Pharmacy School Cost and Opioid Dispensing: A Hidden Connection?*

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Abstract

The opioid crisis in the United States has reached unprecedented levels, but little is known about the role of pharmacists. Using large-scale data from pharmacists' online job profiles linked with data on opioid dispensing at the pharmacies where they work after graduation, we investigate how the financial burden of pharmacy education influences their career choices and subsequent dispensing behaviors. We compare opioid dispensing quantities across pharmacists from institutions in the same county but with different tuition costs. First, we show that pharmacies dispensing more opioids tend to provide higher wages. Second, we find that even among pharmacies in the same county, pharmacists from higher-tuition institutions are more likely to work at pharmacies with higher opioid dispensing. Lastly, we demonstrate that the positive association between pharmacy education costs and opioid dispensing is stronger among pharmacists who are in their first two years post-graduation, male pharmacists, and those working in areas with more severe prescription opioid use. Our findings suggest that pharmacists from institutions with higher tuition, who likely face greater student debt, may be more inclined to work at pharmacies that dispense larger quantities of opioids due to financial concerns.

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1 Introduction

The United States is experiencing the worst opioid epidemic in its history. Between 1999 and 2020, fatal drug overdoses increased by 445 percent, claiming more than one million lives (National Institute on Drug Abuse, 2024). The rise in overdose deaths is largely driven by opioid-involved overdoses, which account for 75 percent of these fatalities (Compton et al., 2021). Previous research has examined the factors contributing to this crisis, with extensive focus on pharmaceutical manufacturers, physicians, and insurers as key drivers of the epidemic.[1] However, despite their critical position as gatekeepers in the dispensing of prescription medications, relatively little attention has been paid to the involvement of pharmacies and pharmacists.

Emerging evidence suggests that pharmacies and pharmacists have contributed to fueling the epidemic. Over the past decade, multiple lawsuits have been filed against major pharmacy chains, including Walgreens, CVS, and Walmart. These lawsuits claimed that pharmacies had played a key role, primarily through improper dispensing and failure to monitor suspicious opioid orders. Although there is growing attention on the causes of these improper dispensing practices, there is still limited understanding of the factors determining pharmacists' dispensing behavior.

In this paper, we examine whether financial motivations among pharmacists contribute to their opioid dispensing practices. Specifically, we investigate whether pharmacists who graduated from pharmacy schools with higher education costs are more likely to work in pharmacies that dispense greater quantities of opioids after graduation. We hypothesize that the financial pressure of repaying student debt may drive pharmacists to seek employment at pharmacies with higher opioid sales, where the financial rewards are potentially greater.

Recent evidence highlights the plausibility of this hypothesis by uncovering systemic factors that influence pharmacists' dispensing practices. Internal documents from the pharmaceutical industry, which have become available through litigation between 1997 and 2020, suggest that some pharmacies prioritized profits over patient safety (Yakubi et al., 2022; Caleb Alexander et al., 2022; Chiu et al., 2023). For example, incident reports by Walgreens pharmacists reveal that

[1] Manufacturers have invested heavily in advertising, using targeted campaigns to promote the widespread use of opioids and influence prescribing practices (Van Zee, 2009; Nguyen et al., 2019; Alpert et al., 2022b). Prescribers have contributed by issuing high volumes of opioid prescriptions, often influenced by aggressive marketing and limited recognition of addiction risks (Schnell, 2017; Eichmeyer and Zhang, 2022; Alpert et al., 2022a). Insurers have also contributed to the crisis by providing generous coverage for opioids, which substantially lowered out-of-pocket costs for patients and increased their accessibility (Zhou et al., 2016; Pacula and Powell, 2018).

managers pressured them to fill more opioid prescriptions, even in cases with red flags. These reports also suggest that higher opioid sales are associated with increased compensation for managers, whose salaries are linked to prescription volume (Chiu et al., 2023). Moreover, pharmacists who refused to fill opioid prescriptions in good faith often faced a negative work environment created by their managers. Overall, this evidence suggests that higher opioid sales may contribute to both negative work environments and increased compensation for pharmacists. If pharmacies provide financial benefits—such as higher wages or bonuses—based on their opioid sales, this may influence pharmacists' career decisions and dispensing behavior, particularly among those facing greater financial pressure.

However, investigating the link between educational costs for pharmacists and opioid dispensing behavior is empirically challenging, mainly due to data limitations. Conducting such an analysis would require comprehensive information on a pharmacist's education, tuition costs, post-graduation employment, and the opioid dispensing patterns of the pharmacies where they work, which are typically unavailable in the U.S.

We address this data challenge by constructing a novel dataset that links worker-level online job profile data with education costs and pharmacy-level opioid dispensing data. Our data are from three primary sources. First, Lightcast provides detailed job and education information by compiling longitudinal job histories from online career platforms, capturing both worker and job-level characteristics. Using this dataset, we identify the schools each pharmacist graduated from and the pharmacies where they are employed after graduation. Second, the College Scorecard offers data on higher education institutions, including tuition, fees, and completion rates, which we use to estimate the expected college costs for each pharmacist. Lastly, data from the Drug Enforcement Administration (DEA) provide detailed information on opioid dispensing at the pharmacy level over time.[2] By linking these datasets, we capture pharmacists' education, associated tuition costs, and their subsequent employment and opioid dispensing practices at the pharmacies where they work. Our sample consists of pharmacists from the Lightcast job profile data who were employed at opioid-dispensing pharmacies at any point between 2006 and 2019, representing approximately ten percent of pharmacists working in health and personal care retail settings across the U.S.

[2]We focus primarily on oxycodone in our baseline analysis and conduct a supplemental analysis on hydrocodone, as the DEA pharmacy-level database only includes information on these drugs. Note that oxycodone and hydrocodone account for the majority of legal opioid distributions to retail pharmacies (Griffith et al., 2021).

We begin by presenting a simple two-period theoretical framework to model a pharmacist's decision-making process, emphasizing the trade-off between wages earned and the disutility arising from higher opioid sales. The framework leads to two key predictions. First, pharmacists with higher student debt are more likely to work at high-opioid-dispensing pharmacies early in their careers, as these positions tend to offer higher wages. Second, as the debt is repaid over time, the influence of financial constraints diminishes, reducing the likelihood of employment at high-opioid-dispensing pharmacies later in their careers.

We provide supportive evidence that pharmacies with higher levels of opioid dispensing tend to offer higher wages to pharmacists. To establish this, we construct a separate dataset that links pharmacy-level opioid dispensing to offered wages using the Lightcast Online Job Posting Database. Using this dataset, we find a positive correlation between opioid dispensing and average wages at the pharmacy level, showing that one standard deviation (about 63%) higher OxyContin dispensing is associated with a 2.4% increase in wages. This positive correlation aligns with the idea that pharmacists with greater education costs may be incentivized to work at pharmacies with higher opioid dispensing.

We then turn to empirically testing the first prediction of our theoretical framework by examining the impact of college costs on opioid dispensing at the pharmacies where pharmacists work after graduation. To address concerns that differences in opioid dispensing may be driven by selection mechanisms rather than a causal effect of college costs, we control for various individual, college, pharmacy, and county characteristics, building on the approach suggested by Schnell and Currie (2018).[3] For example, our controls include proxies for individual ability that may be associated with college characteristics, such as the college's average SAT scores, admission rates, and an individual's skills. Importantly, in our alternative specification, we also include county fixed effects for both the pharmacy school and the pharmacy to account for geographic factors influencing education costs and opioid dispensing practices.

Using these approaches, we find a strong positive association between college costs and opioid sales during a pharmacist's career, even among pharmacists working within the same county. Our estimates indicate that pharmacists from the highest-tuition colleges work at pharmacies that

[3] Schnell and Currie (2018) employs a similar approach to study the impact of medical school rankings on opioid prescribing.

dispense approximately 2.5 times more opioids than pharmacies where pharmacists from the lowest-tuition colleges work, based on our baseline sample divided into seven tuition categories. Our elasticity estimates further support this relationship, indicating that a 1% increase in expected tuition and fees is associated with a 1.45% increase in opioid sales. This association persists even after controlling for various factors, such as pharmacist skills and local opioid exposure. Robustness checks and additional analyses confirm the consistency of these findings across different specifications.

Our analysis reveals important heterogeneity in the relationship between college costs and opioid dispensing across several dimensions. We find that the association is stronger in regions with higher rates of prescription opioid use and among male pharmacists. In addition, pharmacists from high-ranked schools show weaker associations, potentially due to unobservable advantages or institutional factors. We find little evidence that economic conditions at the time of graduation affect this relationship.

We then turn to empirically testing the second prediction of our theoretical framework through two approaches: analyzing the heterogeneity in the effect of college costs across pharmacists at different career stages and examining job turnover patterns. First, we show that the positive association between college costs and opioid dispensing is strongest in the first two years post-graduation. This is consistent with the idea that recent graduates with high debt may prioritize high-opioid-dispensing pharmacies for financial reasons. Second, our turnover analysis shows that a 100% increase in opioid sales is associated with a 6.2 percentage point increase in overall turnover and a 4.5 percentage point increase in transitions to low-opioid pharmacies among pharmacists with high college costs. In contrast, those with low costs show no significant relationship. Overall, our results suggest that the association between tuition costs and opioid dispensing declines over time in a pharmacist's career. This decline may be attributed to factors such as growing ethical considerations and increased awareness of the disutility associated with opioid dispensing, which could outweigh financial motivations as student debts diminish as student debts are gradually repaid.

Our study contributes to the extensive literature on the causes and consequences of the opioid crisis, which has explored the roles of opioid policies (Alpert et al., 2018; Evans et al., 2019), physicians (Schnell, 2017; Eichmeyer and Zhang, 2022; Alpert et al., 2022a), manufacturers

(Van Zee, 2009; Nguyen et al., 2019; Alpert et al., 2022b), and insurers (Zhou et al., 2016; Pacula and Powell, 2018) in fueling the epidemic.[4] For example, Schnell and Currie (2018) find that physicians who trained at top-ranked medical schools prescribe substantially fewer opioids than those from lower-ranked schools, suggesting that physician education may have a causal effect on prescribing behavior. Despite the critical role that pharmacists play as the final gatekeepers of opioid distribution, surprisingly little is known about how their educational background and financial pressures from college costs influence their opioid dispensing practices.[5] In this paper, we address this gap by examining the role of pharmacists in the opioid crisis, focusing on how pharmacy education costs may influence their workplace choices and dispensing behaviors.

Our paper also contributes to a broader literature investigating the effects of education debt on human capital investment and career decisions. Using policy changes in financial aid in universities, Rothstein and Rouse (2011) find that more student debt induces college graduates to pursue higher-salary jobs but reduces the probability of choosing low-paid public jobs. Using a similar context, Zhang (2013) shows that more college debt lowers graduate school attendance. A few other studies investigate how debt from college costs affects the career choice of medical students, who pay the highest tuition and fees among fields of study in the U.S. Rohlfing et al. (2014) surveyed medical students and report a strong association between debt level and the choice of their specialties.[6] Nicholson et al. (2015) surveyed dentists and find that dentists with higher initial debt are more likely to enter private practice, which offers higher salaries than public ones. Our study adds to this literature by exploring how education costs influence pharmacists' career trajectories.

Our research is also related to the literature on the trade-off between wages and non-pecuniary job disamenities. According to the theory of equalizing differences, wages should compensate for non-wage job disamenities such as job insecurity, health risks, and performance pressure (Rosen,

[4] A comprehensive review of this literature is provided in Maclean et al. (2020).

