Whistleblowers, Private Enforcement, and Medicare Fraud

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Abstract

This paper examines the effects of private anti-fraud enforcement under the False Claims Act, which compensates whistleblowers for litigating against healthcare providers who overbill the Medicare program. Pairing a new dataset on whistleblower lawsuits and the universe of Medicare Fee-for-Service claims from 1999-2016, I measure the deterrence effects of whistleblowing. I find that $1.9 billion worth of whistleblower settlements generated future Medicare cost savings of more than $18 billion over 5 years. Public costs are comparatively small at under $108.5 million in 2018. In a case study of spine surgery, whistleblower-induced changes to medical provision appear to benefit patients by redirecting care away from those harmed by a profitable procedure. Private enforcement by whistleblowers is a cost-effective way to correct healthcare fraud.

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Fraud is a serious concern in the governmental provision of health insurance. An information asymmetry exists between private firms that provide healthcare services and the US government agencies which reimburse these providers based on self-reported activity. This information asymmetry provides opportunities and incentives for healthcare firms to increase their profits through misreporting. In contrast, the federal insurer has a limited capacity for monitoring and enforcement. With the United States government spending more than a trillion dollars per year on health care, even small shares of impropriety can be very expensive, motivating the concern that healthcare has become a source of illicit profit for providers willing to commit fraud.

Whistleblowing is a method to curb improper behavior by incentivizing individuals to come forward with their private information. The False Claims Act (FCA) is a federal law that since 1986 has allowed whistleblowers, usually healthcare workers, to recover over-billed money for the government and receive a share of the recoveries. Uniquely, FCA whistleblowers conduct their own litigation on behalf of the government in federal civil court, combining whistleblowing with the private enforcement of law. This process has generated thousands of whistleblowing cases and tens of billions of dollars of recovered money over the past 35 years. In fiscal year 2018 alone, whistleblowers recovered almost $2 billion for the government from FCA healthcare lawsuits, for which whistleblowers were awarded $266 million (Civil Division, U.S. Department of Justice, 2018).

Private antifraud enforcement faces a tradeoff between social benefits, private costs, and public costs, none of which are fully internalized by the whistleblower. By paying whistleblowers a share of the money recovered, the False Claims Act creates incentives for whistleblowers to conduct enforcement when they expect cases to be profitable, which scales with the size of the fraud already committed. Yet whistleblowing can also have deterrence effects for which the whistleblower is not paid. Whistleblowing can change spending on the types of fraud the whistleblower identifies, called specific deterrence, and also cause spillovers to inhibit fraudulent billing throughout the medical industry, known as general deterrence\(^1\). In contrast to these benefits, private enforcement faces the risk of over-enforcement because whistleblowers do not bear the full costs of their lawsuits. Lawsuits have both public and private costs, including to the Department of Justice, the court system, plaintiff’s attorneys, and defense attorneys. Finally, whistleblowing can affect care decisions by providers, with either positive or negative consequences for patient health, neither of which are internalized in the whistleblower’s enforcement decision.

In this paper, I examine the economics of whistleblowing under the False Claims Act and empirically

\(^{1}\) The distinction between “specific” and “general” enforcement and deterrence comes from Shavell (1991).
measure the costs and benefits of private enforcement. First, I model the decision of the whistleblower to litigate as compared to socially optimal behavior and discuss the key magnitudes needed to understand efficiency. For the empirical analyses, I pair a novel dataset on whistleblower filings and their allegations with large samples of Medicare claims data from 1999-2016. Using these data, I measure the benefits of whistleblowing, including the specific deterrence effects of select whistleblower cases, as well as the public costs of whistleblowing and its affects on patient health outcomes.

To measure deterrence effects, I conduct a series of case studies of large settled whistleblower lawsuits and analyze their effects on Medicare claims and spending. I apply a synthetic control methodology to these case studies to estimate counterfactuals in the absence of whistleblowing. The standard synthetic control methodology is augmented by an additional parameter, a time-shift for each control, which I estimate. This method allows the comparison between similar trends in spending that occur at different points in time, which improves the pre-period fit of the synthetic control design. I compare spending on types of medical care subjected to whistleblowing against a synthetic control group constructed of similar types of care not subject to whistleblowing. The difference between these series provides the measure of specific deterrence in the post-whistleblowing periods.

My results point to a high specific deterrence value of whistleblower cases. The total specific deterrence effect of the 4 case studies exceeds $18 billion in the first 5 years after the cases were filed. On average, specific deterrence is 6.7 times the case’s settlement value, with wide variation in this ratio. Importantly, these specific deterrent effects do not count the general deterrence value of these cases in deterring other types of fraud, and therefore this constitutes a lower bound of the total deterrence effects of these cases.

Whistleblowing incurs relatively low public costs given the magnitude of its benefits. Whistleblowing incurs public expenditures by federal agencies that oversee and contribute to the litigation, as well as private costs by plaintiff’s attorneys and defense attorneys. Using data from federal budget reports, I estimate that total public expenditures are small relative to the deterrence effects of whistleblowing, at no more than $108.5 million in 2018. This indicates that whistleblowing has an incredibly high return on investment for federal resources, and that privatization is a promising way to proceed with antifraud enforcement.

Finally, I examine the effects of whistleblowing on provider care decisions. Whistleblowing has the potential to change provider care decisions by changing the compliance requirements, litigation risk, and profitability of care that doctors conduct. I conduct a case study on kyphoplasty, a spine procedure for patients with vertebral compression fractures from osteoporosis. A set of whistleblower lawsuits alleged that many hospitals fraudulently admitted patients for inpatient kyphoplasty rather than perform this procedure
outpatient. Kyphoplasty is linked to decreased mortality in the medical literature, and there was a large effect of whistleblowing on treatment. I model the effects of kyphoplasty on Medicare patient death among two cohorts of roughly 8 million patients each, from before and after the lawsuits. My model interacts patient covariates and medical history with treatment, which produces estimated treatment effects of kyphoplasty for each patient. These effects provide a scale by which to measure how beneficial it is for a patient to receive treatment.

I find that in the case of kyphoplasty, whistleblowing had positive overall effects on patient care. Following whistleblowing, there was better targeting of the procedures to those patients for whom greater benefit is predicted. Patients for whom it is expected that kyphoplasty increased mortality were 7% less likely to be treated, while patients with reduced mortality if treated were 7% more likely to be treated. This targeting change was concurrent with a substitution from inpatient kyphoplasty to less expensive outpatient kyphoplasty and vertebroplasty, a close substitute. This indicates that whistleblowing can have positive effects on care delivery by changing the incentives in the care decision process by providers, even while reducing spending.

While there has been substantial disagreement in the public sphere over the value of the False Claims Act\(^2\), there has been little empirical evidence as to the effects of this law. Engstrom (2012; 2013) presents descriptive statistics on FCA cases and settlements but does not measure the law’s effects on providers and spending. In the accounting literature, Heese (2018) shows that hospitals prosecuted under the FCA are less likely to participate in broad measures of overbilling. Howard and Desai (Forthcoming) show that FCA investigations lower angioplasty volume in investigated hospitals. This paper also relates to the legal literatures on private enforcement and Medicare fraud. Polinsky (1980) is the seminal work on the private enforcement of law. Becker and Stigler (1974) began a wide literature on the deterrence effects of enforcement, and Shavell (1991) formulates the differences between specific and general enforcement of law used here.

This paper also relates to the economics literature on health care fraud more broadly, which has thus far not discussed whistleblowing. Silverman and Skinner (2004) and Dafny (2005) describe the financial incentives for misreporting among for-profit hospitals. The types of fraud described in those papers were ultimately litigated by whistleblowers under the False Claims Act. More recently, Fang and Gong (2017)mea-

\(^2\)Proponents of whistleblowing point to the volume of settled cases and the billions of dollars recovered as evidence of the effectivity of the Act. Attorney General Eric Holder said in a 2012 press release: “In the last quarter century, the False Claims Act’s success has been unparalleled with more than $30 billion dollars recovered...and $8.8 billion since January 2009” (United States Department of Justice, 2012). Detractors suggest that profit-seeking whistleblowers use civil litigation to force settlements from providers, regardless of the validity of their allegations. In an amicus brief to the Supreme Court, the U.S. Chamber of Commerce, a pro-business organization, wrote: “[whistleblowers] can extract settlements from defendants averse to high discovery costs, the risk of large losses, and...reputational harms” (Chamber of Commerce, 2015).
sure and detect the magnitude of overbilling in Medicare Part B claims. This paper fills a gap in the existing literature by evaluating the whistleblowing program that seeks to catch and inhibit the fraud described in those papers.

This paper is organized as follows. Section 1 describes the institutional details of the False Claims Act, and Section 2 and models the economics of private enforcement. Section 3 describes the data and provides stylized facts about FCA lawsuits and recoveries. Section 4 presents the time-shifted synthetic control method, describes a series of case studies of successful whistleblower lawsuits and measures specific deterrence. Section 6 presents the effects of the kyphoplasty lawsuits on patient care, and Section 7 concludes.

1 Background

Medical care has a fundamental information asymmetry between providers, insurers, and patients (Arrow, 1963), which creates opportunities for misreporting. A patient who receives medical care rarely observes the billing process, which is conducted by the provider. Moreover, patients are less informed than doctors about the care they need, making health care a credence good; patients are not sufficiently able to monitor doctors for bad behavior (Dulleck and Kerschbamer, 2006). Conversely, insurers have limited means of directly observing care, relying on provider’s claims for payment. This information asymmetry provides opportunities for misreporting by providers, whose billing practices tie directly to their profits. It is difficult to uncover misreporting using top-down enforcement, as insurers often lack other sources of information besides the provider’s claim and supporting documentation. As such, private information from providers or their staff is useful for uncovering any misreporting or fraud.

When the insurer is the federal government, as is the case with Medicare and Medicaid, these problems are exacerbated. Medicare and Medicaid are massive programs, spending respectively around $700 and $400 billion per year (Congressional Budget Office, 2019), creating bureaucratic issues due to the sheer volume of claims. Indeed, the Government Accountability Office (GAO) estimates that $48 billion (8%) of Fee-for-Service Medicare expenditures in 2017 were “improper,” i.e. lack necessary documentation to ensure the correct amount was paid to the right person for a valid claim (United States Government Accountability Office, 2019). Though most improper payments are not fraudulent, this underscores the opportunism that may arise from expensive and overwhelmed federal programs. Even small shares of fraud in Medicare spending can amount to tens of billions of dollars per year.

With these issues in mind, in 1986 Congress amended the False Claims Act to enable whistleblowers to

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3 The FCA was amended in 1986, but originally existed during the Civil War to combat fraud against the Union army. It
directly conduct lawsuits against those who overbill the government (United States Department of Justice, 2012). Though not restricted to healthcare, the False Claims Act has largely been used against healthcare-related fraud, overbilling, and misreporting. Under the False Claims Act, individuals who uncover misreporting against the US government, themselves often healthcare workers (e.g. a hospital employee), hire their own attorneys and sue those committing the impropriety in federal civil court. The whistleblower sues *qui tam*, i.e. on behalf of the US government. These civil court cases have 3 parties: the whistleblower⁴, the defendant, and the US government. In some cases, the Department of Justice intervenes in what it believes to be a lucrative lawsuit by assigning its own attorneys, conducting additional investigation and overseeing litigation. In other cases, the whistleblower does not receive federal support, and either pursues the case alone or drops it. All cases are filed under seal, meaning the defendant is not immediately notified of the filing, giving the government an opportunity to investigate and elect to intervene before the defendant is made aware. The Department of Justice must approve any settlements between the whistleblower and the defendant, regardless of their intervention status.

Critics may assert that whistleblowers could extort payments from firms without filing a False Claims Act lawsuit, using private nondisclosure agreements. From an institutional standpoint, this is unlikely, because privately contracting with a whistleblower does not release the firm from liability for similar claims from other whistleblowers or direct government enforcement, while such release of liability is standard in an FCA settlement. However, firms do face pressure to self-disclose billing errors to Medicare administrators, as this can circumvent the FCA process and allow an out-of-court repayment without large punitive damages.

False Claims Act lawsuits can be high stakes for all parties involved. These cases are conducted in civil court, and the burden of proof is the preponderance of the evidence, i.e. “more likely than not.” Violators of the False Claims Act are jointly and severally liable, and so each defendant to an FCA case involving multiple parties could be held responsible for the full damages⁵. Because litigation is expensive, few cases go to trial; unsuccessful cases are often voluntarily dismissed by the whistleblower, and clear-cut cases are settled. In successful cases, the federal government can recover up to 3 times the amount of the proven false claims from the defendants, plus potentially large criminal fines. Upon settlement, the whistleblower is entitled to 15-25% of the recovery amount if the government intervened, and 25-30% if the government did not intervene. Whistleblowers regularly earn 6-figure payouts and above from these cases, of which their attorneys, working on contingency, take around 30%. Defendants are also often hit with criminal fines and can furthermore be sued for legal fees by successful whistleblowers. Enforcement is compounded

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*was ineffective and out of use in the 20th century before the 1986 amendments.*

⁴In legal terms, the whistleblower is called a “relator” in the civil lawsuit.
by the use of Corporate Integrity Agreements, where settling providers agree to additional federal oversight, or by the use of exclusion of the provider from the Medicare and Medicaid programs. Section 3.1 provides summary statistics on FCA lawsuits.

The ability for the whistleblower to conduct the case in lieu of the government creates a profit motive for rooting out impropriety that may be otherwise lacking in the federally-administered programs. This profit motive is in contrast to the usual incentives of federal bureaucrats, and thus can alleviate principal-agent problems within the government that can cause inefficient investment in monitoring and enforcement. Prosecution conducted by the government has capacity constraints due to the limited resources of the Department of Justice, while privatized enforcement creates a market for whistleblowing information and generates substantially more litigation than the federal government conducts alone. 

2 Private Antifraud Enforcement by Whistleblowers: Theory

Consider the following simplified model of private enforcement against Medicare fraud under the False Claims Act. This model is motivated by other general models of private litigation not specific to the FCA, including Shavell (1982) and Spier (2007). This model explores the divergence between whistleblower’s private incentives to litigate and the decision a social planner would take.

A whistleblower receives a private signal about fraud occurring against the government, in the form of the probability that they can win a False Claims Act lawsuit $\pi$ and the amount of fraud being committed as measured by the expected federal recovery amount $R$. If the case is successfully pursued by the whistleblower, the whistleblower expects to receive a share $s$ of the recovery. The whistleblower also observes private costs $C_w$ associated with conducting litigation. Then, a risk-neutral whistleblower would choose to litigate if:

$$\pi s R > C_w$$

The expected whistleblower compensation $\pi s R$ creates incentives for the whistleblower to come forward with their private about fraud or misconduct, and can alleviate personal and professional costs arising from whistleblowing on one’s employer, as well as the realized costs of litigation, all captured in $C_w$.

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5 The False Claims Act has a provision for enforcement by the Department of Justice without whistleblowers, if for some reason the government has information about misreporting or fraud against federal programs without a whistleblower filing a lawsuit. Since 1993, FCA lawsuits filed by whistleblowers have exceeded FCA lawsuits by the government; in 2016, there were 501 new whistleblower suits to 69 non-whistleblower suits (Civil Division, U.S. Department of Justice, 2018). Non-whistleblower suits are not used in any analysis for this paper; these statistics are included as a point of comparison.
In practice, the whistleblower’s decision is disciplined by his or her attorney. Whistleblowers are not permitted to represent themselves, and the whistleblower’s attorney faces slightly different incentives. Attorneys working on contingency expend resources pursuing litigation, most notably their time, which carries a high opportunity cost. A whistleblower attorney may be able to recover some of the costs of litigation from the defense in the case of a successful suit, although this fee-shifting is not always practiced. Furthermore, the whistleblower attorney only receives some fraction of the whistleblower’s share of the recovery. Denoting $s_a$ the attorney’s share of the total recovery and $C_a$ the attorney’s expected net costs, a risk-neutral attorney will file suit if

$$\pi s_a R > C_a$$

Equation 2 is similar in form to Equation 2, and each reflect the fact the decision to litigate is increasing in the probability of settlement as well as the magnitude of the recovery, and decreasing in the expected litigation costs. This indicates that whistleblowers are more likely to litigate against large frauds, as well as frauds for which they have the greatest evidence, as evidence can both increase the likelihood of a successful suit and also decrease investigatory litigation costs.

