

# Fixed effects analysis of the incidence of cardiovascular outcomes under managed care following the managed care backlash

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**Abstracts** To examine the impact of increased managed care activity on 30-day readmission and mortality for acute myocardial infarctions and congestive heart failure in U.S. hospitals following the managed care backlash against managed care cost containment practices.

The Centers for Medicare and Medicaid Services (CMS) Hospital Compare files, CMS Hospital Cost Report, CMS Medicare Advantage Enrollment files, and Health Resources and Services Administration Area Resource File data for the period 2008 to 2011 were used to construct the study sample. Multivariate fixed effects regression with robust standard errors, hospital fixed effects, and year fixed effects were used to estimate the impact of managed care penetration on adverse cardiovascular outcomes. Our primary outcome measures were readmission and mortality for patients discharged with acute myocardial infarction and congestive heart failure for acute, non-federal hospitals with emergency rooms. To examine effects of hospital ownership status, not-for-profit hospitals were compared to proprietary hospitals.

The main analysis revealed that an increase in managed care penetration was associated with a decline in both 30-day readmission and mortality for acute myocardial infarction and congestive heart failure. In the hospital ownership analysis, only the acute myocardial infarction results for proprietary hospitals was statistically significant. All hospital types reported similar congestive heart failure trends as the full sample; however, proprietary hospitals reported greater declines in readmission and mortality.

Increased managed care activity is associated with reductions in hospital readmission and mortality following the legislative and consumer backlash against managed care, with differential impacts across hospital ownership type. These findings highlight the important role of managed care in creating quality improvements in the delivery of care in the hospital setting.

**Abbreviation:** CMS = Centers for Medicare and Medicaid Services.

**Keywords:** heart attacks, heart failure, hospital quality, managed care, Medicare, Medicare advantage

## 1. Introduction

Throughout the 1980s and 1990s, managed care plans dominated the health insurance marketplace over fee-for-service plans due to their ability to reduce overall healthcare costs using supply-side (provider) incentives to curb the use of marginally beneficial

healthcare services.<sup>[1–3]</sup> However, consumer concern that managed care firms focused more on cost than quality lead to widespread disenrollment and a legislative backlash against managed care firms throughout the late 1990s and early 2000s.<sup>[4]</sup> During the legislative backlash, most states passed<sup>[1]</sup> any willing provider laws that required managed care firms to accept any provider into its network if the licensed provider was willing to accept the managed care firm's contract terms and<sup>[2]</sup> freedom of choice laws that allowed managed care enrollees more flexibility to seek out-of-network care without incurring the penalty of paying the full amount for care. Overall, these laws were designed to place restrictions on the tools that managed care firms used to curtail provider costs and provide managed care enrollees with more care options. Since the consumer and legislative backlash, managed care plans have become popular again, particularly in the Medicare marketplace, where Medicare Advantage (MA) managed care plans covered 20.4 million Medicare beneficiaries in 2018, up from 9.7 (110.3%) million in 2008.<sup>[5,6]</sup>

Past research examining the effects of managed care penetration primarily focused on hospital performance and documented that increased activity of managed care plans in the healthcare marketplace can generate spillover effects, which lead to standardization of care management and medical practice that generates cost savings for both managed care and non-managed care enrollees.<sup>[4,7,8]</sup> However, the evidence remains mixed on the impact of such changes to the organization of healthcare delivery that are associated with increased managed care activity on health outcomes for diseases, such as acute myocardial infarction

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The datasets generated during and/or analyzed during the current study are publicly available.

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and congestive heart failure, which require a high intensity of medical treatment in its acute phase and are sensitive to clinical practice, management, and organization.<sup>[1–3,7]</sup> Moreover, it is unclear how managed care firm activity impacts the quality of care delivered following the managed care backlash period. This study examines the impact of increased managed care penetration on readmission and mortality for acute myocardial infarction and congestive heart failure in U.S. hospitals in the time directly following the managed care backlash. We hypothesize that despite the restrictions imposed on managed care to limit their ability to control costs, it did not have a negative impact on managed care firms' ability to generate quality improvements in the delivery of care to patients diagnosed with acute myocardial infarction and congestive heart failure.

## 2. Methods

### 2.1. Data source

Four main datasets used in this study are from the Centers for Medicare and Medicaid Services (CMS) Hospital Compare files, the CMS Hospital Cost Reports, CMS Medicare Advantage Enrollment files, and the Health Resources and Services Administration Area Health Resource File for 2008 to 2011. These data are combined to form an unbalanced panel with hospital-year serving as the unit of observation. The CMS Hospital Compare and Hospital Cost Reports contain detailed information on providers, such as ownership type, utilization, reimbursement, and patient readmission and mortality. The Area Health Resource File contains county-level factors, such as the economic and sociodemographic environments and the organization of local healthcare systems. The study sample is restricted to acute, non-federal hospitals with emergency rooms, as these organizations are most likely to organize their operations to treat acute medical conditions in an emergency setting. After these exclusions, the analysis sample includes 7622 overall observations and 2267 individual hospitals. All of the data in this study utilize public use datasets that are made publicly available through CMS and Health Resources and Services Administration; therefore, ethical review was not necessary.