[5] A small but growing literature highlights the role of pharmacies in the opioid crisis. For example, Janssen and Zhang (2023) show that independent pharmacies dispense 39 percent more opioids than chain pharmacies, driven by competitive pressures and financial incentives associated with ownership. Similarly, Churchill and Burton (2024) find that "pill mill" laws, implemented to address opioid overprescription, led to reductions in retail pharmacy sales and employment, driven largely by the closure of independent pharmacies.

[6] Prior studies also show that an increase in college costs affects graduation timing and satisfaction among students. Garibaldi et al. (2012) find that increasing continuation tuition by 1,000 euros reduces the probability of late graduation by at least 6.1 percentage points. Velez et al. (2019) find that a 1,000-pound increase in tuition fees for UK full-time degree students in 1998 led to higher student debt and lower satisfaction, particularly among disabled students and those without family support. It also resulted in increased term-time employment for the latter group.

1986). A strand of papers reports compensation differentials caused by non-wage workplace characteristics in various contexts (French and Dunlap, 1998; Villanueva, 2007; Wissmann, 2022; Nagler et al., 2023). However, some studies point out the difficulty in estimating the effects of job disamenities on compensating differentials because of endogenous matching and incomplete compensation information (Duncan and Holmlund, 1983; Eriksson and Kristensen, 2014; Lavetti, 2023). This is the first paper to suggest the existence of pharmacists' willingness-to-pay (WTP) to avoid opioid dispensing and evidence for sorting into high-opioid-dispensing pharmacies based on pharmacists' potential valuation of this disamenity. In particular, our paper takes advantage of a relatively homogeneous workplace setting of pharmacies with similar firm sizes, tasks, skill requirements, and working conditions.

Lastly, our study is part of the growing literature that leverages data from online job profiles, which are increasingly used in studies on the labor market for their rich worker-level details (Conzelmann et al., 2023; Berry et al., 2024; Curtis et al., 2024; Dorn et al., 2024; Gortmaker et al., 2024; Evsyukova et al., 2025). For instance, Berry et al. (2024) and Evsyukova et al. (2025) use the connection of workers with different demographics to investigate discrimination in the labor market. Curtis et al. (2024) and Dorn et al. (2024) analyze self-reported skills in online job profiles and reveal that this skill information effectively reflects trends in labor demand, earnings variation, and human capital accumulation. In addition, Conzelmann et al. (2023) use data on individual education and job history from online job profiles to characterize the labor markets that are unique to different colleges. Our paper uses online job profile data to link workplace characteristics with college characteristics at the pharmacist level, allowing us to investigate the lasting impact of college costs on career decisions among pharmacists.

Our paper has important policy implications. First, the role of pharmacists in the opioid crisis has long been a black box, but our findings shed light on a key mechanism: pharmacists facing financial constraints due to high college costs are more likely to sort into pharmacies with higher opioid dispensing rates. This suggests that financial pressures may drive pharmacists to seek out positions where dispensing behavior is more aggressive, raising concerns about the sustainability of such practices. If college costs were lower, this sorting mechanism would be weakened, potentially reducing the concentration of pharmacists with strong financial incentives in high-dispensing environments. Second, our findings highlight the need for policies that address the rising costs of pharmacy education, as these financial burdens may inadvertently contribute to the perpetuation of risky opioid dispensing practices. By alleviating the financial strain on pharmacists, policies could mitigate the influence of economic pressures on their professional behavior, promoting more responsible opioid dispensing practices across the industry.

2 Background

2.1 The Role of Pharmacists in the Opioid Epidemic

Prescription opioids are dispensed through pharmacies, making pharmacists gatekeepers in preventing and addressing opioid misuse and overdose (Vadiei et al., 2022; Kosobuski et al., 2022). Pharmacists can identify individuals at risk of opioid use disorder or overdose and provide necessary consultations (Vadiei et al., 2022). Furthermore, nearly 90% of Americans live within two miles of a community pharmacy, allowing pharmacists to reach a broad population (Qato et al., 2017).

2.2 Factors Contributing to Improper Opioid Dispensing Practices

One of the key challenges to fulfilling the critical role as gatekeepers is systemic factors in pharmacy practices. Using pharmaceutical industry documents released in litigation between 1997 and 2020, Chiu et al. (2023) conducted an observational, retrospective content analysis to assess the opioid dispensing practices of a retail community pharmacy chain, Walgreens.[7] The study identified four key factors contributing to improper opioid dispensing: (1) store-level procedures, (2) management pressure, (3) distribution center activities, and (4) pharmaceutical company sponsorship.[8] Management pressure was the most frequently mentioned factor, appearing in ten out of the 21 documents reviewed in the study.

The documents reviewed by Chiu et al. (2023) suggest that Walgreens management applied

[7] Investigating the practices of retail chain pharmacies has historically been challenging due to restricted access to internal decision-making processes (Bero, 2003). Recent studies on the opioid crisis have addressed this challenge by investigating internal documents that became available through litigation (Yakubi et al., 2022; Caleb Alexander et al., 2022).

[8] Issues included unresolved red flags at the store level, pressure on pharmacists to fill more opioid prescriptions, and distribution centers' failure to monitor high-volume orders (Chiu et al., 2023).

pressure on both store-level and firm-level employees, which contributed to improper opioid dispensing practices. Internal reports from the Walgreens employee hotline between 2010 and 2018 highlight numerous conflicts between pharmacists and their supervisors regarding opioid prescriptions. Pharmacists often expressed concerns about being overruled by managers when they refused to fill certain prescriptions due to red flags. Managers often prioritized customer satisfaction and productivity metrics over professional judgment, pressuring pharmacists to approve prescriptions. This created a work environment where pharmacists felt their autonomy was limited, contributing to improper opioid dispensing.

In addition, incident reports reveal that Walgreens' incentive structures, including performance metrics and bonus schemes, influenced these practices. Managers were rewarded based on the number of opioid prescriptions filled, which encouraged them to pressure pharmacists to approve more opioid prescriptions, regardless of red flags or errors. At the firm level, Walgreens management expressed concern about stores with lower opioid sales, even suggesting investigations into why these stores were not filling more prescriptions. This emphasis on sales, coupled with bonus systems tied to prescription volumes, created a culture where dispensing opioids was prioritized over patient safety.

Financial incentives for opioid dispensing and improper dispensing practices are not exclusive to chain pharmacies. Janssen and Zhang (2023) highlight that independent pharmacies have even stronger financial incentives to dispense more opioids than chain pharmacies. The study also shows that increased competition pressure is linked to higher rates of opioid dispensing.

2.3 Association Between Opioid Sales and Pharmacist Compensation

Anecdotal evidence documenting financial incentives for pharmacies and their managers in opioid dispensing, discussed in Section 2.2, raises questions about whether opioid sales are associated with the compensation of pharmacists employed at those pharmacies. If this link exists, it may more directly influence pharmacists' behavior and career paths.

We examine this relationship by using linked data on offered wages from Lightcast online job postings and opioid dispensing records from the DEA at the pharmacy level.[9] We run an ordinary

[9]Lightcast Job Posting Database covers the near universe of online job advertisements in the U.S. from 2007 and 2010–2019. We link the job posting data with opioid dispensing data from the DEA's Automation of Reports and

least squares regression of offered wages on opioid dispensing along with a wide range of controls.[10]

Our regression analysis reveals a positive relationship between pharmacy-level OxyContin dispensing and the wages offered for pharmacist positions. Specifically, a doubling of oxycodone sales is associated with a 3.8% increase in offered wages, which is equivalent to a 2.4% increase in offered salaries in response to one standard deviation higher oxycodone dispensing.

3 Theoretical Framework

In this section, we present a simple two-period occupation choice model to illustrate the intuition behind our empirical test. Assume that a pharmacist chooses from a continuum of job options with wage w and the level of opioid sales s in each period. Period utility U derives from consumption c and non-pecuniary job amenity x and satisfies the following properties: $U_c > 0$, $U_x > 0$, $U_{cc} < 0$, and $U_{xx} < 0$. The job amenity is a function of the level of opioid sales, and higher opioid sales imply lower job amenities and utility ($x'(s) < 0$). In other words, a pharmacist gets disutility from selling opioids, which is consistent with the anecdotal evidence discussed in Section 2.2. At the same time, higher opioid sales imply higher wages ($w'(s) > 0$), an assumption supported by the analysis discussed in Section 2.3. Let D denote the debt from the student loan when a pharmacist graduates from pharmacy school. We assume that the pharmacist should repay the debt in the first period, considering the pre-determined repayment schedule of student loans. Then, we can formally express a pharmacist's utility maximization problem subject to her budget constraint as follows:

$$\begin{aligned} &\max_{(c_i, s_i)} U(c_1, x(s_1)) + U(c_2, x(s_1)) \qquad (1) \\ &\text{s.t. } c_1 = w(s_1) - D \ \&\ c_2 = w(s_2), \end{aligned}$$

where U is additively separable ($U_{cx} = 0$) and, the Inada conditions hold for both arguments.

The model abstracts many vital aspects of the labor market of pharmacists but provides practical

Consolidated Orders System (ARCOS) at the pharmacy level.

[10]The regression is based on 1,378 observations at the pharmacist position-by-year level. The dependent variable is the inverse hyperbolic sine transformation of the offered wage. We include fixed effects for state and year and controls for job characteristics such as employment type (full-time vs. part-time), internship status, required years of education, required years of experience, and specific skill requirements (general, cognitive, social, IT, software, engineering, sales, administrative, manufacturing, and business skills).

guidance for our research purpose. However, there are a couple of data limitations for directly testing the model predictions: First, we could not observe an individual pharmacist's debt level from student loans. Second, we could not identify when a pharmacist completes her student loan repayment. Considering the empirical constraints, we test the following two viable hypotheses from the model prediction.

Prediction 1. There is a positive correlation between the cost of college where a pharmacist graduated from and opioid sales in her career.

The first-order conditions of the maximization problem in Equation (1) can be expressed as:

$$\begin{aligned} w'(s_1) &= -\frac{U_s(w(s_1) - D, x(s_1))}{U_c(w(s_1) - D, x(s_1))} \\ w'(s_2) &= -\frac{U_s(w(s_2), x(s_2))}{U_c(w(s_2), x(s_2))}. \end{aligned} \tag{2}$$

The first equation suggests that when the debt from student loan increases, a pharmacist raises both wage level and opioid sales because the marginal utility of consumption increases ($dw'(s_1)/dD > 0$ and $ds_1/dD > 0$). On the contrary, the second equation indicates that opioid sales in the second period are not a function of debt from student loans ($ds_2/dD = 0$) because a pharmacist should fully repay the student loans in the first period. The comparison of the first-order conditions for the two periods implies that a pharmacist chooses a higher wage in the first period than in the second period if she has a positive debt from a student loan ($w(s_1) > w(s_2)$). Since the wage is an increasing function of opioid sales, we can also say that the level of opioid sales decreases in the second period ($s_1 > s_2$). In other words, the model implies that a pharmacist transfers to a pharmacy selling fewer opioids throughout her career as she repays student loans in the early stages of her career.

