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The Impact of Management on Clinical Performance: Evidence from Physician Practice Management Companies

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Abstract. Mergers and acquisitions in healthcare are increasingly leading to changes in firm management. This paper studies how a change in firm management impacts clinical performance using data on an understudied phenomenon: medical practice acquisitions by physician practice management companies (PPMCs). PPMCs market themselves as offloading the administrative burden of running a medical practice without compromising physician autonomy over clinical decisions. However, a PPMC's management strategy and practices, such as performance monitoring and financial incentives, could influence physician behavior. For example, some PPMCs advertise increasing revenue through better financial management, whereas others also advertise improving quality through better clinical management. In this paper, I collect data on three large PPMCs that manage the practices of more than 40% of obstetricians and gynecologists (Ob-Gyns) in Florida between 2006 and 2014. An Ob-Gyn's main clinical decision in childbirth involves a tradeoff between financial and clinical outcomes: cesarean sections (C-sections) are often more highly reimbursed than vaginal births but pose risks to maternal and infant health when not medically necessary. Using difference-in-differences methods, I find heterogeneous effects on C-sections depending on a PPMC's publicized management strategy. Physicians acquired by PPMCs that focus on financial management increase the use of C-sections, resulting in less clinically appropriate care and worse patient outcomes. The opposite result is found when PPMCs focus on clinical management. I provide qualitative and quantitative evidence that differences in firm management are the most likely driver of changes in C-sections. This paper informs how the corporatization of medicine can alter clinical performance outcomes.

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Keywords: acquisitions • management practices • physician behavior • quality of care • empirical

1. Introduction

Across nearly all industries, variation in firm performance can be partly explained by differences in management. For example, large-scale survey collection efforts have revealed that better management practices are associated with higher productivity and financial success in the manufacturing, retail, and healthcare sectors (Bloom and Van Reenen 2010, Bloom et al. 2014). Differences in management practices may also help explain variation in clinical performance across healthcare organizations (McConnell et al. 2013, Bloom et al. 2015, Tsai et al. 2015).

Understanding how differences in managerial priorities, processes, and practices influence healthcare outcomes is of particular importance given the ongoing corporate transformation of medicine. For-profit corporations are increasingly acquiring healthcare organizations, leading to changes in firm ownership and management. For example, corporate takeovers have been documented among dialysis clinics and nursing homes, with evidence that they lead to quality reductions because of managerial emphasis on financial rather than clinical outcomes (Eliason et al. 2020, Gupta et al. 2021). A similar pattern has emerged among physicians: as of 2016, the majority of physicians no longer own their medical practice because of acquisitions by hospitals (Kane 2016), private equity firms (Zhu et al. 2020), and management companies (Frack and Hong 2014).

This paper studies how a change in management impacts clinical performance using the context of medical

practice acquisitions by physician practice management companies (PPMCs). Most physicians in the United States are not taught the management skills needed to run a practice in medical school (Klasko 2015, Finnegan 2020). For this reason, PPMCs advertise themselves as providing the business expertise and administrative support needed to increase practice profitability, typically through services such as insurance contracting, medical supply purchasing, and human resources (Burns 1997). PPMCs are similar to property management and financial services companies, but PPMCs provide in-house rather than outsourced management through a centralized management services organization (MSO). Acquired practices remain distinct legal entities that are unified under a single tax identification number, which allows the MSO to collectively bargain with insurance companies and realize other operational efficiencies (Hoyme 2014, Graham 2019).[1] To comply with state and federal regulations, PPMCs also minimize disruptions to a physician's clinical environment. For example, physicians should maintain control of clinical care, continue to work in the same locations with the same colleagues, and retain admitting privileges to the same hospitals.

Therefore, unlike acquisitions that lead to structural integration between the target firm and the acquiring firm, acquisitions by PPMCs provide an opportunity to study a change in management absent concurrent changes to the medical practice environment. The appeal of this organizational structure has led physicians to increasingly sell their practices to PPMCs instead of hospitals (Frack and Hong 2014, Hernandez 2020). In fact, PPMCs market themselves as a better option to hospital ownership by claiming physicians can receive the economic benefits of a larger organization without compromising their autonomy over clinical decisions (Luria and Hagood 2019).

Although a PPMC's organizational structure and marketing materials may promote physician autonomy, the management strategies and practices implemented by PPMCs could influence physician behavior. For example, management practices such as performance monitoring and financial incentives could be used to align physician behavior with a PPMC's stated objectives. The typical PPMC markets itself as a strategic partner for practice growth, with websites using physician-centered language such as "are you seeing ever-increasing bites taken out of your ever-diminishing income?"[2] These PPMCs focus on financial support services, including negotiating higher-paying managed care contracts and improving revenue cycle management, which can provide physicians with new incentives and feedback on their medical practice's financial performance. As an alternative approach, more PPMCs are evolving to address the growing demands of value-based care (Madden 2016). In addition to financial management services, these PPMCs provide clinical management services such as analyzing and tracking clinical outcomes and developing clinical guidelines to make practices competitive for value-based contracts. The websites of these PPMCs typically emphasize patient-centered care: "As healthcare transforms from volume-based to value-based care, you'll enjoy having a practice development partner who helps you implement population health management programs."[3] These PPMCs, therefore, also provide physicians with feedback on their clinical performance.

This paper studies three PPMCs that acquire medical practices focused on women's health in Florida between 2006 and 2014, representing more than 40% of obstetricians and gynecologists (Ob-Gyns).[4] Two of the PPMCs have marketing materials consistent with a strategy focused on financial management, and one of the PPMC's has marketing materials consistent with a strategy focused on clinical management. To evaluate the impact of these management strategies, I study the tradeoff between revenue and quality inherent to an Ob-Gyn's choice of cesarean section (C-section) or vaginal birth for low-risk births. Labor and delivery account for the majority of an Ob-Gyn's income, and C-sections are often more highly reimbursed than vaginal births but can pose risks to maternal and infant health when not medically necessary (Grivell and Dodd 2011, Truven Health Analytics Marketscan Study for Childbirth Connection 2013). As a result, the overuse of C-sections is often an indicator of low-value care or subpar clinical performance (Baker 2019). PPMCs that emphasize financial performance outcomes could lead Ob-Gyns to increase their use of C-sections and shift care away from lower-income patients as a means of increasing revenue. Alternatively, by tracking clinical outcomes and developing protocols to standardize care, PPMCs could encourage more appropriate C-section use.

I use a difference-in-differences design to estimate how a change in management affects the C-section decision and associated outcomes. Identification is based on the staggered timing of PPMC practice acquisitions between 2006 and 2014. I hand-collect data from corporate filings to determine when a medical practice was acquired and use the SK&A Office-based Provider Database to identify the name and location of each Ob-Gyn's practice. Florida hospital discharge records provide unique physician identifiers, allowing the physician data to be linked to patient data.

On average, PPMCs lead to a 1.6-percentage-point increase in low-risk C-sections. This average obscures significant heterogeneity based on each PPMC's publicized management strategy. The PPMC that focuses on providing clinical management services decreases low-risk C-sections by 5.7 percentage points (22.3% reduction of the preacquisition C-section rate), resulting in more clinically appropriate care and a decrease in patient

morbidity. In contrast, the PPMCs that focus on providing financial management services increase low-risk C-sections by 2.6–2.9 percentage points (10.1%–11.2% increase), resulting in less clinically appropriate care and an increase in patient morbidity. These PPMCs also treat a greater share of Medicaid patients, but after an acquisition, the share of Medicaid patients is reduced in favor of more privately insured patients. Subsample analyses also reveal that, although C-sections increase regardless of patient insurance, physicians perform more C-sections among privately insured patients than Medicaid patients. This result is consistent with physician behavior being influenced by a PPMC's emphasis on financial performance and raises concerns over equity in access to care and appropriate treatment.

The empirical challenge is to determine whether the observed postacquisition changes in C-sections are driven by changes in management, changes in the patient population, or by differences in which types of physicians join a PPMC. The primary estimation includes controls for more than 20 patient risk factors observed by the Ob-Gyn before the onset of labor, allowing for comparisons of patients with the same characteristics being treated by the same physician before and after acquisition. Even excluding patient controls yields similar point estimates and analyses using patient risk factors as outcomes finds no systematic evidence that patient C-section risk changes after acquisition. As an additional strategy, I estimate whether an increase in the proportion of Ob-Gyns in a PPMC within a 15-mile radius of a patient influences their probability of C-section. This patient exposure analysis yields qualitatively similar results to the primary difference-in-differences analysis and is robust to the inclusion of controls for market concentration. Primary results are also similar between acquisitions that did or did not lead to an increase in market concentration that would warrant scrutiny by antitrust agencies.

Selection is an inherent feature of the PPMC setting: Physicians choose to sell their practice to a specific PPMC, and each PPMC chooses to acquire a specific practice. I use several empirical strategies to mitigate concerns of selection bias, still, the results should be interpreted as capturing the effect of PPMCs in the presence of selection. First, to minimize confounding factors at the time of acquisition, the primary analysis only includes "switchers:" physicians observed in the same practice before and after acquisition by a PPMC. Therefore, only physicians eventually acquired by a PPMC act as controls for those yet to be acquired. This strategy helps compare physicians that may be similar in unobservable ways given their choice to sell to a PPMC, although results are similar in a matched sample with non-PPMC physicians. Second, event study analyses show limited pretrends in the C-section probability, providing evidence of exogeneity in the timing of practice acquisitions. Third, I show results are robust to different time periods with minimal overlap in a physician's choice between the PPMCs. Last, based on reports that include the timing of clinical initiatives, I show that C-sections also decrease among Ob-Gyns that joined the PPMC focused on clinical management before the sample period.

This paper provides evidence that a change in firm management can impact clinical performance using data on medical practice acquisitions by PPMCs. I find heterogeneous effects on C-sections depending on a PPMC's publicized management strategy and practices. The PPMC that focuses on clinical management reduces C-sections and improves the quality of care, whereas the opposite result occurs under the financial management model. These two models represent the publicized management approaches undertaken by other PPMCs nationwide and are important in their own right. Fueled by recent private equity investments, these three PPMCs continued to expand, and by 2019, delivered 1 in every 25 babies in the United States. Such expansions have raised concerns that PPMCs are simply a means to increase market power and reduce competition (Scheffler et al. 2021). Although I find that PPMCs influence C-sections regardless of changes in competition, the PPMCs do amass considerable market power, and their growth may eventually lead to more salient anticompetitive effects. Another policy consideration is whether PPMCs comply with corporate practice of medicine (CPOM) laws meant to prevent corporations from influencing clinical decisions. Most scrutiny for CPOM violations has focused on staffing companies such as TeamHealth and Envision (Arnsdorf 2020, Haefner 2020); however, this research shows that even PPMCs claiming to preserve physician autonomy can alter clinical outcomes for better or for worse.