Consider instead the decision of a social planner of whether a particular fraud should be litigated against. Whistleblowers fail to internalize the costs whistleblowing that they do not bear. The defendant must spend $C_d$ to defend against the lawsuit, and the lawsuit also has public cost $C_p$, reflecting the resources expended by the federal government in oversight and trial of the case.

Litigation by the whistleblower can also produce benefits that whistleblowers fail to internalize. Whistleblowing produces specific deterrence effects $D_s$, measured in cost savings by the government for the type of fraud the whistleblower deters. Figure 1 shows the relationship between spending, damages and specific deterrence. Specific deterrence is the difference between spending with and without whistleblowing, integrated after time of the lawsuit:

$$D_s = \int_{t_s}^{t_e} (S_w - S_f) \delta^{t_s - t} dt$$

where $t_s$ denotes the time the lawsuit initiates, $S_w$ is spending with whistleblowing, $S_f$ is spending with unaddressed fraud, and $\delta$ is a discount factor. In a circumstance where whistleblowers cause a decrease in one specific type of spending but an increase in a substitute procedure, $S_w - S_f$ reflect the net changes in spending.

In contrast, the recovery $R$ is a multiple of the damages the government faces, where damages are the integral of fraudulent and non-fraudulent spending up to the lawsuit:
\[ R \propto \text{Damages} = \int_{t_0}^{t_s} (S_f - S_n) \delta' dt \] (4)

where \( S_f \) is fraudulent spending without whistleblowing and \( S_n \) is spending without fraud. Without loss of generality, spending with whistleblowing \( S_w \) and spending without fraud \( S_n \) may be the same if whistleblowing completely deters fraud and returns spending to a non-fraudulent level. As shown in Figure 1, the relationship between the magnitude of damages and of specific deterrence are governed by the amount of fraudulent spending as well as the extent to which whistleblowing curbs this behavior.

In addition to specific deterrence, whistleblowing can cause general deterrence \( D_g \). Whistleblowing against a particular fraud may cause providers committing unrelated frauds to stop doing so because they fear being caught. Moreover, the existence of whistleblower lawsuits may deter providers from committing other frauds in the first place. The magnitude of general deterrence is difficult to measure empirically, as it concerns behavior not identified by the whistleblower. However, general deterrence effects must weakly decrease spending on fraudulent or misreported procedures, because providers are weakly less likely to commit fraud given increased scrutiny. Therefore, I assume \( D_g > 0 \).

In addition to the financial costs and benefits discussed above, whistleblowing cases may also have impacts on provider decisions over patient care. False Claims Act cases may inform providers’ care decisions as they seek to comply with the shifting landscape of regulation and litigation risk. These changes in provider behavior can be consequential to patient health outcomes, as whistleblowing has touched such critical types of care as acute inpatient hospitalization and spine surgery. These changes to patient health outcomes may pose an additional cost \( H_c \) if whistleblowing distorts care away from the social optimum, or may provide additional benefits \( H_b \) if whistleblowing corrects fraudulent behavior that jeopardizes patient health. This relates to similar research on malpractice liability, in particular Kessler and McClellan (2002), whose model predicts that malpractice liability can cause either inefficiently high or low levels of care. I expect that the patient effects of whistleblowing may differ between lawsuits, with some providing net positive changes, and others causing net negative changes.

From a social welfare perspective, a whistleblower should pursue litigation if the total expected benefits exceed the total costs of the lawsuit:

\[ \pi \beta (1 - s) R + \pi D_s + D_g + H_b > C_w + C_d + C_p + H_c \] (5)
The social planner values the government’s portion of the recovery \((1 - s)R\) with a multiplier \(\beta > 0\). This reflects the fact that this disgorgement is a transfer from the defendant to the government, and therefore the social benefit is the marginal benefit of public funds. The whistleblower’s share \(sR\) is a transfer from the defendant to the whistleblower and does not factor into social welfare. The probability of settlement \(\pi\) gives the probability that the government gains the recovery \((1 - s)R\), and also governs the probability that specific deterrence effects \(D_s\) are produced. General deterrence effects \(D_g\), measured in spillovers of this case onto other fraud decisions, can be produced even if the whistleblower’s case is not successful.\(^6\) Costs and changes to healthcare outcomes associated with litigation are borne regardless of the outcome of the suit.

The difference between the whistleblower’s decision as captured in Equation 2 and the social planner’s choice in Equation 2 highlight some of the key issues facing private antifraud enforcement.

Whistleblower cases have the potential for valuable specific deterrence effects \(D_s\), which contribute to the public good but not to the whistleblower’s decision. Following a lawsuit, both the defendants and other providers of the same care face incentives to change their behavior to avoid further litigation or to comply with the terms of their settlement agreements and avoid exclusion from the Medicare and Medicaid programs. Because the defendants may be only a small share of those committing litigable behavior, these specific deterrent effects have the potential to affect providers far exceeding the scope of the settlement. One might expect that providers who commit “rational fraud” do so having fully internalized the expected costs of their behavior, and observing settlements would not affect their decisions. However, observing settlements can either update other providers’ beliefs about being caught, or increase the salience of the expected costs, thus causing behavioral changes and specific deterrence effects. Finally, behaviors that constitute litigable FCA violations may be “gray areas” of billing or care, in which case settlements can draw a clear line on what is acceptable behavior, and can prompt rule changes and clarifications from the Medicare administrators.

This model gives rise to a set of cases where the private and public interests diverge. If damages prior to the whistleblower’s signal are small, the expected recovery \(R\) may be too small to be worth pursuing by the whistleblower, and the inequality in Equation 2 fails to hold. Yet from a social welfare perspective, these cases might be valuable to litigate if the deterrence value is large. Moreover, there are potential circumstances in which the specific deterrence values are small. Specific deterrence is the difference between spending with and without whistleblowing, and when these values are similar then specific deterrence is small. This could occur when the increase in spending due to fraud all occurs before the whistleblower files, and future

\(^6\)I assume specific deterrence effects only apply if a lawsuit is successful, as the unsuccessful prosecution of a lawsuit may indicate to firms that the behavior in question will not produce a settlement even if litigated. More generally, the effect of unsuccessful lawsuits on fraudulent behavior is captured as part of the general deterrence effect \(D_g\).
spending would look the same with or without whistleblowing. In this circumstance, the settlement serves as a transfer from the defendant to the government and whistleblower for past bad actions, but there is no specific deterrence. However, this still retains the potential benefits of general deterrence, if observing this transfer changes others’ beliefs about their own enforcement probability or about the profitability of fraud. Another circumstance with little specific deterrence effect is one in which whistleblowing is not meaningful; for example, if fraud continues to be profitable even following a settlement, whistleblowing may not deter future bad behavior of the same sort, and $S_w - S_n$. In these circumstances, whistleblowing is potentially inefficient because the settlement only serves to correct retrospective damages, and the lawsuit incurs its full costs without providing social value into the future.

The value of the deterrence effects $D_s + D_g$ is policy-relevant in evaluating the compensation of whistleblowers. Whistleblowers are paid a portion of the settlement recovery, which is itself proportional to the amount of damages due to pre-settlement overbilling. Therefore, whistleblowing compensation is purely retrospective. However, the value of whistleblowing depends on both the settlement and the deterrence effects, the latter of which does not factor into whistleblower compensation. This disconnect between whistleblower compensation and whistleblower value added may indicate that whistleblowers are inefficiently compensated. Whistleblowers could be compensated based on both settlement and their ex-post deterrence effects. This discussion ties directly to the literature on incentives for private enforcers, explored thoroughly in Polinsky (1980).

The timing of whistleblowing also factors into its social benefits as well as the whistleblower’s compensation. The faster that fraud is litigated against, the smaller the retrospective damages and, therefore, the smaller the whistleblower’s share $sR$. This could in theory cause whistleblowers to increase their payout by waiting before filing their lawsuit, if fraud is ongoing, to allow damages to realize. However, these effects are mitigated by a priority race, in which the first-to-file whistleblower generally receives the bulk of the compensation. The False Claims Act also has a statute of limitations of at most 10 years from the date of the fraud to the filing of the whistleblower lawsuit (31 U.S. Code Section 3731, 1986). From a social welfare perspective, the timing of the whistleblower lawsuit is ambiguous, because smaller recoveries due to earlier litigation are reflected in greater deterrence amount. In practice, plaintiff attorneys report that they tend to file the lawsuit as quickly as they are able to put together a good case.

Unlike other whistleblower programs, such as the IRS or SEC whistleblower programs, False Claims Act prosecution is conducted directly by the whistleblower. This eliminates any prosecutorial discretion by the government, and may lead to the litigation of cases for which there is little social harm or even explicit
misconduct. Because there is no restriction on the filing of False Claim Act lawsuits, there is a potential for frivolous litigation by profit-motivated whistleblowers seeking a settlement. These problems are exacerbated by the fact that whistleblowers generally enter into contingency arrangements, face a potential for a very high-value settlement, and may take advantage of fee-shifting provisions in the case of successful lawsuits, all factors which have been analyzed as contributing to frivolous lawsuits in other legal literature (Bebchuk and Chang (1996) and Bebchuk and Kelemen (1998)). Defending against FCA lawsuits can be expensive, and defendants should settle if the expected cost of settlement $R$ is below the expected costs of fighting the lawsuit (and potentially losing), $C_d + \pi R$, regardless of the truthfulness of the whistleblower’s claims.

There are some institutional barriers to whistleblowing that deter low-quality cases. First, whistleblowers are not allowed to represent themselves in court (United States District Court, D.C., 2003). Due to the costs of litigation, and the fact that plaintiffs’ attorneys work on contingency, plaintiffs’ attorneys have incentives not to take on low-quality lawsuits. This provides a barrier to filing frivolous cases. Furthermore, FCA cases are most likely to be successful if the government intervenes, due to the resources and investigatory power the federal government brings when litigating a case. Since low-quality lawsuits are unlikely to generate an intervention from the federal government, this further exacerbates the unwillingness of plaintiffs’ attorneys to self-fund any low-quality cases. Empirically, Kwok (2013) studies data on whistleblower attorneys and finds no evidence for “filing mills”, i.e. law firms pursuing a large volume of low-quality cases.

In light of the costs of whistleblowing cases, the net efficiency of the law relies on the extent to which the benefits of whistleblowing, namely the deterrence effects, outweigh the costs of private enforcement. For this reason the measurement of deterrence effects, and the ratio of future deterrence to retrospective damages, is necessary (though not sufficient) for understanding the overall efficiency of the False Claims Act. Section 4 undertakes an exercise to measure these effects.

3 Data

The data for this project come from a variety of complementary sources which aggregate information on whistleblower cases and their downstream impacts on medical care provision and patient health outcomes.

Data on Medicare claims and payment are necessary for the analysis of the medical and fiscal impacts of whistleblowing cases. My available data include 100% samples of Fee-for-Service Medicare, i.e. Parts A and B, from 1999-2016, of all types. This includes inpatient and outpatient claims, the MedPar files that aggregate inpatient care at a hospital stay level, data on durable medical equipment, hospice care, skilled
nursing facilities, home health data, Part D drug data from 2006-2016, and beneficiary information through the base files and chronic condition segments. Outpatient data are only available as cleaned files from 2002 onwards. Death dates are available at a patient level through the base files. These data, containing 100% samples of each type of care over nearly 20 years, cover tens of billions of claims from hundreds of millions of patients. Section 4 presents the methodology by which I selected whistleblowing cases for analysis, which translates into the usage of these data. Medicare data are used only as they related to each case presented there, and for the analysis of patient health outcomes in Section 6. As such, only a portion of the available data is used in these analyses, reflecting the “needle in a haystack” aspect of Medicare overbilling.

Data on whistleblower lawsuits was compiled from multiple federal sources. Overview data on whistleblowing at a case level comes from a FOIA request I conducted on the Department of Justice for data on all completed (settled or dismissed) qui tam FCA cases. These data describe more than 5,000 whistleblowing cases and include information on the defendant, whistleblower, filing date, federal agency to which the case relates, federal court district of filing, government intervention election status and date, settlement amount, and whistleblower share. These data start with the introduction of the law in 1987, and the coverage declines after 2012, as many newer cases are still under seal. These data are used for descriptive statistics and stylized facts in section 3.1, as well as for providing supplementary information on whistleblower lawsuits for each case study in Section 4. See Appendix A for more details on the data cleaning process.

For substantive information on whistleblower cases related to Medicare, I scraped the Department of Justice website for all press releases related to Medicare and whistleblowing. Generally, each press release corresponds to one settlement, and my data contain 262 Medicare-related press releases through 2014. I hand-coded these press releases for the type of care and type of fraud as well as settlement value reported. I group lawsuits of similar nature into categories, and I find settlement totals within each category. As an example, one category of enforcement is the manipulation of the outlier payment system of inpatient hospitalization; this category contains 11 press releases for a total of $923 million in settlements. Each lawsuit and press release in this category contains nearly identical allegations against the defendants. Section 4 describes this process and presents its results.

For more detailed information on the whistleblower lawsuits for which I conduct case studies, I collected whistleblowers’ original court filing documents (complaints), settlement agreements, and other court documents from a variety of sources. These documents detail exact filing dates, settlement timing, allegations of fraud, and the conduct covered by the settlement agreements. Sources for these documents include the fed-

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7This data set is similar to that used in (Engstrom 2012; 2013), which also came from a DOJ FOIA request. However, to access the most recent data, I conducted an original FOIA request.
eral court record system (PACER), the Department of Justice digital archives, SEC filings of publicly traded companies, and the legal database of Taxpayers Against Fraud, a not-for-profit supporting whistleblowers' attorneys. Combined with the press release and FOIA data, the court filings give a complete picture of the allegations and outcomes of a subset of the whistleblower lawsuits.

3.1 Stylized Facts About False Claims Act Lawsuits

An analysis of the DOJ case-level whistleblowing data underscores the strong incentives that the FCA provides for whistleblowers to litigate, and also raises questions about inefficiencies in enforcement. Since the 1986 introduction of qui tam whistleblowing, the volume of FCA litigation has grown immensely. The number of cases rose from 32 filed in 1987 to nearly 400 in 2012. There were 5,949 completed cases from 1999-2012, of which 3,262 come from the healthcare sector. Of these healthcare cases, only 36% result in a recovery of funds; the rest were dismissed by the whistleblower, the judge, or the Department of Justice. This points to a high level of cases for which the federal government receives no compensation, yet bears the burden of administrative costs on the court system and Department of Justice.

Figure 2 shows the trend of healthcare whistleblowing cases by year of filing and whether they end in a settlement. Settlements rose between 1990 and 1995 to around 50 cases per year, and have stayed rather constant since. Conversely, the total number of cases and the share of dismissed cases have both risen substantially since 1987, and continue to grow. Cases that are ultimately dismissed now constitute the majority share of whistleblowing. In terms of the raw case count, the high volume of dismissed cases highlights the issue that privatized enforcement allows for the filing of frivolous and costly cases. Naturally, the settling or dismissal of cases does not reveal their underlying merit.

Despite the relatively stable level of settled cases, settlement dollar amounts have grown substantially over time. Successful healthcare cases have had settlements as high as billions of dollars, although the median is substantially lower at around $1.5 million. Total healthcare settlement values have increased vastly, dominated by a few extremely large settlements. Total settlements were just $85 million in 1995, when the number of settled cases grew to its current stable levels. However, settlement totals exceed $3.5 billion in 2012, the last year of the data. The 2012 total was in a large part due to a single $1.5 billion settlement against GlaxoSmithKline for allegedly promoting its pharmaceuticals for non-FDA-approved uses. Appendix Figure A1 plots the histogram of healthcare-related settlement values. The healthcare-related settlements in my data total to $26.4 billion of recovery.