From the first-order condition for the first period,

$$w'(s_1) = -\frac{U_s(w(s_1) - D, x(s_1))}{U_c(w(s_1) - D, x(s_1))}, \tag{3}$$

we observe that when the debt D is higher, the pharmacist's marginal utility of consumption increases, which leads to a higher wage $w(s_1)$ and opioid sales level s_1 in the first period. Since the college cost is often directly related to the debt burden, this prediction implies that pharmacists graduating from colleges with higher costs are more likely to work in positions with higher wages $w(s_1)$, which correlate with higher opioid sales s_1.

Empirical Testing for Prediction 1. We empirically test the first hypothesis by investigating the effect of college-level tuition and fees on the level of opioid sales from the pharmacies where the pharmacists work post-graduation, controlling for a wide range of individual, pharmacy, and college-level controls. We discuss our empirical strategies and potential threats to our identification in Section 5.

Prediction 2. The positive correlation between a pharmacist's college cost and opioid sales decreases over time in their career.

The first-order condition for the second period,

$$w'(s_2) = -\frac{U_s(w(s_2), x(s_2))}{U_c(w(s_2), x(s_2))}, \tag{4}$$

shows that opioid sales s_2 in the second period do not depend on the initial student debt D, as the pharmacist repays the debt in the first period. This implies that, over time, the influence of college costs (and associated debt) on opioid sales diminishes, which leads to a weaker correlation between college costs and opioid sales in later periods as pharmacists become less financially constrained by their student loans. This finding could extend to a multi-period model, with debt levels progressively decreasing as repayments are made over time.

The first order conditions imply $\frac{d(s_1-s_2)}{dD} > 0$, suggesting that as the initial debt D increases, the difference between opioid sales levels in the first period s_1 and the second period s_2 also increases. This is because higher debt D in the first period raises the pharmacist's incentive to work in a higher-wage, high-opioid-dispensing pharmacy to maximize income for debt repayment. As the debt is repaid, the marginal benefit of remaining in such a position diminishes, leading to a reduced opioid sales level s_2 in the second period. As a result, pharmacists are more likely to transfer from high-opioid-dispensing pharmacies early in their careers to pharmacies with lower opioid sales later on, as financial constraints ease over time.

Empirical Testing for Prediction 2. We empirically test this prediction using two approaches. First, we investigate whether the effect of college costs on pharmacy-level opioid sales is larger for pharmacists early in their careers. Second, we explore within-individual job transitions to test whether pharmacists are more likely to move to pharmacies with lower levels of opioid dispensing as their careers progress. We provide more details on this analysis and discuss the results in Section 6.

4 Data

To examine the relationship between opioid dispensing and college cost, we use three primary data sources: (1) Lightcast Job Profile Data (formerly Burning Glass Technologies); (2) College Scorecard; (3) Automation of Reports and Consolidated Orders System (ARCOS). This section describes each of these data sources and the construction of our sample.

To collect job and education information on pharmacists in the U.S., we rely on the Lightcast Job Profile Database ("Lightcast" henceforth), which contains the longitudinal job history of more than 130 million workers in the U.S. Lightcast collects professional profiles from online career platforms such and LinkedIn and Indeed, where individuals share information about their employment, skills, and education. Lightcast uses machine-learning algorithms to unify duplicate profiles to create one unique master profile corresponding to one person. Based on the job profiles, the Lightcast database reports worker-level characteristics, such as gender, degree, field of study, experience year, and skill sets, and job-level characteristics, such as job title, employer name, occupation, industry, start and end dates, and location.

The dataset covers the workers currently in the U.S. or working in the U.S. for their most recent jobs. We use the profiles of workers who report "pharmacist" as their occupation (SOC code = 29-1051) and have education information. Based on the pharmacists' job histories, we construct pharmacy-by-year panel data for 2006-2019. For each pharmacist, we identify the primary college degree if the field of study of the degree is a pharmacy-related major or if the college title includes "pharmacy school."[11]

We also employ the College Scorecard provided by the U.S. Department of Education to capture college costs and other college characteristics. The College Scorecard includes detailed information

[11] For pharmacists with missing field of study information, we define the last graduate degree as their primary college degree, considering that pharmacy schools offer graduate degrees in the U.S.

on the cost and value of 4,000 higher education institutions nationwide. Among other factors, we use tuition and fees, cost of attendance, admission rates, and percentages completed within 4, 6, and 8 years. Our primary measure of college costs is the expected tuition and fees until earning a diploma. Specifically, we use the completion rate within each year (4, 6, and 8 years) conditional on completing the program as the probability of earning a diploma in the year and multiply it by the corresponding year times the annual tuition and fees. We use tuition and fees as the primary measure of college costs because it is the most frequently reported among various cost measures. In our data, the average expected tuition and fees until earning a diploma is $82,042 in the 2010 dollar value.

As a robustness check, we use the average attendance cost, including tuition and fees, books and supplies, and living expenses. The correlation between tuition and fees and the average cost of attendance is 0.96, conditional on both observed. Though these college-level cost measures are not specific to pharmacy schools, we use them as proxies for the costs of attending pharmacy schools under the assumption that college-level and department-level costs are highly correlated. Though tuition and fees at the college-department-year level is not available, we find that a dollar increase in the college-level annual tuition and fees is associated with a 0.452 dollar increase in the median student loan debt at the college-major level using the Field of Study Survey of College Scorecard (See Appendix Figure A1). In a similar logic, we control for college-level characteristics, such as college type, SAT scores, and the composition of students as proxies for the characteristics of pharmacy schools. We link College Scorecard and Lightcast via OPE ID for institutions.

Our data on opioid dispensing in retail pharmacies are from the DEA's Automation of Reports and Consolidated Orders System (ARCOS). This database tracks all legal transactions of certain controlled substances from their manufacture through commercial distribution channels to their point of sale or distribution at the dispensing or retail level, including hospitals, retail pharmacies, practitioners, mid-level practitioners, and teaching institutions. We use transaction records where retail pharmacies acted as buyers during the period from 2006 to 2019. We use annual oxycodone transactions measured in Morphine Milligram Equivalents (MME) as our main measure of pharmacy-level opioid sales. We focus on oxycodone sales since the DEA's pharmacy-level database includes data only on oxycodone and hydrocodone. We also check the robustness of the results using hydrocodone sales. Note that oxycodone and hydrocodone account for the majority of legal opioid distributions to retail pharmacies and are among the most widely abused prescription opioids (Griffith et al., 2021; Cai et al., 2010). Both oxycodone and hydrocodone sales vary greatly across pharmacies in the ARCOS database. While 25th-percentile pharmacies do not sell opioids at all, 25th-percentile pharmacies sell 2.07 million MME of oxycodone and 0.54 million MME of hydrocodone annually.[12] We link ARCOS to Lightcast via a job's employer name and location.

Table 1 presents the summary statistics of our sample across the tuition fee level (low, middle, and high based on college-level annual tuition and fees), considering our specifications comparing pharmacists across college costs. Our sample includes 13,563 pharmacists and 65,863 pharmacist-by-pharmacy-by-year observations,[13] which cover about 10% of pharmacists working in health and personal care retailers.[14] As shown in Panel A, about 40% of the sample pharmacists are women, meaning that female pharmacists are under-represented in our sample.[15] Panel B reports the large variation in the cost of attending college across three groups, while there is not much difference in academic level and student composition. Most importantly, in Panel C, we observe the positive gradient of pharmacy-level oxycodone sales across college cost levels.

5 Empirical Strategy

We investigate whether higher college costs induce graduates from pharmacy schools to dispense more opioids during their careers (or, more realistically, to get a job at pharmacies that sell more opioids). It is possible that graduates from colleges with high tuition and fees feel more of a financial burden after graduation and try to find a more lucrative job to expedite the repayment of student debt. At the same time, pharmacies selling more opioids, regardless of whether patients seem to misuse them, may offer higher salaries in general. To identify this

[12]Morphine Milligram Equivalents (MME) is the amount of milligrams of morphine an opioid dose is equal to when prescribed. For instance, 6.6mg of oxycodone is the equivalent dose to 10mg oral morphine.

[13]About 98.7% of pharmacist-by-year observations involve a single pharmacy. In these cases, pharmacist-by-pharmacy-by-year observations are equivalent to pharmacist-by-year observations.

[14]U.S. Bureau of Labor Statistics reports that the number of pharmacists working in the industry of health and personal care retailers is 134,050 as of 2023. See here for more information.

[15]For instance, women accounted for 63% of pharmacy degree recipients in 2020 (Draugalis et al., 2022). This under-representation is partly because our sample includes pharmacists who graduated before the share of women in the pharmaceutical profession sharply increased and partly because males are more likely to use online job platforms. For instance, 56.2% of LinkedIn users are male, while 43.6% are female as of 2024 according to Expandi.

relationship, we estimate regressions of the following form:

$$\text{IHS}(y_{ispt}) = \alpha + \sum_{k=2}^{7} \beta_k \mathbf{1}(\text{Rank}_s = k) + X_i'\gamma + Z_s'\eta + R_p'\delta + \theta_t + \varepsilon_{ispt}, \tag{5}$$

where $\text{IHS}(y_{ispt})$ is the inverse hyperbolic sine (IHS) transformation of opioid dispensing at the pharmacy p where pharmacist i, who graduated from pharmacy school s, works in year t.[16] $\mathbf{1}(\text{Rank}_s = k)$ is a binary variable representing whether the expected tuition and fees of college s, where pharmacist i graduated, fall into group k. Colleges are grouped into seven categories (septiles) from lowest ($k = 1$) to highest ($k = 7$) expected tuition and fees, and the lowest tuition group is the reference category.[17] Using this vector of indicators allows the effect of college costs to be nonlinear. It also enables us to check if particular groups drive the association between college costs and opioid sales. So, β_k coefficients capture the percentage difference in opioid dispensing for each group compared to the group with the lowest tuition level.

Alternatively, we use the IHS transformation of expected college tuition and fees instead of the vector of indicators to measure the elasticity of opioid sales to college costs, which takes the following form:

$$\text{IHS}(y_{ispt}) = \alpha + \beta \text{IHS}(\text{Expected Tuition}_s) + X_i'\gamma + Z_s'\eta + R_p'\delta + \theta_t + \varepsilon_{ispt}. \tag{6}$$

In the baseline model, X_i is a vector of individual-level characteristics such as gender, graduation year fixed effects, and the number of degrees (Bachelor's, Master's, and Doctoral). Z_s is a vector of college-level characteristics such as college type (public, profit private, and non-profit private), average SAT score, the shares of students in racial and gender groups, and characteristics of the county where the college is located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010). R_p includes pharmacy type (chain and independent) and characteristics of the county where the

[16] The IHS transformation ($\text{IHS}(y) = \text{arsinh}(y) = \ln(y + \sqrt{y^2 + 1})$) is used to include observations with zero opioid dispensing. As the IHS transformation approximates the natural logarithm, we interpret the estimated coefficients in the same way as those from a standard log-transformed outcome variable.

[17] College Scorecard misses college cost information for some years, even for the same college. We construct time-invariant cost measures for each college to minimize missing observations without losing generality. Specifically, we first deflate observed college costs to the level of 2010. Then, we regress the deflated college costs on college and year fixed effects. We classify colleges into subgroups based on the college fixed effects.

pharmacy is located, which include the same set of county-level characteristics as those for the college's location. θ_t is the year fixed effects to rule out mechanical association driven by increasing opioid use over time. We cluster the observations at the college level, considering that the tuition and fees vary across colleges.