2. Literature and Contribution

This paper contributes to the research on "management as technology" or how the adoption of different management priorities, processes, and practices influence firm performance. Management practices often include performance monitoring (i.e., performance tracking and feedback), target setting (i.e., setting and communicating specific goals), and incentives (i.e., reward provision) (Bloom et al. 2012). Using cross-sectional surveys in the hospital setting, researchers find that management quality is strongly correlated with financial and clinical outcomes (McConnell et al. 2013; Bloom et al. 2015, 2020; Plough et al. 2017) and that hospital boards that emphasize clinical quality have more effective management practices and better outcomes (Tsai et al. 2015). However, a recent study of CEO turnover in UK hospitals finds little evidence that CEOs change hospital performance despite large variation in perceived CEO

managerial quality (Janke et al. 2020). Given the complex and dynamic nature of the healthcare industry, more research is needed to understand how managerial changes impact performance. PPMCs provide a useful setting to evaluate a change in management because their stated business purpose is to manage the back-end administrative functions of medical practices without disrupting a physician's clinical environment. In addition to studying within-firm changes, this paper complements the management research by providing a case study of how differences in publicized management strategies can contribute to differences in firm performance.

This paper also adds to the literature on the impact of healthcare mergers and acquisitions (M&A). There is substantial evidence that healthcare consolidation leads to higher prices (Dafny 2009, Baker et al. 2014, Dunn and Shapiro 2014, Gowrisankaran et al. 2015, Capps et al. 2018). There is also a growing literature studying the effect of M&A on healthcare quality. Studies of U.S. hospitals find that either quality deteriorates or there are no changes after acquisition (Ho and Hamilton 2000, Huckman 2006, Beaulieu et al. 2020). Research linking physician market concentration to quality of cardiac care finds quality deteriorates when prices are administratively set but no change when prices are negotiated (Dunn and Shapiro 2017, Koch et al. 2018). In addition to changes in market structure, this paper considers how acquisitions could impact quality through changes in a firm's management strategy. This approach complements the research on corporate takeovers in healthcare, which finds that regardless of changes to market structure, quality deteriorates after acquisition because acquired firms adopt the parent company's strategies (Eliason et al. 2020, Gupta et al. 2021).

Another related literature studies physician behavior and variation in treatment choices. In particular, the use of C-sections varies dramatically: among low-risk mothers, the C-section rate varies between 2% and 36% across U.S. hospitals (Kozhimannil et al. 2013). Epstein and Nicholson (2009) find evidence that within-hospital variation in C-sections is even larger than between hospital variation and that Ob-Gyn treatment patterns do not converge over time. The rigidity of treatment decisions makes the findings of this paper more striking. The PPMC focused on clinical management distributed clinical guidelines and performance feedback on physician C-section use among other initiatives, which coincided with a decline in C-sections. The effectiveness of these interventions is supported by research on changes in physician behavior in response to new information such as letters, feedback, and report cards (Kolstad 2013, Song et al. 2017, Sacarny et al. 2018). In contrast, acquisitions by PPMCs focused on financial management coincided with an increase in C-sections. Potential channels for this behavior change include receiving new knowledge on practice revenue trends and billing, feeling pressure to increase productivity, and changes to financial incentives. In particular, PPMC marketing materials emphasize negotiating higher-paying managed care contracts, which could lead physicians to substitute toward C-sections (Gruber et al. 1999, Johnson and Rehavi 2016, Foo et al. 2017).

Last, this paper contributes to research on different models of physician organization. Although researchers have studied the characteristics and effectiveness of practice models such as Accountable Care Organizations (Shortell et al. 2014, Nembhard and Tucker 2016) and Independent Physician Associations (McMenamin et al. 2004, Casalino et al. 2013), research on PPMCs remains limited. Exceptions include research on physician staffing firms, a type of PPMC that focuses on providing hospital staffing and management solutions (Cooper et al. 2020, La Forgia et al. 2022). In contrast, this paper focuses on PPMCs that manage the business functions of private practices. There has been a resurgence in both types of PPMCs over the last decade, with their growth often fueled by private equity investments (see Online Appendix A for a brief history). In this sample, two of the PPMCs were acquired by private equity firms with the goal of expanding the models nationwide. As PPMCs continue to proliferate, it will become even more important to understand how they impact healthcare delivery.

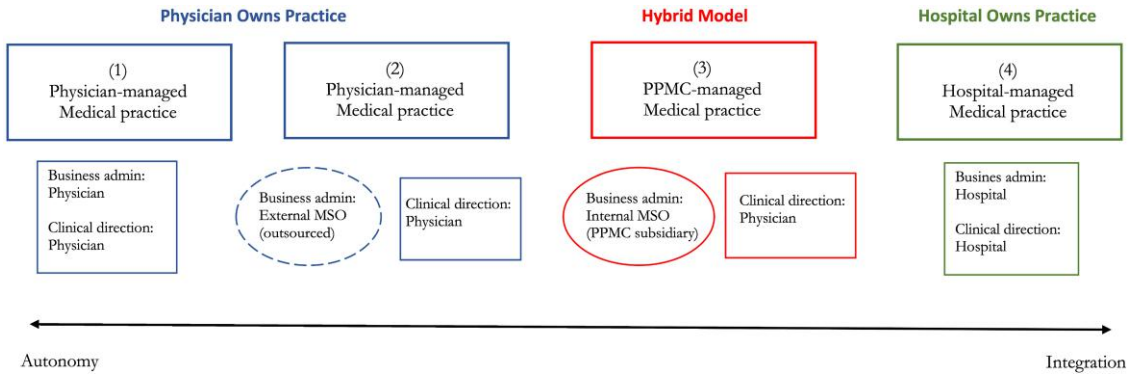
3. Institutional Background

3.1. Physician Choice Set

To understand the value proposition of a PPMC, it is important to consider the other options available to physicians. Figure 1 provides a spectrum of organizational structures based on the degree of professional autonomy offered to the physician. Under full autonomy, the physician manages all clinical care and practice administration and bears the financial risk of their decisions. Under no autonomy (full integration), the physician is a salaried employee with clinical care and practice administration directed by the hospital.

Model (1) is the most common type of physician organization: the medical practice is physician-owned and operated, and the physician has autonomy over business and clinical decisions. Model (2) is similar to (1), except the physicians outsource their business administration to an independent Management Services Organization (MSO). MSOs often specialize in certain nonclinical service areas such as practice administration (e.g., human resources and information technology (IT) support), revenue cycle management (e.g., billing and claims processing), and patient access and communication (e.g., patient portals) (Swift and Barnes 2016). A single practice often hires several MSOs to manage different parts of the business (Cantlupe 2018). In this

Figure 1. (Color online) Comparison of PPMCs to Other Models of Physician Organization



Note. Author's illustration.

model, the physician still manages clinical care and essentially directs the MSO as an employee.

Although the outsourcing model allows physicians to remain independent of the MSO, the PPMC-managed medical practice (model (3)) sets up a full-service in-house MSO that owns the assets of practices and manages them directly. In other words, the medical practice "no longer owns the administrative expense and burden of managing those assets" (Madden 2016). The PPMC model unifies physician practices under a single tax identification number (TIN), allowing the MSO to conduct insurance contract negotiations, group purchasing arrangements, and realize other operational efficiencies not available in the outsourcing model (Hoyme 2014). The aim is to offer physicians higher and more stable revenue compared with model (1) or (2). The potential downsides associated with selling to a PPMC can include pressure to keep minimum productivity thresholds, noncompete clauses that make it difficult to leave a PPMC, and loss of control over business decisions and practice operations (more details provided in Section 3.2).

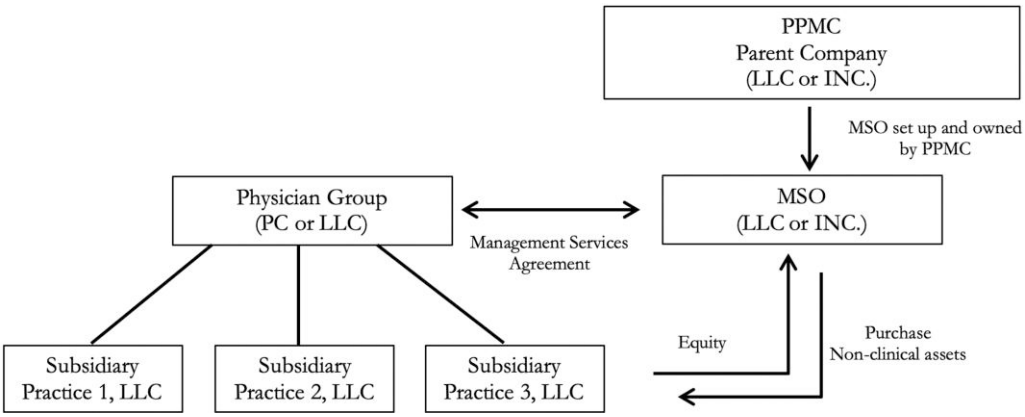
PPMCs are also commonly contrasted to the hospital ownership model (model (4)). After being acquired, physicians usually become salaried employees of the hospital, and both the clinical and business functions of the practice become managed by the hospital. Although physicians relinquish significant autonomy, they benefit from income stability through salary guarantees and legal protections provided by the hospital. However, the loss of autonomy is often used as a PPMC marketing strategy that promises an alternative that alleviates the burden of running a business while preserving clinical autonomy. Another appealing feature is the easy transition into a PPMC because no structural changes or integration occurs with other acquired practices. Overall, for a physician in model (1) or (2), the choice between a PPMC and a hospital will depend on their preferences over autonomy and the associated financial risks.

3.2. PPMC Organization

3.2.1. Corporate Structure. Figure 2 illustrates the general corporate structure of a privately held PPMC. For example, suppose a medical practice called Practice 1 sells its practice to a PPMC. Upon selling, the practice dissolves its existing business entity and files to become a subsidiary of a holding company representing all other acquired practices (the Physician Group in Figure 2). This change allows Practice 1 to go from billing under its own TIN to billing under the TIN of the Physician Group. This means Practice 1 gives up its existing health plan contracts and accepts the health plan arrangements of the Physician Group after acquisition (Hoyme 2014). However, Practice 1 does not share patients with the other subsidiary practices, and physicians may never even interact with physicians in other subsidiary practices.

On the business side, the PPMC operates as the parent company. The PPMC's subsidiary MSO acquires the medical practice's tangible assets (e.g., medical equipment, office space, supplies). The purchase price is often a multiple of practice earnings to be paid out over a three- to five-year period if the practice complies with the terms of the acquisition. These terms can include keeping practice revenue to 90% of the preacquisition level.[5] Through the Physician Group, the medical practice enters a long-term exclusive contract with the MSO to provide comprehensive administrative support services in exchange for a monthly fee. The physician is not an employee of the PPMC. Each practice remains the residual claimant of their practice revenue less the management fee and other direct expenses such as rent and overhead. However, to align financial incentives, physicians often receive an equity stake in the MSO in the form of company stock (Cohen Healthcare Law 2015). Overall, the MSO manages the

Figure 2. General Corporate Structure of a PPMC



Notes. Author's illustration. Actual PPMC corporate structures may vary.

business aspects of each practice, the physicians manage clinical care, and they are tied together through a service contract and equity.