### 2.2. Measures

In this study managed care penetration is measured using Medicare Advantage activity. Medicare Advantage activity is a good measure of overall managed care activity, as Medicare Advantage activity is only present in markets where commercial managed care plans are offered.<sup>[9]</sup> Moreover, as Medicare Advantage plans increase their presence in markets, their increased market power leads providers to alter procedures and practice patterns that affect both managed care and non-managed care enrollees.<sup>[1,2,7]</sup> CMS Medicare Advantage Enrollment file reports measures of Medicare Advantage penetration at the county-level; however, as all hospitals included in the study sample contain detailed information regarding the discharge volume attributable to Medicare patients, a hospital-level Medicare Advantage penetration measure is calculated and utilized for this study. The main outcome variables for this study are 30-day readmission and mortality rates for patients with acute myocardial infarction and congestive heart failure. The readmission (mortality) rates for acute myocardial infarction and congestive heart failure are estimates of readmission (mortality) in the 30 days after a patient enters the hospital for acute

myocardial infarction or congestive heart failure or after receiving a coronary artery bypass graft surgery. The morbidity and mortality rates reported in the CMS Hospital Compare files were calculated using Medicare claims and eligibility data for patients enrolled in traditional Medicare for 12 months before their hospital admission. As only data from traditional Medicare patients are used to calculate readmission and mortality rates, we can accurately measure the spillover effects that are generated from increased managed care activity on quality for patients with acute myocardial infarction and congestive heart failure.

**2.2.1. Statistical analysis.** Fixed effects regression with robust standard errors, hospital fixed effects, and year fixed effects are used to estimate the effects of managed care penetration on readmission and mortality for acute myocardial infarction and congestive heart failure. In particular, the fixed effects model was selected over other models for its ability to control for time-invariant hospital characteristics. The reported regression coefficients on managed care penetration were adjusted to reflect a 10% increase in managed care penetration. All analysis performed in Stata MP, version 15, controlled for hospital factors (e.g., hospital ownership, bed counts, number of employees, and volume) and area characteristics (e.g., race/ethnicity, density, gender, and poverty rates). Coefficients with *P*-values below .10 are considered statistically significant. Since researchers have documented that quality of care can systematically differ by ownership type, a subgroup analysis separates hospitals by proprietary and not-for-profit status.<sup>[10]</sup> Government hospitals were excluded from the analysis due to data unavailability.

## 3. Results

Figure 1 presents unadjusted hospital 30-day rates of acute myocardial infarction and congestive heart failure by managed care penetration rate measured in quartiles. The figure demonstrates that hospitals located in markets with the highest managed care penetration rates reported lower 30-day readmission rates for acute myocardial infarction (0.246%,  $P < .001$ , Fig. 1.a) and lower 30-day congestive heart failure (0.601%,  $P < .001$ , Fig. 1.b) than hospitals located in markets with the lowest managed care penetration rates. Similarly, hospitals located in markets with the highest managed care penetration rates reported lower 30-day mortality rates for acute myocardial infarction (0.376%,  $P < .001$ , Fig. 1.c) than hospitals located in markets with lower managed care penetration rates. No differences in 30-day mortality rates for congestive heart failure were observed across the highest and lowest penetration markets (Fig. 1.d).

In the overall sample, the fixed effects regression analysis revealed that a 10% increase in managed care penetration was associated with a decline in 30-day readmission (−0.142%,  $P = .001$ ) and 30-day mortality (−0.171%,  $P = .015$ ) for acute myocardial infarction (Table 1). Similarly, a 10% increase in managed care penetration was associated with a decline in 30-day readmission (−0.280%,  $P < .001$ ) and 30-day mortality (−0.143%,  $P = .014$ ) for congestive heart failure. When the analysis is broken down by hospital ownership type, only the acute myocardial infarction results were statistically significant for proprietary hospitals. For congestive heart failure, both the proprietary and not-for-profit hospitals reported similar trends for the total sample; however, proprietary hospitals reported significantly higher declines in 30-day readmission (−0.391%,  $P = .014$ ) and 30-day mortality (−0.209%,  $P = .082$ ).

