EXHIBIT F

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

IN RE: MCKINSEY & CO., INC. NATIONAL PRESCRIPTION OPIATE CONSULTANT LITIGATION

This Document Relates to:

ALL THIRD-PARTY PAYOR ACTIONS

Case No. 21-md-02996-CRB (SK)

SETTLEMENT AGREEMENT AMONG THIRD-PARTY PAYORS AND MCKINSEY DEFENDANTS

EXPERT REPORT OF PROFESSOR MEREDITH ROSENTHAL

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I. EXECUTIVE SUMMARY

1. I have been asked by counsel to the Third-Party Payor (TPP) plaintiffs in this matter to propose a method of allocation for the Settlement with McKinsey & Company, Inc. (hereafter, "McKinsey"). I understand that the Settlement is intended to compensate the TPPs for overcharges related to the alleged involvement of McKinsey in the false marketing of opioids. In this report, I describe an allocation method that relies on data reasonably available to TPPs and an algorithm that takes account of the fact that the quantum of impact on TPPs varied by year and region of the country. In particular, the proposed allocation takes as its point of departure the number of enrollees or beneficiaries covered by the TPP, with adjustments for timing (i.e., which years during the class period these enrollees were covered) and the extent to which the states in which enrollees resided were targeted by the marketing efforts of opioid manufacturers.

2. Using publicly available data and adapting methods developed in the academic literature, I propose and demonstrate the use of an allocation method that is feasible given data constraints faced by class members, that relies on methods used by economists to estimate the impact of opioid marketing, and that ensures that TPPs that were impacted more by the alleged misconduct receive a larger share of the Settlement. In addition to the primary methodology, I have also proposed an approach to determining Settlement shares for TPPs: (1) with incomplete data, and (2) that cover only prescription drugs or medical care, but not both.

3. I reserve the right to update my analyses and conclusions if additional information becomes available.

II. QUALIFICATIONS

4. My name is Meredith B. Rosenthal. I am the C. Boyden Gray Professor of Health Economics and Policy at the Harvard T.H. Chan School of Public Health and an Academic Affiliate of Greylock McKinnon Associates ("GMA"), a consulting and litigation support firm. My principal research interests concern the economics of the health care industry, including pharmaceuticals.

5. At Harvard, I have taught undergraduate-, Masters-, and Ph.D.-level health economics and health policy courses. I have conducted research on a wide variety of health economics topics, with a focus on the financing and organization of the U.S. health care system. Specific topics I have studied include the effect of payment incentives on provider behavior,[1] payment and delivery system reform,[2] and advertising of prescription drugs.[3] I have published more than 170 peer-reviewed journal articles, essays, and book chapters.

6. Since 1996, I have worked through GMA as an expert in health economics on litigation in health care markets and the pharmaceutical industry. I have submitted written and oral testimony in litigation regarding allegations of foreclosure of generic entry, improper marketing, fraudulent use of list prices, anticompetitive contracting, and violations of the false claims act.[4]

7. I received an A.B. in International Relations from Brown University in 1990 and a Ph.D. in Health Policy (Economics Track) from Harvard University in 1998. A more complete description of my qualifications is found in my *Curriculum Vitae*, which is included as Attachment A to this report. Attachment A also includes a list of my testimony in the past four years and a list of my publications. Attachment B is a listing of the materials I relied upon in forming the opinions included in this report. GMA is currently compensated at a rate of $950 per hour for my time. I may also receive additional compensation from GMA based on staff billings in this matter. Neither my nor GMA's compensation in this matter is contingent upon the

[1] M. Rosenthal, "Risk Sharing and the Supply of Mental Health Services," *Journal of Health Economics*, 19(6), November 2000, pp. 1047-65. M. Rosenthal, R. Frank, Z. Li, and A. Epstein, "From Concept to Practice: Early Experience with Pay-for-Performance," *Journal of the American Medical Association*, 294(14), October 2005, pp. 1788-93. M. Rosenthal, Z. Li, A. Robertson, and A. Milstein, "Impact of Financial Incentives for Prenatal Care on Birth Outcomes and Spending," *Health Services Research*, 44(5), Part 1, October 2009, pp. 1465-79.

[2] M. Rosenthal, "Beyond Pay for Performance: Emerging Models of Provider-Payment Reform," *New England Journal of Medicine*, 359(12), September 2008, pp. 1197-1200. M. Rosenthal, M. Friedberg, S. Singer, D. Eastman, Z. Li, and E. Schneider, "Effect of a Multipayer Patient-Centered Medical Home on Health Care Utilization and Quality: The Rhode Island Chronic Care Sustainability Initiative Pilot Program," *JAMA Internal Medicine*, September 2013, PMCID: 24018613. S. Edwards, M. Abrams, M. Rosenthal, *et al.*, "Structuring Payment to Medical Homes After the Affordable Care Act," *Journal of General Internal Medicine*, 2014, PMCID: 417661.