The Physician Group and the MSO are organized as separate entities to comply with corporate practice of medicine (CPOM) laws, among other state and federal regulations such as fee-splitting and antikickback laws. CPOM laws vary by state but generally prohibit "corporations from practicing medicine or employing a physician to provide professional medical services" so that physicians "maintain actual control over the practice of medicine" (Chapman Insights 2017).[6] However, a PPMC's corporate structure does not guarantee autonomy: The management services provided by the PPMC could still influence a physician's clinical decision making.

3.2.2. PPMC Objectives and Management Strategy. The goal of a PPMC is to increase company value by increasing practice revenue. Many PPMCs also actively seek outside funding to continue acquiring practices, especially from private equity (Maruca 2019, Meyer 2019). This occurs whether the PPMCs advertise providing financial management or clinical management services.

The typical PPMC focuses on increasing practice revenue through better financial management and negotiating higher-paying managed care contracts. Financial management services can include accounting and taxes, billing and claims processing, accounts payable, and financial forecasts and compensation reports. Other relevant support services include human resources, facilities management, including group purchasing for medical supplies, and information technology. These support services are meant to offload the administrative burden of running a practice and provide physicians with new information on the financial health of their practice. The marketing language used by these PPMCs often centers around physician concerns over loss of income and autonomy. For example, a PPMC's website says: "Are you seeing ever-increasing bites taken out of your ever-diminishing income? While caring for patients, are you fighting to find time to deal with business? Partner with us. We're Women's Health USA, The Business Partner for Physicians. Consider us your "back room" business support team" (Women's Health USA 2015). Similarly, a PPMC focused on dermatology advertises "QualDerm Partners helps top-tier dermatologists position their practices for sustainable growth and profitability" (QualDerm Partners 2021).

In response to the rise in value-based payments, other PPMCs are increasingly focusing on clinical management to help practices become competitive for these performance-linked contracts (Madden 2016). Clinical management can include tracking and analyzing clinical care metrics, providing performance feedback, and helping physicians develop prevention and wellness programs, clinical guidelines, and best practices. Some PPMCs always adopted a clinical management strategy, but some established PPMCs are also shifting toward this model. Either way, the websites of these PPMCs still promise an increase in practice profitability and offer the typical practice management services while emphasizing population health management. For example, Axia Women's Health advertises: "We're about improving patient outcomes, achieving value-based care, and setting an example for how women's health care should be managed" (Axia Women's Health 2021). Similarly, the multispecialty PPMC CareMount Health Solutions helps "providers develop and execute on a population health strategy including development of risk-based contract optimization, population health analytics, and clinical care redesign that transform group practice reimbursement models from fee-for-service to value" (CareMount Health Solutions 2021).

These quotes emphasize how the PPMCs harness clinical data to help physicians improve health outcomes.

4. Research Setting

4.1. PPMC Sample

This paper collects data on three privately held PPMCs that manage the practices of Ob-Gyns in Florida between 2006 and 2014. These PPMCs (referred to as PPMCs 1, 2, and 3) were the dominant nonhospital owners of Ob-Gyn practices in Florida. Table 1 presents a high-level comparison of key characteristics. The PPMCs vary in size, location, and founding dates, which limits the choice that physicians had between the PPMCs. This PPMC information was collected through archived website data using "The Wayback Machine," publicly available corporate filing data, and off-the-record conversations with PPMC executives that provided high-level background. The quoted materials in this section come directly from PPMC or insurer websites. Documentation and details on the qualitative data collection process are provided in Online Appendix B.

4.1.1. PPMC 1: Clinical Management PPMC 1 was founded by Ob-Gyns in West Central Florida who united to form their own MSO in 2002. New practice acquisitions focused on the same region, with member practices mainly located between Tampa and Orlando. Before 2004, the PPMC operated a website that resembled a typical PPMC model. For example, PPMC 1 described itself as "Consolidation for Business. Individualization for Health Care," where each practice operated as an "independent care center." PPMC 1 also emphasized practice profitability, advertising that within a year, practices "experienced 15% higher reimbursements from third party payers" and a "60% reduction in accounting costs." Then, starting in 2005, they created a single, patient-facing website that included a patient portal and information on member practices. This change signaled a shift toward clinical management, as seen in their advertised mission of "improving the lives of women every single day." Based on conversations with PPMC 1, their goal was to increase quality and decrease costs to position themselves for value-based contracts.

As an organization, PPMC 1 emphasized care quality by encouraging physicians to join quality committees, establishing a code of conduct signed by all physicians, and creating a publicly available "value report" that summarized key objectives, initiatives, and clinical data. However, efforts to standardize care quality became particularly salient in 2011 when they implemented a series of initiatives to reduce the primary C-section rate. These efforts included creating and distributing best practices for labor management and tracking and sharing C-section rates with physicians, including comparisons across practices. By late 2013, PPMC 1 achieved its objective by signing "collaborative care" contracts with Cigna and United Healthcare, where Ob-Gyns would be paid on performance measures in labor and delivery.[7] In this way, PPMC 1 advertised itself as providing both typical management services meant to increase practice profitability and clinical management services meant to improve the quality of care.

4.1.2. PPMC 2: Financial Management PPMC 2 was founded by Ob-Gyns in the Miami Metropolitan area in 2004 with the explicit goal of speaking "with one powerful voice to managed care organizations." Acquisitions of new practices remained in South Florida until 2010 when it began expanding into East Central and Central Florida. The website of the PPMC was primarily focused on physician recruitment, whereas PPMC 2 physicians kept their own separate website and patient portals. The lack of unified branding supports PPMC 2's marketing emphasis on "maintaining a physician's autonomy."

Table 1. Summary of PPMC Characteristics and Advertised Objectives

	PPMC 1	PPMC 2	PPMC 3
Date founded	1998	2004	2009
Location founded	West Central Florida	South Florida	South Florida
Physicians (2018)	400	600	1,500 (600 in FL)
Mission/aim	"Improving the lives of women every single day"	"Best of both worlds together: solo practice autonomy with the resources of a group practice"	"Protect the private practice of medicine and the economic security of Ob-Gyns"
Financial objectives	Increase practice revenue and operational efficiency	Increase practice revenue and operational efficiency Increase company value through practice acquisitions	Increase practice revenue and operational efficiency Increase company value through practice acquisitions
Clinical objectives	Reduce early term deliveries and primary C-section deliveries Increase primary care visits	None specified	None specified

Notes. PPMC 1 says it was founded in 1998 but did not resemble a PPMC until 2002. The number of physicians is the total (of any specialty) reported by the PPMC in 2018. Only a selected list of advertised clinical and financial objectives are presented. The mission/aim is a representative quote from the PPMC websites' "About Us" pages.

PPMC 2 materials also predominantly emphasized increasing the financial performance of practices: "our goal is to support you in any way that can improve your bottom line" and "physicians who have joined [PPMC 2] have experienced significant practice growth and increased reimbursements." The 2007 website listed accounting and finance, managed care negotiations and contract administration, operations, human resources and personnel management, and IT support as the key service offerings. Although PPMC 2 stated that these services would "improve the quality of healthcare to their patients," they did not advertise clinical management services or specific quality initiatives.

PPMC 2's focus on negotiating higher-paying contracts also created pushback from insurers. For example, in 2013, Florida Blue entered a payment dispute with PPMC 2 and shared a press release discussing "affordability concerns" and "collective concerns over [PPMC 2's] business model," as well as scrutinized PPMC 2's "demand for uncontrolled physician acquisition growth." Similarly, in 2014, Aetna shared that "the [PPMC 2] physicians are generally more costly to Aetna and our plan sponsors compared to some of their peer physicians." Although agreements were eventually reached, these quotes show PPMC 2's ability to increase reimbursement for acquired practices and highlight PPMC 2's managerial emphasis on financial performance.

4.1.3. PPMC 3: Financial Management PPMC 3 was founded by Ob-Gyns in the Miami Metropolitan area in 2009. The PPMC grew rapidly throughout Florida, including into less urban areas. The PPMC 3 website focused on promotional materials, whereas physicians in PPMC 3 kept their own websites and patient portals. Similar to PPMC 2, PPMC 3 "wants to protect the private practice of medicine and ensure the economic security of Ob-Gyns for the foreseeable future." PPMC 3 materials also explicitly focused on profitability, suggesting that the top five reasons to join the PPMC were "1. Increased income, 2. Stabilization of income, 3. Reduced costs, 4. Preservation of independent practice model, and 5. Increased Productivity." PPMC 3 even provided profit projections that suggested "many of our group members enjoy up to a 30% increase in profits and a 30% decrease in expenses." PPMC 3 advertised the same services as PPMC 2 and similarly did not list clinical management services or quality initiatives on their website. However, PPMC 3 did emphasize that reducing managerial burden would create "a profitable medical practice that provides top quality patient care and an excellent working environment."

PPMC 3 also had some legal troubles and contract disputes. Although not in Florida, PPMC 3 received push back from United Healthcare for "seeking a 20 percent increase in reimbursements" after expanding into North Carolina in 2014. The Department of Justice also led an investigation into whether a PPMC 3 subsidiary group in Florida focused on urogynecology intentionally billed Medicare for services never performed and for unnecessarily large amounts. This example illustrates the potential pressure physicians in a PPMC face to increase practice profitability.

4.2. How Can PPMCs Influence Clinical Performance?

This paper studies three PPMCs: two that emphasize increasing practice profitability through better financial management and one through better clinical management. Although a PPMC's organizational structure and marketing materials may promote physician autonomy, these different management strategies and practices implemented by PPMCs could influence a physician's clinical decision-making. To understand the impact of a PPMC on clinical performance, I focus on an Ob-Gyn's decision in childbirth to perform a C-section or vaginal birth. C-sections are the most common major surgical procedure performed in the United States: 31.9% of births (37.4% in Florida) are delivered via C-section, which is more than twice the recommended rate of 10%–15% (Hall et al. 2010, Centers for Disease Control and Prevention 2014, World Health Organization 2015). C-section overuse has received widespread attention, with a growing consensus that unnecessary C-sections contribute to rising medical spending while at best providing no medical benefit and at worst harming maternal and infant health (Ellison and Martin 2017, Dembosky 2018, Oster and McClelland 2019). This is because the decision to perform a C-section often involves a tradeoff between revenue and quality.