One could argue that our covariates for counties where the pharmacy and college are located fail to capture some crucial observable or unobservable geographic characteristics that affect opioid dispensing and college costs simultaneously. To mitigate this concern, we also report the regression results from an alternative specification where we replace the county-level covariates in equation (5) with fixed effects for both the college county ($\xi_{county(s)}$) and the pharmacy county ($\phi_{county(p)}$) as follows:

$$\text{IHS}(y_{ispt}) = \alpha + \sum_{k=2}^{7} \beta_k \mathbf{1}(\text{Rank}_s = k) + X_i'\gamma + Z_s'\eta + R_{pt}'\delta + \theta_t + \xi_{county(s)} + \phi_{county(p)} + \varepsilon_{ispt}. \quad (7)$$

However, a positive association between college costs and opioid sales from equation (5) does not necessarily reflect a causal effect of college costs. There are two key threats:

1. Pharmacists who have a low repulsion against opioid misuse ex ante may have systematically chosen colleges with high tuition and fees for other reasons. Then, the association between college costs and opioid sales will reflect sorting across pharmacy schools at the time of college admission.

2. Pharmacists who graduated from colleges with high costs may be systematically more likely to join pharmacies that encounter patients with a greater need for opioids because of reasons other than high college costs. Then, the association between college costs and opioid sales could be at least partly driven by other sorting mechanisms.

While we do not have the data necessary to test whether pharmacists select into pharmacy schools based on the school characteristics correlated with their view on opioid sales, we can control for the potentially correlated school characteristics. We primarily control for college characteristics that affect a college applicant's choice, such as SAT scores, admission rate, and the composition of enrolled students by race and gender.

We conduct two additional analyses to rule out sorting mechanisms across pharmacies unrelated to college costs. First, we examine whether the results of the heterogeneity analyses are consistent with the context of sorting mechanisms driven by college costs. Specifically, we examine how the association between college costs and opioid sales differs across regions more or less exposed to local prescription opioid use.[18] If the relationship between college costs and opioid sales reflects a causal effect, we would expect this relationship to be stronger in areas that are more exposed to local opioid use, given the larger variation in opioid sales across pharmacies in these areas. In addition, we investigate whether the association between college costs and opioid sales differs based on other observable characteristics, such as gender and the business cycle.

Second, we additionally control for the factors that could potentially affect pharmacists' sorting across pharmacies with different levels of opioid sales. These include their skill sets (the number of certificates and the number of skills in each category) reported in the online profiles as well as the opioid exposure levels of local communities where their college and pharmacy are located. The former reflects a pharmacist's ability or understanding of the potential risks associated with opioid misuse. The latter controls for the geographic variation in opioid use that could mechanically generate the association between college costs and opioid sales. Alternatively, we test the robustness of our results by including fixed effects for both the pharmacy county and the college county in equation (7), as previously discussed.

6 Results

6.1 Opioid Sale Gradient Across College Costs

We begin by investigating the impact of college costs that a pharmacist incurred for her education on opioid dispensing at the pharmacy where she works after graduation. Figure 1 shows the differences in the IHS of pharmacy-level annual oxycodone sales among pharmacists from different college cost groups, relative to those from the group with the lowest college costs. College cost groups are categorized based on expected tuition and fees in panels (a) and (b) and based on annual tuition and fees in panels (c) and (d). As described in Section 5, we classify the

[18] The literature demonstrates that local opioid prescription rates are strongly associated with opioid misuse and mortality (Alpert et al., 2018; Evans et al., 2019, 2022).

observations into seven college cost bins (the lowest in Group 1 and the highest in Group 7). However, we also conduct robustness checks using different numbers of subgroups in Section 6.2.

In each panel, we control for individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, and year fixed effects. To address potential confounding effects from geographic variations, we additionally control for characteristics of the counties where the pharmacy and college are located in panels (a) and (c), as in our baseline specification (equation (5)). These county characteristics include the shares of female, white, black, Hispanic, and Asian populations and the IHS of median income for the period 2006–2010. In panels (b) and (d), we replace these county-level characteristics with fixed effects for both the pharmacy's county and the college's county, as specified in our alternative specification (equation (7)). For the subsequent analyses, we control for county-level characteristics as in the baseline model, rather than including county fixed effects, given that within-county variation in college costs is limited in our sample.

Panel (a) of Figure 1 shows that a higher expected tuition cost in college is associated with more opioid sales in the pharmacist's career: pharmacists from the colleges with the highest tuition cost (Group 7) sell about 3 times more oxycodone during their career than pharmacists who graduated from the cheapest colleges (Group 1). Considering that the expected tuition cost for the lowest group is \$45,650 and that for the highest group is \$135,557 in the value of 2010, opioid sales increase twice in every \$29,969 of college tuition and fees, all other things being equal. The graph also presents that oxycodone sales monotonically increase as the college tuition level increases, indicating that a particular subgroup of pharmacists does not drive the positive association. Panel (b) shows the parallel results after controlling for county fixed effects rather than county-level demographic characteristics. Appendix Table A3 also reports the corresponding point estimates. These results confirm that time-invariant unobservable heterogeneity across locations does not fully drive our baseline estimates. Panels (c) and (d) also present consistent opioid sales gradients across annual tuition and fees.

Turning to the results for pharmacists from the colleges without the information on tuition and fees, who account for about 8% of our sample, we see from Figure 1 that opioid sales of these pharmacists are not statistically different from those of pharmacists who graduated from the cheapest colleges. Though we cannot explicitly identify the level of tuition and fees for those colleges because of data limitations, we can infer that the costs of these colleges should be low on average because about 64% of them are public schools specializing in health science, and only 0.4% are private for-profit schools.

To capture the quantitative association between college costs and opioid sales, we report the estimated elasticity of oxycodone sales to tuition and fees in Table 2. Column (1) reports the positive elasticity of oxycodone sales to the expected tuition and fees, which is visualized in panel (a) of Figure 1. A 1% increase in the expected tuition and fees is associated with about a 1.072% increase in oxycodone sales during the pharmacist's career after controlling for the baseline covariates. The elasticity to annual tuition and fees is similar (1.170), as shown in column (4).

As discussed in Section 5, the striking positive association between college costs and opioid sales does not necessarily indicate the causal effect of the financial burden of college costs on opioid dispensing during a pharmacist's career. The other mechanisms resulting in sorting to pharmacy schools or pharmacies could mechanically generate the association. To address these concerns, we control for additional factors, capturing other mechanisms in the subsequent columns of Table 2.

First, in columns (2) and (5), we add a pharmacist's skill set (the number of certificates, general skills, software skills, cognitive skills, and social skills) reported in the profile data as proxies for his/her ability. If there are skill premiums in the labor market of pharmacists and if higher education costs reflect better training for those skills, then their sorting based on skill levels could result in a positive association between college costs and opioid sales, considering the strong positive relationship between opioid sales and wage. Our results suggest that this is not the case. Controlling the IHSs of the skill measures does not mitigate the elasticities, and the regression estimates slightly increase. The increase in the point estimates results from the strong negative associations between skills and oxycodone sales. Because a higher college cost results in better skills, which could raise cautiousness or reluctance about selling opioids, the partial effect of college costs could be higher after controlling them.

It is also worth noting that the skill sets have a statistically significant negative association with oxycodone sales. A 1% increase in the number of a pharmacist's software, cognitive, and social skills is correlated with a 0.220%, 0.144%, and 0.164% decrease in oxycodone sales, respectively. In contrast, the number of certificates and general skills show no strong relationship. These results imply that high-skilled pharmacists may sort into pharmacies in consideration of their opioid sales for two reasons. First, the skill measures are likely related to the awareness of the consequences of opioid abuse and the pang of conscience. Second, if pharmacists were sorted solely based on wage level, the association between the skill measures and oxycodone sales should have been positive, considering the strong positive association between wage level and opioid sales.

Second, in columns (3) and (6), we additionally control for the local exposure to the opioid crisis around a pharmacist's college and workplace. The literature points out that there has been a substantial geographic variation in the number of opioid prescriptions and that local opioid prescriptions predict opioid abuse and mortality (Alpert et al., 2018; Evans et al., 2019; Powell and Pacula, 2021). If colleges with higher costs are concentrated in the areas that are more exposed to the opioid crisis or if graduates from those colleges are more likely to work in the more exposed areas, then our estimates may capture the mechanical relationship between college costs and opioid sales. To check this possibility, we control for normalized opioid prescriptions per capita in the counties where a pharmacist's college and workplace are located.

Columns (3) and (6) present that local opioid prescriptions have a strong correlation with pharmacy-level opioid dispensing. In column (3), a one standard deviation increase in opioid prescriptions in the counties of college and workplace raises opioid sales from the pharmacy where the pharmacists work by 81.6% and 195.1%, respectively. However, the positive association between college costs and opioid sales gets even stronger with these additional covariates, indicating that the geographic variation in the exposure to the opioid crisis does not drive the association between college costs and opioid sales.

Our findings on the positive association between college costs and opioid sales provide important policy implications. First, it suggests that pharmacists at least indirectly influence opioid dispensing. If a pharmacist owns a pharmacy, the findings imply that they might overlook patient red flags to raise opioid sales, increase pharmacy revenue, and expedite student debt repayment. Alternatively, if the pharmacist is employed at a high-paying pharmacy with high levels of opioid dispensing, they may feel pressure to meet the pharmacy's sales expectations to maintain their salary, potentially ignoring warning signs of opioid abuse. Second, our findings suggest that alleviating financial pressure among pharmacists could be a key strategy in addressing the opioid epidemic. Reducing the financial burden of pharmacy education or tackling systemic factors in pharmacies that incentivize dispensing more opioids could help curb risky dispensing practices.

6.2 Robustness Checks

To ensure that the estimated association between college costs and opioid dispensing is not driven by our specifications and variable choices, we test the robustness of our results using alternative approaches. First, one may be concerned that the clear monotonic relationship in Figure 1 could depend on the specific number of subgroups. Appendix Figure A3 indicates this is not the case, showing that the monotonic relationship holds with five and ten subgroups. Second, we use the expected or annual tuition and fees to measure college costs in our baseline model because they have the fewest missing observations among similar cost measures. In Appendix Table A1, we use a more inclusive college cost measure, the cost of attendance, which includes tuition and fees, books and supplies, and living expenses. We observe a clear positive association with this cost measure, though the point estimates are statistically less significant.

Lastly, we use hydrocodone instead of oxycodone as an alternative measure of opioid sales in Appendix Figure A2 and Appendix Table A2. While oxycodone is the most commonly prescribed opioid, as shown in Table 1, hydrocodone is also among the most frequently prescribed and abused opioids (Cicero et al., 2013; Beheshti, 2023). The results indicate that hydrocodone sales are also positively correlated with college costs across all specifications used in our baseline analyses for oxycodone sales.

6.3 Heterogeneity in Opioid Sale Gradient

In this section, we explore heterogeneity in the association between college costs and opioid sales across various dimensions, including geography, gender, business cycle, and school ranking. The purpose of this exercise is twofold. First, we examine whether the heterogeneous patterns support the mechanism of pharmacists' sorting into pharmacies with different levels of opioid sales due to the financial burden of college costs. Second, we discuss the policy implications derived from the results of our heterogeneity analysis.

Figure 2 reports the non-parametric relationship between the expected tuition and fee and opioid sales across the subgroups of pharmacists, as in Figure 1. First, given the substantial geographic variation in opioid prescriptions and abuse reported in the literature, it would be reasonable to see that pharmacists' sorting is more prominent in the regions more exposed to the opioid crisis. Panel (a) reports the association by counties with above-median opioid prescriptions per capita (high-exposed areas) and the other counties (low-exposed areas). The results support this hypothesis, showing that the positive association between college costs and opioid dispensing is stronger for pharmacists working in the more exposed areas. We also observe a positive association in the low-exposed areas, but only a few top college cost groups drive the result.