[3] M. Rosenthal, *et al.*, "Promotion of Prescription Drugs to Consumers," *The New England Journal of Medicine*, 346(7), February 2002, pp. 498-505. M. Rosenthal, *et al*., "Demand Effects of Recent Changes in Prescription Drug Promotion," *Forum for Health Economics & Policy*, 6(1), January 2003, pp. 1-26. M. Mello, M. Rosenthal, and P. Neumann, "Direct-to-Consumer Advertising and Shared Liability for Pharmaceutical Manufacturers," *Journal of the American Medical Association*, 289(4), January 2003, pp. 477-81. J. Donohue, E. Berndt, M. Rosenthal, A. Epstein, and R. Frank, "Effects of Pharmaceutical Promotion on Adherence to the Treatment Guidelines for Depression," *Medical Care*, 42(12), December 2004, pp. 1176-85.

[4] See Attachment A for a listing of my most recent testimony.

outcome of this litigation. Should additional materials become available after the submission of this report and if asked to do so by counsel or the Court, I reserve the right to update my analysis.

III. INTRODUCTION

8. A national class-action suit was brought on behalf of TPPs alleging that McKinsey contributed to harms caused by opioid manufacturers through their consulting business. McKinsey is alleged to have assisted opioid manufacturers in their efforts to distort the benefits of opioid treatments and downplay their risks, leading to overuse of opioids and the opioid epidemic that continues to this day. TPPs were (and continue to be) affected by the alleged misconduct as they pay for pharmaceuticals for their enrollees, including opioids and other prescription drugs, and medical care, including treatments for opioid use disorder and its complications.

9. The TPP Class for which this Settlement is designated, is defined as follows[5]:

> All entities that paid and/or reimbursed for (a) opioid prescription drugs manufactured, marketed, sold, or distributed by the Opioid Marketing Enterprise Members (Purdue, Johnson & Johnson, Janssen, Cephalon, Endo, and Mallinckrodt), for purposes other than resale, and/or (b) paid or incurred costs for treatment related to the misuse, addiction, and/or overdose of opioid drugs, on behalf of individual beneficiaries, insureds, and/or members, during the period June 1, 2009 to October 31, 2023. For clarity, included in the class are: (a) private contractors of Federal Health Employee Benefits plans, (b) plans for self-insured local governmental entities that have not settled claims in MDL 2804, (c) managed Medicaid plans, (d) plans operating under Medicare Part C and/or D, and (e) Taft Hartley plans.
>
> Excluded from the class are (a) all federal and state governmental entities, (b) all tribal entities, (c) local governmental entities and school districts, (d) Pharmacy Benefit Managers (PBMs), (e) consumers, and (f) fully-insured plans. For the avoidance of doubt, entities that are otherwise members of the class are not excluded on the basis that they own an interest, including a controlling interest, in a PBM.

10. In the remainder of this report, I describe my approach to allocation, which builds on methods first used in peer-reviewed studies in economics and health policy.

[5] Settlement Agreement Among Third Party Payors and McKinsey Defendants, *IN RE: McKinsey & CO., INC. National Prescription Opiate Consultant Litigation*, United States District Court, Northern District of California (Case No. 21-md-02996-CRB (SK) (hereafter, "Settlement").

IV. PROPOSED METHOD OF ALLOCATION

A. Approach

11. Conceptually, a fixed settlement to compensate TPPs for overcharges related to opioid marketing should be allocated in a way that reflects the relative burden borne by individual TPPs. This relative burden could theoretically be measured by statistically estimating the incremental amount of a TPP's actual spending on opioids and the health care sequelae of opioid addiction (e.g., medications for opioid use disorder, emergency department visits for overdose, etc.) that is attributable to the alleged misconduct. In the context of this Settlement allocation, the data burden for such an analysis seems disproportionate to the task. The time and resources required for TPPs to produce and tabulate detailed pharmaceutical and medical claims data for the relevant period would be substantial. Allocating the Settlement based on actual spending alone (i.e., by summing opioid-related paid claims) would also run the risk of awarding a higher share of the Settlement to TPPs with higher opioid use unrelated to marketing.

12. An alternative approach to allocation would be to focus on the size of the affected population, measured in the number of covered beneficiaries, and account for differential exposure to the challenged conduct. Enrollment data, particularly in aggregate, will be more readily available from reports and regulatory filings, and easier to access and analyze. My allocation approach for the McKinsey TPP Settlement is predicated on the idea that the impact of opioid manufacturers' marketing on TPPs is a function of the size of their covered populations over time and their exposure to the challenged marketing. Following recent work exploring the impact of opioid marketing on downstream outcomes, I measure exposure as a function of the extent to which the prescribers who cared for the TPPs' covered population were targeted by the opioid manufacturers' marketing efforts.