Whistleblowers face a potential for a very large payout. Among settled healthcare whistleblowing cases,
the mean whistleblower payout is $3.8 million. However, the distribution has a long right tail; median whistleblower payout is only $250,000, while 4 cases have had whistleblower payouts in excess of $100 million. Appendix Figure A2 plots the histogram of healthcare-related whistleblower shares. Total whistleblower payouts for all of the healthcare-related cases in my data is $4.29 billion. These awards are split between the whistleblower and their attorney, who usually take 30%.

The Department of Justice Data also include lawsuits from outside of the medical field, and exhibit the broad use of the False Claims Act. Medical-related suits, those categorized by the DOJ as relating to the Department of Health and Human Services, the Food and Drug Administration, or the Center for Medicare and Medicaid Services, constitute 55% of cases. But suits regarding the Department of Defense account for 11% of the nearly 6,000 whistleblower lawsuits, and cases have arisen from nearly all parts of the federal government, including the Department of Education (3% of cases) and the Goods and Services Administration (2% of cases). The use of FCA whistleblowing outside of the medical field is beyond the scope of this paper and poses an opportunity for future research.

4 Measuring Specific Deterrence Effects

The economic effect of False Claims Act cases depends not only on the money they recover, but also the savings to the government from fraud or misreporting that is not committed due to the deterrent effects of these lawsuits. This deterrence takes two forms: specific deterrence, from changes in spending on types of care named as improper in whistleblower lawsuits, and general deterrence, from fraud of all types of medical care that are deterred due to litigation risk. This analysis measures the dollar value of the specific deterrence of the largest categories of whistleblower cases. However it does not consider the general deterrence effect, which is substantially more difficult to measure, and therefore provides a lower bound of the total deterrence effects.

4.1 Method

4.1.1 Motivation

The goal of this analysis is to estimate the amount of specific deterrence caused by FCA lawsuits that change provider behavior and Medicare spending. The measurement of deterrence requires an analysis of a counterfactual, between the real world in which enforcement happened and one in which it did not. Synthetic controls, first introduced in Abadie and Gardeazabal (2003), provide a mechanism by which to
produce such a counterfactual. Here, the outcome of interest is spending on the type of medical care treated by whistleblowing, and the treatment effect of interest is the change in spending following whistleblowing. The idea of synthetic controls is to use untreated control groups to construct a series that most closely matches the treated unit in the pre-treatment periods. Then, the difference between the treated unit and the synthetic control group in the post-treatment periods can be used to measure treatment effects.

My analysis builds on the traditional synthetic control method with the inclusion of a time-shift parameter for each control. Under traditional synthetic controls, control groups are used to estimate the counterfactual of the treated unit under the assumption of shared time fixed effects. In many circumstances, the assumption of shared time fixed effects is valuable. For the whistleblowing cases estimated here, as well as in other situations, these assumptions do not accurately reflect the circumstances. Whistleblowing often affects types of care with unusual trends: they exhibit high growth in spending and claims, potentially driven by the improper conduct of the defendants. Yet there are many reasons why certain types of medical care may exhibit a rise in spending besides fraud, such as technological changes or changes in best practice. When the treated unit is on a different time trend than the untreated units, traditional synthetic controls can fail to find a sufficient fit in the pre-treatment periods.

The addition of a time-shift parameter allows for the treated unit to be compared to control units that exhibit similar patterns at different points in time. When a treated unit experiences a large pre-treatment increase and a subsequent post-treatment fall, the relevant counterfactual question is whether the increase would have persisted in the absence of treatment. Rather than comparing the treated unit to untreated units at the same time, which may not have seen the same pre-treatment increase, the relevant control units are other treatments that saw a similar rise at other points the available data. In practice, this is implemented with a two step procedure: first, I shift the control units forward or back in time to match the pre-treatment series of the treated type of spending; and second, I construct a synthetic control group by assigning weights to the time-shifted controls. The resulting synthetic control unit is used to estimate the post-treatment trends of the treated unit in the absence of treatment. The following model details the econometrics of this procedure and closely resembles that of Abadie et al. (2010).

4.1.2 Empirical Model

Synthetic controls with time shifts are motivated by the assumption that treated and untreated units have common trends at different times.

Consider spending on a type of medical care that could be affected by whistleblowing treatment. For
\( i = 1, \ldots, N \) and time \( t \), we would observe the spending level \( Y^U_{it} \) in the absence of treatment and \( Y^I_{it} \) following treatment. Call \( T_i \) the treatment period for unit \( i \), which is the filing of the whistleblower’s lawsuit. Assume that the treatment has no effect on periods \( t < T_i \); then \( Y^U_{it} = Y^I_{it} \) for all \( t < T_i \). Let \( \delta_{it} \) be the effect of treatment at time \( t \). Because \( Y_{it} \) represents spending, \( \delta_{1t} \) represents the change in spending on a procedure following whistleblowing. Thus the spending level can be written as:

\[
Y^I_{it} = Y^U_{it} + \delta_{it} \mathbb{1}_{t \geq T_i}
\]

Let \( i = 1 \) be the unit treated by whistleblowing, which is the only unit subject to treatment; thus \( Y^U_{it} = Y^I_{it} \) for all \( i > 1 \) for all \( t \), and units \( i > 1 \) serve as control groups. The treatment effect of interest is \( \delta_{1t} \), which is given by:

\[
\delta_{1t} = Y^I_{1t} - Y^U_{1t}
\]

in periods \( t \geq T_i \).

Because \( Y^U_{it} \) is always observed for all times \( t \geq T_i \), estimation of the treatment effect relies on estimation of \( Y^U_{it} \), which is not observed in those periods.

Suppose that control units exhibit similar time trends at different points in calendar time, beginning at \( t_{0i} \), which varies between units. Suppose that for all units, \( Y^U_{it} \) is given by the factor model:

\[
Y^U_{it} = \kappa_{\tau} + \lambda_{\tau} \mu_i + \epsilon_{it}
\]

Here, \( \tau = t - t_{0i} \) is the time after the start of the control unit’s trend begins; \( \kappa_{\tau} \) is a common shock across all units at time \( \tau \) relative to the starting point; \( \lambda_{\tau} \) is a vector of common factors describing the trajectory of an outcome along a common trend; the parameter \( \mu_i \) is an unknown vector describing the individual factor weights; and \( \epsilon_{it} \) is a set of unobserved shocks of 0 mean.

Consider a \((N - 1 \times 1)\) vector of weights \( \vec{W} = (w_2, w_3, \ldots, w_N) \), such that \( w_i \geq 0 \) for \( i = 2, \ldots, N \) and \( \sum_{i=2}^{N} w_i = 1 \). These values represent weights on the untreated control units, and every value of the vector \( \vec{W} \) represents a possible synthetic control. Then, a weighted average of the control units is given by:

\[
\sum_{i=2}^{N} w_i Y_{it} = \kappa_{\tau} \sum_{i=2}^{N} w_i + \lambda_{\tau} \sum_{i=2}^{N} w_i \mu_i + \sum_{i=2}^{N} w_i \epsilon_{it}
\]
If weights $w^*_i$ can be constructed such that:

$$\sum_{i=2}^{N} w^*_i \mu_i = \mu_1$$

Then it holds that

$$E[\sum_{i=2}^{N} w^*_i Y_{it}] = E[\kappa + \lambda \sum_{i=2}^{N} w^*_i \mu_i + \sum_{i=2}^{N} w^*_i \epsilon_{it}]$$

$$= E[\kappa + \lambda \mu_1] + \sum_{i=2}^{N} w_i E[\epsilon_{it}] = E[Y_{11}^U]$$

Therefore, the weighted average of the control units provides an unbiased estimator of the untreated counterfactual of the treated unit:

$$\hat{Y}_{11}^U = \sum_{i=2}^{N} w^*_i Y_{it}$$

and we can estimate $\hat{\delta}_{1t} = \hat{Y}_{11}^U - Y_{11}^I$.

By integrating $\hat{\delta}_{1t}$ over the post-treatment periods, we can estimate a discounted specific deterrence effect:

$$D = \int_{t=T_1}^{t} (\hat{Y}_{11}^U - Y_{11}^I) \beta^{t-T_1} dt \quad (7)$$

where $T_1$ is the treatment period and $\beta^{t-T_1}$ is a discount factor starting at the treatment period.

### 4.1.3 Implementation

The practical estimation of this model can be performed as a two-step procedure: shifting control units in time to match the pre-treatment spending on the treated unit, and then finding synthetic control weights $w_i$.

First, I align the control units with the treated unit to ensure they are on common trends in the pre-treatment period. For each control, I construct a set of leads and lags, and find the lead or lag with the best fit to the treated series in the pre-period. With any fixed set of data, producing leads and lags creates missing data at the front or back of the series: in a monthly series, if one uses a 5 month lag, the first 5 months of available data have no value. In practice, this means that shifting the control units too far forward
or back in time leaves a limited set of data for the evaluation of pre-treatment fit and post-treatment effects.

Here, I bound the time shifts to ensure that there are 36 months of pre-treatment data, used to construct the synthetic control weights, and 60 months of post-treatment data, used to compute the deterrence effect. 8

Within these bounds, I select the appropriate lead or lag for each control unit that minimizes average square distance from the treated unit in the pre-period:

$$\min_d \frac{\sum_i^M (Y_{1t} - Y_{it+d})^2}{M}$$

for control unit \(i\), where \(d\) indexes the different leads and lags, and \(M\) is the number of pre-treatment periods in which the shifted control and the treated unit overlap. 9 Figure 3 provides a simple graphical explanation of the time-shifting process for two controls, one shifted forward in time and one shifted backward.

After associating each control with a time shift, I conduct the standard synthetic control process to choose weights as per Abadie et al. (2010). Weights are chosen to minimize mean-square error over all pre-treatment periods in which all of the controls overlap:

$$\min_{\vec{W}} \sum_{t \in M^*} (Y_{1t} - \sum_{i=2}^N w_i Y_{it+d^*})^2$$

where \(M^*\) is the set of periods for which all of the time-shifted controls overlap with the treated unit; \(d^*\) is the optimal time shift found by 8; and \(\vec{W}\) is the set of all potential \((N - 1 \times 1)\) vectors of weights \((w_2, \ldots, w_N)\) where \(w_i \geq 0\) and \(\sum_{i=2}^N w_i = 1\). Given the optimal shift for each control, the Stata package “Synth” finds the optimal weights \(w_i^*\).

Once these weights are found, the synthetic control unit is produced as the weighted sum of the control groups:

$$\hat{Y}_{1t} = \sum_{i=2}^N w_i^* Y_{it+d^*}$$

The two-step procedure for time-shifted synthetic controls is a tractable way to implement this methodology by leveraging existing methods. Separating the time shift component from the weighting component is necessary, because allowing weights to be applied to the entire set of leads and lags could produce synthetic

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8 In circumstances where the treatment period is too close to the start of the data, 36 pre-treatment periods are unavailable, and all of the available periods are used.

9 Average square distance and not total square distance must be used because the number of points over which this sum is evaluated depends on the time shift.
control units constructed of multiple instances of the same control at different points in time. However, a better search algorithm over the full space of time shifts and weights could theoretically outperform the two-step procedure by jointly choosing time shifts with weights to better estimate the treated unit in the pre-treatment periods.

In this paper, the outcome variables $Y_{it}$ are all spending amounts. Therefore, the difference between the synthetic control and treated unit is a difference in spending, which can be integrated over the post-treatment periods. I estimate the specific deterrence effect as the discounted difference between the treated and synthetic control over 5 years post-treatment:

$$\hat{D} = \sum_{t=T}^{T+60} \frac{Y_{1t}^U - Y_{1t}}{(1.11^{1/12})^{t-T}}$$

where $t$ is the time in months, $T$ is the treatment period, and the denominator $1.11^{1/12}$ provides the monthly rate for a 10% annual discount rate. Deterrence is totaled for 5 years from the treatment date of filing. A positive deterrence value indicates that post-whistleblowing spending $Y_{1t}$ is lower than that of the synthetic control group $Y_{1t}^U$.

The analysis conducted here is conservative in two ways. First, the use of time-shifted synthetic controls extends the donor pool of potential controls to anything on a similar pre-whistleblowing trajectory as the treated units at any time. Because a time shift of 0 is available for all control units, time-shifted synthetic controls uses a superset of the controls used for a traditional synthetic control methodology. Second, I compute deterrence using only 5-years of post-treatment effects. In the absence of whistleblowing, fraud or abuse may have continued indefinitely into the future, in which case the total deterrence effect would be like a perpetuity, providing value at all later periods. Rather than assume that the deterrence effects persist indefinitely, the use of 5 years of post-treatment effects is a conservative estimate of the deterrence effects and avoids excess extrapolation.

In order to conduct inference on my results, I employ a permutation test as per Abadie et al. (2010). Each synthetic control is substituted in for the treated unit, and the same two-step procedure detailed above is performed, fitting leads and lags and constructing weights, using all other controls. These weights give a synthetic control unit for the placebo, from which the deterrence measurement can be computed. The deterrence effects corresponding to each control unit form an empirical distribution against which the deterrence effect of the treated unit can be compared.
4.2 Case Selection

FCA whistleblowing has impacted many different types of Medicare payment and care delivery. Yet mapping from data on whistleblower lawsuits to the Medicare data is difficult, hindering a complete analysis of all lawsuits. The DOJ case-level data do not provide information on the nature of the cases nor the alleged false claims, beyond naming the defendant and whistleblower. To find details on successful whistleblowing cases, I scraped the universe of press releases from the Department of Justice website that relate to Medicare and whistleblowing, from 1994 (the start of the archives) through 2014. From these press releases, I hand-coded categories of cases that contain similar allegations of fraud in similar types of medical care. For example, one category is the misuse of the outlier payment system, which contains 11 press releases from different settlements with similar allegations. I omit categories for which I do not have data, including enforcement that precedes the start of my data, or allegations related to falsification not visible in the Medicare claims. Appendix B describes this process in detail. Table 1 lists the 4 categories of enforcement with the largest total settlement amounts for which I have data, which comprise 29 press releases detailing $1.9 billion in total settlements. In the following sections, I conduct case studies for each of these 4 categories. For each case study, I use court documents including whistleblower complaints and settlement agreements to gather details about the alleged conduct and guide the analysis of claims.

4.3 Case Details

4.3.1 Outlier Payment Falsification

The first category concerns the misuse of outlier payments for inpatient hospitalization, for which over $900 million in settlements was recovered by the government between 2004 and 2010. Medicare pays providers of inpatient medical care a fixed reimbursement amount for the diagnosis related group (DRG) under which the patient is coded. By fixing reimbursement for each diagnosis, providers have incentives to keep costs down. However, this raises concerns that providers would be unwilling to treat high-cost patients. In response to these concerns, the Medicare system contains a provision for outlier payments, which are additional reimbursements for very-high-cost patients. Before 2004, to qualify for outlier payments, a patient must have exceeded a cost threshold, computed with a complicated formula based on the provider’s labor costs, capital costs, historic charges, and a geographic adjustment factor. This formula provided an opportunity for misreporting: by manipulating charges over time, hospitals were able to change their thresholds and

\footnote{Rawlings and Aaron (2005) provide a detailed analysis of this computation.}
collect more outlier payments.

On November 4, 2002, Tenet Healthcare, a large investor-owned hospital company, was sued under the False Claims Act for manipulating its cost reports in order to illicitly receive additional outlier payments.1112 This lawsuit was settled in June, 2006, with Tenet paying $788 million to resolve these allegations without admission of guilt. The DOJ press releases describe 10 other settlements for alleged manipulation of outlier payments. Appendix C.3 contains additional details about the related lawsuits.

Outlier payments constitute their own type of spending by the Medicare system. Therefore, for its controls, I consider all types of payments made by Medicare that are observable in my data. The controls I use include durable medical equipment, home health care, hospice care, nursing care, and disproportionate share payments for hospitals that serve many low-income patients. The two largest categories of Medicare expenditures, inpatient and outpatient claims, are not comparable in scale to outlier payments and are omitted from the donor pool. Spending on drugs via Part D is also not included because these data only start after 2006.