On average, C-sections are more highly reimbursed than vaginal births: claims data from 2004 to 2010 indicate that insurers paid a total of $16,673 for C-sections and $12,520 for vaginal births (Truven Health Analytics Marketscan Study for Childbirth Connection 2013).[8] Of this amount, physicians received, on average, $3,350 for Cesarean birth and $2,887 for vaginal birth. Additionally, procedure time may factor into a physician's choice: C-sections are often more convenient, generally lasting between 45 and 60 minutes, whereas vaginal births are more variable and can require monitoring up to eight hours before delivery (Patterson and Winslow 2008, NIH Office of Research on Women's Health 2018). Because labor and delivery account for the majority of an Ob-Gyn's income, Ob-Gyns could increase revenue by performing more C-sections (see Online Appendix C for more information on Ob-Gyn income).

Although C-sections can be a medically necessary or life-saving intervention, the majority occur at the

discretion of the physician (Main et al. 2011). This discretion is especially salient for unplanned C-sections: the two most common clinical justifications, fetal distress during labor and failure to progress to labor, are considered subjective diagnoses (Cunningham et al. 2010).[9] As a result, even among low-risk mothers, the C-section rate varies between 2% and 36% across U.S. hospitals (Kozhimannil et al. 2013). The major problem with C-section overuse is that, on average, C-sections lead to longer hospital stays, longer recovery times, and increased severe maternal and infant morbidity compared with vaginal births (Grivell and Dodd 2011).

In the PPMC setting, an emphasis on improving practice profitability through financial management, including negotiating higher-paying contracts, could lead to an increase in C-sections. This is supported by empirical work that links higher reimbursement to increases in C-sections (Gruber et al. 1999, Johnson and Rehavi 2016, Foo et al. 2017). New information and feedback provided on the financial health of their practice could also motivate physicians to shift care toward patients with higher-paying insurance, increase their patient panel size, and change treatment patterns on the margin. More generally, critics of management companies suggest the pressure to increase shareholder value could increase the use of high-cost, low-value care (Luria and Hagood 2019). This concern is supported by past legal cases against staffing firms and PPMCs (Heath and Rosenbaum 2012, Stewart 2018, Oberheiden PC 2021).

Alternatively, by decreasing time spent on administrative responsibilities, providers could have more time to spend with patients during labor, leading to a decrease in C-sections (Shute 2014). If offered by PPMCs, clinical management services could also help reduce C-section overuse. In labor and delivery, clinical protocols, checklists, and other healthcare standardization methods have been shown to improve quality outcomes (see American College of Obstetricians and Gynecologists 2015 for a review). Tracking clinical data and providing relative performance feedback could also have powerful effects on physician behavior (Kolstad 2013, Staats et al. 2016, Song et al. 2017, Sacarny et al. 2018). Altogether, it remains an empirical question whether the financial and clinical management services offered by PPMCs impact clinical decisions after a practice acquisition.

5. Data and Sample

5.1. Patient Data

De-identified patient-level data are available from hospital discharge records purchased from the Florida Agency for Healthcare Administration. These data include all recorded inpatient episodes in Florida between 2006 and 2014. Each observation is a birth record that consists of the patient's age, race, insurance status, zip code, and procedure and diagnosis codes, as well as the hospital identification number, hospital location, and the operating physician's medical license number.

5.2. Physician Data

I use the SK&A Office-based Provider Database (rebranded as IQVIA OneKey), which has information on a physician's medical practice name and location, to link physicians to a single practice in a given year. I then hand-collected data from corporate filing data to determine when a practice filed to become a PPMC subsidiary. This information was merged with the SK&A data and verified using Medicare Physician Compare data in 2014 and Florida Licensure Data. I also used historical versions of physician and PPMC websites to verify the date a physician appeared on the website. See Online Appendix D for more details on data sources and construction.

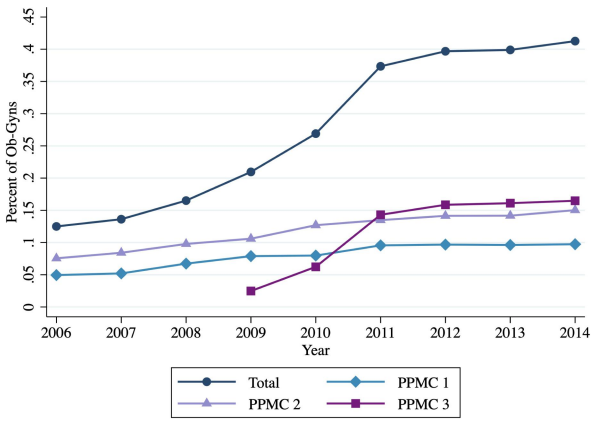
5.3. Sample Selection

Over the sample period, there were 1,930,033 total births and 1,400,412 low-risk births. To make relevant comparisons between PPMC and non-PPMC physicians, I limit the sample to physicians delivering at least 100 babies between 2006 and 2014. Births from patients under 13 and over 55 are excluded, as are births from patients residing outside the United States or that have no documented residence. The primary analysis focuses on the sample of low-risk births because physicians yield more discretion over this decision. Using the AHRQ Inpatient Quality Indicators #33, low-risk births are defined as live babies born at or beyond 37 weeks of gestation to women with no prior C-section, are singleton (no twins or beyond), and in the vertex presentation. The final analytic sample includes 1,770,722 total births and 1,262,357 low-risk births performed by 1,693 physicians between 2006 and 2014, with an overall C-section rate of 40.6% and low-risk C-section rate of 24.0%.

As shown in Figure 3(a), more than 40% of Ob-Gyns in Florida were in a PPMC by 2014. Figure 3(b) presents the sample size of each PPMC, where the switcher subsample is defined as Ob-Gyns observed in the same private practice before and after acquisition. This distinction is made because other Ob-Gyns may join a practice already in a PPMC after completing residency or after leaving a hospital-based position. Additionally, for PPMCs 1 and 2, many Ob-Gyns are always observed as part of the PPMC because practices were acquired before the first year of the sample. The primary analysis focuses on the switcher subsample to minimize confounding factors at the time of acquisition because they remain in the same private practice, retain the same physician colleagues, and

Figure 3. (Color online) PPMC Growth and Sample Size

(a)



(b)

	Ob-Gyns	Practices	Births: Low-Risk	Births: All
Panel A: Full Sample				
PPMC 1	151	23	91,010	124,887
PPMC 2	220	90	135,925	194,363
PPMC 3	282	117	238,563	326,078
Non-PPMC	1040	487*	796,859	1,125,394
Total	1,693	717	1,262,357	1,770,722
Panel B: Switcher Subsample				
PPMC 1	40	12	30,247	41,916
PPMC 2	114	57	70,776	100,643
PPMC 3	183	104	190,743	261,472
Total	337	173	291,766	404,031

Notes. (a) Share of Ob-Gyns in a PPMC. (b) Sample statistics for the full sample of Ob-Gyns, the switcher subsample of PPMC joiners, and physicians who never joined a PPMC. Only Ob-Gyns who perform at least 100 births between 2006 and 2014 are included in all samples. *Practice data excludes information on 145 Ob-Gyns who did not match to the SK&A data.

deliver in the same hospitals after acquisition (Online Appendix, Table E.1).

5.4. Descriptive Statistics

For the sample of low-risk births, Table 2 presents the unadjusted mean C-section rate, birth volume, and patient characteristics for PPMC and non-PPMC physicians. These summary statistics shed light on whether patients in PPMCs are inherently different from non-PPMC patients and whether the patient mix changes after an acquisition. There are several notable differences. PPMCs 1 and 2 have higher unadjusted C-section rates than non-PPMC physicians. PPMC 2 has the highest C-section rate with a preacquisition average of 28.20% (although risk-adjusted rates are more similar as seen in the Online Appendix, Figure E.1). All the PPMCs see a larger share

Table 2. Descriptive Statistics by PPMC for Low-Risk Births

	PPMC 1		PPMC 2		PPMC 3		
	Pre	Post	Pre	Post	Pre	Post	Non-PPMC
Birth type (%)							
All C-Sections	25.47	24.28	28.20	28.43	22.79	23.56	23.24
Planned	12.15	11.67	14.09	14.80	10.95	11.25	11.15
Unplanned	13.32	12.61	14.11	13.63	11.84	12.31	12.10
Birth volume							
Yearly births per Ob-Gyn	99.47	85.74	96.32	80.16	139.90	109.28	116.35
Total births	11,041	19,206	22,923	47,853	108,561	82,182	796,859
Patient demographics							
Age[a]	28.99	29.17	28.79	29.61	27.03	27.80	26.52
Insurance (%)							
Private	80.00	77.25	62.00	65.36	48.25	45.90	32.42
Medicaid	12.78	16.17	27.96	24.08	40.26	39.18	49.18
Medicaid managed	1.55	2.74	3.87	4.19	4.69	8.1	10.01
Self-pay	3.38	1.87	3.74	3.84	3.3	2.51	4.46
Other insurance	2.29	1.96	2.43	2.53	3.5	4.31	3.93
Race/ethnicity (%)							
Black	11.41	11.09	16.48	14.35	15.26	15.31	24.45
Hispanic/Latina	10.46	9.90	30.42	32.71	18.47	24.98	22.27
White	70.17	70.75	44.12	44.33	58.26	52.78	45.60
Other race	7.96	8.26	8.98	8.60	8.02	6.92	7.69

Notes. Unadjusted mean values are shown for the switcher subsample and non-PPMC physicians. The sample is restricted to Ob-Gyns performing 100 yearly deliveries of any type. Therefore, the number of low-risk births may be less than 100 a year.

[a]Regressions only include "Advanced Maternal Age" (a mother 35 years or older) as a control. See the Online Appendix, Table E.2, for patient risk factors for low-risk births and Table E.3 for all births.

of privately insured patients compared with non-PPMC physicians who treat a larger share of Medicaid patients. In particular, in PPMC 1, 80% of patients are privately insured in the preacquisition period. Across the PPMCs, the unadjusted birth volume declines after acquisition. However, once year fixed effects are included to account for overall declines in fertility rates, the volume change is not economically or statistically significant (Online Appendix, Table 1.2).

The Online Appendix, Table E.2, shows mean values for maternal risk factors, which were identified using ICD-9-CM diagnosis and procedure codes commonly used by researchers to control for a patient's risk of C-section (Henry et al. 1995, Gregory et al. 2002, Xu et al. 2015, Johnson and Rehavi 2016). These risk factors represent preexisting or developing complications observed by the Ob-Gyn before the onset of labor that could impact the C-section decision, such as diabetes, hypertension, and fetal abnormalities. In the empirical analysis that follows, I use several strategies to account for differences in patient risk factors across PPMCs and changes within PPMCs.