13. I develop my estimates by adapting a methodology used by Dennett and Gonsalves (2023), which in turn built on two earlier economics papers. Dennett and Gonsalves examine the impact of opioid marketing on long-term health outcomes associated with opioid use and addiction.[6] They combine insights from two previous papers (described below) that developed

[6] J.M. Dennett and G.S. Gonsalves. "Early OxyContin Marketing Linked to Long-Term Spread of Infectious Diseases Associated with Injection Drug Use," *Health Affairs*, 42(8), 2023, pp. 1081-1090.

proxies for exposure to opioid marketing and showed that early targeting of states with certain characteristics caused differences in long-term opioid impacts. The proxies these authors use derive from internal information on Purdue's marketing strategies that were made public during litigation. First, researchers found that a state's use of triplicate prescription programs, a strict set of prescription drug monitoring policies, was a deterrent to opioid marketing because physicians in states with triplicate prescribing were less likely to use opioids.[7] Second, other researchers found that cancer mortality was a predictor of opioid marketing because these drugs were initially indicated for cancer-related pain.[8] Dennett and Gonsalves combine both proxies to categorize states as low, middle, and high-exposure to opioid marketing. In their primary analysis and a series of robustness checks, they demonstrate that these categories are strong predictors of the long-term consequences of opioid marketing and independent of their dependent variables. Notably, in supplemental analyses Dennett and Gonsalves demonstrate that their exposure variables are associated with trends in opioid shipments (wholesale quantities).[9]

14. In this report, I employ a regression analysis that replicates the Dennett and Gonsalves approach to measuring exposure to marketing as its point of departure but focuses on opioid use rather than long-term health outcomes. Using this regression, I construct inflation factors to reflect differential exposure to opioid marketing by state and year. These inflation factors can be applied to reported state-year enrollment data supplied by individual class members to give weight to differential exposure to the alleged misconduct in allocating the Settlement. In the sections below, I describe the data I use for my analysis, the statistical model, and the results. Finally, I describe how this methodology will be applied to class members' enrollment information to calculate settlement shares for each class member, including approaches to addressing incomplete data and different types of TPPs (those that only covered medical care and those that only covered pharmaceutical care).

[7] A. Alpert, W.N. Evans, E.M.J. Lieber, and D. Powell, "Origins of The Opioid Crisis and Its Enduring Impacts," *Quarterly Journal of Economics*, 2022, 137(2), pp.1139–79.

[8] C. Arteaga and V. Barone, "A Manufactured Tragedy: The Origins and Deep Ripples of The Opioid Epidemic," working paper, October 10, 2023, (https://viquibarone.github.io/baronevictoria/Opioids_ArteagaBarone.pdf).

[9] Dennett and Gonsalves, *op. cit.*, Supplemental Appendix, Figure S2.