4.3.2 Medically Unnecessary Botox

The second case regards medically unnecessary usage of Botox. Despite popular branding as an “anti-wrinkle" procedure, Botox is FDA-approved for a number of important medical uses, including treatment of crossed eyes (strabismus) and neck spasms (cervical dystonia). Medicare covers medically necessary Botox injections for FDA-approved uses, but not for non-FDA-approved uses. Between 2007 and 2009, Allergan, the sole manufacturer of Botox, was sued by a set of whistleblowers who alleged that Allergan had illegally promoted Botox for non-FDA-approved (“off-label”) uses, including headaches. In order to ensure that Medicare would pay for the injections, Allergan allegedly instructed physicians to miscode the injections, using diagnosis codes for approved uses. Additional details about the outpatient coding of Botox and the whistleblower lawsuits are presented in Appendix C.2. On August 31, 2010, Allergan settled with the federal government for $600 million, of which $210 million was for federal civil liability, $375 million was a criminal fine, and $14.85 million was to recompense affected state Medicaid programs.

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11One lawsuit against HealthSouth, settled in 2004, contains allegations about outlier payment manipulation and an $89 million settlement for those allegations. This settlement related to lawsuits originally filed in 1998, but the original allegations did not concern outlier payments. The HealthSouth settlement does not attribute these allegations to any whistleblower cases (which would make the whistleblowers eligible for compensation for this portion of the recovery); instead, it appears the DOJ added enforcement of outlier overuse to a pending case, following the filing of the Tenet lawsuit. Therefore, I consider the Tenet lawsuit the first outlier lawsuit, and use its filing date as the treatment date.

12Around the time of filing, Tenet also received substantial negative press regarding its overuse of outlier payments; the timing of these reports, days before the filing of the lawsuit, may indicate that the whistleblowing case was leaked to investors. Rawlings and Aaron (2005) provide further details about the Tenet case.
For the synthetic control design, Botox is compared to other outpatient procedures that saw similar pre-whistleblowing trends in spending. Spending for Botox under the relevant diagnoses codes grew from 2 million dollars in 2003 to more than $5 million in 2006, the year before the lawsuit against Allergan was filed. As controls, I use other outpatient treatments for which spending started between $2 million and $5 million and saw a 2-3x rise over any 3-year period between 2002 and 2011, of which there are 67 control units. Appendix C.2 contains additional details about these control units.

4.3.3 Unnecessary Inpatient Kyphoplasty

Kyphoplasty is a spine procedure to repair vertebral compression fractures that cause pain and deformity of the back, often observed among patients with osteoporosis. Kyphoplasty involves the percutaneous (through the skin) injection of bone cement into an inflatable balloon placed within the affected vertebra. Because the procedure is performed percutaneously, kyphoplasty can be safely conducted as an outpatient procedure. The kyphoplasty procedure was developed, patented, and marketed by the company Kyphon, which sold a spine surgery kit as well as other related medical devices (Kasper, 2010). Hospitals using the kyphoplasty procedure on Medicare patients would purchase the equipment from Kyphon and bill Medicare for its usage.

In December, 2005, Kyphon was sued by FCA whistleblowers who alleged that Kyphon illegally promoted the procedure as an inpatient procedure as opposed to outpatient. By doing so, hospitals received greater reimbursement for the treatment, allowing Kyphon to charge more for its products. Hospitals kept patients for a short inpatients stay so they could receive the inpatient reimbursement level for a low amount of inpatient care. Inpatient stays under the relevant diagnosis-related groups (DRGs) were reimbursed in the $6,000 - $11,000 range, as opposed to outpatient kyphoplasty which was reimbursed between $500 and $2000. In May 2008, Kyphon settled these allegations with the Department of Justice for $75 Million, without admission of guilt. Between 2009 and 2015, the DOJ released another 9 press releases detailing settlements with 140 hospitals having performed unnecessary inpatient kyphoplasty. The sum of the settlements against Kyphon and the defendant hospitals was $214.2 Million. Appendix C.3 provides additional details for these lawsuits. I analyze spending on short stays of 7 or fewer nights under the inpatient DRGs promoted by Kyphon, and outpatient spending on all spine procedures. As controls for short-stay inpatient visits, I use inpatient spending for short stays of 7 or fewer nights under other DRGs. For controls on outpatient spine procedures, I use spending on other outpatient surgical procedures on the musculoskeletal system. Appendix C.3 describes the coding of inpatient and outpatient Kyphoplasty and the control units used.
4.3.4 Unnecessary Inpatient Admission

The fourth case study concerns the unnecessary admission of Medicare beneficiaries for inpatient care at hospitals, instead of receiving observational or outpatient care. Starting in 2004, there were a series of whistleblowing lawsuits that alleged that hospitals around the country unnecessarily admitted patients. Many of these patients presented at the hospital’s emergency department and should have been held under observational or outpatient status, which are reimbursed much less than inpatient care. The first successful lawsuit of this type was filed in October 2004, and in total, 7 settlements were reached regarding 135 hospitals for a total of $172.3 million in recovery between 2007 and 2014. The majority of the enforcement comes from the settlement with Community Health Systems, the country’s largest operator of acute care hospitals at the time, which settled for $98 million in 2014 for similar conduct in 119 of their hospitals. Appendix C.4 provides additional details about these lawsuits.

Unnecessary admissions were concentrated among certain hospitals, motivating an analysis of the defendants of these lawsuits. The set of potential controls for the defendants are other hospitals not litigated against for unnecessary inpatient procedures. To mitigate spillover effects into the control groups, I restrict the controls to hospitals in the 23 states that contained no defendants. These hospitals treat different patient pools than the defendants and are less likely to have doctors or administrators cross-employed with the defendant hospitals. For each of the defendants, I construct a random sample of 100 control units, using the same number of hospitals as the defendant. For example, two defendants were groups of 6 hospitals each; I create 100 control units of 6 randomly grouped control hospitals, drawn with replacement, from the set of controls. Similarly, to measure substitution by the defendant providers to increased outpatient expenditure, I use randomly grouped outpatient providers from the unaffected states. Appendix C.4 provides further details about this process.

4.4 Results

Figure 4 shows the main results of the synthetic control method. Spending is used as the outcome variable for each case study. For each case, the first vertical line shows the date of filing of the first lawsuit of that category, which is used as the treatment date, and the second line shows the first settlement. For the unnecessary inpatient admissions case, where I analyze multiple defendants, this graph includes the results from Community Health Systems (CHS), which constituted the bulk of the defendant hospitals. In each case, the control groups provide a good pre-period fit for each case, matching the trends and levels of the treated units. However, there is divergence from the control units in each of the post-whistleblowing periods.
The largest of these effects is in the outlier case (top left): the 5-year discounted deterrence measurement for the outlier payments computed is $17.46 billion, which is roughly 19 times the total settlement value of the outlier whistleblowing lawsuits of $923 million. This is largely driven by the scale of spending on outlier payments, which exceeded $500 million per month in its pre-whistleblowing peak, and then dropped off substantially following the lawsuits. The synthetic control group, constructed of other types of Medicare payments, shows a similar pre-period rise and continues to rise in the absence of whistleblowing. Appendix Table A3 shows the synthetic control weights and time shifts for the control units. Most of the synthetic control weight is placed on disproportionate share payments, with only a 1-month time shift. Disproportionate share payments operate very similarly to outlier payments in that they are additional payments for inpatient stays. The fact that the synthetic control is mostly made up of such a similar type of spending, and with very little time shift necessary to fit the pre-period, reinforces the validity of this control group in estimating outlier payments in the counterfactual without whistleblowing.

Notably, for the Botox case (top right), there is a small negative deterrence effect: Botox spending exceeds the synthetic control group post-lawsuit. The 5-year discounted deterrence effect is -$3.99 million, a little smaller than 1% of the settlement value of $600 million. One potential reason for the negative deterrence effect is that Botox gained FDA approval for migraine coverage about 2 months months after settling with the Department of Justice for illegally promoting botox for headaches (Singer, 2010). Because civil litigation and settlement negotiations can stretch out for indefinite periods of time, it is possible that Allergan timed the settlement to coincide with its expected FDA approval. This case exhibits that deterrence effects are not necessarily positive, and that the future value of misconduct is not necessarily large when compared to the past costs and settlement amount. In this circumstance, the $600 million settlement paid by Allergan to the United States functioned as a penalty for promoting its product for a use that was not yet FDA approved. But given that FDA approval did ultimately arise, the future value of the damages and the specific deterrence effect are small.

For the kyphoplasty case (bottom left) and unnecessary admissions case (bottom right), Figure 4 shows that inpatient spending declined relative to the respective synthetic controls. The short-stay inpatient deterrence total for kyphoplasty is $538.9 million, caused by a post-whistleblowing decline in short kyphoplasty stays and a continued increase in the synthetic control group. Appendix Table A5 displays the synthetic control weight and time shift for each control group. For the unnecessary inpatient admissions case, inpatient deterrence for the defendant Community Health Systems is $693.2 million, and the total inpatient deterrence for all defendants is $1.124 billion. The corresponding plots for the other defendants are in-
cluded in Appendix Figures A3 and A4. Inpatient spending at CHS rose before whistleblowing and fell after whistleblowing, while the synthetic control group shows a continued rise in inpatient spending in the absence of whistleblowing. While the difference between CHS spending and the synthetic control group is visually modest, the large deterrence amount arises because the rate of spending at the time of treatment was more than $150 million per month.

The decreases in inpatient spending in the kyphoplasty case and the unnecessary admissions case must be weighed against an expected increase in outpatient spending in both cases. Figure 5 plots the substitute outpatient spending for these cases. Inpatient kyphoplasty spending was substituted for outpatient spending on kyphoplasty, vertebroplasty, and other outpatient spine procedures, as evidenced by a rise in outpatient spending relative to the synthetic control group. The increase in outpatient spending totals to $257.8 million; when compared with an inpatient spending decrease of $538.9 million, this results in a net deterrence effect of $281.1 million. For the unnecessary admissions case, outpatient spending at the defendant CHS did not rise relative to the control providers. The total estimated change in outpatient spending for all defendants combined is a small negative number, indicating if anything that outpatient spending at these hospitals fell post-lawsuit. Appendix Figure A4 displays the similar synthetic control setup for each of the other defendants’ outpatient spending, and shows heterogeneity, with some defendants’ outpatient spending rising post-lawsuit and others’ falling.

Table 2 summarizes the deterrence effects for these cases and provides totals, deterrence values, and deterrence ratios. These 4 whistleblower case studies recovered around $1.9 billion for the federal government, but exhibit even greater benefit in deterrence effects, totaling around $18.9 billion. The average deterrence effect for these cases is around 6.7 times the settlement value over 5 years. There is substantial heterogeneity in the deterrence ratios, from a small negative deterrence effect in the botox case to a particularly high positive deterrence ratio for the outliers case. Notably, the deterrence metric used here is computed using a discounted difference between the treated and control units for only 5 years after the filing of the case, and thus may potentially understate the true benefit of whistleblowing. Overall, these results indicate that the specific deterrence benefits of whistleblowing cases often exceed the settlement values many times over, and greatly exceed the retrospective damages used to compute those settlement values. This indicates a large savings to the Medicare program as a result of these whistleblowing cases, exceeding both the recoveries to the government from the settlement as well as the whistleblower compensation.

Placebo testing allows for inference on these results. For each control, I conduct a series of placebo studies by applying the time-shifted synthetic control method to a every other control group in the donor pool. The
deterrence for each real treated unit is compared to the deterrence values from each of these placebos. I conduct a 1-tailed test, which counts what fraction of placebos exceed the value of the treated unit’s deterrence amounts, comparing positive deterrence values to other positive deterrence values and negative to negative. Importantly, the distribution of placebo controls is only one piece of evaluating the synthetic control strategy, and does not account for pre-period fit or the timing of the post-whistleblowing trends. Therefore, while my estimates are statistically significant, these placebo results must also be evaluated in the context of the good pre-period fit of the results displayed in Figures 4 and 5.

Table 3 presents the results of the placebo test. These results indicate that the large positive deterrence effects I find are not due to chance, while the small negative finding for botox is indistinguishable from the value of the placebos. The deterrence figure for outlier payments exceeds 100% of the placebo units. The small negative deterrence effect for Botox does not exceed 10 of the 67 placebos, indicating that this effect may be due to noise, and that the negative point estimate is not distinguishable from 0. For the kyphoplasty case, the reduction in inpatient spending exceeds 26 of the 30 placebos, and the corresponding increase in outpatient spending exceeds 14 of the 15 placebos. For the unnecessary inpatient case, there is strong evidence that the reduction in inpatient spending is not a chance finding; the 5 largest defendants (of 7) exceed between 93 and 99 of the 100 placebo units. However, substitution to outpatient spending shows mixed results, including statistically significant values in both the positive and negative direction. This mix of positive and negative effects indicates heterogeneity in how whistleblowing changed outpatient spending at the defendant hospitals.

4.5 Robustness Checks

The presentation of the new methodology above requires additional verification that the results withstand scrutiny. This section seeks to address the primary concerns about synthetic controls with time shifts.

One potential concern about synthetic control with time shifts is that controls that are shifted backward in time to match the treated unit could potentially be contaminated by the event in question. This is of particular concern if the controls are substitutes for the treated unit. In such circumstances, the pre-period fit of the controls on the treated unit would be an invalid way of constructing an estimate of the counterfactual untreated series. To mitigate these concerns, I repeat the time-shifted control exercise with the additional restriction that controls are only shifted forward in time; that is, the trends of the controls used in fitting the pre-period occurred exclusively before the treatment date, and therefore cannot be contaminated by spillovers. Appendix Figure A5 presents the corresponding figure for this analysis. The figure is nearly
indistinguishable from the original Figure 4, and the deterrence measurements are nearly identical, if only slightly greater than the original estimates. Therefore, spillovers onto the time-shifted controls is not a source of bias in this analysis.

Another potential concern is that the control units fail to accurately describe the trajectory of the treated unit. This is a criticism not unique to this variation of synthetic controls; indeed, the same could be said for all synthetic control methods. What makes the treated unit different, and why was it the one treated? In the context of this analysis, one particular version of this concern is that treated units are known to be fraudulent, while the control units are not necessarily fraudulent. Mitigating this concern are two arguments: one about the nature of fraud, and one about the specific controls used here. First, consider that rise in spending due to fraud is ultimately a change in the way in which providers bill for medicine due to the incentives they face. Fraud is a form of technology, and the rise in fraudulent spending is the adoption curve of this technology. From this perspective, control units serve as acceptable counterfactuals, as the rise in those units is the adoption curve of other forms of technology, be it changes in medical care, novel billing practices, or also fraud. Second, in practice some of controls used in this paper are in fact fraud that was not discovered until much past the treated unit. In particular, the majority of the weight in the case study of outlier payments, as shown in Appendix Table A3, belongs to Disproportionate Share Payments (DSH); DSH was also the subject of a lawsuit for overuse and fraud, just at a much later date. While the estimates here may struggle from some imprecision by matching fraudulent spending to non-fraudulent trends, this analysis provides the best estimates of the counterfactual trends in fraudulent spending we could have expected to observe in the absence of whistleblowing.

5 Estimating the Costs of Medicare Whistleblowing

Although False Claims Act litigation is conducted privately, whistleblowing incurs public and private costs, as discussed in the model above. While FCA litigation produces strong deterrence effects, this policy could be inefficient if it does so by incurring high legal costs associated with enforcement. Conversely, if FCA costs are low, it indicates that the FCA is a cost-effective way of combatting healthcare fraud. The goal of this section is to provide a consistent estimate of the costs of healthcare-related FCA cases and to contextualize these costs against the benefits of private enforcement and the costs of other enforcement mechanisms.
5.1 Public Costs

Overall, I estimate that public expenditure on the 445 healthcare-related False Claims Act cases filed in 2018 amounted to less than $108.5 million. Public expenditure on FCA occurs from a few different federal agencies: the Department of Justice, the Office of the Inspector General of Health and Human Services, and the federal courts. For each of these agencies, there are limitations to estimating costs expressly associated with the False Claims Act, because data are aggregated across multiple responsibilities of these agencies. To overcome this limitation, I estimate FCA-related spending by combining on the legal process of FCA lawsuits, data on the number of FCA lawsuits, and the agencies’ public budgets. Each of the amounts included are intentionally conservative in the direction of overestimation.