Second, panel (b) reports heterogeneity in the association between college costs and opioid sales by gender. Drawing on the long-standing literature on gender differences in risk attitudes (Powell and Ansic, 1997; Eckel and Grossman, 2008; Croson and Gneezy, 2009), we hypothesize that female pharmacists may be more conservative in dispensing opioids because they are more concerned about its health and legal consequences compared to male pharmacists. Although there is no clear evidence for pharmacists, a meta-analysis on prescribing practices by gender concludes that female physicians are more likely to engage in conservative drug prescribing and to reduce the incidence of adverse drug events than male physicians (Mishra et al., 2020). Panel (b) suggests that this pattern is also observed among pharmacists, showing that the positive association between college costs and oxycodone sales is much more prominent among male pharmacists than among female pharmacists.

Third, we also examine heterogeneity by business cycle, which could influence how college costs impact pharmacists' workplace decisions. Specifically, we explore how the sales gradient differs between pharmacists who graduated during economic busts and those who graduated during economic booms. The literature on college graduate outcomes across business cycles suggests that individuals graduating during economic downturns face fewer job opportunities and greater financial constraints (Kahn, 2010; Oreopoulos et al., 2012; von Wachter, 2020). Thus, if the variation in financial debt from college costs among pharmacists is substantially greater during economic downturns, one might expect a steeper gradient for pharmacists who graduated during these periods. However, as shown in panel (c), we do not find clear evidence to support this hypothesis.

To investigate whether the quality of education affects how college costs influence opioid dispensing behavior, we investigate heterogeneity by pharmacy school ranking. Schnell and Currie (2018) find evidence suggesting that quality education in high-ranked medical schools may reduce opioid prescribing among physicians. Similarly, pharmacists who completed their training at high-ranked pharmacy schools may be less likely to engage in risky opioid dispensing than those from lower-ranked schools, ceteris paribus. We use three pharmacy school rankings for comparison: (1) the widely recognized U.S. News and World Report (USNWR) ranking, (2) the education ranking, and (3) the research ranking, both constructed by Lebovitz et al. (2022). While the USNWR ranking reflects a wide range of pharmacy schools' education, research, and finance factors, the rankings by Lebovitz et al. (2022) separate the quality in education and research factors. We estimate the elasticity of opioid sales to college costs by high-ranked (1–30), middle-ranked (31–70), and low-ranked (70+) schools and report the results in Figure 3.[19]

Panel (a) of Figure 3 indicates that the association between college costs and opioid sales is weaker among pharmacists who graduated from high-ranked schools in terms of the USNWR ranking than those from lower-ranked schools, suggesting that education quality may help mitigate the impact of college costs on opioid sales. However, this heterogeneity does not necessarily result from the education quality or curriculum of high-ranked schools and may reflect unobservable characteristics of pharmacists who graduated from these schools. For instance, pharmacists from high-ranked schools may have advantages in earning high income, independent of dispensing more opioids. We see a similar, but less apparent, pattern by education ranking (panel (b)) and no heterogeneity across research ranking (panel (c)). Overall, these findings provide suggestive evidence that improvements in pharmacy education could play a role in reducing risky opioid dispensing resulting from the financial burden of college costs.

6.4 Job Turnover of Pharmacists

So far, we have shown that pharmacists sort into pharmacies after graduating from pharmacy schools in a way that generates a robust positive association between college costs and opioid sales. We have also found that pharmacies dispensing more opioids offer higher salaries on average. Taken together, one might be concerned that pharmacists burdened by substantial student

[19]This classification is to maintain a sufficient number of observations for each group, and the results are robust to alternative methods of grouping.

loans could end up in higher-paying pharmacies without fully recognizing the high levels of opioid sales at these places. Then, this may reflect a mechanical relationship between college costs and opioid dispensing, driven by sorting based on financial burden from college costs and wage level. While the association remains an interesting pattern, we aim to determine whether pharmacists are actively concerned about opioid dispensing throughout their careers. To explore this, we test several hypotheses related to a pharmacist's job turnover, as discussed in Section 3.

First, we investigate whether a pharmacist's job turnover is associated with pharmacy-level oxycodone sales in Table 3. Pharmacists may initially choose their workplace primarily based on wage levels. However, if they later face moral conflict or emotional distress when dispensing opioids despite noticing warning signs in individuals who may misuse them, or if they face pressure from managers to meet dispensing targets—essentially, if opioid dispensing increases non-pecuniary job disamenities—they may become more inclined to seek employment elsewhere. Column (1) in panel A of Table 3 shows the regression of a hundred times the indicator of job turnover on the IHS of oxycodone sales with the full covariates controlled. A hundred percent increase in oxycodone sales is associated with a 4.9 percentage point increase in the probability of job turnover. This relationship is economically significant, considering that the average job turnover rate is 2.864%.

In the following columns, we check whether the movers transfer to low-opioid (lower than the median) or high-opioid pharmacies (higher than and equal to the median). If pharmacists move because of the disutility of opioid dispensing, they are likely to move to low-opioid pharmacies. The outcome in column (2) is a hundred times the indicator of a job transition to a pharmacy with oxycodone sales lower than the median, and the outcome in column (3) is a hundred times the indicator of a job transition to a pharmacy with oxycodone sales higher than or equal to the median. A hundred percent increase in oxycodone sales is associated with a 3.4 percentage point increase in the probability of job turnover to low-opioid pharmacies. At the same time, there is no statistically significant relationship between oxycodone sales and a job transition to high-opioid-dispensing pharmacies. Note that these results are not mechanically driven by mean reversion because we use the level of opioid sales to classify pharmacies, not comparing opioid sales in the current job and the next job. These results indicate that dispensing opioids could cause disutility to pharmacists, inducing them to transfer to another workplace that dispenses a few opioids on average.

Panels B and C report the parallel associations for pharmacists who experienced college costs lower than the median and those who experienced college costs higher than and equal to the median, respectively. Panel B indicates that the turnover rate of pharmacists with low college costs is not statistically related to the level of oxycodone sales, though the point estimates are economically significant. On the contrary, we can observe distinctly positive associations for pharmacists who paid high college costs in panel C. A 100 percent increase in opioid sales results in a 6.2 percentage point increase in the total turnover rate and a 4.5 percentage point increase in the rate of job turnover to a low-opioid pharmacy. In other words, pharmacists who experienced high college costs show more job transitions to low-opioid pharmacies when the current opioid sales are higher. Thus, it is hard to argue that pharmacists with high college costs happen to get jobs in high-paying pharmacies, which also sell many opioids, and that pharmacists are not concerned about dispensing abusable opioids.

Now, we additionally analyze how this tendency of pharmacists' job turnover affects the correlation between college costs and opioid sales during their careers. Considering the unwillingness of pharmacists to sell opioids, the association between college costs and opioid sales should diminish by experience year. In other words, pharmacists having high debt from college costs may move to another pharmacy selling fewer opioids after clearing off the debt when the marginal disutility of debt gets lower than the marginal disutility of selling opioids. Otherwise, we expect the positive association to be stable across years of experience. It can even increase because a high-opioid pharmacy is a high-paying one on average.

Panel (a) of Figure 4 supports our hypothesis. The point estimates indicate the elasticity of opioid sales to college costs across experience years. We classify the observations into five subgroups based on experience years (1-2 years, 3-4 years, 5-6 years, 7-8 years, longer than 9 years) to balance the number of observations. The figure visualizes the decline of the elasticity by experience year, indicating that less experienced pharmacists mainly drive the positive association between college costs and opioid sales. If pharmacists who experienced high college costs target high-paying pharmacies regardless of opioid sales, there is no reason to observe this decline by experience years.

In panels (b) and (c), we check the parallel elasticity over experience years by local opioid exposure and gender, which showed clear distinctions in the opioid sale gradient in Section 6.3.

Panel (b) presents a distinct pattern between pharmacists in the high-exposed and low-exposed areas. As shown in panel (a) of Figure 2, pharmacists in the regions that are highly exposed to the opioid crisis have high associations between college costs and opioid dispensing in general. More importantly, the association does not decline for pharmacists in the high-exposed areas over experience years. There are a couple of potential mechanisms to explain this result. First, in the high-exposed areas, opioid abuse is so prevalent that pharmacists may get used to it and may not feel disutility in dispensing opioids as their experiences grow. So, they may not have the incentive to move to a pharmacy selling fewer opioids. Still, pharmacists with high college debt tend to work in high-opioid pharmacies after graduation because of the high wages there. Second, even if pharmacists would like to move to a low-opioid pharmacy after relieving debt, finding such a workplace in high-exposed regions may not be easy.

Panel (c) indicates that the association between college costs and opioid dispensing sharply declines by experience years for male pharmacists. At the same time, it does not change over the years of experience for female pharmacists because they have a weak association even in the early stages of their careers. Consistent with panel (b) of Figure 2, these results suggest that the observed association is primarily driven by male pharmacists. However, on top of that, we also observe that male pharmacists move to low-opioid pharmacies as they gain experience or as they repay their student loans to some extent. This pattern also cannot be explained by the sorting based on wage levels. Overall, the findings from this subsection indicate that pharmacy-level opioid sales are systematically related to pharmacists' job transitions and that the association between college costs and opioid sales becomes less pronounced over the course of a pharmacist's career.

7 Conclusion

The United States continues to battle an opioid epidemic. While prior research has largely focused on manufacturers, physicians, and insurers as drivers of the crisis, relatively little attention has been paid to pharmacists and the factors driving inappropriate opioid dispensing, despite their critical role in dispensing medications.

Using a unique dataset that links individual-level online job profiles with pharmacy-level opioid dispensing data, this paper investigates how financial burdens from college costs influence pharmacists' workplace choices and opioid dispensing behaviors throughout their careers. Our analysis reveals a strong positive relationship between college costs and opioid dispensing in pharmacies where pharmacists work after graduation, with the effect most pronounced during the early years of their careers when financial constraints from student loans are at their peak. These findings suggest that economic factors, such as education costs, may indirectly influence pharmacists' professional decisions and their contribution to the opioid epidemic.

Our study has important policy implications. Reducing the financial burden of pharmacy education could help mitigate the sorting of pharmacists into high-opioid-dispensing environments driven by economic pressures. Policies such as tuition reduction, targeted loan forgiveness programs for healthcare professionals, or incentives for pharmacists to work in underserved, low-opioid-dispensing settings could address the financial drivers of risky dispensing practices. Moreover, enhanced monitoring of systemic factors in pharmacies, including dispensing practices and wage structures, could help address a culture prioritizing sales over patient safety and discourage financial incentives tied to controlled substance sales.

The findings of this paper contribute to a deeper understanding of the role pharmacists play in the opioid crisis and the factors influencing their decisions. By examining the intersection of education costs, workplace decisions, and opioid dispensing, this paper provides a new perspective for policymakers to develop strategies to combat the opioid crisis. Addressing systemic factors such as the financial pressures faced by healthcare professionals is critical for fostering safer dispensing practices, ultimately contributing to broader efforts to tackle the opioid crisis.