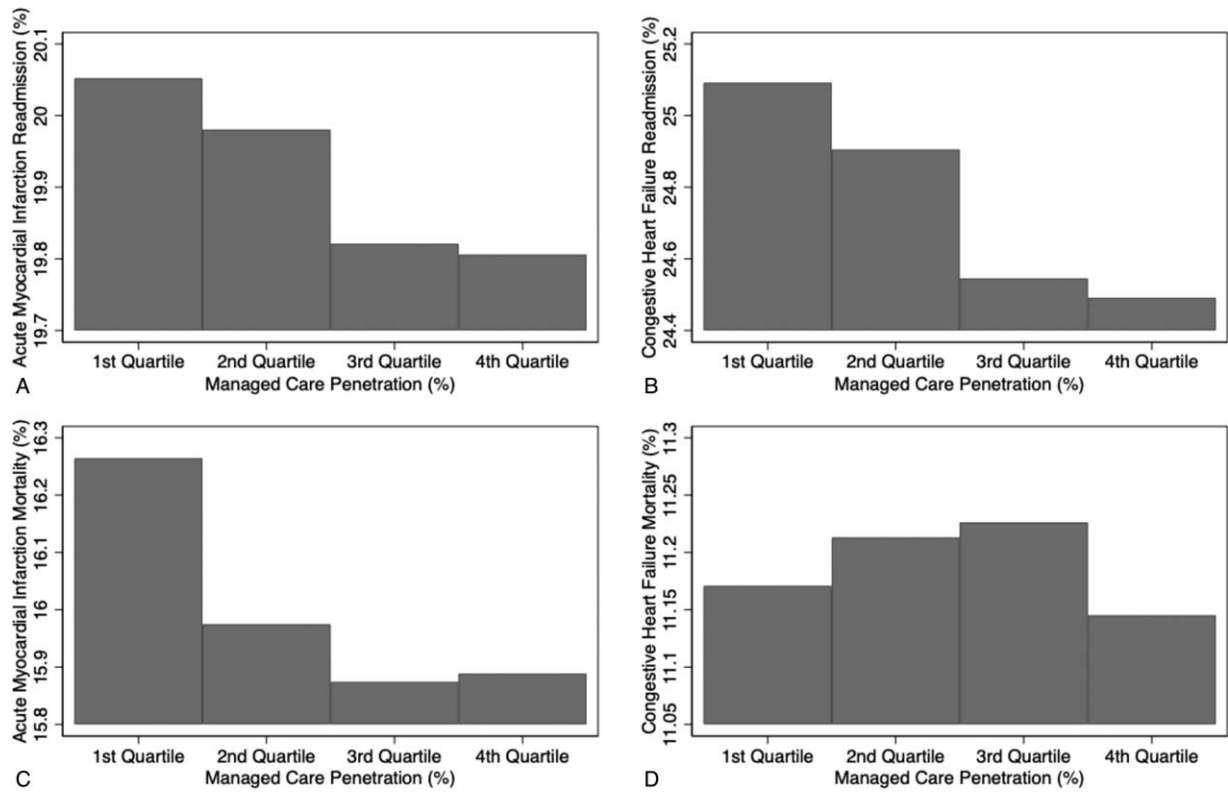


Figure 1. Hospital 30-day readmission and mortality rates for patients with acute myocardial infarction and congestive heart failure by managed care penetration.

#### 4. Discussion

The results of this study demonstrate that increases in managed care penetration were associated with declines in 30-day readmission and mortality for acute myocardial infarction (Table 1). There are several potential explanations for these findings. First, increased managed care penetration has been observed to alter hospital skill mix. For example, 1 study using a sample of Tennessee hospitals found that managed care penetration was associated with changes in an increase in the

number of administrative employees and registered nurses and a decline in the number of licensed practical nurses.<sup>[11]</sup> This finding is significant, as researchers have documented that a richer skilled nurse mix is associated with lower odds of patient mortality and lower reports of poor safety grades.<sup>[11,12]</sup> Second, managed care organizations use a number of supply-side controls such as utilization review and care planning to curb use of marginally beneficial healthcare services. While utilization review requires providers to follow a set of authorized procedures that standardizes treatment across disease groups, care management

Table 1

Fixed effects regression analysis of 30-day readmission and mortality for acute myocardial infarction and congestive heart failure, 2008 to 2011.

	Hospitals by ownership type					
	All hospitals		Proprietary hospitals		Not-for profit hospitals	
	30-d Readmission	30-d Mortality	30-d Readmission	30-d Mortality	30-d Readmission	30-d Mortality
A. Acute myocardial infarction						
Managed care penetration × 10 (%) <sup>*</sup>	-0.142 (0.056) [P=.001]	-0.171 (0.070) [P=.015]	-0.293 (0.124) [P=.018]	-0.431 (0.158) [P=.006]	-0.561 (0.590) [P=.342]	-0.100 (0.076) [P=.188]
Number of observations	6048	6724	1201	1374	4845	5350
Number of hospitals	1854	2038	429	488	1508	1641
B. Congestive heart failure						
Managed care penetration × 10 (%) <sup>*</sup>	-0.280 (0.080) [P<.001]	-0.143 (0.058) [P=.014]	-0.391 (0.159) [P=.014]	-0.209 (0.120) [P=.082]	-0.250 (0.091) [P=.006]	-0.135 (0.099) [P=.040]
Number of observations	7622	7619	1663	1654	5959	5965
Number of hospitals	2267	2258	562	558	1809	1804

Numbers in parenthesis are robust standard errors and P-values are in brackets. All regressions included hospital controls (e.g., ownership type, number of beds, number of employees, patient discharge volume), area controls (e.g., racial composition, population density, gender, and poverty), and year fixed effects.