The Department of Justice, whose attorneys review and sometimes intervene in whistleblower cases, spent no more than $99.1 million on healthcare-related whistleblower FCA lawsuits in Fiscal Year 2018. In the Health Care Fraud and Abuse Control Program Annual Report for Fiscal Year 2018 from the Department of Justice and HHS to Congress, Department of Justice expenditures on overall healthcare fraud amounted to $135.3 million. However, these resources include $25.3 million for the criminal division and $10.9 million for the civil rights division, neither of which handle whistleblower suits. This leaves $99.1 million for all other DOJ spending related to healthcare fraud, including all healthcare anti-fraud spending by the DOJ civil division, the US attorneys, and the FBI. While certainly much of these expenditures were for non-FCA cases, particularly FBI expenditures on criminal healthcare fraud, $99.1 million forms an upper bound of total healthcare whistleblower-induced spending by the DOJ in 2018.

False Claims Acts healthcare-related whistleblower lawsuits involve the Office of the Inspector General of Health and Human Services (OIG-HHS). The main relationship between OIG-HHS and the False Claims Act is through the Office of Counsel, a small internal department that provides general legal support to the Office and also oversees Corporate Integrity Agreements for companies settling False Claims Act lawsuits. The total expenditure of the Office of the General Counsel was $7.1 million in 2018 (CITE: HCFAC). Although some of these expenditures support non-FCA responsibilities of the Office of Counsel, I use $7.1 million as an upper bound on OIG-HHS spending on these cases.

I estimate that the Federal Courts, which try the whistleblower lawsuits, spent no more than $2.3 million in 2018 on FCA cases. While there are no data available from the Courts on case-specific spending, the average cost of lawsuits is an upper bound for the marginal cost of lawsuits. In 2018, the federal courts spent a total of $7.7 billion on all operations, handling 1.48 million federal lawsuits across a variety of topics, including criminal prosecutions, bankruptcy, and the court of international trade (CITE: 2020 Court
budget). The Department of Justice reported 445 healthcare-related lawsuits (CITE: DOJ Qui tam fraud stats), or about 0.03% of the total federal cases. Therefore, the average cost associated with these cases can be estimated at $0.0003 \times 7.7\text{Bil} = 2.3\text{Mil}. Given that the federal court system handles nearly a million and a half lawsuits, the marginal costs associated with these additional 445 cases is potentially even smaller, as they benefit from use of an established court system largely devoted to other areas of law.

Overall, the total expenditures of the federal government on False Claims Act whistleblower healthcare lawsuits was around $108.5 million in FY2018. This expenditure is small compared to both the deterrence effects of the False Claims Act and also to government expenditure on top-down antifraud enforcement. In Fiscal Year 2018, total federal health care fraud and abuse resources across agencies amounted to $2.04 billion, of which the vast majority was unrelated to civil False Claims Act enforcement (CITE: HCFAC 2018). The largest budget item by far is the Medicare Integrity Program (MIP) at $809 million in FY 2018, focusing on top-down fraud identification including audits and medical reviews. In comparison to the large anti-fraud expenditure, whistleblowing is a particularly low-cost way to combat and deter healthcare fraud, and produces extensive public benefit.

Whistleblower payouts also appear as a liability to the government when considering the costs of the False Claims Act. However, these payments do not affect social welfare, as discussed in Section 2, because they are transfers from the defendant to the whistleblower. Total whistleblower payouts for healthcare-related cases in my data total to $4.29 billion, which is a relatively small figure compared to the tens of billions of dollars in recovery and deterrence that these cases have produced. That said, statistics focused on whistleblower payouts, which are regularly included as a “cost” in government accounting, misconstrue the nature of these payments which are not in fact a public cost at all.

6 Measuring Changes in Patient Care

In addition to the fiscal effects described in the previous section, whistleblowing under the FCA creates incentives for providers to change the way they conduct healthcare. These changes can could be either positive or negative: if whistleblowing curbs behavior that was profitable to providers at the expense of patient health, then we expect whistleblowing to benefit patients. However, whistleblowing could also induce defensive behavior among physicians, influencing their care decisions away from what is beneficial to patients and instead to what would be justifiable if they were sued.

To examine one instance of these effects, I examine provider care decisions following changes in kypho-
plasty care as discussed above. Kyphoplasty is an ideal case study for the discussion of provider care decisions for a few reasons. First, the analysis of claims performed above shows that there was a large reduction in inpatient procedures and a substitution to outpatient procedures, indicating a change in actual care decisions by providers. This is in contrast to the outlier payments case, which seems to be a change in billing procedures, or to the Botox case, where there was little effect on usage. Second, kyphoplasty is a single procedure with previously-studied health effects (discussed below), allowing for a targeted analysis of the effects of the whistleblowing lawsuits on patient care. This is in contrast to the unnecessary inpatient admissions case, which related to a broad set of medical procedures. As such, kyphoplasty is the largest-settlement-value case study for which I can conduct an analysis of provider care decisions.

Kyphoplasty is a spine procedure to repair compressed vertebrae in patients with osteoporosis, and can be very beneficial for patient health. Kyphoplasty is similar to vertebroplasty, a similar, older procedure that does not use a balloon (Denaro et al., 2009). A meta-analysis of vertebral compression fractures (VCFs) shows that patients with VCFs have 2.5 times the mortality rate of patients without them, and that kyphoplasty and vertebroplasty are successful at reducing mortality rates compared with non-operative care (Kurra et al., 2018). Estimates in this meta-analysis range from 35% to 70% mortality reduction over a 3 to 5 year period after receiving kyphoplasty, indicating a substantial health benefit to the procedure. As shown in above, short-stay inpatient treatment for kyphoplasty was drastically reduced following whistleblowing, which could therefore have an impact on patient mortality.

To understand the impact of these changes, I model patient death as a function of receiving inpatient kyphoplasty within a heterogeneous treatment effects framework. The goal of this exercise is to measure how provider care decisions changed due to whistleblowing, based on whether the patient is expected to benefit from the procedure. First, I construct two non-overlapping cohorts of patients from before and after the Kyphoplasty lawsuit. For the purposes of this analysis, I define “treatment” as receiving a 1-night inpatient stay under the DRGs allegedly promoted by Kyphon. My 2005 cohort includes every 70-75 year old treated for the first time in 2005 and the full population of never-before-treated 70-75 year old control Medicare patients. My 2011 sample similarly contains every 70-75 year old treated for the first time in 2011 and the full population of never-before-treated 70-75 year old control patients. These cohorts are non-overlapping, and therefore all 2011 cohort members are not potential controls for the 2005 cohort. The

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13In contrast to this setup, the spending amounts used to compute deterrence in Section 4 used all short stays (7 nights or fewer) under these DRGs and all outpatient spine spending. This was useful to compute fiscal effects, but potentially lumped in some non-kyphoplasty treatment, which was unaffected by whistleblowing and was differenced out when computing deterrence values. To compute health effects, I focus on 0 or 1-night stays under these DRGs, which almost completely vanished post-whistleblowing, as I have greater confidence that kyphoplasty was performed during these inpatient visits. Correspondingly, outpatient treatment is restricted to the outpatient codes specifically for kyphoplasty and vertebroplasty.
2005 cohort consists of 8.2 million patients, and the 2011 cohort consists of 9.3 million patients.

For each patient, I analyze extensive data, including treatment, all inpatient medical history, chronic conditions, and demographic data. Patient covariates include age, state, sex, race, original and current reasons for Medicare qualifications (i.e. age or disability), and HMO coverage. Inpatient medical history was taken from the 100% MedPar files for 6 years before the cohort year, i.e. 1999-2004 for the 2005 cohort and 2005-2010 for the 2011 cohort, and includes an indicator for any inpatient stay, the number of stays, the patient’s total inpatient stay length, a count of the number of stays under each DRG, and the total Medicare payment amount for that patient’s inpatient treatment. Furthermore, I include chronic condition indicators for each patient in the cohort year, which detail a patient’s history of chronic conditions such as Alzheimer’s, hip fractures, or osteoporosis. Finally, for each patient I collect death dates, and produce an indicator of whether the patient died within 5 calendar years post-surgery, i.e. 2005-2010 for the 2005 cohort and 2011-2016 for the 2011 cohort. The length of the medical history and death data used are due to the availability of data, which span from 1999-2016, and the requirement that the cohorts not overlap.

Using these data, I directly estimate the heterogeneous treatment effects on mortality of receiving a short-stay inpatient treatment among the 2005 cohort, with the following logistic regression:

\[
\text{Death}_i = \alpha + \beta T_i + \gamma^\prime C_i + \delta^\prime T_i C_i + \eta^\prime M_i + \theta^\prime T_i M_i + \varepsilon_i \tag{11}
\]

The outcome variable \(\text{Death}_i\) is an indicator if patient \(i\) died within 5 years. This limited dependent variable motivates a logit framework for the regression. \(T_i\) is the treatment indicator, \(C_i\) is the matrix of patient covariates and \(M_i\) is the matrix of patient medical history and chronic conditions. This specification models death in terms of treatment interacted fully with these controls. As such, the fitted model captures the effect of each covariate and each aspect of medical history on death, with or without short-stay inpatient kyphoplasty treatment. Appendix Table A1 details the results of this regression.

Using this model fitted to the 2005 sample, I can then predict the effects of kyphoplasty among both 2005 and 2011 patients. I construct: \(\hat{Y}_{i1} = P(\text{Death}|M_i, C_i, T_i = 1)\) and \(\hat{Y}_{i0} = P(\text{Death}|M_i, C_i, T_i = 0)\) for each patient, using the regression coefficients fit to the 2005 sample. I then produce a predicted treatment effect for each patient:

\[
\hat{TE}_i = \hat{Y}_{i1} - \hat{Y}_{i0} = P(\text{Death}|M_i, C_i, T_i = 1) - P(\text{Death}|M_i, C_i, T_i = 0) \tag{12}
\]

It is important to note that treatment \(T_i\) is not assigned randomly. This model makes the standard
conditional independence assumption: that conditional on a rich set of controls, here medical history, chronic conditions, and patient covariates, that potential outcomes $Y_{1i}$ and $Y_{0i}$ under treatment or non-treatment are independent of actual treatment status. That is, by controlling for the factors that influence probability of treatment, one can construct both potential outcomes for each patient, despite only ever observing $Y_1$ or $Y_0$ for any given patient. Appendix Figure A8 shows the histogram of estimated treatment effects for patients in 2005 and 2011. These histograms exhibit a similar shape between the cohorts, which means the comparison between these cohorts is between like populations.

Figure 6 plots the probability of short-stay inpatient treatment by estimated treatment effect in each cohort\(^\text{14}\). The estimated treatment effect on the horizontal axis is the change in mortality from receiving treatment versus not receiving treatment. Units to the left of 0 are estimated to have reduced mortality if treated, while units to the right of 0 have increased mortality if treated. The ideal targeting of treatment to patients who benefit would place all of the mass to the left of 0. In both 2005 and 2011, patients who stood to benefit from the procedure were about twice as likely to receive treatment. The comparison between 2005 and 2011 shows that there was a reduction in inpatient probability treatment across the spectrum of treatment effects, both for those harmed and helped by the treatment.

Total inpatient treatment volume for kyphoplasty was counteracted by substitution to outpatient treatments. Figure 7 plots the probability of receiving an outpatient kyphoplasty or vertebroplasty within each group. Because these procedures are similar whether performed inpatient or outpatient, differing mostly in terms of billing, the estimated inpatient treatment effect on the horizontal axis is a reasonable way of understanding the effect of having had the procedure in either location. In both cohorts, the probability of receiving treatment is higher for those helped by the treatment, to the left of the distribution. Between 2005 and 2011, outpatient treatment probability grew for all types of patients, but substantially more for patients for whom kyphoplasty is expected to reduce mortality\(^\text{15}\).

To examine the net effect of the substitution from inpatient to outpatient procedures, I examine the probability of either inpatient or outpatient treatment by heterogeneous treatment effect. Figure 8 breaks the population into two categories: those with reduced mortality if they receive the procedure (negative value treatment effect) and those with increased mortality (positive valued treatment effect). The results show an overall decrease in treatment probability to those harmed by the procedure between 2005 and 2011, and an increase in treatment probability to those who benefit from the treatment across the same time.

\(^{14}\)To satisfy Medicare data cell-size suppression rules against reporting any result with $n < 11$, the bins in Figure 6 have been top coded at .4 and -.2 to achieve a minimum number of treated units within the extreme bins.

\(^{15}\)Similar to Figure 6, bins in Figure 7 have been top coded to achieve a minimum number of treated units within the extreme bins, in compliance with Medicare cell-size suppression rules.
Those helped by the procedure saw an increase from 0.144% to 0.155% probability of treatment, a 7.6% increase. The small raw percentages reflect the fact that the analysis sample is the entire never-before-Medicare treated 70-75 year old population in these years, and that kyphoplasty is relatively rare. Correspondingly, patients who were expected to be harmed by the procedure saw a decrease in probability of treatment from 0.0547% to 0.0506%, a decrease of 7.4%. Appendix Figure A10 breaks this same analysis into finer groups, and plots the probability of receiving either inpatient kyphoplasty or outpatient kyphoplasty or vertebroplasty by heterogeneous treatment effects. There was, in general, an increase in the probability of receiving treatment between 2005 and 2011 for those who benefit from the procedure, and a decrease in treatment for those harmed by the procedure. As a caveat, this analysis uses a coarse measure of patient health, mortality, which does not capture changes to patient quality of life from receiving treatment.

These results are consistent with the better targeting of kyphoplasty following the whistleblowing cases that reduced the volume of care. Patients who benefit from kyphoplasty were more likely to receive the procedure following the lawsuit, and those harmed were less likely to receive the procedure. One potential explanation is the change in incentives for providers, who before the lawsuit were more profit-motivated in their treatment, picking low-cost patients to receive procedures that could be heavily reimbursed, with less focus on the patient's expected health outcomes. Under this explanation, whistleblowing refocused provider attention on expected patient health outcomes, creating better targeting toward individuals who benefit the most.

Overall, in the case of kyphoplasty, whistleblowing seems to have had positive effects on patients by inducing better targeting of the procedure to those who benefit from it. This evidence indicates that kyphoplasty was overused in 2005, before the lawsuit, as evidenced by treatments performed on those expected to be harmed by the procedure. Whistleblowing enforcement was successful at reducing treatment to those individuals as well as increasing treatment to individuals likely to be helped by the procedure. In this case, the positive effects of whistleblowing went beyond financial benefits to the Medicare program, and indeed had substantial positive effects for patient care.

7 Conclusion

Whistleblowing under the False Claims Act is an effective way to both penalize and deter overbilling and fraud to the Medicare program. I undertake a set of case studies of the top categories of whistleblowing enforcement and measure specific deterrence effects. Settlements for the 4 categories of whistleblowing
analyzed here recovered $1.9 billion in federal funds; I estimate that they generated more than $18 billion in specific deterrence effects. In contrast, public costs for all lawsuits filed in 2018 amounted to less than $108.5 million. The few largest whistleblowing cases more than cover the public costs of the program over its lifespan.

Changes in medical care induced by whistleblowers can have a variety of effects on patient care. In the example of kyphoplasty, I find beneficial changes to patient care, with better targeting to patients who are expected to benefit from this procedure. This case study motivates further analysis of the effects of whistleblowing on patient care. Whistleblowing generates changes to the care of patients that are potentially unrelated to the quality of the provider or the procedure, and this may provide experimental variation that other researchers find useful in the analysis of medical outcomes.