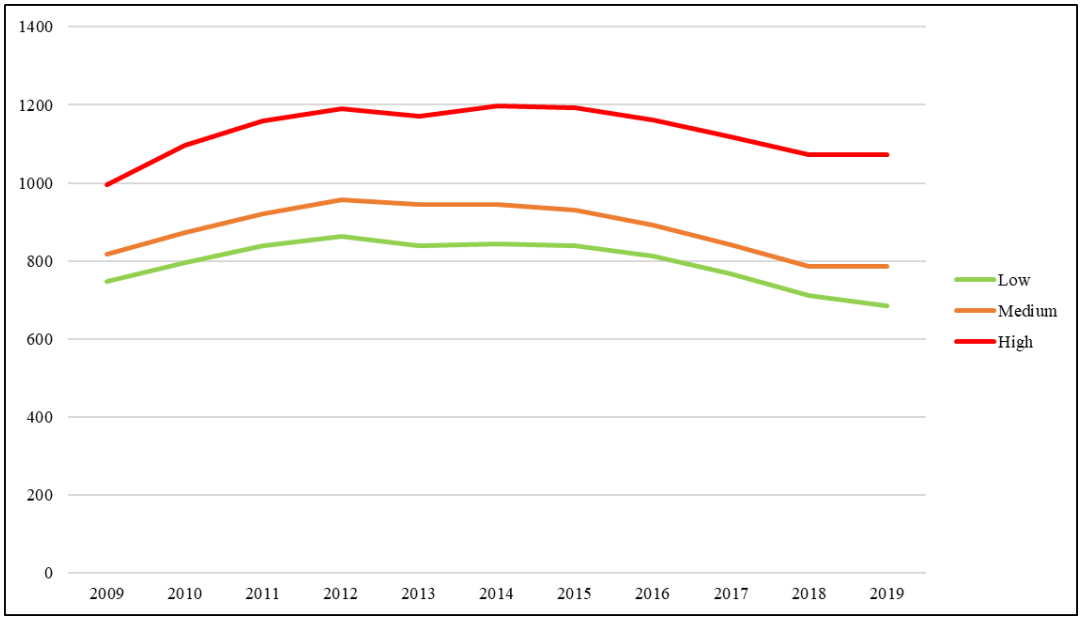
B. Data

15. My allocation method will combine self-reported enrollment data from class members with a set of multipliers that account for the differential impact of the misconduct by geography and year. Each class member will be asked to report the number of covered beneficiaries in each state where their beneficiaries reside and each year of the damage period.

16. For my dependent variable (the variable to be explained in the regression analysis described below), I use data from the Drug Enforcement Agency on total quantities sold of opioids by state and year (2009 to 2019, which are the latest data I have available) measured in Milligrams of Morphine Equivalents (MMEs). Independent variables include sociodemographic characteristics of each state based on estimates from the U.S. Census (share of the population aged 0-18, 19-25, 26-34, 35-54, 55-64, and 65+, race/ethnicity, and the share of the state population living in poverty) as control variables in the analysis.

17. Figure 1 charts the average MMEs per capita for states categorized as low, medium, and high exposure, respectively. As expected, there is a clear difference in the levels of MMEs across the three exposure groups. To account for other changes in population characteristics that may also be associated with trends in MMEs per capita, I estimate a linear regression with fixed effects for year (leaving out 2009 as the comparator), dummy variables for states in the medium and high exposure categories (leaving out the low exposure category as the comparator), and interactions between year and the two exposure category variables, in addition to the sociodemographic variables listed above. The regression accounts for clustering at the state level and population weights. Output from this regression is reported in the appendix.

Figure 1: Mean MMEs per Capita, by State Exposure Level



18. In the regression analysis, the variables capturing the main effect of opioid marketing show a significant and positive impact of exposure. For the medium exposure states, this impact is relatively constant over time; for the high exposure states, the effect increases over time. Using the coefficients from the model, I calculate the incremental contribution of exposure category on MMEs per capita for each year and calculate a multiplier that can be applied to the number of covered beneficiaries by exposure category. The adjusted MMEs per capita in 2009 in low exposure states is the reference and its multiplier is set to one; all other multipliers represent a ratio of MMEs per capita in that year and exposure group as compared to the 2009 low exposure rate, after adjusting for trends in sociodemographic characteristics of the states.[10] These multipliers are presented in the table below.

[10] I tested several models, including some without any demographic covariates. I selected the model with demographic covariates as its explanatory power (measured by R^2 value) of 0.61 exceeded the model without covariates (0.51).

Table 1: Multipliers Calculated from Regression Analysis of MMEs per Capita[11]

Year	Low Exposure	Medium Exposure	High Exposure
2009	1.00	1.06	1.27
2010	1.01	1.12	1.37
2011	1.05	1.15	1.36
2012	1.07	1.18	1.32
2013	1.05	1.19	1.33
2014	1.07	1.20	1.36
2015	1.10	1.18	1.36
2016	1.11	1.17	1.37
2017	1.07	1.17	1.38
2018	1.04	1.16	1.37
2019	1.04	1.20	1.39

C. Weighting of Covered Enrollees for Exposure Level by Year

19. Using the weights from Table 1, I will calculate weighted enrollment for each TPP class member that submits data to the Court. Weighted enrollment will be totaled for claimants and settlement shares will be calculated as a percentage of the total weighted enrollment. To illustrate, Table 2 imagines a hypothetical example with three TPP class members who report enrollment data as follows:

Table 2: Example Application of Multipliers in a 3-TPP Class

	TPP # 1			TPP # 2			TPP # 3		
Exposure Category	Low	Medium	High	Low	Medium	High	Low	Medium	High
2009	0	0	0	0	0	10,000	0	1,000	0
2010	0	0	0	0	0	10,000	0	2,000	0
2011	0	0	0	0	0	10,000	0	3,000	0
2012	0	0	0	0	0	10,000	0	4,000	0
2013	5,000	5,000	0	0	0	10,000	0	5,000	0
2014	5,000	5,000	0	0	0	10,000	0	5,000	0
2015	5,000	5,000	0	0	0	10,000	0		0
2016	5,000	5,000	0	0	0	10,000	0		0
2017	5,000	5,000	0	0	0	10,000	0		0
2018	5,000	5,000	0	0	0	10,000	0		0
2019	5,000	5,000	0	0	0	10,000	0		0

[11] The ARCOS data I used ends in 2019 and I am not able to access the detailed data needed to compute MMEs per state after that time period. For later years, I propose using the estimated 2019 weights as a proxy. Given that there was little change in the weights from 2018 to 2019, holding them steady for 2020 is a reasonable approach.