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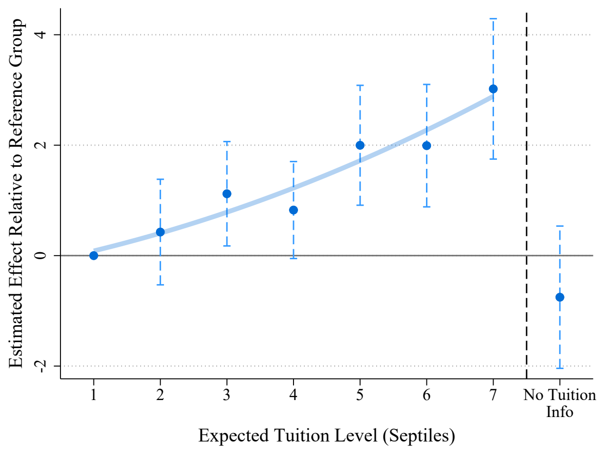
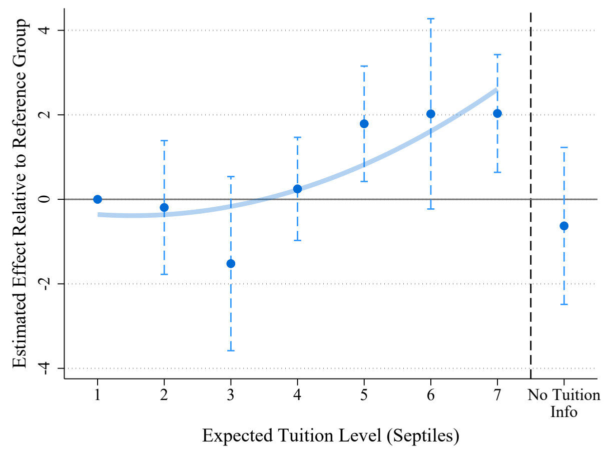
8 Figures and Tables

Figure 1: Oxycodone Sales by Pharmacy School Tuition Level

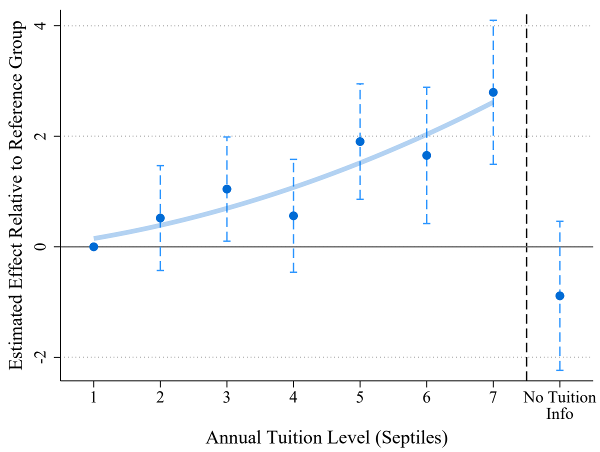
(a) By Expected Tuition and Fee



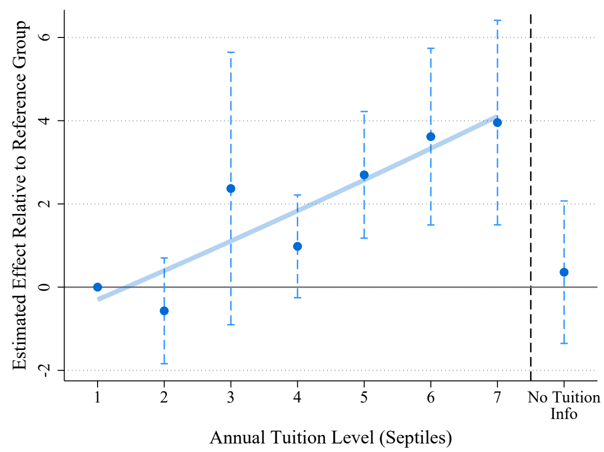
(b) By Expected Tuition and Fee (county FEs)



(c) By Annual Tuition and Fee



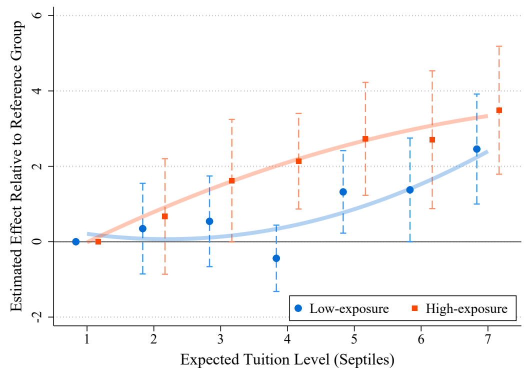
(d) By Annual Tuition and Fee (county FEs)



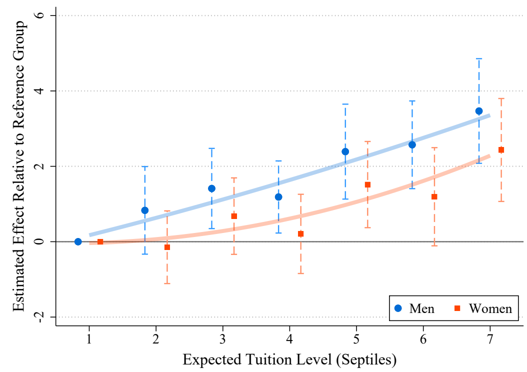
Notes: This figure shows the association between the IHS of pharmacy-level oxycodone sales and pharmacist-level tuition levels. In Panels (a) and (b), the estimated effect relative to the reference group is plotted across septiles of expected tuition and fees. Panels (c) and (d) display a similar pattern, using annual tuition levels. In each panel, the controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, and year fixed effects. Panels (a) and (c) additionally include characteristics of counties where the pharmacy and college are located (the shares of female, white, black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010). Panels (b) and (d) include the fixed effects of the counties instead of county characteristics. The observations are clustered at the college level.

Figure 2: Heterogeneity in the Association between Tuition Fee and Oxycodone Sales

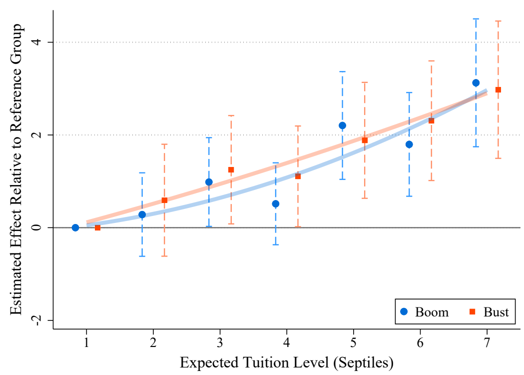
(a) By Opioid Exposure



(b) By Gender



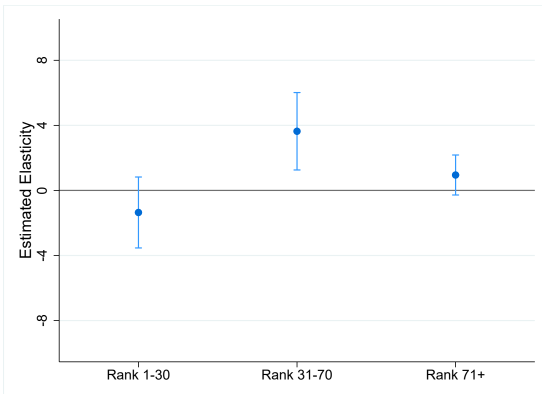
(c) By Business Cycle



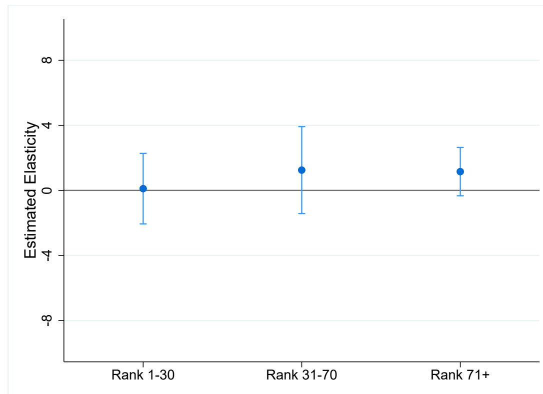
Notes: This figure shows the association between pharmacy-level oxycodone sales and pharmacist-level tuition levels across subgroups of pharmacists. The estimated effect relative to the reference group is plotted across septiles of expected tuition and fees. Panel (a) reports the estimates for pharmacists in counties with below-median opioid prescriptions (blue dots) and pharmacists in counties with above-median opioid prescriptions (orange dots). Panel (b) reports the estimates for male pharmacists (blue dots) and female pharmacists (orange dots). Panel (c) reports the estimates for pharmacists who graduated in years with below-median employment rate (blue dots) and pharmacists who graduated in years with above-median employment rate (orange dots). The controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, white, black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. The observations are clustered at the college level.

Figure 3: Association between Tuition Fee and Oxycodone Sales by Pharmacy School Rank

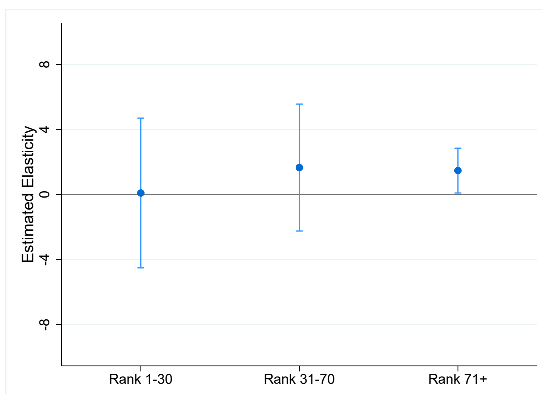
(a) By USNWR



(b) By Education Rank



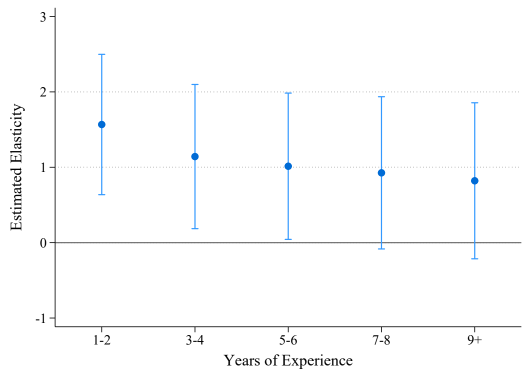
(c) By Research Rank



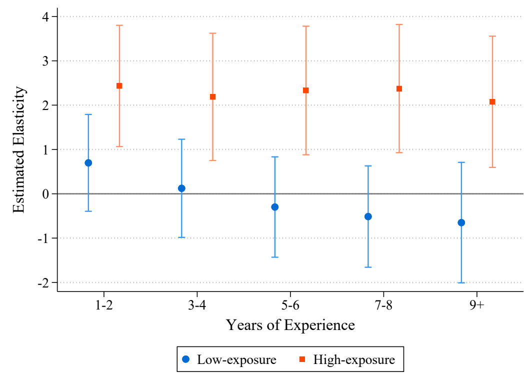
Notes: This figure shows the elasticity of pharmacy-level oxycodone sales to the expected tuition and fees by the ranking of pharmacy schools. The panels report the elasticity by the US News and World Report (USNWR) ranking (panel a), by education (panel b) and research (panel c) rankings constructed by Lebovitz et al. (2022). The controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy is located (the shares of female, white, black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. The observations are clustered at the college level.