Whistleblowing has other potential costs and benefits not analyzed in this paper. The risk of litigation may cause providers to forgo misreporting in the first place, particularly when whistleblowers are empowered to directly sue for their own profit. These general deterrence effects are hard to measure without knowing the types of potential fraud that could have been committed. Conversely, increased compliance requirements impose costs on providers that are not measured here. FCA whistleblowing also incurs attorney expenses for both plaintiffs and defendants, for which little data are available. I do not impose the assumptions necessary here to compute net welfare. However, this paper estimates some of the parameters required for a broader efficiency computation, and motivates future work measuring other costs and benefits of the False Claims Act.

The results of this paper estimate the fiscal benefits of privatized enforcement as compared to the absence of such enforcement. However, a different counterfactual would be better public enforcement. Paying whistleblowers 15-30% of recovered funds is expensive if the government could produce similar recoveries without whistleblowing. Given the vast amount of data collected by the Medicare program, some of the effects of whistleblowing could likely be accomplished through machine learning, pattern detection, and automated audits. The fact that these programs are not yet in place may point to the limited capacity of the federal bureaucratic institutions. From this perspective, a major benefit of the False Claims Act is not just the information provided by the whistleblower, but also the profit motivation to conduct private enforcement.
References


Chamber of Commerce of The United States of America, Amicus Brief, State Farm Fire and Casualty Company v United States ex rel Cori Rigsby; Kerri Rigsby, 15-513 (Supreme Court 2015) 2015.


Notes: This figure describes the theoretical effects of a successful whistleblowing case on federal spending. When fraud is committed, the government has damages that are the difference between spending with fraud and the counterfactual spending without fraud. After the whistleblower sues, spending decreases back to its pre-fraud levels. The specific deterrence effect is the difference between how much would have been spent without whistleblowing and how much is spent after whistleblowing occurs. Because whistleblowers are paid proportionally to the damages, they have incentives to blow the whistle later and allow the damages to accumulate; however, because the first whistleblower to come forward receives greater compensation, they have countervailing incentives to file as soon as possible.
Figure 2: Trends in Healthcare Whistleblowing Cases

Notes: This figure plots the number of healthcare-related whistleblower lawsuits by year and splits the data by the outcome of the lawsuit. Data begin in 1986, when Congress amended the False Claims Act to allow for whistleblower lawsuits, and go through 2012, the last available year of data. Settlements rose to around 50 per year in 1995 and have stayed relatively constant, while total cases and dismissed cases have both continued to rise.
Notes: This figure exemplifies the time fitting process for time-shifted synthetic controls. Spending on the treated unit is a solid black line that increases pre-treatment and decreases post-treatment. Control A exhibits a similar rise to the pre-period, but at an earlier time, and is shifted forward. Control B exhibits a comparable rise at a later period, and is shifted backward. The shifts are picked to best approximate the pre-treatment period in both shape and levels. These fits are agnostic to how the controls develop in the post-treatment period; Control A falls while Control B continues to rise. Following these fits, a synthetic control unit can be constructed from Time-Shifted Control A and Time-Shifted Control B.
Notes: This figure plots the main effects of the 4 case studies: Outlier payments (top left), Botox (top right), kyphoplasty (bottom left), and unnecessary inpatient admissions (bottom right). For each case, the spending affected by whistleblowing is plotted in solid blue, while the synthetic control series is plotted in dashed red. The synthetic controls are produced using time-shifted control groups, and hence the period with which the synthetic control overlaps with the treated unit differs for each case. The grey dots represent the spending on the treated unit in the period before it overlaps with the synthetic control group. The first vertical line of each case represents the filing of the first related whistleblower lawsuit, which is used as the treatment date, and the second vertical line reflects the first settlement. Post-treatment effects are analyzed for 5 years after the treatment date. For the unnecessary inpatient admissions case (bottom right), multiple defendant providers were analyzed, and the series included here reflects Community Health Systems, the largest defendant provider. Appendix Figure A3 plots the same figure for the other defendants in that case. See the main text for the description of the control units used in each case.
Figure 5: Synthetic Controls for Substitute Outpatient Spending

Notes: This figure plots the substitution effect to outpatient spending for the kyphoplasty (left) and unnecessary inpatient admission (right) case studies. These graphs correspond to the bottom half of Figure 4 and are scaled identically to those panels for comparison. In both lawsuits, whistleblowers alleged that patients should have been treated outpatient instead of inpatient. Outpatient spine procedure spending (left) rose following the kyphoplasty case as compared to the synthetic controls. However, there is no increase in outpatient spending at defendant hospitals (right) following the unnecessary admissions case. For the unnecessary inpatient admissions case, multiple defendant providers were analyzed, and the series included here reflects Community Health Systems, the largest defendant provider. Appendix Figure A4 plots the same figure for the other defendants in that case and shows heterogeneity in the outpatient effects, with both increases and decreases at different defendants.
Figure 6: Kyphoplasty Short-Stay Inpatient Treatment Probability by Estimated Treatment Effect

Notes: This figure plots the probability of receiving short stay inpatient kyphoplasty among the 2005 and 2011 cohorts, by the estimated treatment effect. Treatment effect is scaled as the difference in the probability of death in the next 6 years, and negative values correspond to a lower probability of dying. Absolute treatment probabilities are low, reflecting the inclusion of the full population in this analysis and the relative rarity of kyphoplasty. In both cohorts, patients with higher expected benefits are more likely to receive the treatment. The reduction in treatment probability occurs evenly across the treatment effect distribution.

Figure 7: Outpatient Treatment by Heterogeneous Treatment Effects

Notes: This figure plots the probability of receiving outpatient kyphoplasty or vertebroplasty by expected treatment effect among the 2005 and 2011 cohorts. The treatment effect is scaled as the change in probability of death in the next 6 years if one receives inpatient treatment; negative values indicate a lower probability of dying if treated. The whistleblower lawsuit settled in 2008 alleged that patients should have been treated outpatient instead of inpatient, and correspondingly, patients in 2011 were much more likely to receive outpatient treatment. These gains are greatest among patients to the left of the treatment effect distribution, which corresponds to the greatest benefits from the procedure.
Notes: This figure plots the probability of receiving either inpatient or substitute outpatient treatment by the estimated treatment effect, before and after the 2008 whistleblower settlement concerning unnecessary inpatient kyphoplasty. Patients in 2011 who are expected to benefit from the procedure were 7% more likely to be treated in 2011 than in 2005, and patients who are expected to be harmed were 7% less likely to be treated.
Table 1: Categories of Medicare Whistleblowing Enforcement

<table>
<thead>
<tr>
<th>Type of Care</th>
<th>Type of Fraud</th>
<th>First Case Filed</th>
<th>First Settlement</th>
<th># DOJ Press Releases</th>
<th>Settlement Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td>Manipulation of Outlier Payments</td>
<td>Nov, 2002</td>
<td>Dec, 2004</td>
<td>11</td>
<td>$923,033,623</td>
</tr>
<tr>
<td>Botox</td>
<td>Off-Label Promotion</td>
<td>June, 2007</td>
<td>Aug, 2010</td>
<td>1</td>
<td>$600,000,000</td>
</tr>
<tr>
<td>Kyphoplasty</td>
<td>Inpatient Procedure Should be Outpatient</td>
<td>Dec, 2005</td>
<td>May, 2008</td>
<td>10</td>
<td>$214,238,775</td>
</tr>
<tr>
<td>Inpatient</td>
<td>Unnecessary Hospital Admissions</td>
<td>Nov, 2004</td>
<td>Dec, 2007</td>
<td>7</td>
<td>$172,296,460</td>
</tr>
</tbody>
</table>

Notes: This table shows the 4 highest settlement value categories of Medicare whistleblowing enforcement for which I have data. Categories are constructed using Department of Justice press releases to link cases with similar allegations. Cases filed before the start of the data are omitted, as are cases that concern allegations not potentially observable in the Medicare claims data. For each category, I conduct a case study of the effects of whistleblowing on spending on the related conduct. Appendix B contains more details about the construction of categories and on the smaller categories of enforcement not studied here.

Table 2: Deterrence Effects of Major Whistleblowing Categories

<table>
<thead>
<tr>
<th>Type of Care</th>
<th>Type of Fraud</th>
<th>Settlement Total</th>
<th>Specific Deterrence</th>
<th>Deterrence Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td>Manipulation of Outlier Payments</td>
<td>$923 Million</td>
<td>$17.46 Billion</td>
<td>18.92</td>
</tr>
<tr>
<td>Botox</td>
<td>Off-Label Promotion</td>
<td>$600 Million</td>
<td>-$3.99 Million</td>
<td>-.006</td>
</tr>
<tr>
<td>Kyphoplasty</td>
<td>Inpatient Procedure Should be Outpatient</td>
<td>$214.2 Million</td>
<td>$281.1 Million</td>
<td>1.31</td>
</tr>
<tr>
<td>Inpatient</td>
<td>Unnecessary Hospital Admissions</td>
<td>$172.3 Million</td>
<td>$1.124 Billion</td>
<td>6.52</td>
</tr>
</tbody>
</table>

Total: $1.91 Billion $18.86 Billion

Average Ratio: 6.69

Notes: This table summarizes the results of case studies on the 4 largest categories of Medicare whistleblowing enforcement. Specific deterrence values are computed using a time-shifted synthetic control strategy to compare treated units to their counterfactual in the absence of whistleblowing. The specific deterrence is computed over 5 years post-treatment with a 10% annual discount rate compounded monthly. The deterrence ratio is computed as the ratio of the deterrence value to the settlement total.
Table 3: Placebo Tests for Synthetic Controls

<table>
<thead>
<tr>
<th>Case</th>
<th>Deterrence Value</th>
<th>1-Tail Placebo Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlier Payments</td>
<td>+$17.46 Billion</td>
<td>0.0 (n = 5)</td>
</tr>
<tr>
<td>Botox</td>
<td>-$3.99 Million</td>
<td>0.149 (n = 67)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case</th>
<th>Inpatient Deterrence</th>
<th>1-Tail Placebo Test</th>
<th>Outpatient Deterrence</th>
<th>1-Tail Placebo Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kyphoplasty</td>
<td>+ $538.9 Mil</td>
<td>0.133 (n = 30)</td>
<td>-$257.8 Mil</td>
<td>0.067 (n = 15)</td>
</tr>
</tbody>
</table>

Unnecessary Inpatient Admission:

- Defendant: St Joseph’s Atlanta
  - Deterrence Value: +$44.8 Mil
  - 1-Tail Placebo Test: 0.01 (n = 100) - $27.4 Mil 0.00 (n = 100)

- Defendant: Wheaton Hospital
  - Deterrence Value: +$5.8 Mil
  - 1-Tail Placebo Test: 0.13 (n = 100) - $83.8k 0.31 (n = 100)

- Defendant: El Centro Medical Center
  - Deterrence Value: +$5.3 Mil
  - 1-Tail Placebo Test: 0.35 (n = 100) -$4.0 Mil 0.02 (n = 100)

- Defendant: Overlook Hospital
  - Deterrence Value: -$16.0 mil
  - 1-Tail Placebo Test: 0.02 (n = 100) +$10.7 mil 0.08 (n = 100)

- Defendant: Morton Plant Hospitals
  - Deterrence Value: +$266.6 Mil
  - 1-Tail Placebo Test: 0.01 (n = 100) +$12.7 Mil 0.07 (n = 100)

- Defendant: Shands Hospitals
  - Deterrence Value: + $124.2 Mil
  - 1-Tail Placebo Test: 0.02 (n = 100) +$50.7 Mil 0.00 (n = 100)

- Defendant: Community Health Systems
  - Deterrence Value: +$693.2 Mil
  - 1-Tail Placebo Test: 0.07 (n = 100) +$54.5 Mi 0.20 (n = 100)

Notes: This table summarizes the placebo test for the synthetic control strategy. For each control group, I compute the placebo deterrence effect, using the time-shifted synthetic control method with all other controls. The 1-tail test counts how many placebo groups exceed the deterrence value of the treated unit. For the kyphoplasty and unnecessary admissions cases, this test is conducted separately for the inpatient and outpatient spending. Deterrence effects are positive if spending on the treated unit is less than the control unit, and negative if spending on the treated unit is greater than the control unit.
Appendix: For Online Publication

A Cleaning of the FOIA Data on Qui Tam Whistleblower Suits

Data on the full set of whistleblowing lawsuits were gathered from a Freedom of Information Act (FOIA) request I conducted on the Department of Justice. For each lawsuit, the available data include: the docket number, district of filing, and case caption; the date the Attorney General was served notice of the suit; the primary federal agency to which the lawsuit related; whether or not the government intervened, and what date that election was made; the date of the settlement, judgement, or dismissal; the settlement amount if any, and the whistleblower’s share. Each line of the FOIA dataset contains information about a suit that was dismissed, or in the event of a settlement, a settlement related to that suit. Lawsuits against multiple defendants can have more than one settlement, and therefore appear in more than one line of the data. To correct this issue, I collapse the data by docket, filing state, and year: if two lawsuits contain identical docket numbers and were filed within the same state and year, I assume they are a single suit, and create a total of their settlement values. For the descriptive statistics on medical-related lawsuits provided in Subsection 3.1, I restrict to suits for which the primary federal agency is either Health and Human Services, the Center for Medicare and Medicaid Services, or the Food and Drug Administration.

B Constructing Categories of Enforcement from DOJ Press Releases

The FOIA data described in Appendix A present a complete set of court-related information, but do not give information about the alleged behaviors for which the whistleblower sued, which are necessary for the case studies conducted here. To find details about the nature of these lawsuits, I scraped the Department of Justice press release archives for all press releases that contain the words “false claims,” “Medicare,” and either “qui tam” or “whistleblower.” The DOJ makes an effort to publicize all of its successful cases, in particular because this strengthens later cases against providers who claim ignorance about what conduct constitutes an FCA violation.

From this universe of press releases, I created categories of enforcement against different types of improper conduct. First, I read and hand-coded all press releases through 2014, which contained 325 press-releases. The majority of press releases describe settlements; however, press releases occasionally describe government
intervention in a case, or provide year-end totals of successful recoveries, and were discarded. Then, each settlement press release was coded for the type of medical care and the type of fraud it pertains to.

Certain types of care and certain types of fraud are not analyzable with my data and were omitted from the pool of potential cases to study. For example, cases regarding hospital cost reports, cases against Medicare claims processors, or cases that primarily concerned Medicare Advantage plans were discarded due to the lack of data. Similarly, some of the alleged frauds involve illegal kickbacks or improper financial relationships between providers. However, my available Medicare data do not contain financial information about providers, and therefore these types of cases were excluded from this study.

Following these restrictions, there are 170 remaining press releases that I group into categories. Press releases are grouped by the type of fraud and the type of care they describe, and within each case I create a total settlement amounts. For 3 of the largest settlements, all against groups of hospital providers, the settlement press releases describe multiple types of allegations relating to different categories of conduct reflected in other press releases. In these cases, the settlements were apportioned to the different categories of conduct, as described in the settlement agreement or press release. For example, the June 2006 Tenet Healthcare settlement (described in Appendix C.4) was a $900 million settlement, and the press release states that $788 million was for outlier payments and $46 million was for DRG upcoding. The outlier payment category therefore is apportioned $788 million from this press release and the DRG upcoding category gets $46 million.

The categorization process results in 54 distinct categories, most of which are very small. There are 23 categories with total settlements of less than $10 million and each contain 1 or 2 press releases. The top 11 categories detail more than $100 million in settlements each; these categories are described in Appendix Table A2. Within these categories, one final restriction was imposed, due to availability of data. If a lawsuit began before the data are available, I am unable to observe a pre-whistleblowing period, and therefore the case is omitted. In one category, hospice care, there is insufficient data in the court filings or within the public records to identify the defendant providers, and this case is omitted. Appendix Table A2 details the exclusion reasons for each of the top categories that were omitted, including the timing of the first lawsuit in circumstances where that drove the omission. Researchers with access to earlier data may be able to conduct similar analyses on these categories of whistleblowing.