20. To calculate the allocation for this hypothetical 3-TPP class, I first multiply the number of covered beneficiaries in each cell by the respective weight for the exposure category and year combination. I then sum these weighted enrollment data for each TPP and for the class as a whole. The Settlement share for each TPP is the ratio of its weighted enrollment to the total weighted enrollment for the class as a whole. In my example, those shares are 31.4%, 59.3%, and 9.3% for TPP #1, #2, and #3 respectively. An unweighted calculation of enrollment shares would yield 35%, 55% and 10% respectively, showing how my methodology assigns a larger share of the Settlement to TPP#2 based on their coverage of beneficiaries in high marketing exposure states.

D. Calculating Shares for TPPs with Incomplete Data

21. There may be situations where TPPs can demonstrate they were paying for health care during the relevant period but do not have complete data on enrollment by state and year. If it is possible to determine the share of enrollment in low, medium, and high exposure states for any year, we can use those shares to allocate enrollment in other years. For TPPs with information on the states where their enrollees are located (e.g., a Taft-Hartley Fund that covers union members in Illinois and Wisconsin) but without specific enrollment numbers in each state, we can assume equal shares across those states. For other kinds of missing data, it may be possible to interpolate or extrapolate enrollment figures, using linear methods.

E. Calculating Shares for TPPs that Cover Only Prescription Drugs or Only Medical Care

22. Published research has examined the relative importance of prescription drugs and other medical care as drivers of spending for people with opioid use disorder in commercial insurance.[12] Health care spending for people with opioid use disorder is more than eightfold that of people without opioid use disorder. Spending on prescription drugs represents 13% of all spending for people with opioid use disorder, or 12% of the incremental costs of opioid use

[12] S. Davenport, *et al.,* "Costs and Comorbidities of Opioid Use Disorder," Milliman White Paper, 2019; A.G. White, *et al*., "Direct Costs of Opioid Abuse in an Insured Population in the United States," *Journal of Managed Care & Specialty Pharmacy*, October 26, 2020, 26(10), pp. 1188-1198.

disorder.[13] Although not all excess use of opioids caused by the alleged misconduct resulted in opioid use disorder, this share is a reasonable approximation for the portion of the overcharges that derives from prescription drugs vs. other medical care utilization.

F. Summary and Conclusions

23. An economically reasonable approach to allocation for the Settlement in this matter recognizes that, while all TPPs were impacted by the alleged misconduct, the quantum of impact varied over time and space because of the nature of Defendants' promotion scheme and factors such as state regulations. The algorithm I propose accounts for these factors to derive a set of weights to apply to covered enrollees. While a similar approach could be undertaken with claims data, in my opinion, using enrollment data as I propose here is more efficient and captures the relative impact of the alleged misconduct across TPPs.

24. Based on my expertise in health economics, experience working with industry data, and knowledge of this matter, I conclude that using the exposure-weighted shares of covered enrollees offers a feasible and fair approach to settlement allocation in this matter.

Meredith Rosenthal

Meredith Rosenthal, Ph.D.
December 20, 2023

[13] *Ibid.*, Figure 2. I calculated the share of incremental costs using the difference in prescription drug direct costs for people with and without opioid use disorder, divided by the difference in total direct costs using the data reported in Figure 2.

ATTACHMENT A

CURRICULUM VITAE

Date: November, 2023

NAME: Meredith B. Rosenthal

ADDRESS: Harvard T. H. Chan School of Public Health
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Boston, MA 02115
Tel: (617) 432-3418
meredith_rosenthal@harvard.edu

BIRTHPLACE: Boston, Massachusetts

EDUCATION:

1998 Health Policy (Economics track), Ph.D., Harvard University

1990 International Relations (Commerce), A.B., Brown University

ACADEMIC APPOINTMENTS:

2011-present C. Boyden Gray Professor of Health Economics and Policy
Department of Health Policy and Management
Harvard School of Public Health

2006-2011 Associate Professor of Health Economics and Policy
Department of Health Policy and Management
Harvard School of Public Health

1998-2006 Assistant Professor of Health Economics and Policy
Department of Health Policy and Management
Harvard School of Public Health

ADMINISTRATIVE APPOINTMENTS:

2017-2018 Senior Associate Dean for Academic Affairs
Harvard T. H. Chan School of Public Health

2013-2017 Associate Dean for Diversity
Harvard T. H. Chan School of Public Health

2019-2023 Faculty Chair, Advanced Leadership Initiative
Harvard University

PROFESSIONAL SOCIETIES:

