463	***	9,921
N	13,016	4,600	8,416			

Note — The table presents descriptive statistics for demographic characteristics, the initial hospital stay, mortality, and healthcare use for patients with a first-time hospitalization for heart disease. We define heart disease as either acute myocardial infarction (I21) or heart failure (I50). Column (1) shows the average for the full sample, Column (2) for patients with high socio-economic status, and Column (3) for patients with low socio-economic status. Column (4) shows the difference between high- and low-SES patients, while Column (5) indicates the statistical significance of these differences. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Column (6) provides the number of observations.

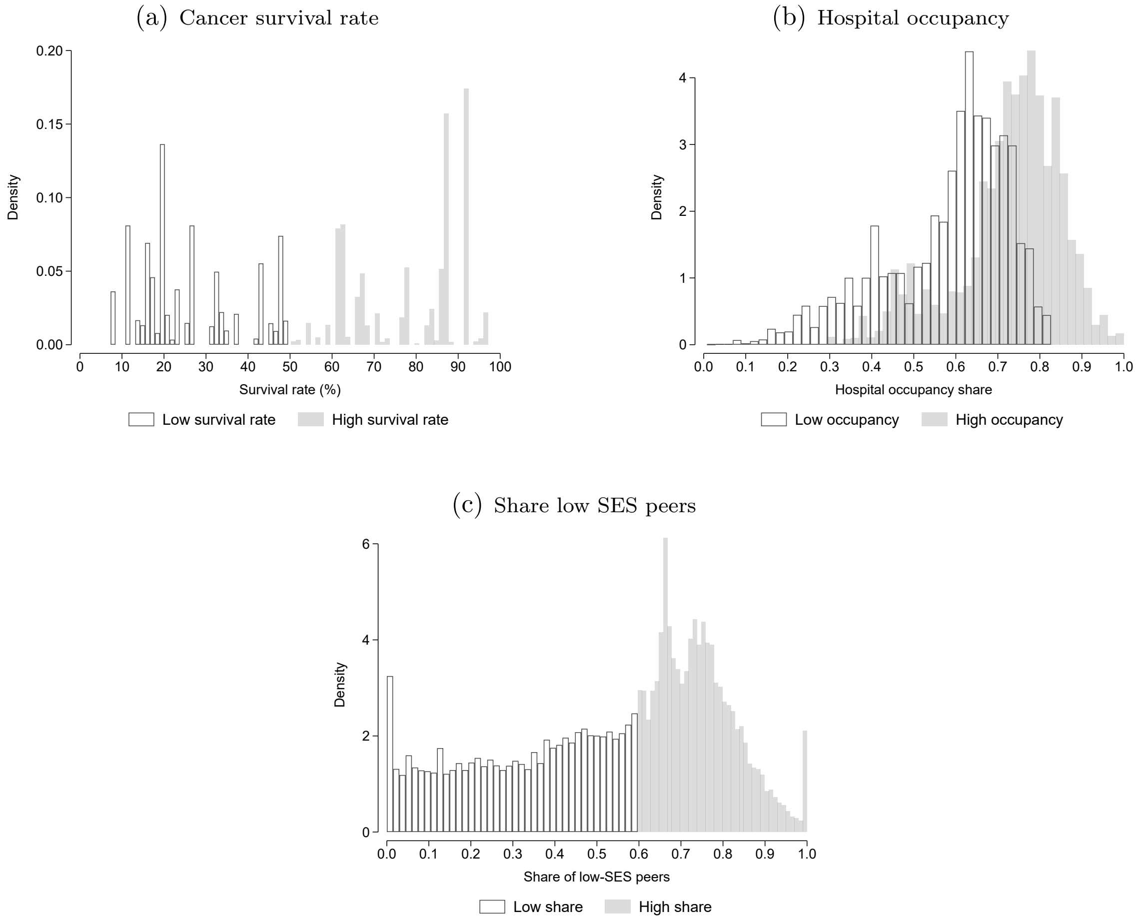

Figure A.2: Distributions of Several Sample Split Variables

Note — This figure presents the distributions of several sample split variables used in the mechanism analysis. The distributions are plotted separately for different samples corresponding to the analyses in Table 7. Panel (a) shows five-year cancer survival rates. High five-year survival rates are defined as ≥50 percent and low survival rates as <50 percent. Information on cancer survival rates is obtained from *Statistics Austria*. For each cancer type, survival rates are available by year and patient's sex. To calculate the survival rate for each cancer type, we first use our analysis sample (see Section 3.1) and match the cancer survival rates on the patient's cancer type, year of hospitalization, and sex. We then compute the average five-year survival probability for each cancer type. Cancer survival rates are available for 77.5 percent of the hospitalizations in our sample. The cancer types for which we do not have a match tend to be less common, except for the diagnosis "C44 - Other malignant neoplasms of the skin". Panel (b) shows hospital occupancy shares. Occupancy is defined as the share of patients hospitalized with cancer on a given day relative to the daily maximum number of patients the hospital admitted with cancer between 2010 and 2015. High and low occupancy is then defined as above or below the median in the occupancy measure conditional on the hospital and day of the week. Panel (c) shows the share of low-SES peers. High and low share of low-SES peers is defined as above or below the median share of blue collar working peers in firms worked, averaged over the patients' career from 1972 to 2005.