<sup>\*</sup> Interpreted as a 10% increase in managed care penetration.

strategies are designed to target patients with complex conditions that represent the highest proportion of a hospital's costs and evaluate alternative treatment plans that can reduce their need for future expensive care like readmissions for previously treated conditions.<sup>[13]</sup> Therefore, increased managed care penetration can increase case management, which can reduce readmission and mortality for complex conditions such as acute cardiovascular conditions. Similar findings were observed for hospital 30-day readmission and mortality for congestive heart failure. These results are in contrast to previous studies that found no spillover effects of increased managed care penetration on hospital-level acute myocardial infarction outcomes.<sup>[7]</sup>

The hospital ownership subgroup analysis revealed that only proprietary hospitals reported statistically significant declines in hospital 30-day readmission and mortality for acute myocardial infarction (Table 1). Both proprietary and not-for-profit hospitals also reported statistically significant declines in hospital 30-day readmission and mortality for congestive heart failure; however, proprietary hospitals reported larger reductions than not-for-profit hospitals. This finding could be attributable to differences in allocation on advertising and capital investment by ownership type. For example, proprietary hospitals are more likely to allocate resources to advertising and investing in new medical technologies, which is considered an inefficient allocation of resources away from critical services utilizing standard technologies.<sup>[14,15]</sup> In the presence of increased managed care penetration, both hospital ownership types reduce acquisition of marginally beneficial technology. On the other hand, while proprietary hospitals reduce their allocations to advertising, not-for-profit hospitals have been observed to increase their allocations to advertising in an effort to increase their leverage in contract negotiating that may force them to reduce their budgets to support case management for complex conditions.<sup>[14]</sup>

To my knowledge, this study is the first to use a hospital-level measure of managed care penetration to measure population-level measures of adverse cardiovascular outcomes in U.S. hospitals and analyze the impact of managed care penetration on hospital quality following the managed care backlash. There have been studies that examine the effects of managed care penetration on cardiovascular outcomes; however, these studies either focused on the pre-backlash period using market-level measures of managed care penetration without observing any statistically significant effects or they focus on the process of care (i.e., echocardiograms, revascularization, catheterization, coronary angiography).<sup>[7]</sup>

Despite the positive results of this study, there are 2 potential limitations. First, this study focuses on examining 30-day readmission and mortality in the hospital setting, but does not capture outcomes related to care delivered in other provider settings such as freestanding ambulatory surgical centers. However, since patients primarily receive treatment for myocardial infarction and congestive heart failure in their acute phase in the hospital setting, this study captures the overwhelming majority of treatment for acute myocardial infarction and congestive heart failure and the results are representative of the effects of managed care activity on treatment for U.S. cardiovascular disease patients. Second, the results in this study could be attributable to the fact that managed care plans have higher reimbursements than traditional Medicare and/or managed care beneficiaries are healthier and have a lower risk of death than traditional Medicare beneficiaries.<sup>[10,16]</sup> However,

other studies investigating the managed care population during this study period do not suggest the results are biased by the presence of service level selection or increased medical expenditures.<sup>[17,18]</sup>

## 5. Conclusion

The result that increases in managed care penetration is associated with a decline in both 30-day readmission and mortality for acute myocardial infarction and congestive heart failure is a particularly important finding, as it suggests that the cost-cutting restrictions imposed on managed care firms during the managed care backlash period did not have a negative effect on managed care firms' ability to standardize care management and medical practice patterns to generate quality improvements in acute myocardial infarction and congestive heart failure care directly following the backlash. As managed care plans are set to continue their expansion, future research should examine trends in hospital management and procedures to identify the specific factors that are driving acute myocardial infarction and congestive heart failure outcomes and determine whether these trends continue to persist. In particular, it is critical to not only gain a stronger understanding of the course of treatment for cardiovascular disease patients following an acute event, but to also identify potential population level case management and discharge management strategies that focus on monitoring cardiovascular risk factors that can lead to increased population morbidity and future acute events for existing cardiovascular disease patients.

## Author Contributions

JD conceived the study and its design, and acquired, analyzed, and interpreted the data. JD drafted and revised the manuscript, and gave final approval of the version to be published. JD is accountable for all aspects of the work.

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