2014-present Elected Member, National Academy of Medicine (Institute of Medicine)
2004-present American Society of Health Economists
2000-present International Health Economics Association
1995-present AcademyHealth
Planning Committee for 2008 Annual Research Meeting

OTHER PROFESSIONAL EXPERIENCE:

1996-present Academic Affiliate, Greylock McKinnon Associates

1993-1994 Analyst, Health Economics Research, Inc./The Center for Health Economics Research

1990-1993 Consultant, Price Waterhouse, Tax Economics Department

SERVICE:

2016-present	Member, Massachusetts Center for Health Information and Analysis Oversight Council
2013-2017	Board Chair, Massachusetts Health Quality Partners
2007-2016	Member, Massachusetts Public Health Council
2005	Expert Testimony, House Committee on Education and Workforce, House Subcommittee on Employer-Employee Relations, Hearing on Examining Pay-for-Performance Measures and Other Trends in Employer-Sponsored Health Care
2003	Expert Testimony, Senate Special Committee on Aging, Hearing on Direct to Consumer Advertising of Prescription Drugs: Exploring the Consequences
2001	Chair, Massachusetts Special Commission on Physician Compensation

HONORS AND DISTINCTIONS:

2016	AcademyHealth Paper of the Year Award
2016	Harvard TH Chan School of Public Health Student Mentoring Award
2015	Harvard TH Chan School of Public Health Advancement of Women Faculty Mentoring Award
2014	Harvard School of Public Health Junior Faculty Mentoring Award
2011	Harvard School of Public Health Teaching Citation
2010	Academy of Management Best Theory to Practice Paper in Health Care Management
2006	Alfred P. Sloan Foundation Industry Studies Fellowship
2003	Labelle Lectureship in Health Policy, McMaster University

MAJOR ADMINISTRATIVE RESPONSIBILITIES:

2016-2018	University President's Task Force on Inclusion and Belonging
2012-2014	Harvard School of Public Health Faculty Council, Vice-Chair (2012)
2007-2014	Harvard School of Public Health Committee on Admissions and Degrees, Chair (2010)
2007	Co-Chair, Harvard School of Public Health Child Care Task Force
2006-2011	Harvard School of Public Health Committee on the Concerns of Women Faculty
2000-present	Executive Committee on Higher Degrees in Health Policy, Harvard University
1999-present	Admissions Committee, Ph.D. Program in Health Policy, Harvard University

EDITORIAL ACTIVITIES:

1997-present Referee: *Journal of Health Economics*, *Inquiry*, *Health Services Research, Health Affairs, Journal of the American Medical Association, New England Journal of Medicine, and others*

2012-2015 Member, *New England Journal of Medicine*, Perspective Advisory Board

2008-2014 Associate Editor, Medical Care, Research and Review

1997-1998 Assistant Editor, Evidence-based Health Policy and Management

MAJOR RESEARCH INTERESTS:

1. Market-oriented health policy
2. Physician payment incentives
3. Consumerism and consumer-directed health plans
4. Economics of the pharmaceutical industry

RESEARCH SUPPORT:

Past Funding:

2015-2021 Accelerating the Use of Evidence-based Innovations in Healthcare Systems, AHRQ, *Principal Investigator*

2016-2021 Identifying Cascades of Low-Value Care and the Organizational Practices that Prevent Them, AHRQ, *Co-Investigator*

2016-2018 Generic Drug Pricing: Actionable Research for Policy, Commonwealth Fund, Principal Investigator

2015-2017 Improving the Value of Health Care Choices, Arnold Foundation, *Principal Investigator*

2012-2017 Optimizing Ambulatory Patient Safety in Partnership with Primary Care Transformation, HMS Gift/CRICO, *Co-Principal Investigator*

2016-2017 Physician Payment in ACOs, Arnold Foundation, *Principal Investigator*

2013-2015 Understanding the Use and Impact of Price Data in Health Care, RWJF, *Co- Investigator*

2013-2015 Impact of Price Transparency Tools on Consumer Behavior, RWJF, *Co- Investigator*

2013-2015 Getting the Complete Picture: What Does the Body of Research on the Patient-Centered Medical Home Really Tell Us? CMWF, *Principal Investigator*

2013-2015 Prevalence and Variation in Over-Use of Health Services in Commercially Insured Patients, Peter G. Peterson Foundation, *Principal Investigator*

2013-2015 Measuring Overuse of Health Care: Are Providers and Patients 'Choosing Wisely'?, CMWF, *Co-investigator*

2013-2014 Prevalence and Variation in Over-Use of Health Services in Medicare: Choosing Wisely, RWJF, *Co-investigator*