6. Impact of PPMCs on Clinical Performance

In this section, I use a difference-in-differences research design and data on acquisitions by PPMCs to study the impact of management on clinical performance. The primary specification focuses on the switcher sample of physicians observed in the same practice before and after acquisition. Therefore, estimates capture the effect of PPMCs among physicians who choose to join a PPMC. The identifying variation is based on the staggered timing of practice acquisitions by PPMCs and the comparison of physicians in their overlapping periods. Because all practices eventually become acquired, the key assumption is that the average C-section rate for physicians first acquired by a PPMC would follow a similar trend to those yet to be acquired in the absence of acquisition. This strategy intends to minimize selection bias driven by the observable and potentially unobservable differences between physicians acquired by a PPMC and those never acquired by a PPMC. The primary specification is as follows, where the key clinical performance outcome is whether patient i received a C-section from physician p in year y:

$$C\ section_{ipy} = \sum_{j=1}^{3}[\alpha^j * \mathbf{1}\{y = t_{pj}\} + \beta^j * \mathbf{1}\{y > t_{pj}\}] + \gamma \mathbf{X}_{iy} + \theta_p + \theta_{yj} + \epsilon_{ipy}. \quad (1)$$

In Equation (1), t_{pj} represents the time of acquisition by PPMC j. Therefore, $\mathbf{1}\{y > t_{pj}\}$ is an indicator for the years after acquisition, whereas $\mathbf{1}\{y = t_{pj}\}$ is an indicator for the year of acquisition. This variable accounts for the transition period from private practice into a PPMC because the date of switch is likely different than the corporate date of filing. The coefficient of interest, β^j, estimates the treatment effect for each PPMC. The preferred specification controls for patient sociodemographic characteristics and clinical risk factors ($\mathbf{X}_{iy}$), physician fixed effects (θ_p), and year × PPMC fixed effects (θ_{yj}). Year × PPMC fixed effects account for differences between physicians who eventually join PPMC 1, 2, or 3 that may vary other time. Alternative specifications assess robustness of the results to (1) year × hospital fixed effects, which account for hospital-specific factors that vary over time, (2) year × patient zip code fixed effects, which account for region-specific factors that vary over time, and (3) year fixed effects, which account for statewide factors that vary over time. Each estimation uses cluster-robust standard errors at the practice level.

In this setting, a management change occurs when the practice is acquired. The concern with the identification strategy is that the timing of acquisition may be correlated with other contemporaneous factors that impact the C-section decision, such as changes to the patient population or the nonrandom acquisition of practices. To help mitigate selection concerns, I conduct several additional analyses and robustness checks described in Sections 6.2 and 6.3.

6.1. Main Effect on C-Sections

Table 3, column 1, shows that low-risk C-sections increase by 1.6 percentage points after acquisition when the three PPMCs are pooled together. However, the results of estimating Equation (1) reveal important differences across the PPMCs (column 2): For the patients of Ob-Gyns acquired by PPMC 1, the probability of a low-risk C-section decreases by 5.7 percentage points (22.3% of the preacquisition C-section rate); for PPMC 2, the probability increases by 2.9 percentage points (10.1%); and for PPMC 3, the probability increases by 2.6 percentage points (11.2%). Results are qualitatively similar when using different fixed effects (columns 3–5), although point estimates are attenuated for PPMC 1. One reason why PPMC 1 estimates are attenuated when year × PPMC are excluded is that the C-section rate of physicians who eventually joined PPMC 1 was trending upwards before acquisition, whereas the rates were flat or weakly negative for PPMCs 2 and 3.

6.2. Patient Selection

The results of Table 3 include controls for patient insurance, race, and risk factors, allowing for comparisons of patients with the same characteristics being treated by the same physician before and after acquisition. However, if observable patient characteristics changed after acquisition, this would raise the concern

Table 3. PPMC Effects on C-Sections for Low-Risk Births

	(1)	(2)	(3)	(4)	(5)
Pooled estimate					
β^{PPMC}	0.016**				
	(0.008)				
By PPMC estimate					
β^{PPMC1}		−0.057***	−0.025**	−0.030***	−0.019*
		(0.017)	(0.011)	(0.010)	(0.010)
β^{PPMC2}		0.029**	0.026***	0.025**	0.025**
		(0.013)	(0.007)	(0.011)	(0.010)
β^{PPMC3}		0.026***	0.034***	0.027***	0.017**
		(0.008)	(0.007)	(0.008)	(0.007)
Patient controls	X	X	X	X	X
Physician fixed effects	X	X	X	X	X
Year × PPMC fixed effects	X	X			
Year × hospital fixed effects			X		
Year × patient zip fixed effects				X	
Year fixed effects					X
Observations	291,766	291,766	291,737	289,390	291,766
R^2	0.172	0.172	0.178	0.196	0.172

Notes. The dependent variable is a C-section (one for C-section, zero otherwise). An observation is a patient-year. The preacquisition unadjusted C-section rate is 25.5% in PPMC 1, 28.2% in PPMC 2, and 22.8% in PPMC 3. Standard errors are clustered at the practice level.

$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

that changes in unobservable patient characteristics may create omitted variables bias in the estimates. Physicians could also select patients of higher or lower risk, which would directly impact the C-section decision. I provide evidence that changes in patient risk composition do not appear to drive changes in C-sections.

6.2.1. Changes in Patient Risk. The Online Appendix, Table F.1, shows that point estimates for Equation (1) are similar when excluding all patient controls, when controlling for a parsimonious set of preexisting comorbidities, and when using the full sample of births instead of only low-risk births, suggesting that changes in patient risk are not driving observed results. Results are also robust to including interactions between patient risk factors and the PPMC postacquisition variables to account for potential changes in coding practices, to including patient zip code fixed effects that help capture patient risk factors associated with residence, and to restricting the sample to patients with Florida zip codes (predominantly excludes patients from bordering states). I also estimate a series of difference-in-differences specifications with patient risk factors as the dependent variable displayed in Figure 4. Across the three PPMCs, there is no systematic evidence that patients became of higher or lower risk. If anything, patients in PPMC 1 became of slightly higher risk, which would work against finding a decrease in C-sections.

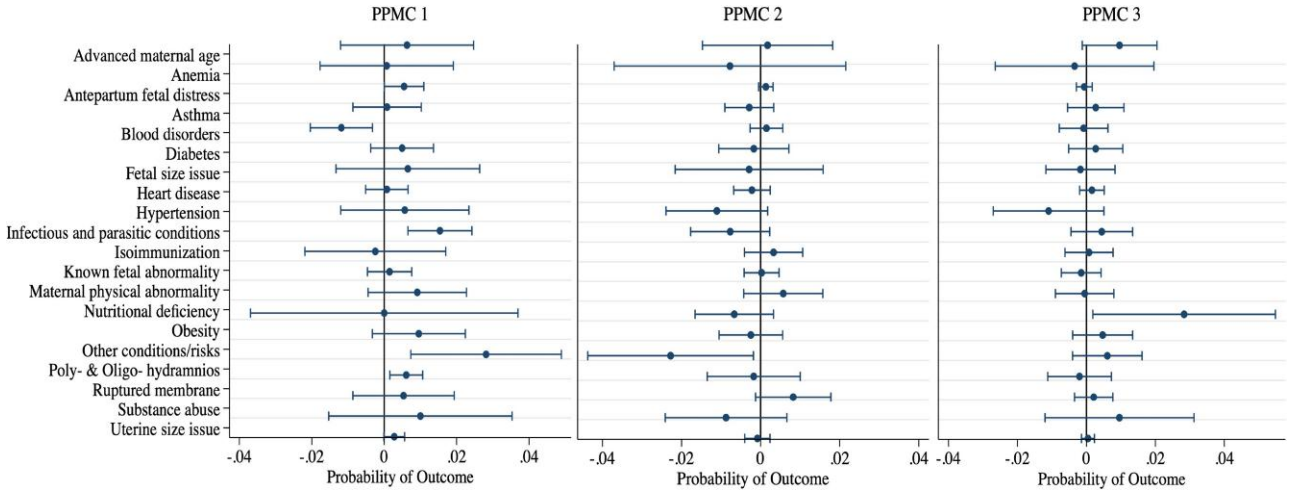
6.2.2. Patient Exposure to a PPMC. As an alternative strategy, I consider whether a patient's exposure to a PPMC could impact their probability of receiving a C-section. The intuition is that as PPMCs expand by acquiring practices, this increases a patient's probability of being treated by a PPMC physician only based on their location. That is, a patient's health and preferences are not likely to change concurrently with physicians in their area becoming acquired by a PPMC. The empirical model is as follows:

$$C\ section_{ipy} = \sum_{j=1}^{3}[\delta^j Share_i^j] + \gamma \mathbf{X}_{iy} + \theta_p + \theta_y + \epsilon_{ipy}. \quad (2)$$

The analysis uses the full data sample to estimate the share of PPMC j physicians within a given distance of a patient i's zip code centroid in year y. The mean distance between a patient's zip code centroid and a physician's practice (based on the coordinates of a physician's primary office location) is 11.3 miles, excluding the top percentile of distances. To assess robustness to different distances, I use the following measures: (1) 15-mile radius, (2) 10-mile radius for urban zip codes and 20-mile radius otherwise, and (3) sample-based cutoffs based on mean distances between patients and physicians: 10-mile radius if the mean distance is less than 10 miles, 15-mile radius if the mean distance is greater than 10 miles but less than 15 miles, and 20-mile radius if the mean distance is greater than 15 miles.[10] Table 4 displays the results of Equation (2).

The estimates are qualitatively similar to the primary difference-in-differences analysis, although estimates are smaller and less precise for PPMC 3. This is likely because PPMC 3 is more geographically dispersed than PPMCs 1 and 2, which means patients would receive less exposure to PPMC 3 within a defined geographic area. Similar results are also found in an analysis using

Figure 4. (Color online) PPMC Effects on Patient Risk for Low-Risk Births



Notes. This figure depicts patient risk factors as the outcome of the difference-in-differences specification. "Previous pregnancy" is omitted for scaling purposes given a large confidence interval; the point estimates and standard errors are −0.042 (0.044) for PPMC 1, 0.014 (0.026) for PPMC 2 and 0.038 (0.029) for PPMC 3. As seen in Table H.2 in the Online Appendix, all risk factors positively impact a patient's probability of C-section except for previous pregnancy, isoimmunization, nutritional deficiency, and substance abuse, which reduce C-section risk. Regressions include physician and year × PPMC fixed effects. Bars are 95% confidence bands. Standard errors are clustered at the practice level.

the hospital location where the physician performed the most deliveries in a given year rather than using a physician's practice location (Online Appendix, Table F.2). This robustness check is provided because (1) 145 of 1,693 physicians do not match to SK&A and therefore do not have practice location data, and (2) there may be measurement error in practice location based on SK&A reporting.