Figure 4: Association between Oxycodone Sales and Tuition Fee by Experience Year

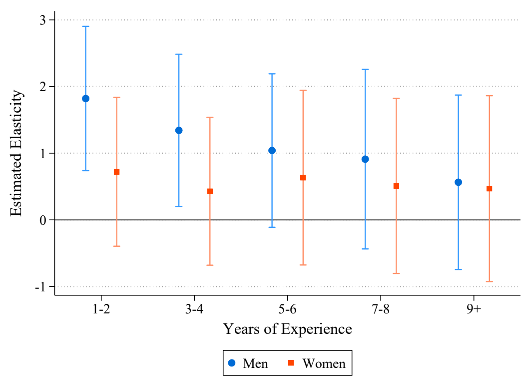
(a) Overall



(b) Heterogeneity by Opioid Exposure



(c) Heterogeneity by Gender



Notes: This figure shows the elasticity of pharmacy-level oxycodone sales to the expected tuition and fees by experience years. Panel (a) reports the elasticities for all pharmacists. Panel (b) reports the elasticities for pharmacists in counties with below-median opioid prescriptions (blue dots) and pharmacists in counties with above-median opioid prescriptions (orange dots). Panel (c) reports the elasticities for male pharmacists (blue dots) and female pharmacists (orange dots). The controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. The observations are clustered at the college level.

Table 1: Summary Statistics

	Tuition Fee Level			
	Low	Mid	High	No Info
Number of pharmacists	4047	4182	4151	1183
Pharmacist-pharmacy-year obs	20289	21320	18849	5405
A. Pharmacist Characteristics				
Female	0.42 (0.49)	0.38 (0.49)	0.39 (0.49)	0.39 (0.49)
Year of Graduation	2001.73 (12.15)	1999.98 (12.91)	2002.93 (11.74)	2003.67 (11.46)
Number of Certificates	0.57 (1.12)	0.60 (1.09)	0.66 (1.19)	0.65 (1.18)
General Skills	2.07 (3.24)	2.12 (3.24)	2.29 (3.31)	2.25 (3.40)
Cognitive Skills	1.14 (2.10)	1.29 (2.29)	1.27 (2.18)	1.49 (2.78)
Social Skills	5.75 (6.38)	5.98 (6.41)	6.30 (6.63)	6.56 (6.68)
Software Skills	0.54 (1.53)	0.56 (1.39)	0.66 (1.49)	0.62 (1.50)
B. College Characteristics				
Public College	0.96 (0.20)	0.89 (0.31)	0.02 (0.13)	0.65 (0.48)
Private Non-profit College	0.02 (0.12)	0.11 (0.31)	0.98 (0.13)	0.35 (0.48)
Annual Tuition and Fees	12033.6 (2200.7)	16762.9 (1857.5)	28257.8 (3931.0)	1879.8 (.)
Exp. Tuition and Fees	54279.9 (9363.5)	73690.3 (6718.0)	121372.9 (17251.9)	. (.)
Annual Cost of Attendance	19901.3 (2942.5)	23999.2 (4517.1)	43099.7 (5331.7)	. (.)
SAT Score	1117.86 (89.74)	1194.22 (85.89)	1165.39 (85.98)	. (.)
Admission Rate	0.74 (0.15)	0.63 (0.14)	0.69 (0.12)	0.43 (0.18)
Completion within 4 Years	0.40 (0.13)	0.52 (0.10)	0.55 (0.11)	0.77 (0.13)
Share of White Students	0.57 (0.19)	0.53 (0.17)	0.53 (0.15)	0.44 (0.26)
Share of Black Students	0.12 (0.17)	0.10 (0.15)	0.08 (0.07)	0.07 (0.07)
Share of Hispanic Students	0.08 (0.09)	0.08 (0.06)	0.07 (0.07)	0.09 (0.14)
Share of Female Students	0.54 (0.07)	0.53 (0.08)	0.58 (0.08)	0.76 (0.14)
C. Pharmacy Characteristics				
Retail Pharmacy	0.71 (0.45)	0.73 (0.44)	0.72 (0.45)	0.80 (0.40)
Oxycodone Sales (Million MME)	1.31 (2.62)	1.44 (2.59)	1.53 (3.06)	1.35 (3.03)
Hydrocodone Sales (Million MME)	0.52 (0.96)	0.52 (0.91)	0.40 (0.80)	0.46 (0.87)

Notes: This table presents the summary statistics of individual-, college-, and pharmacy-level characteristics of the pharmacists in our sample. Panel A presents the statistics of individual characteristics collected from the Lightast Job Profile Database. Panel B presents the statistics of college characteristics reported in the College Scorecard. Panel C presents the statistics of pharmacy characteristics from the Automation of Reports and Consolidated Orders System (ARCOS).

Table 2: Association between Oxycodone Sales and Tuition Fee

	(1)	(2)	(3)	(4)	(5)	(6)
			IHS(Oxycodone)			
IHS(Exp. Tuition Fee)	1.072**	1.142**	1.510***			
	(0.482)	(0.478)	(0.472)			
IHS(Annual Tuition Fee)				1.170**	1.253**	1.594***
				(0.506)	(0.502)	(0.503)
IHS(Certificates)		-0.125	-0.117		-0.128	-0.120
		(0.095)	(0.094)		(0.095)	(0.095)
IHS(General Skills)		0.106	0.108		0.106	0.108
		(0.083)	(0.084)		(0.083)	(0.084)
IHS(Software Skills)		-0.220*	-0.220**		-0.220*	-0.220**
		(0.113)	(0.111)		(0.113)	(0.111)
IHS(Cognitive Skills)		-0.144*	-0.101		-0.146*	-0.104
		(0.087)	(0.084)		(0.087)	(0.084)
IHS(Social Skills)		-0.164***	-0.174***		-0.164***	-0.174***
		(0.060)	(0.059)		(0.060)	(0.059)
Opioid Rx (College)			0.816**			0.838**
			(0.347)			(0.358)
Opioid Rx (Pharmacy)			1.951***			1.935***
			(0.318)			(0.319)
Observations	60,394	60,394	59,649	60,400	60,400	59,655
Baseline Controls	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Skill Controls	N	Y	Y	N	Y	Y
Local Opioid Controls	N	N	Y	N	N	Y

Notes: This table reports the elasticity of pharmacy-level oxycodone sales to the expected tuition and fees in columns (1) to (3) and to the annual tuition and fees in columns (4) to (6). The baseline controls in columns (1) and (4) include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. Columns (2) and (5) additionally control a pharmacist's skill set (the IHSs of certificates, general skills, cognitive skills, social skills, and software skills). Columns (3) and (6) add the total opioid prescriptions in the counties of college and workplace as covariates. The observations are clustered at the college level.

Table 3: Association between Job Turnover and Oxycodone Sales

	(1) Turnover	(2) Turnover to Low Opioid	(3) Turnover to High Opioid
Panel A: Overall Sample			
IHS(Oxycodone)	0.049***	0.034***	0.015
	(0.015)	(0.012)	(0.009)
Observations	58,094	58,094	58,094
Mean	2.864	1.473	1.390
Panel B: Pharmacists with Low College Costs			
IHS(Oxycodone)	0.042	0.029	0.013
	(0.026)	(0.021)	(0.016)
Observations	28,776	28,776	28,776
Mean	2.864	1.473	1.390
Panel C: Pharmacists with High College Costs			
IHS(Oxycodone)	0.062***	0.045***	0.017*
	(0.015)	(0.014)	(0.010)
Observations	29,318	29,318	29,318
Mean	2.864	1.473	1.390
Baseline Controls	Y	Y	Y
Year FE	Y	Y	Y
Skill Controls	Y	Y	Y
Local Opioid Controls	Y	Y	Y

Notes: This table reports the association between the IHS of pharmacy-level oxycodone sales and pharmacist-level job turnover. The outcome variables are the dummies for overall turnover (column 1), turnover to a pharmacy with below-median oxycodone sales (column 2), and turnover to a pharmacy with above-median oxycodone sales (column 3). The samples are all pharmacists (panel A), pharmacists who paid below-median expected tuition and fees (panel B), and pharmacists who paid above-median expected tuition and fees (panel C). The baseline controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects.

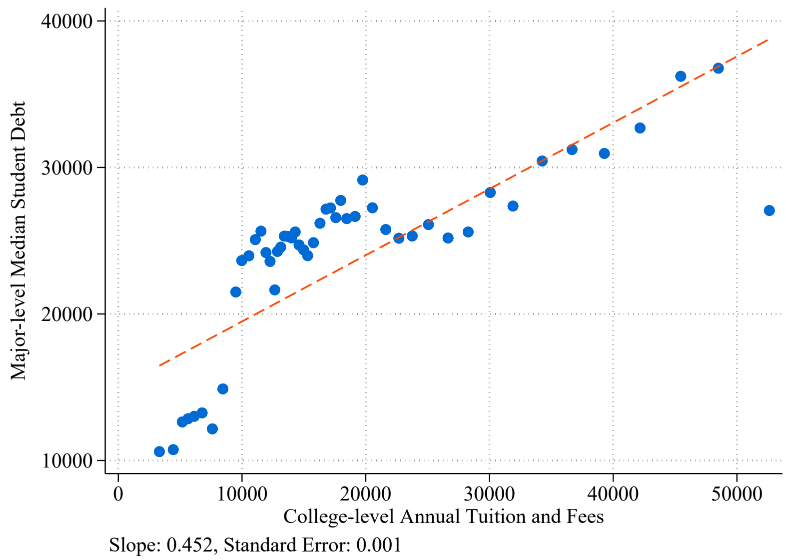
For Online Publication

"Pharmacy School Cost and Opioid Dispensing:
A Hidden Connection?"

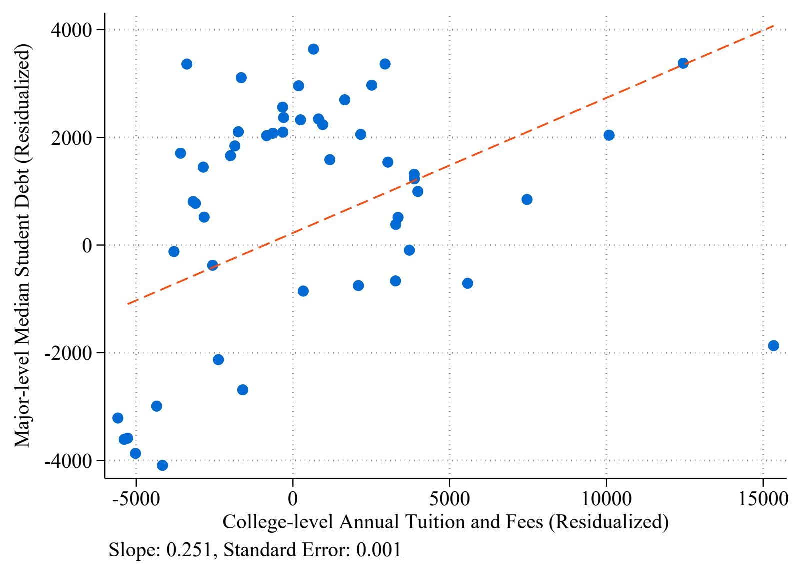
Kim, Kim, and Park (2025)

Figure A1: Association between College-level Tuition and Fees and Major-level Student Debt