2012-2015 Evaluating Sequential Strategies to Reduce Readmission in Diverse Populations, AHRQ, *Co-investigator*

2010-2014 Factors Associated with Effective Implementation of a Surgical Safety Checklist, AHRQ (R18), *Co-investigator*

2010-2014 A Randomized Trial of Behavioral Economic Interventions to Reduce CVD Risk, NIA (RC4), *Co-investigator*

2008-2010 Rewarding Quality Diabetes Management, RWJF/Hudson Health Plan, *Principal Investigator*

2008-2009 Effects of High-Deductible Health Plans on Families with Chronic Conditions, RWJF/Harvard Pilgrim Healthcare Plan, *Co-Investigator*

2008-2008 Implications of Value-Based Purchasing for Health Disparities: A Synthesis of the Evidence, Office of Minority Health, Department of Health & Human Services, *Principal Investigator*

2008-2008 Payment Reform Opportunities for Medicaid Programs, University of Pittsburgh, *Principal Investigator*

2007-2009 Changes in Health Care Financing and Organization: How does Fragmentation of Care Contribute to the Costs of Care? RWJF/HCFO, *Co-investigator*

2006-2008 Evaluating the Impact of a Novel Pay for Performance Program in a Medicaid Managed Care Plan, The Commonwealth Fund, *Principal Investigator*

2006-2008 Sloan Industry Studies Fellowship for Meredith Rosenthal, Alfred P. Sloan Foundation, *Principal Investigator*

2005-2008 Incentive Formularies and the Costs and Quality of Care, Agency for Healthcare Research and Quality, *Co-investigator*

2005-2007 Strategies to Improve the Value of Health Benefit Spending for Low-Wage Workers, The Commonwealth Fund, *Principal Investigator*

2005–2007 Uptake and Impact of Health Risk Appraisals, RWJ Health Care Financing and Organization Initiative, *Principal Investigator*

2003-2007 The Patterns and Impact of Value Based Purchasing, Agency for Healthcare Research and Quality, *Co-investigator*

2002-2007 Coverage, Organization of Care, and Colorectal Screening, National Institutes of Health, *Co-investigator*

Current Funding

2019-2022 Price, Spending and Utilization Impacts of Vertical Integration in Massachusetts, Laura and John Arnold Foundation

2018-2022 Generic cancer drugs: pricing and affordability, American Cancer Society

In this study there will be extensive conducting of empirical research using pharmaceutical data and analyzing economic and policy issues related to health care cost control.
Role: Co-Investigator

TEACHING EXPERIENCE

2021-present Health Policy 2000: Core Course for the PhD Program in Health Policy

2016-present Health Policy and Management 260: Health Economics with Applications to Global Health Policy

2003-present Health Policy and Management 209: Economics for Health Policy

2013-2014 Global Health and Health Policy 50 (Harvard College): The Quality of Care in the United States

1999-2001 Health Policy and Management 507: Mental Health Economics and Policy in the United States

BIBLIOGRAPHY

Peer-Reviewed Articles

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4. **Rosenthal MB**. Risk sharing and the supply of mental health services. *Journal of Health Economics*. 2000 Nov;19(6):1047-65.
5. Cutler DM, Epstein AM, Frank RG, Hartman RS, King C, Newhouse JP, **Rosenthal MB**, Vigdor ER. How good a deal was the tobacco settlement?: Assessing payments to Massachusetts. *Journal of Risk and Uncertainty*. 2000;21(2/3):235-61.
6. **Rosenthal MB**, Frank RG, Buchanan JL, Epstein AM. Scale and structure of capitated physician organizations in California. *Health Affairs*. 2001 Jul-Aug;20(4):109-19.
7. **Rosenthal MB**, Landon BE, Huskamp HA. Managed care and market power: Physician organizations in four markets. *Health Affairs*. 2001 Sept-Oct;20(5):187-93.
8. Frank RG, **Rosenthal MB**. Health plans and selection: Formal risk adjustment vs. market design and contracts. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*. 2001 Fall;38(3):290-8.

9. Cutler DM, Gruber J, Hartman RS, Landrum ME, Newhouse JP and **Rosenthal MB.** The economic impacts of the tobacco settlement. *Journal of Policy Analysis and Management*. 2002 Winter; 21(1):1-19.

10. **Rosenthal MB**, Berndt ER, Donohue JM, Frank RG, and Epstein AM. Promotion of prescription drugs to consumers. *New England Journal of Medicine*. 2002 Feb; 346(7):498-505.

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In re Loestrin 24 Fe Antitrust Litigation, (all actions), United States District Court for the District of Rhode Island, MDL No. 2472, C.A. No. 1:13-md-2472-S-PAS.