The press release data do not contain sufficient detail to conduct analyses in the Medicare data, only to generally compare allegations. To augment the details of the press releases, I collect whistleblower complaints and settlement agreements from the lawsuits detailed by the press releases. The identification of these cases
is done either by docket number, which the press release sometimes specifies, or by defendant name. The FOIA data described in Appendix Section A were also used for mapping from press releases to court case docket numbers, which allowed for the retrieval of court documents. Whistleblower allegations and settlement documents contain specifics on the allegations of fraud or misconduct, including information on the medical coding of related procedures.

C  Lawsuit Details for Case Studies

C.1  Outlier Payment Case Study Details

Medicare reimburses most inpatient stays under a prospective payment system, with each stay classified under a Diagnosis Related Group (DRG). Hospitals are paid a fixed reimbursement for each DRG based on the average costs of treating patients under that DRG. This incentivizes providers to keep costs down, as they can recover profits by spending less per patient than the DRG pays. However, this contains the potential incentive to avoid treating high-cost patients. To correct this issue, Medicare has a system by which hospitals treating exceptionally high cost patients receive additional reimbursements called outlier payments. The gravamen of the accusations in the outlier payment lawsuits were that the defendants manipulated the reimbursement process for outlier payments to classify more patients as outliers and receive additional payments.

Between December, 2004 and March, 2010 the Department of Justice published 11 press releases detailing settlements related to outlier payment falsification. The outlier-related conduct from these press releases totals to $923 million in settlements. The first press release in this category was in December 2004, for the case U.S. ex rel James Devage et al. v. HealthSouth et al. This case was originally filed in 1998; however, looking at the court documents from this case, whistleblowing was only a portion of this settlement, and the allegation of outlier falsification was not alleged by the whistleblower. Rather, it appears the Department of Justice included a provision for outlier falsification in this settlement at a later date. The first whistleblower complaint alleging outlier falsification comes from U.S. ex rel. [Under Seal] v. Tenet Healthcare Corporation. et al., Case No. 02-8309, (E.D. Pa.). The filing of the Tenet Case, November 4, 2002, is used as the treatment date for this case. This case settled in June 2006, and was followed immediately by a Department of Justice press release. The Tenet settlement contains $788 million of recovery for outlier falsification, the bulk of the settlement total for this category.

Outlier data were gathered from the 100% Medpar files, which detail each inpatient stay paid for by
Medicare, from 1999-2016. There are more than 5 million total stays classified as cost outliers in this period, and at its peak usage in 2002 (pre-whistleblowing), outlier payments exceeded $500 million per month. The outlier payment system also theoretically contained a provision for outpatient outlier payments. However, in practice there are almost no outlier payments listed in the outpatient claims files, even at the height of inpatient outlier spending. This analysis is therefore restricted to inpatient cost outliers.

The control groups for the Outlier payment case are other categories of expenditure that are of similar size and nature to outlier payments. Medicare pays for durable medical equipment (DME), home health aide services (HHA), hospice care (HOS), and skilled nursing facilities (SNF) as part of its broader package of benefits for older Americans. Spending on each of these types of care are included in the pool of potential controls. Furthermore, Medicare has a system for compensating hospitals who provide services to a disproportionate share of low income patients, called disproportionate share hospital (DSH) adjustments. Much like outlier payments, DSH payments are an adjustment above regular inpatient DRG pricing.

Table A3 details the time shifts (in months) and synthetic control weights for these control groups in constructing a synthetic control unit. The synthetic control method places greatest weight to DSH payments, which are the most similar in nature to outlier payments.

C.2 Botox Case Study Details

The whistleblower lawsuits against Botox alleged that Botox was prescribed for non-FDA approved, non-Medicare-reimbursable uses. The whistleblowers further allege that Allergan, the maker of Botox, explicitly promoted the product for these “off-label” uses, giving Allergan civil liability for the False Claims made to the Medicare and Medicaid programs. In September 2010, Allergan settled with the Department of Justice to resolve 3 pending whistleblower lawsuits of the same accusations: these cases have federal court docket numbers 1:07-cv-1288, 1:08-cv-1883, and 1:09-cv-3434, all conducted in the Northern District of Georgia. The first case was filed on June 5, 2007, which is used as the treatment date for this case. As part of this settlement, Botox agreed to pay $600 Million to the federal government, which includes both a civil settlement and a criminal penalty, for which whistleblowers received $37.8 million. This settlement was described in a Department of Justice press release in September, 2010.

Botox injections are outpatient procedures. Outpatient treatments are given a Current Procedural Terminology (CPT) or Healthcare Common Procedure Coding System (HCPCS) code that determines the reimbursement for the procedure, and an ICD-9 diagnosis code for the condition being treated. Documents from the whistleblower lawsuits provide details on the coding of outpatient Botox procedures. Medicare
allowed reimbursement for Botox injections coded under CPT/HCPCS codes 64612, 64613, 64614, 64640, 64650, 67345, or J0585. The settlement agreement specifies that it resolves liability for false claims under ICD-9 diagnosis codes for spasm of muscle (728.85), other facial nerve disorders (351.8), spasmodic torticollis (333.83), unspecified torticollis (723.5), and bladder conditions (788.30 through 788.34, and 599.82).

Botox spending data were compiled from 100% samples of outpatient claims from January 2002-September 2015, using the CPT codes listed above and filtered for claims where the principal diagnosis matched the ICD-9 codes specified in the settlement. Data start at 2002 due to the availability of cleaned outpatient files, and data are truncated from October 2015 onwards due to the change from ICD-9 to ICD-10 diagnosis codes. Spending for Botox under the relevant diagnoses codes grew from 2 million dollars in 2003 to more than $5 million in 2006, the year before the lawsuit against Allergan was filed.

There are thousands of CPT/HCPCS codes, motivating a restriction of these groups to better potential controls. The candidate groups for this study are all other outpatient CPT/HCPCS codes for which spending started between $2 million and $5 million and saw a 2-3x rise over any 3-year period between 2002 and 2011, of which there are 67 control units. Table A4 shows the weights and time shifts for the 10 control groups given the highest weights by the synthetic control method.

C.3 Kyphoplasty Case Study Details

The main allegation of the kyphoplasty lawsuits was that hospital providers, at the urging of the product manufacturer Kyphon, were conducting kyphoplasty as an inpatient procedure, rather than outpatient. Under Medicare, inpatient stays are paid a fixed amount for the Diagnosis Related Groups (DRG) under which a patient is coded. Therefore, for short stays, providers can receive the full reimbursement and incur relatively low costs. Kyphon allegedly instructed its sales representatives and marketers to push usage of the DRGs 233, 234, and 216, which are various non-specific inpatient spine surgery codes, not designed for kyphoplasty. The specific descriptors of these DRGs were, in 2005, the year the lawsuit was filed: DRG 234: “Other musculoskeletal system & connective tissue O.R. procedure without comorbidities and complications”; DRG 233, ibid, “... with comorbidities and complications”; and DRG 216: “biopsies of musculoskeletal system & connective tissue.” (Center for Medicare and Medicaid Services, 2005)

Tracing spending on DRGs across time requires cross-walking when new versions of the DRG coding are released. This occurred twice in the relevant time period, in October 2007 and in October 2015. The October 2007 change was a complete overhaul of the DRG system, and changed from DRGs to a severity-based system (called MS-DRGs). Under this change, sets of 1 to 2 DRGs before October 1, 2007 usually correspond to
3 DRGs after that date. No 1 to 1 crosswalk exists, and so I collapse the DRGs into groups which can be
cross-walked through this change. The DRGs allegedly promoted by Kyphon exhibit this pattern: DRG
216 became MS-DRGs 477, 478, and 479, and DRGs 233-234 became MS-DRGs 515, 516, and 517. I create
groups for the DRGs that map across this change, and these DRG groups provide the control units. I omit
DRGs that were entirely eliminated or newly generated during this switchover, as they cannot be analyze
across the relevant time period. To handle the second DRG coding change in 2015, data from the 2016 fiscal
year (starting October 1, 2015) are dropped and no crosswalk is implemented. This second change is close to
the end of the available data and happened many years after the relevant lawsuit, so these are not necessary
for analysis.

The treated unit for this analysis is the total payment for stays of 7 nights or fewer under the groups
corresponding to DRGs 233, 234, and 216, the DRGs allegedly promoted by Kyphon. The set of controls are
payments for stays of 7 nights or fewer under other DRG groups. I include DRG groups which experienced a
more than double growth in annual spending over any 3-year period before 2011. The restriction to growing
groups picks DRG groups on similar trajectories to the treated unit, which experienced a 2.5 times increase
between 2002 and 2004, the year before the lawsuit was filed. The cutoff for growing controls is placed
at 2011 to ensure that the data can be shifted back to match the Kyphoplasty series and still allow for
5 years of post-treatment comparison, as my data end in 2015. I exclude DRGs which saw discontinuous
jumps (a 500%+ increase in any single month), or which were not in use for at least 12 months of the
pre-whistleblowing period. There are 30 DRG groups included as controls. Appendix Table A5 details the
time shift and synthetic control weights for these DRGs.

The kyphoplasty lawsuits alleged that kyphoplasty should have been coded as an outpatient procedure
rather than inpatient. Outpatient procedures are billed to Medicare under HCPCS codes. Kyphoplasty
was a new technology during this period, and coding for it changed over the course of the relevant period.
Kyphoplasty was often billed under the catch-all unlisted spine procedure code 22899, but also was coded
under the HCPCS codes 22523, 22524, 22525, 22513, 22514, 22515, C9718, or C9719 at various times, the
latter two very infrequently. Furthermore, to measure substitution effects to outpatient procedures, I need
to consider spending on vertebroplasty, a close substitute procedure, which was coded under HCPCS codes
22520, 22521, 22522, 22510, 22511, or 22512.

For the purposes of the health analysis in Section 6, the codes listed in the previous paragraph are used
to identify outpatient kyphoplasty and vertebroplasty, as almost everything under these codes were in fact
those procedures. However, whistleblowers also alleged that Kyphon, the maker of the kyphoplasty kit, also
pushed providers to miscode the procedure under HCPCS codes 22327, 22325, 22328 for open reduction of thoracic or lumbar vertebrae. Kyphoplasty is not an open procedure, but is rather percutaneous. To analyze the sum of the fiscal effects, and to construct appropriate control groups, the outpatient deterrence analysis considers spending on all outpatient spine procedures, in the CPT code range 22010-22899. Some of these procedures were unaffected by whistleblowing, and therefore will difference out on average before and after the treatment period and will not bias the deterrence measurement. As controls, I consider other categories of surgical outpatient procedures on the musculoskeletal system, all of which are in the 20000-29999 range, of which the treated unit is a subset. These categories are constructed from the AAPC Coder code ranges (AAPC Coder, 2019) and include procedures like shoulder surgeries, hip surgeries, etc. and are not substitutes for the treated procedure. Two other codes in this range, CPT Codes 20000 and 20005, which correspond to surgical drainage procedures, were also included; these codes were deprecated in 2019. Table A5 gives the time shifts and weights for these control units.

C.4 Unnecessary Inpatient Admission Case Study Details

When a patient visits a hospital, particularly for emergency services, physicians at that hospital make a decision on whether to admit the patient for an inpatient stay, which generally results in an overnight stay of at least one night. Besides admitting patients, doctors have the ability to treat a patient outpatient, or to hold them for observation without admission. Inpatient admission receives greater reimbursement than outpatient or observational care. Under Medicare rules, inpatient stays are reserved for acute illnesses, and hospitals are expected to conduct utilization reviews to ensure that patients are admitted appropriately. The allegations in this category of whistleblowing are that the defendant hospitals improperly admitted Medicare patients because of the greater reimbursement provided.

Between 2007 and 2014, the Department of Justice issued press releases detailing 7 settlements with different providers and provider chains regarding this conduct. Four of the settlements concerned a single hospital: St Joseph’s Atlanta; Wheaton Hospital in Wheaton, Minnesota; El Centro Medical Center in Southern California; and Overlook Medical Center in Summit, NJ. Two of the settlements concerned groups of 6 hospitals: Shands Hospitals and Morton Plant Hospitals, both in Florida. The final settlement was against Community Health Systems (CHS), described the Department of Justice in this press release as the “nation’s largest operator of acute care hospitals.” CHS settled for $98 million for conduct in 119 hospitals in 28 states. The total recovery from these 7 settlements was $172.29 million.

The evidence suggests that the conduct described in these cases was localized among the defendants.
Appendix Figure A6 plots the total inpatient spending from all providers in the US and shows no changes with the filing of the first lawsuit in October 2004. This is unsurprising, as total Medicare inpatient spending was around $10 billion per month at the time of filing, and the entirety of these settlements was less than $200 million. Therefore, the computation of specific deterrence conducted here focuses only on the defendants. This may undercount spillover effects to other hospitals who were also deterred from unnecessary inpatient admissions as a result of these settlements.

The goal of this analysis is to measure the specific deterrence effects of these lawsuits on spending at the defendant providers. Because the lawsuits indicate that patients were unnecessarily admitted to the hospital rather than being seen outpatient, I expect a decrease in inpatient spending and an increase in outpatient spending. To measure this change, I construct control units using a set of untreated hospitals. Because some of the untreated hospitals may have been affected by spillovers, I restrict my control sample to hospitals in the 23 states (including the District of Columbia) with no defendant providers. These control units see different patient populations than the defendants and are less likely to be influenced by their behavior. This ensures the control units are isolated from the treated units, at least geographically, to mitigate spillover effects. Next, I construct a random sample of 100 control units for each defendant. For the four defendants that were 1 hospital, the control units are 100 randomly selected hospitals. For the two defendants which were 6 hospitals, the control units are 100 units of 6 randomly-grouped hospitals, drawn with replacement from the set of control hospitals. For CHS, which had 119 hospitals settle, I construct 100 control units of 119 randomly grouped hospitals, drawn with replacement from the set of control hospitals. These control units serve as the controls for the inpatient spending. For outpatient spending, I repeat the same process, drawing from the set of outpatient providers in states with no defendants.

Each of the 7 defendants here is conducted as its own case study. Each has its own controls, and the treatment date for each defendant is the earliest filing date of the lawsuit(s) settled in the settlement agreement with that hospital. Because CHS constitutes 119 of the 135 hospitals in this study, plots from CHS are included in the main results. Inpatient and outpatient plots from the other defendants are presented in Appendix Figures A3 and A4 respectively.
Appendix Figures

Figure A1: Histogram of Healthcare-Related False Claims Act Settlement Values

Notes: This figure plots the histogram of settlement values for settled False Claims Act whistleblower lawsuits related to healthcare from 1986-2012. Each bin is of width $50$ million, and all cases included here have nonzero settlement values. Appendix A describes the cleaning process for these data. The median settlement value is $1.5$ million, and the maximum is $1.52$ billion. The total of all settlements for healthcare-related cases is $26.4$ billion.
Figure A2: Histogram of Healthcare-Related False Claims Act Whistleblower Shares

Notes: This figure plots the histogram of whistleblower shares from settled False Claims Act lawsuits related to healthcare from 1986-2012. Each bin is of width $5 million, and all cases included here have nonzero whistleblower share. Appendix A describes the cleaning process for these data. The median whistleblower share is $250,307, and the maximum is $300.7 million. The total of all whistleblower payments for healthcare-related cases is $4.29 billion.

Figure A8: Treatment Effect Histogram by Cohort

Notes: This figure plots the histogram of expected patient health effects from receiving a short-stay inpatient kyphoplasty treatment among the population of never-before-treated 70-75 year olds in 2005 and in 2011, which correspond to pre- and post-whistleblowing in the kyphoplasty case. Each cohort contains roughly 8 million patients. The horizontal axis is the difference in probability of death in the next 6 years if one receives treatment; values greater than 0 indicate a greater probability of death if treated, and negative values indicate a lower probability of death if treated. This treatment effect is computed using a model fit to the 2005 pre-whistleblowing cohort. The similarity of these histograms indicates that the sample population did not change in composition following the lawsuit.
Figure A3: Inpatient Spending at Other Defendants in the Unnecessary Admissions Case Study

Notes: This figure plots the synthetic control strategy for inpatient spending at the other defendant providers in the unnecessary inpatient admissions case. The largest defendant, CHS, appears in the bottom-right panel of Figure 4. On average, inpatient spending at these providers fell relative to the synthetic control group.