6.3. Physician Selection

Selection is an inherent feature of the PPMC setting: physicians choose to sell their practice to a specific PPMC, and each PPMC chooses to acquire a specific practice. To help account for this nonrandom selection, all analyses include physician fixed effects that control for time-invariant differences across physicians, including observable characteristics such as physician gender and medical school training, and unobserved characteristics such as technical skill and fixed treatment beliefs (Epstein and Nicholson 2009, Currie et al. 2016). Although the inclusion of physician fixed effects and the additional analyses described later help to mitigate selection concerns, physicians could still select into a PPMC with the intention of changing their treatment style to align with that PPMC's objectives. Therefore, the estimates should be interpreted as capturing the effect of PPMCs in the presence of selection.

6.3.1. Event Study. The event study is an extension of Equation (1), where instead of aggregating years before and after an acquisition, each physician's C-section decision is estimated relative to the year of acquisition.

Table 4. Role of Patient Exposure to a PPMC on C-Sections for Low-Risk Births

	(1) 15-mile radius	(2) 10 miles if urban, 20 miles otherwise	(3) Sample-based cutoffs
δ^{PPMC1}	−0.027***	−0.023***	−0.031***
	(0.007)	(0.006)	(0.008)
δ^{PPMC2}	0.044***	0.028***	0.024***
	(0.009)	(0.007)	(0.008)
δ^{PPMC3}	0.019***	0.009**	0.012**
	(0.006)	(0.004)	(0.005)
Observations	1,177,810	1,159,413	1,205,571
R^2	0.164	0.164	0.164

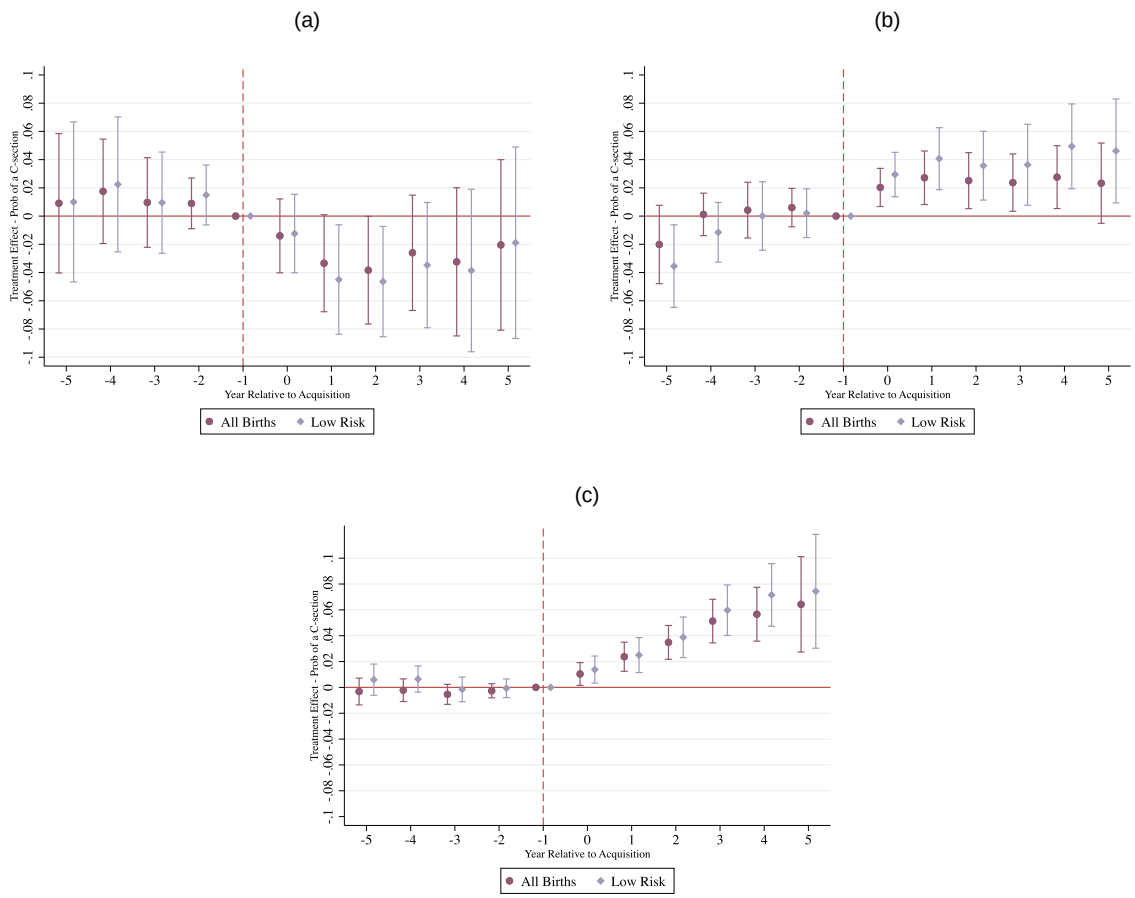
Notes. The dependent variable is a C-section (one for C-section, zero otherwise). The δ represent that share of PPMC physicians within a given radius of a patient zip code centroid. All regressions adjust for patient controls and include physician and year fixed effects. Standard errors are clustered at the patient zip code level.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Empirically, indicators are included for each year relative to acquisition for each PPMC. For the three PPMCs, Figure 5 shows that there are limited preacquisition trends in the probability of a C-section. In the postperiod, there is an immediate increase in the probability of a C-section for PPMC 2. PPMC 3 also shows a small and immediate increase after acquisition. The estimates for PPMC 1 are less precise and the only significant effects for low-risk births are observed in the second and third years after acquisition. This contrast may be from the differences between clinical and financial management, where it could take longer to change behavior through clinical initiatives than through financial incentives. In the Online Appendix, Figures F.1–F.3, I find similar results for specifications using a balanced physician panel, a control group of non-PPMC physicians, and two relative period indicators to address potential multicollinearity in treatment timing (Borusyak and Jaravel 2016).

6.3.2. Additional Control Group. Equation (1) is estimated using the sample of eventually acquired physicians, where the benchmark model (Table 3, column 2) includes year × PPMC fixed effects. This equation limits comparisons to physicians who eventually become acquired by the same PPMC to mitigate concerns over observable and unobservable differences between physicians that may lead them to select a specific PPMC. However, including non-PPMC physicians would help account for common year and location effects that could influence the C-section rate. To homogenize comparisons between PPMC and non-PPMC Ob-Gyns, I estimate nonparametric nearest neighbor matching regressions where each PPMC physician is matched to three non-PPMC physicians based on all patient panel risk factors in the year before acquisition. The Online Appendix, Table F.3, replicates Table 3 with the matched sample. Although point estimates are qualitatively similar, they are smaller and less precise in several specifications, especially for PPMC 2. This suggests some degree of selection on unobservables between PPMC and non-PPMC physicians and supports using the sample of physicians in practices eventually acquired by a PPMC.

Figure 5. (Color online) Event Study Results by PPMC



Notes. (a) PPMC 1. (b) PPMC 2. (c) PPMC 3. The dependent variable is a C-section (one for C-section, zero otherwise). Bands indicate 95% confidence intervals constructed from practice level clustered standard errors. Regressions adjust for patient controls, and physician and year × PPMC fixed effects. Base period of $t = -1$ normalized to zero.

6.3.3. Selection Between PPMCs. A related concern is physician selection between PPMCs. In other words, are the observed changes in C-sections driven by differential sorting of physicians across the PPMCs? First, the Online Appendix, Figure E.1, shows that the three PPMCs and non-PPMC physicians have similar distributions in the risk-adjusted C-section rate before acquisition. Although PPMC 2's C-section rate does skew right compared with non-PPMC physicians, the distributions still suggest that PPMCs were not targeting physicians with significantly higher or lower C-section rates. Second, variation in when and where a PPMC was founded limited the diffusion of PPMCs to specific geographic areas, which limited a physician's choice between the three PPMCs. Specifically, there was minimal regional overlap between practices in PPMC 1 and PPMC 2 (and no overlap until 2011), whereas overlap with PPMC 3 did not start until it was founded in 2009. The Online Appendix, Table F.4, shows that the point estimates are similar whether physicians had a choice of PPMC and that acquisitions earlier in the sample had similar effect sizes.

7. Mechanisms

The previous analyses find that physicians decrease C-sections after being acquired by PPMC 1 and increase C-sections after being acquired by PPMCs 2 and 3. Alternative specifications and robustness checks help minimize concerns that these changes are driven by patient or physician selection into PPMCs. Based on the qualitative research and marketing materials provided in Section 4 and Online Appendix B, the key distinction between the PPMCs appears to be their management strategy of focusing on financial versus clinical management. This section provides evidence that the differences in firm management are the most likely explanation for the changes in C-sections.

7.1. Market Concentration

PPMC marketing materials suggest one way they increase practice profitability is by negotiating higher-paying insurance contracts. Higher payment could result from better negotiating tactics or increased market power, or a combination of both. Either way, before acquisition, physicians had little ability to negotiate with insurers and would often accept a standard contract from an insurer. After acquisition, the practice would likely receive higher payments based on the PPMC's collective bargaining with insurance companies. An increase in payment could lead physicians to substitute from vaginal birth to C-sections after acquisition.[11] In addition to influencing payment, an increase in PPMC market power could also reduce incentives to provide higher quality care. Therefore, a physician's decision to perform a C-section could be influenced by increases in market concentration in addition to changes in management. I conduct several robustness checks and additional analyses to examine the role of market concentration (see Online Appendix G for details).