(a) Raw Dollar Values

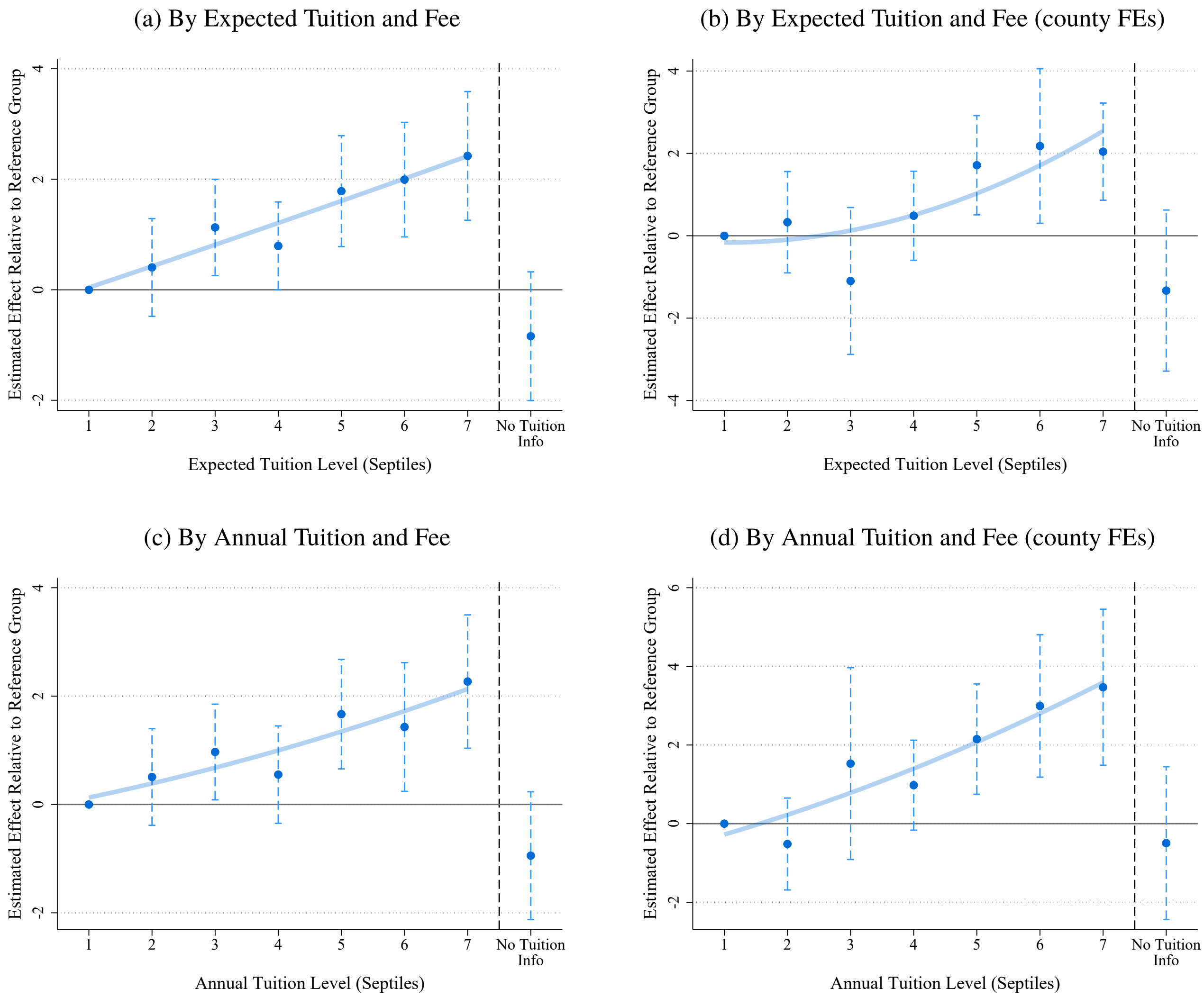


(b) Residualized Dollar Values



Notes: This figure shows the association between college-level average tuition and fees and major-level median student debts. The major-level student debts are federal borrowers' median cumulative federal loan debt from the College Scorecard Field of Study Survey for 2014-2018. The federal loan debt includes only loan disbursement amounts and does not capture any accrued interest. Panel (a) reports the association in raw dollar values and Panel (b) reports the association after controlling for college type, campus type (main campus or not), year fixed effects, and field of study fixed effects (CIP code). The observations are at college-major-year level and are clustered at the college level to estimate the slopes.

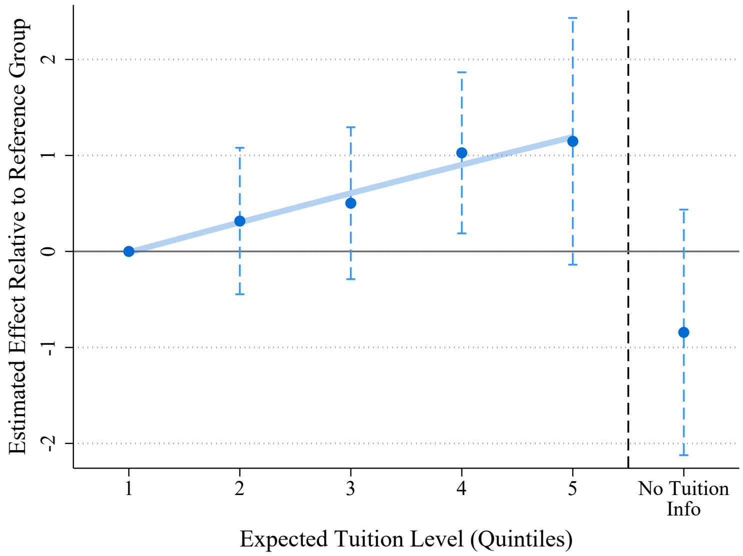
Figure A2: Hydrocodone Sales by Expected Tuition Level



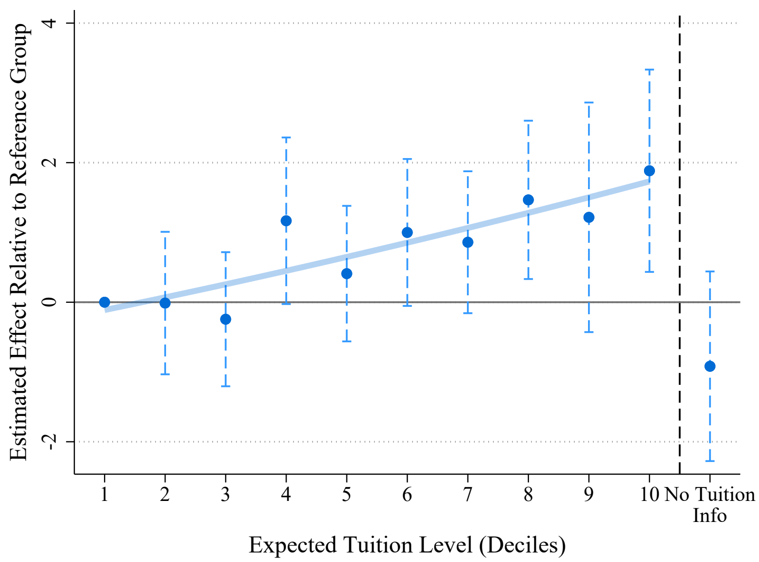
Notes: This figure shows the association between the IHS of pharmacy-level hydrocodone sales and pharmacist-level tuition levels. In Panels (a) and (b), the estimated effect relative to the reference group is plotted across septiles of expected tuition and fees. Panels (c) and (d) display a similar pattern, using annual tuition levels. In each panel, the controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, and year fixed effects. In Panels (a) and (c) additionally include characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010). Panels (b) and (d) include the fixed effects of the counties instead of county characteristics. The observations are clustered at the college level.

Figure A3: Oxycodone Sales by Alternative Tuition Groupings

(a) By Deciles



(b) By Quintiles



Notes: This figure shows the association between pharmacy-level oxycodone sales and pharmacist-level tuition levels across subgroups of pharmacists. Panels report the estimates by deciles (panel a) and quintiles (panel b). The controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. The observations are clustered at the college level.

Table A1: Association between Oxycodone Sales and College Costs

	(1)	(2)	(3)	(4)	(5)	(6)
	IHS(Oxycodone)					
IHS(Exp. College Cost)	1.013	1.059	1.551**			
	(0.787)	(0.775)	(0.765)			
IHS(Ann. College Cost)				1.312	1.361*	1.875**
				(0.817)	(0.802)	(0.778)
Observations	58,839	58,839	58,094	58,839	58,839	58,094
Baseline Controls	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Skill Controls	N	Y	Y	N	Y	Y
Local Opioid Controls	N	N	Y	N	N	Y

Notes: This table reports the elasticity of pharmacy-level oxycodone sales to the expected cost of attendance in columns (1) to (3) and to the annual cost of attendance in columns (4) to (6). The baseline controls in columns (1) and (4) include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. Columns (2) and (5) additional control for a pharmacist's skill set (the IHSs of certificates, general skills, cognitive skills, social skills, and software skills). Columns (3) and (6) add the total opioid prescriptions in the counties of college and workplace as covariates. The observations are clustered at the college level.

Table A2: Association between Hydrocodone Sales and Tuition Fee

	(1)	(2)	(3)	(4)	(5)	(6)
	IHS(Hydrocodone)					
IHS(Exp. Tuition Fee)	0.654	0.735	1.226**			
	(0.563)	(0.552)	(0.537)			
IHS(Annual Tuition Fee)				0.771	0.855	1.350**
				(0.578)	(0.566)	(0.548)
Observations	58,839	58,839	58,094	58,839	58,839	58,094
Baseline Controls	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Skill Controls	N	Y	Y	N	Y	Y
Local Opioid Controls	N	N	Y	N	N	Y

Notes: This table reports the elasticity of pharmacy-level hydrocodone sales to the expected tuition and fees in columns (1) to (3) and to the annual tuition and fees in columns (4) to (6). The baseline controls in columns (1) and (4) include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations and the IHS of median income for the period 2006-2010), and year fixed effects. Columns (2) and (5) additional control for a pharmacist's skill set (the IHSs of certificates, general skills, cognitive skills, social skills, and software skills). Columns (3) and (6) add the total opioid prescriptions in the counties of college and workplace as covariates. The observations are clustered at the college level.

Table A3: Association between Oxycodone Sales and Tuition Fee after Controlling Location Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	IHS(Oxycodone)					
IHS(Exp. Tuition Fee)	1.510***	0.859	1.150***			
	(0.472)	(0.639)	(0.434)			
IHS(Annual Tuition Fee)				1.594***	1.519	1.501**
				(0.503)	(0.976)	(0.598)
Observations	59,649	59,631	59,564	59,655	59,637	59,570
Full Controls	Y	Y	Y	Y	Y	Y
College Location FE	N	Y	Y	N	Y	Y
Pharmacy Location FE	N	N	Y	N	N	Y

Notes: This table reports the elasticity of pharmacy-level oxycodone sales to the expected tuition and fees in columns (1) to (3) and to the annual tuition and fees in columns (4) to (6). The baseline controls include individual characteristics (gender, number of degrees, and graduation year), college characteristics (college type, SAT score, and the shares of students in racial and gender groups), pharmacy type, characteristics of counties where the pharmacy and college are located (the shares of female, White, Black, Hispanic, and Asian populations, the IHS of median income, and the total opioid prescriptions), and year fixed effects. Columns (2) and (5) additionally control for the fixed effects of the county where the college of a pharmacist is located. Columns (3) and (6) add the fixed effects of the county where the workplace of a pharmacist is located as a covariate. The observations are clustered at the college level.