Figure A4: Substitute Outpatient Spending at Other Defendants in the Unnecessary Admissions Case Study

Notes: This figure plots the synthetic control strategy for outpatient spending at the other defendant providers in the unnecessary inpatient admissions case. The largest defendant, CHS, appears in the right panel of Figure 5. On average, outpatient spending at these providers did not increase, even when inpatient spending fell. However, there is heterogeneity among the defendants, with some experiencing increases in outpatient spending and others experiencing decreases.
Figure A5: Robustness Check: Only Allowing Forward Time Shifts

Notes: This figure repeats Figure 4, but only allows controls to be shifted forward in time. The results match the original specification.

Figure A6: Total Inpatient Spending Over Time

Notes: This figure plots total inpatient spending against the timing of the first unnecessary inpatient admissions lawsuit. There is no visible change in overall inpatient spending, which motivates an analysis focused on the defendants in these lawsuits.
Figure A7: One-Night Inpatient Kyphoplasty Claims

Notes: This figure plots inpatient stays for the DRGs promoted by Kyphon for inpatient kyphoplasty that lasted 1 night or less. The first vertical line shows the filing of the lawsuit, and the second line shows the settlement of the lawsuit.

Figure A9: Kyphoplasty Short-Stay Inpatient Treatment Count by Heterogeneous Treatment Effect

Notes: This figure plots the number of patients receiving short-stay inpatient kyphoplasty among the 2005 and 2011 cohorts of never-before-treated 70-75 year olds. Inpatient treatment counts were vastly reduced following the lawsuits against Kyphon and hospitals providing this treatment, which first settled in 2008. The treatment effect is identical to the horizontal axis in Figure A8, and is scaled as the change in probability of death when receiving treatment. The reduction in treatment volume occurs across the treatment effect distribution. The shape of these distributions is mostly driven by the number of units in each bin, as shown in Appendix Figure A8, motivating an analysis by probability of treatment as shown in Figure 6.
Figure A10: Inpatient or Outpatient Treatment Probability by Treatment Effect by Year

Notes: This figure plots the change in total (inpatient or outpatient) treatment probability as a function of the estimated treatment effect. It presents the same result as Figure 8, broken out by the treatment effect bin. Treatment effects are scaled as the change in probability of dying when receiving inpatient kyphoplasty. To satisfy Medicare cell-size-suppression rules, patients with treatment effects in the tails of the distribution are recoded to ±0.4. Patients with beneficial treatment effects, i.e. less than 0, are on average more likely to receive treatment after whistleblowing, while patients that are expected to be harmed are less likely to receive treatment after whistleblowing.
Table A1: Selected Logit Regression Coefficients for Heterogeneous Treatment Effects of Kyphoplasty

<table>
<thead>
<tr>
<th></th>
<th>Coef</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>2.876</td>
<td>2.863</td>
<td>[-2.736, 8.488]</td>
</tr>
<tr>
<td>Age</td>
<td>.0928</td>
<td>.000716</td>
<td>[.0914, .0942]</td>
</tr>
<tr>
<td>Treated × Age</td>
<td>-0.0117</td>
<td>0.0373</td>
<td>[-0.0848, 0.0614]</td>
</tr>
<tr>
<td>Female</td>
<td>-0.419</td>
<td>0.00222</td>
<td>[-0.423, -0.415]</td>
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<tr>
<td>Treated × Female</td>
<td>-0.193</td>
<td>0.139</td>
<td>[-0.465, 0.0782]</td>
</tr>
<tr>
<td>Race White</td>
<td>0.00245</td>
<td>0.0354</td>
<td>[-0.0670, 0.0719]</td>
</tr>
<tr>
<td>Treated × Race White</td>
<td>-1.35</td>
<td>0.679</td>
<td>[-2.68, -0.0229]</td>
</tr>
<tr>
<td>Race Black</td>
<td>0.0706</td>
<td>0.0356</td>
<td>[0.000847, 0.140]</td>
</tr>
<tr>
<td>Treated × Race Black</td>
<td>-1.32</td>
<td>0.811</td>
<td>[-2.91, 0.273]</td>
</tr>
<tr>
<td>OREC = DIB</td>
<td>0.526</td>
<td>0.00310</td>
<td>[0.520, 0.532]</td>
</tr>
<tr>
<td>Treated × OREC = DIB</td>
<td>-0.447</td>
<td>0.170</td>
<td>[-0.780, -0.116]</td>
</tr>
<tr>
<td>OREC = ESRD</td>
<td>0.558</td>
<td>0.0505</td>
<td>[0.459, 0.657]</td>
</tr>
<tr>
<td>Treated × OREC = ESRD</td>
<td>1.28</td>
<td>1.99</td>
<td>[-2.62, 5.19]</td>
</tr>
<tr>
<td>Previous Inpatient Stay</td>
<td>0.253</td>
<td>0.00283</td>
<td>[0.248, 0.259]</td>
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<tr>
<td>Treated × Previous Stay</td>
<td>-0.0688</td>
<td>0.134</td>
<td>[-0.331, 0.194]</td>
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<tr>
<td>Constant</td>
<td>-8.43</td>
<td>.0631</td>
<td>[-8.55, -8.31]</td>
</tr>
</tbody>
</table>

Notes: This table presents selected coefficients from the heterogeneous treatment effects regression described in Equation 11. The full model contains hundreds of coefficients due to the inclusion of state fixed effects and counts for stays under each inpatient DRG as well as full interaction with the treatment indicator. The coefficients presented here are given as examples. OREC indicates the original reason for Medicare qualification. ESRD denotes End Stage Renal Disease and DIB denotes disability insurance benefits.
Table A2: More Categories of Medicare Whistleblowing Enforcement

<table>
<thead>
<tr>
<th>Type of Care</th>
<th>Type of Fraud</th>
<th>First Settlement Year</th>
<th>Settlement Total</th>
<th>Included or Omitted</th>
<th>Reason for Omission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td>Off-Label Promotion</td>
<td>2004</td>
<td>14,359,380,000</td>
<td>Omitted</td>
<td>Part D Data Start 2006</td>
</tr>
<tr>
<td>Inpatient</td>
<td>Outlier Payment Falsification</td>
<td>2004</td>
<td>923,033,623</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Botox</td>
<td>Off-Label Promotion</td>
<td>2010</td>
<td>600,000,000</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Inpatient</td>
<td>DRG Upcoding</td>
<td>2000</td>
<td>458,260,000</td>
<td>Omitted</td>
<td>Case Filed 1995</td>
</tr>
<tr>
<td>Home Health</td>
<td>Medically Unnecessary Care</td>
<td>2000</td>
<td>424,700,000</td>
<td>Omitted</td>
<td>Case Filed 1995</td>
</tr>
<tr>
<td>Nursing Home</td>
<td>Inadequate Care</td>
<td>2001</td>
<td>219,000,000</td>
<td>Omitted</td>
<td>Case Filed 1996</td>
</tr>
<tr>
<td>Kyphoplasty</td>
<td>Inpatient Should be Outpatient</td>
<td>2008</td>
<td>214,238,775</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Physical Therapy</td>
<td>Unlicensed providers; Group Therapy Billed as One-on-One</td>
<td>2004</td>
<td>185,600,000</td>
<td>Omitted</td>
<td>Case Filed 1998</td>
</tr>
<tr>
<td>Hospital</td>
<td>Unnecessary Admissions</td>
<td>2007</td>
<td>172,296,460</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Nursing Home Therapy</td>
<td>Falsified Hours Spent</td>
<td>2000</td>
<td>132,700,000</td>
<td>Omitted</td>
<td>Case Filed 1996</td>
</tr>
<tr>
<td>Hospice</td>
<td>Ineligible Patients</td>
<td>2006</td>
<td>114,886,000</td>
<td>Omitted</td>
<td>Defendants Not Identifiable from Court Data</td>
</tr>
<tr>
<td>Laboratory Tests</td>
<td>Medically Unnecessary; Unbundling Tests</td>
<td>1997</td>
<td>111,161,000</td>
<td>Omitted</td>
<td>Case Settled Before Data Start</td>
</tr>
</tbody>
</table>

Notes: This table describes the top categories of whistleblowing enforcement, as constructed from the Department of Justice press release data using the method described in Appendix B. Cases not related to Medicare claims data are excluded. These are all of the categories for which enforcement totaled to more than $100 million. Four of the top categories are included as case studies. Seven cases are omitted from the case study analysis of this paper because the first lawsuit was filed before the data are available. My available data start in 1999 for all categories except outpatient care and pharmaceuticals, which start in 2002 and 2006 respectively. One category, ineligible hospice patients, is omitted because the lawsuit documents do not identify the defendant providers.
Table A3: Synthetic Control Weights and Time Shifts for Outlier Payments Case

<table>
<thead>
<tr>
<th>Control</th>
<th>Time Shift (Months)</th>
<th>Synthetic Control Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DME</td>
<td>+9</td>
<td>.049</td>
</tr>
<tr>
<td>DSH</td>
<td>+1</td>
<td>.837</td>
</tr>
<tr>
<td>HHA</td>
<td>+10</td>
<td>.024</td>
</tr>
<tr>
<td>HOS</td>
<td>-23</td>
<td>.083</td>
</tr>
<tr>
<td>SNF</td>
<td>+10</td>
<td>.007</td>
</tr>
</tbody>
</table>

Notes: This table details the synthetic control time shifts and weights used for the Kyphoplasty case. The control units are other types of Medicare spending, described in detail in Appendix C.1. The time shift describes the number of months the control unit must be shifted to align with the treated unit in the pre-whistleblowing period. Positive values mean the control unit is shifted forward in time, and negative months mean the control is shifted back in time. For example, a time shift of +9 means that the control unit in March, 2005 serves as a control for the treated unit in December, 2005.

Table A4: Synthetic Control Weights and Time Shifts for Botox Case

<table>
<thead>
<tr>
<th>CPT Code</th>
<th>Descriptor</th>
<th>Time Shift (Months)</th>
<th>Synthetic Control Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>85379</td>
<td>Pathology: Quantitative D-Dimer</td>
<td>-7</td>
<td>0.368</td>
</tr>
<tr>
<td>38510</td>
<td>Biopsy or excision of lymph node(s)</td>
<td>14</td>
<td>0.096</td>
</tr>
<tr>
<td>67028</td>
<td>Intravitreal injection of a pharmacologic agent</td>
<td>-24</td>
<td>0.06</td>
</tr>
<tr>
<td>82570</td>
<td>Pathology; Measurement of Creatinine</td>
<td>0</td>
<td>0.028</td>
</tr>
<tr>
<td>58563</td>
<td>Surgical hysteroscopy with electrosurgical ablation of endometrium</td>
<td>-24</td>
<td>0.022</td>
</tr>
<tr>
<td>63047</td>
<td>Laminectomy</td>
<td>2</td>
<td>0.019</td>
</tr>
<tr>
<td>37607</td>
<td>Ligation or banding of angioaccess arteriovenous fistula</td>
<td>2</td>
<td>0.015</td>
</tr>
<tr>
<td>73718</td>
<td>Magnetic resonance imaging, lower extremity other than joint; without contrast</td>
<td>-12</td>
<td>0.014</td>
</tr>
<tr>
<td>75635</td>
<td>Computed tomographic angiography with contrast</td>
<td>-10</td>
<td>0.014</td>
</tr>
<tr>
<td>43259</td>
<td>Esophagogastroduodenoscopy, flexible, transoral</td>
<td>-10</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Notes: This table details the synthetic control time shifts and weights used for the Botox case. The control units are other types of outpatient care, described in detail in Appendix C.2. The time shift describes the number of months the control unit must be shifted to align with the treated unit in the pre-whistleblowing period. Positive values mean the control unit is shifted forward in time, and negative months mean the control is shifted back in time. For example, a time shift of +2 means that the control unit in October, 2005 serves as a control for the treated unit in December, 2005.
### Table A5: Synthetic Control Weights and Time Shifts for Kyphoplasty Case

#### Inpatient

<table>
<thead>
<tr>
<th>DRG V-24</th>
<th>MS-DRG V-25</th>
<th>Descriptor</th>
<th>Time Shift (Months)</th>
<th>Synthetic Control Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>462</td>
<td>945, 946</td>
<td>Rehabilitation</td>
<td>47</td>
<td>0.431</td>
</tr>
<tr>
<td>533, 534</td>
<td>037, 038, 039</td>
<td>Extracranial Procedures</td>
<td>3</td>
<td>0.049</td>
</tr>
<tr>
<td>524</td>
<td>69</td>
<td>Transient Ischemia</td>
<td>5</td>
<td>0.045</td>
</tr>
<tr>
<td>518</td>
<td>250, 251</td>
<td>Percutaneous cardio procedures w/o coronary artery stent</td>
<td>17</td>
<td>0.045</td>
</tr>
<tr>
<td>535</td>
<td>222, 223</td>
<td>Cardiac defibrillator implant with cardiac catheterization</td>
<td>-5</td>
<td>0.037</td>
</tr>
<tr>
<td>519, 520</td>
<td>471, 472, 473</td>
<td>Cervical spinal fusion</td>
<td>-12</td>
<td>0.035</td>
</tr>
<tr>
<td>155, 156, 567, 568</td>
<td>326, 327, 328</td>
<td>Stomach, esophageal and duodenal procedures</td>
<td>-58</td>
<td>0.03</td>
</tr>
<tr>
<td>515</td>
<td>226, 227</td>
<td>Cardiac defibrillator implant w/o cardiac catheterization</td>
<td>21</td>
<td>0.029</td>
</tr>
<tr>
<td>523</td>
<td>896, 897</td>
<td>Alcohol/drug abuse or dependence w/o rehabilitation therapy</td>
<td>-58</td>
<td>0.026</td>
</tr>
<tr>
<td>496</td>
<td>453, 454, 455</td>
<td>Combined anterior/posterior spinal fusion</td>
<td>-58</td>
<td>0.025</td>
</tr>
</tbody>
</table>

#### Outpatient

<table>
<thead>
<tr>
<th>CPT Code Range</th>
<th>Surgical Category</th>
<th>Time Shift (Months)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>20000, 20005</td>
<td>Incision and Drainage</td>
<td>0</td>
<td>0.158</td>
</tr>
<tr>
<td>22900-22999</td>
<td>Abdomen</td>
<td>0</td>
<td>0.115</td>
</tr>
<tr>
<td>21900-21936</td>
<td>Back or Flank</td>
<td>0</td>
<td>0.096</td>
</tr>
<tr>
<td>21500-21999</td>
<td>Neck or Thorax</td>
<td>0</td>
<td>0.079</td>
</tr>
<tr>
<td>20900-27299</td>
<td>Pelvis or Hip</td>
<td>0</td>
<td>0.077</td>
</tr>
<tr>
<td>21010-21499</td>
<td>Head</td>
<td>0</td>
<td>0.076</td>
</tr>
<tr>
<td>27301-27599</td>
<td>Femur or Knee</td>
<td>0</td>
<td>0.061</td>
</tr>
<tr>
<td>27500-27899</td>
<td>Leg or Ankle</td>
<td>0</td>
<td>0.058</td>
</tr>
<tr>
<td>29000-29799</td>
<td>Casts</td>
<td>11</td>
<td>0.051</td>
</tr>
<tr>
<td>25000-25999</td>
<td>Forearm or Wrist</td>
<td>11</td>
<td>0.048</td>
</tr>
</tbody>
</table>

Notes: This table details the synthetic control time shifts and weights used for the Kyphoplasty case. The top panel describes the controls for inpatient spending, which are groups of other inpatient DRGs. The bottom panel describes the controls for outpatient spending, which are other CPT code ranges of surgery on the musculoskeletal system. These controls are described in detail in Appendix C.3. The time shift describes the number of months the control unit must be shifted to align with the treated unit in the pre-whistleblowing period. Positive values mean the control unit is shifted forward in time, and negative months mean the control is shifted back in time. For example, a time shift of +3 means that the control unit in September, 2005 serves as a control for the treated unit in December, 2005.