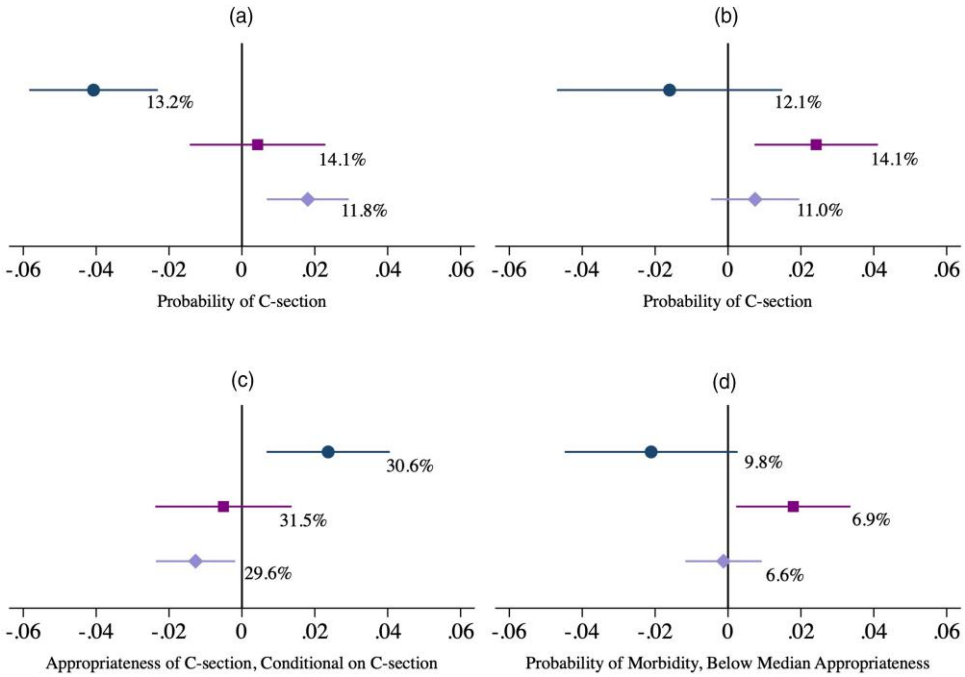
First, in the Online Appendix, Tables G.1 and G.2, I show that the patient exposure results from Table 4 are quantitatively similar after including controls for broad changes in market concentration. Second, I examine whether there is heterogeneity in the effect of PPMC acquisitions on C-sections in markets that became more concentrated due to acquisition. In this analysis, I assess robustness to different market definitions using the location of the physician's practice as follows: the four-digit zip code in which a physician's practice is located or the 4-, 6-, or 10-mile radius around each practice (based on the coordinates of a physician's office location). To measure the increase in concentration only driven by a PPMC acquisition, I calculate the Herfindahl-Hirschman index (HHI) using each PPMC's preacquisition share of births but postacquisition ownership for each market. Scatterplots of pre- and postacquisition HHI show that most markets are already moderately concentrated (preacquisition HHI greater than 1,500) and that PPMC acquisitions often lead to increases in concentration (Online Appendix, Figures G.1–G.5).[12]

Using the 2010 U.S. Horizontal Merger Guidelines, I make mutually exclusive indicators for whether an acquisition leads to a change in HHI in the green, yellow, or red zone (green means the acquisition is unlikely to have adverse competitive effects and red means the acquisition raises significant competitive concerns). The Online Appendix, Table G.4, shows the result of interacting these terms with the post-PPMC indicators and transition period indicators in Equation (1). For the most part, PPMC acquisitions have similar effects on C-sections whether the acquisition led to an increase in HHI that would warrant scrutiny. This analysis suggests that there are PPMC-specific effects on C-sections irrespective of the changes in market concentration.

7.2. Role of Management

7.2.1. Clinical Initiatives. The low-risk C-section rate is a widely used measure of maternal and perinatal quality. PPMC 1 achieved a considerable reduction in the low-risk C-section rate, suggesting that their specific clinical management initiatives impacted the C-section decision. In particular, PPMC 1 focuses on improving labor management through the dissemination of clinical guidelines, which would encourage physicians to allow longer labor and avoid unplanned C-sections. As expected, for PPMC 1, most of the reduction in C-sections occurs among unplanned C-sections (Figure 6, (a) and (b), provides a graphical representation

Figure 6. (Color online) PPMC Effects on Quality of Care for Low-Risk Births



Notes. (a) Unplanned C-section. (b) Planned C-section. (c) Appropriateness. (d) Morbidity. For (a) and (b), the dependent variables are a planned C-section and an unplanned C-section (one for C-section, zero otherwise). A C-section was considered unplanned if there was any indication a woman entered labor using the methodology of Gregory et al. (2002) and Henry et al. (1995). For (c) and (d), the dependent variables are C-section appropriateness conditional on receiving a C-section (continuous from zero, least appropriate, to one, most appropriate) and infant or maternal morbidity (one in case of morbidity, zero otherwise) for those below median appropriateness. Preacquisition averages are shown below each 95% confidence interval, and β^j from Equation (1) are the point estimates. Regressions adjust for patient controls and physician and year × PPMC fixed effects. Standard errors are clustered at the practice level. See the Online Appendix, Table H.1, for regression output.

of β^j from Equation (1)). Recall that planned C-sections usually occur for a clinically indicated reason, so the lower the risk of the mother, the lower the probability of a planned C-section (The Ohio Perinatal Quality Collaborative Writing Committee 2010). Given that the estimates in Figure 6 are for low-risk births, it is surprising that, in PPMC 2, most of the increase in C-sections occurs among planned C-sections. Changes in clinical justifications reveal a potential explanation (Online Appendix, Table H.1): Use of the diagnosis code "no clinical indication for C-section" increases by 6.0 percentage points (124.3%) in PPMC 2, suggesting C-sections may not have been medically necessary. In contrast, for PPMC 3, most of the increase was among unplanned C-sections, with failure to progress to labor as the most commonly coded clinical reason. This suggests PPMC 3 physicians potentially took advantage of the subjectivity around a woman's failure to progress to labor to justify an increase in C-section use.

A change in the C-section rate does not necessarily indicate that quality of care improved. For example, although PPMC 1 aims to increase quality by reducing C-sections, if patients who require a C-section do not receive one, they may experience worse outcomes. To account for this possibility, I test whether C-sections are provided to more medically appropriate patients and whether patient morbidity decreases. I adapt methodology from Baicker et al. (2006) to determine the medical appropriateness of treatment by calculating a patient's probability of receiving a C-section based only on their risk factors, aggregated over the entire sample (see Online Appendix H). As seen in Figure 6, (c) and (d), patients are 2.4 percentage points (7.8%) more likely to receive appropriate treatment in PPMC 1 after acquisition, and the probability of morbidity decreases by 2.1 percentage points (21.4%) for patients of below-median appropriateness.[13] In PPMC 2, there is no change in clinical appropriateness, suggesting that these Ob-Gyns increase C-sections regardless of the medical risk of the patient. This result is consistent with PPMC 2 physicians providing "systematically more aggressive" C-sections and is associated with a 1.8-percentage-point (26.0%) increase in patient morbidity. In contrast, although there is a decline in the medical appropriateness of C-sections in PPMC 3, there is no change in morbidity. A potential reason is that PPMC 3 physicians "rank patients on a distribution of clinical appropriateness and work their way down that distribution"; therefore, by targeting

treatment based on patient risk, they may be less likely to harm patient health (Baicker et al. 2006).

Last, I provide evidence that the clinical initiatives implemented by PPMC 1 may have also influenced physicians acquired before the sample period. Starting in 2011, PPMC 1 instituted several additional initiatives to reduce unnecessary C-sections specifically. The Online Appendix, Figure H.1, plots the risk-adjusted low-risk C-section rate for physicians in the switcher subsample and physicians always observed in PPMC 1. The initiatives coincide with reductions in C-section across both groups and to convergence in the low-risk C-section rate over time.

7.2.2. Financial Incentives. The increase in the C-section rates for PPMCs 2 and 3 are consistent with their financial focus, given the higher reimbursement associated with C-sections. Ideally, data on physician payments would be used to test the role of financial incentives on the C-section decision. Using the data at my disposal, I exploit differences in payment rates between commercial insurance and Medicaid in Florida. Florida is one of the few states where Medicaid reimburses C-sections and vaginal births at the same rate. In 2012, physicians were paid $1,456 for a routine vaginal delivery or C-section (Alexander 2015). Therefore, for Medicaid patients, there should be no differential financial incentives to perform a C-section. If PPMCs were motivating physicians to increase income through unnecessary treatment, the prediction would be an increase in C-sections among privately insured patients rather than Medicaid patients.

Figure 7, (a) and (b), shows that across all the PPMCs, changes in the probability of a C-section are similar within the sample of Medicaid patients and privately insured patients. A potential reason for this externality is "time is money": because C-sections typically take less time, increasing C-sections for Medicaid patients allows more time to treat other patients. However, the Online Appendix, Table 1.1, column (3), shows that PPMCs 2 and 3 increase C-sections by 1.5 and 2.0 percentage points more among privately insured relative to Medicaid patients, respectively. These results provide evidence that PPMC 2 and 3 physicians shift C-sections toward patients with higher reimbursement.

As seen in Figure 7, (c) and (d), there are also large changes to the insurance composition of the patient panel. For PPMC 2, the probability of an Ob-Gyn treating a privately insured patient increases by 8.5 percentage points (13.8%), whereas the probability of treating a Medicaid patient drops by 6.2 percentage points (22.4%). Results are directionally similar for PPMC 3 but not statistically significant. This shift toward privately insured patients and away from Medicaid patients is consistent with physician behavior being influenced by a PPMC's emphasis on financial performance. The Online Appendix, Table 1.2, shows other outcomes that could impact productivity or influence provider payment. There are not economically meaningful changes to birth volume or length of stay, but because C-sections are more costly to provide, total hospital charges increased by $1,264 and $1,609 (10.2% and 12.7%) in PPMCs 2 and 3, respectively.

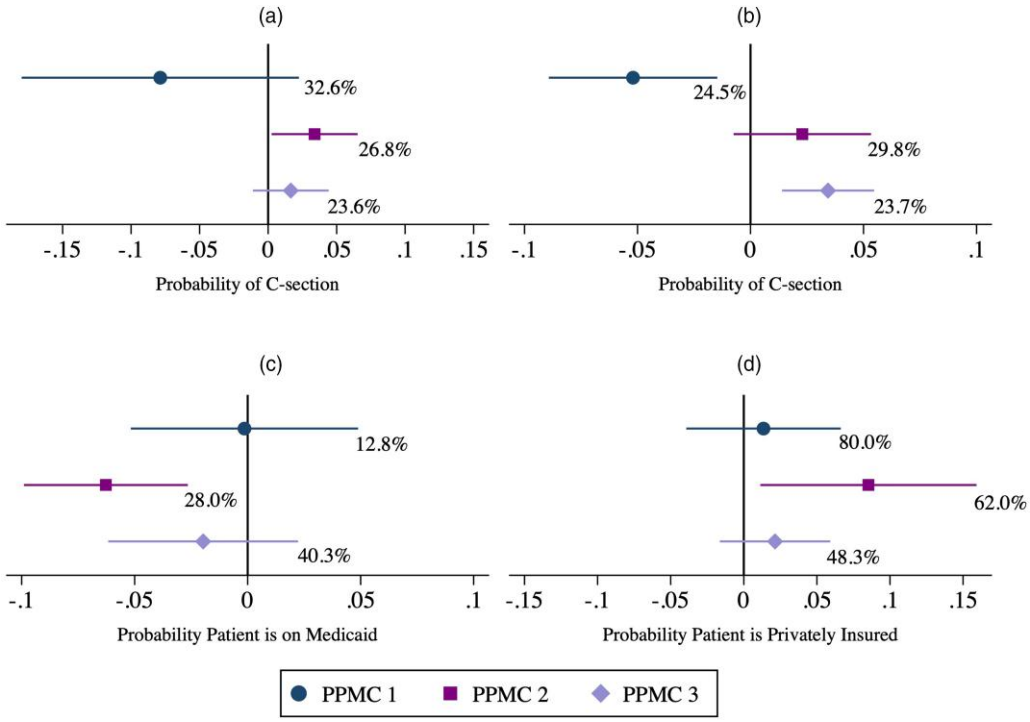
7.3. Limitations

Most analyses estimate changes in a physician's C-section decision comparing physicians within each PPMC. Although I provide evidence that physicians do not differentially sort across the PPMCs, the PPMCs differ in important ways that would caution comparison. For example, most patients in PPMC 1 are privately insured, whereas PPMC 3 physicians see a greater share of Medicaid patients. By treating a higher-paying patient population, PPMC 1 may be able to perform fewer C-sections but still generate greater revenue than PPMC 3. Therefore, the managerial choices made by PPMC 1 may not generalize to patient populations with lower shares of privately insured patients. A similar argument applies to the generalizability of these findings to other PPMCs nationwide. For example, PPMCs in other states may be subject to different regulations that influence their organizational structure. Another limitation of this study is the difficulty linking the exact PPMC management practices to observed results. Without payment data, for example, it is difficult to isolate the role of financial incentives. Nonetheless, the qualitative research and the empirical analyses suggest the most apparent difference between the PPMCs is their publicized focus on clinical versus financial management.

8. Discussion and Conclusion

This paper studies the impact of management on clinical performance using novel data on an understudied phenomenon: medical practice acquisitions by PPMCs. PPMCs provide a useful setting to evaluate a change in management because their stated business purpose is to increase practice profitability through better management while minimizing disruptions to the physician's clinical environment. To study PPMCs, I collect data from corporate registries on physician practice acquisitions by three PPMCs in Florida between 2006 and 2014. These PPMCs manage the practices of Ob-Gyns and represent more than 40% of Ob-Gyns in Florida. Using difference-in-differences methods, I find large and significant changes in the C-section decision: the probability of low-risk C-section decreases by 5.7 percentage points (22.3%) for Ob-Gyns acquired by PPMC 1, whereas in PPMCs 2 and 3, the probability increases

Figure 7. (Color online) PPMC Effects by Patient Insurance for Low-Risk Births



Notes. (a) C-sections, Medicaid. (b) C-sections, private insurance. (c) Medicaid as outcome. (d) Private insurance as outcome. For (a) and (b), the dependent variable is a C-section (one for C-section, zero otherwise) by patient insurance status. For (c) and (d), the dependent variable is patient insurance (one for Medicaid or private insurance, zero otherwise). Preacquisition averages are shown below each 95% confidence interval, and β^j from Equation (1) are the point estimates. All regressions include physician and year × PPMC fixed effects, but only (a) and (b) adjust for patient controls. See the Online Appendix, Table I.1, for regression output.

by 2.9 percentage points (10.1%) and 2.6 percentage points (11.2%), respectively.

I collected archived PPMC website information to understand the mechanisms underlying these changes. This qualitative research reveals that while a PPMC's organizational structure and marketing materials may promote physician autonomy, PPMCs adopt different management strategies and practices that could influence physician behavior. In this setting, PPMC 1's marketing materials are consistent with a strategy that emphasizes improving clinical outcomes through clinical management services, and PPMC 2's and 3's marketing materials are consistent with a strategy that emphasizes improving financial outcomes through financial management services. Qualitative research also suggests that PPMCs use different management practices such as performance monitoring and incentives to align physician behavior with their stated objectives. Data limitations prevent linking these specific management practices to the changes in C-sections. Instead, I connect the broad PPMC strategies to other observable outcomes. I find evidence consistent with PPMC 1's clinical objectives: PPMC 1 provides more clinically appropriate C-sections and decreases patient morbidity, and the timing of their clinical initiatives coincides with declines in C-sections among all physicians in the PPMC. In PPMCs 2 and 3, I find evidence consistent with their financial focus: C-sections increase more for patients with private insurance relative to Medicaid patients, and PPMC 2, in particular, greatly reduces their panel of Medicaid patients in favor of more privately insured patients. This result raises concerns over equity in access to care and appropriate treatment.

The two management strategies explored in this paper represent the publicized management approaches undertaken by other PPMCs across a wide range of specialties in the United States. These three PPMCs are also important in their own right. PPMCs 1, 2, and 3 have continued to acquire practices, with expansions often supported by investments from private equity firms. As a result of this growth, these three PPMCs alone delivered 1 in every 25 babies in the United States in 2019.

8.1. Managerial and Policy Implications

Most physicians in the United States are not taught practice management skills in medical school (Klasko 2015, Finnegan 2020). For many physicians, this generates the burden of running both the complicated business side and clinical side of a medical practice. To

offload this burden, many physicians have sold their medical practices to larger organizations, such as hospitals and PPMCs, that would take over much of the managerial responsibilities. Despite the managerial changes that occur after an acquisition, little research has explored this management channel. This paper provides evidence that changes in practice management can alter clinical outcomes and finds heterogeneous effects depending on a firm's publicized management strategies and practices. This case study cautions against pooling together management companies, and more broadly, informs how changes in quality outcomes may be specific to the acquiring firm's strategy.

The differences in management strategies also provide insights into how medical practices can balance profitability and the quality of care in the era of value-based care. The typical PPMC model benefits from a fee-for-service system: these PPMCs leverage their size to negotiate higher-paying contracts, in addition to the operational efficiencies generated from economies of scale. However, the growing transition from fee-for-service to pay-for-performance has prompted PPMCs like PPMC 1 to shift toward clinical management services to make practices competitive for such contracts. In 2013, PPMC 1 achieved its stated objective and signed "collaborative care" agreements with two insurers that paid Ob-Gyns on performance measures in labor and delivery. Although this may be a less lucrative or niche strategy in the short term, organizations with similar objectives such as Accountable Care Organizations and Patient-Centered Medical Homes may benefit from these managerial insights. In fact, some PPMCs focused on clinical management, such as Privia Health, have expanded their services to help Accountable Care Organizations achieve higher savings. As the United States continues to transition to value-based care, more research is needed on how practice management can help achieve lower cost, higher quality care.

However, most PPMCs still advertise that they can negotiate higher payment rates by leveraging their size and expertise. The rapid acquisition of practices by PPMCs raises concerns that they are simply a vehicle to quietly increase market power and reduce competition (Scheffler et al. 2021). In particular, private equity-backed PPMCs and medical practices have been found to increase prices paid to physicians after acquisition and have been involved in several legal disputes with insurers and government agencies (Braun et al. 2021, La Forgia et al. 2022). Although the PPMCs in this paper gain market power through acquisitions, the changes in C-sections do not appear to be predominantly driven by this market power channel. These results suggest that at least within this setting and study period, there are PPMC-specific effects on C-sections not explained by changes in competition. Since 2014, the PPMCs have continued to acquire practices, often with support from private equity firms, which may lead to more salient anticompetitive effects in the future.

The growth of PPMCs also brings to light the role of corporations in healthcare. Several state and federal laws, such as Corporate Practice of Medicine (CPOM) doctrines, explicitly prohibit corporations from influencing clinical decisions. Yet, research by Eliason et al. (2020) find that dialysis clinics acquired by a large chain increase patient hospitalizations and mortality, and Cooper et al. (2020) find that hospitals that contract with TeamHealth and Envision increase surprise medical bills, leading to several investigations of potential CPOM violations (Arnsdorf 2020, Haefner 2020). Although the results of this paper are more nuanced, the PPMCs still alter clinical outcomes despite claiming to preserve clinical autonomy, with two PPMCs increasing the use of high-cost low-value care. These findings suggest CPOM laws need to be revisited or more strictly enforced, as corporations may appear to comply on paper, but not necessarily in practice (Arnsdorf 2020). Last, although policymakers have pushed for a corporate transparency bill that would require private equity companies to provide "the federal government with information on payments and real estate investments," the first-order problem is the lack of data and difficulty in determining changes in ownership in healthcare (King 2020). Increased transparency and access to data on acquisitions and other organizational relationships will be necessary for future researchers to study the impact of corporate ownership on healthcare delivery.

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Endnotes

[1] The acquired practices operate as subsidiaries of a holding company set up by the PPMC, meaning they are separate legal entities for tax, regulation, and liability purposes. See Section 3.2 for details.

[2] This quote is from the 2015 website of the PPMC Women's Health USA (not studied in this paper): Accessed February 9, 2022, https://web.archive.org/web/20150211122827/; accessed February 9, 2022, https://www.womenshealthusa.com/.

[3] This quote is from the 2015 website of the PPMC Privia Health (not studied in this paper): Accessed February 9, 2022, https://web.archive.org/web/20150808034152/; accessed February 9, 2022, http://www.priviahealth.com/doctors.html.

[4] The PPMCs in this paper resemble others that manage private practices (e.g., QualDerm Partners) rather than those that provide hospital staffing services (e.g., TeamHealth).

[5] Physicians often sign a restrictive covenant that prevents them from practicing in the state (or other specified regions) if they decide to leave the PPMC and/or impose a cash penalty for exiting the company (Hernandez 2020).

[6] Regardless of regulation, enforcement varies widely (Cohen Healthcare Law 2018). Some states like Florida have no formal CPOM laws, but past legal cases have established that corporations should not interfere with the "physician-patient relationship." See Indest (2012) for details.

[7] A press release from Cigna describes the arrangements aim "to reduce primary cesarean delivery" and shares that "practices participating in the program are compensated with a patient care management payment that rewards them for meeting a comprehensive set of quality and cost efficiency targets." See Online Appendix B for more details.

[8] These payment amounts include facility, physician, laboratory, radiology, and pharmacy fees for a mother's prenatal, intrapartum, and postpartum care.

[9] Clinical reasons for scheduling a C-section in advance of labor (referred to as "planned" C-section) can include severe maternal hypertension, previous C-section, or problems with the placenta. Patients could also request a C-section. In 2006, the NIH found evidence that 2.5% of all U.S. births were by maternal request.

[10] 78% of patients live within 15 miles of an Ob-Gyn in the sample. 91% of patients reside in zip codes considered urban based on U.S. Census rural-urban commuting areas.

[11] Even an equal percentage increase in payments for both procedures would widen the differential. Additionally, although the income effect could dominate the substitution effect, previous research has found that higher reimbursement for C-sections can lead physicians to substitute toward C-sections (Gruber et al. 1999).

[12] For example, 44%, 64%, and 39% of four-digit zip code market-years had increases in HHI that would warrant scrutiny according to the 2010 U.S. Horizontal Merger Guidelines after an acquisition by PPMCs 1, 2, and 3, respectively.

[13] I define morbidity as any adverse maternal or infant event during or immediately after childbirth (Currie and Macleod 2017). I focus on morbidity below median appropriateness because, in areas of intensive treatment, patients least appropriate for treatment may have worse outcomes (Chandra and Staiger 2007). For patients of above-median appropriateness, there are no observed changes in morbidity across the PPMCs, likely because low-risk mothers may still not benefit from a C-section.

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