In Re National Prescription Opiate Litigation, United States District Court for the Northern District of Ohio, Eastern Division, MDL No. 2804, Case No. 17-md-2804.

In re Niaspan Antitrust Litigation, United States District Court for the Eastern District of Pennsylvania, MDL No. 2:13-md-2460.

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Government Employees Health Association v. Actelion Pharmaceuticals LTD., et. al., United States District Court for the District of Maryland, Case No. 18-cv-3560-GLR

ATTACHMENT B

ATTACHMENT B: Materials Relied Upon

Legal Documents

Settlement Agreement Among Third Party Payors and McKinsey Defendants, *IN RE: McKinsey & CO., INC. National Prescription Opiate Consultant Litigation*, United States District Court, Northern District of California (Case No. 21-md-02996-CRB (SK)

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Electronic Data

Centers for Disease Control and Prevention (CDC), morphine milligram equivalents conversion.

Drug Enforcement Agency, Automatic of Reports and Consolidated Orders System (ARCOS)

Kaiser Family Foundation, State Health Facts (KFF)

EXPERT REPORT OF PROFESSOR MEREDITH ROSENTHAL

ATTACHMENT C: TECHNICAL APPENDIX

I. METHODS

1. The contents of this technical appendix detail the econometric model used to estimate annual multipliers reported in Table 1 of my report.

A. Econometric Model

2. My econometric model uses a panel data regression to estimate the impact of differing state-level TPP exposure to opioid marketing. As described in my report, I rely on Dennett and Gonsalves (2023) to categorize states into three levels of opioid marketing exposure (low, medium, and high), which the authors show are strongly associated with wholesale opioid shipments over the long run.[1]

3. Formally, the model I estimate is as follows:

$$\boldsymbol{MMEs_{st} = \beta_0 + \beta_1 HighExposure + \beta_2 MediumExposure + \beta_3 Exposure_t \times t + \gamma_t + \beta_i X_i + \epsilon_{st}}$$

where:

MMEs are the per capita number of MMEs shipped to state *s* in year *t.*

HighExposure is a time-invariant indicator for states that were exposed to a high level of opioid marketing.

MediumExposure is a time-invariant indicator for states that were exposed to a medium level of opioid marketing.

Exposure × *t* is a set of interactions between years and state exposure level.

γ denotes year fixed effects.

X is a vector of *i* demographic characteristics for each state and year.

4. All regression estimates are population-weighted, and I cluster standard errors at the state level. Table A1 shows the regression results. The data used in the model are detailed in section IV.B of my report.

[1] J.M. Dennett and G.S. Gonsalves, "Early OxyContin Marketing Linked to Long-Term Spread of Infectious Diseases Associated with Injection Drug Use," *Health Affairs*, 42(8), 2023, pp. 1081-1090.

Table A1 – Regression Results

	Regression Coefficient	Clustered S.E.
Exposure Level		
Medium	**41.65**	(88.99)
High	**199.63**	(121.44)
Year		
2010	**6.86**	(40.06)
2011	**35.09**	(58.52)
2012	**54.01**	(60.12)
2013	**40.28**	(64.23)
2014	**52.49**	(74.65)
2015	**73.78**	(86.38)
2016	**77.62**	(100.37)
2017	**55.26**	(113.37)
2018	**26.60**	(125.42)
2019	**28.12**	(138.8)
Interactions		
M x 2010	**51.74***	(30.15)
M x 2011	**75.44****	(34.26)
M x 2012	**102.19****	(42.3)
M x 2013	**110.59****	(45.05)
M x 2014	**118.81****	(50.05)
M x 2015	**104.08***	(58.36)
M x 2016	**95.93**	(61.72)
M x 2017	**96.58**	(65.21)
M x 2018	**84.09**	(67.01)
M x 2019	**110.97**	(77.17)
H x 2010	**76.44*****	(45.02)
H x 2011	**83.83***	(92.11)
H x 2012	**60.11**	(112.02)
H x 2013	**62.22**	(120.53)
H x 2014	**88.65**	(121.94)
H x 2015	**93.83**	(116.84)
H x 2016	**101.99**	(114.15)
H x 2017	**106.35**	(118.17)
H x 2018	**89.48**	(129.42)
H x 2019	**101.52**	(17.54)
Demographics		
Poverty Rate	**27.81**	(17.54)
Age		
Under 18	**-2081.13**	(2039.27)
19 - 25	**2847.91**	(8185.33)
26 - 34	**-4774.96**	(5.06)
35 - 54	**2587.69**	(3.75)
55 - 65	**139.42**	(5.03)
Race		
Percent Hispanic	**-10.32****	5.06
Share White, Non-Hisp.	**-2.61**	3.75
Share Black, Non-Hisp.	**-6.09**	5.03
Constant	**828.33**	2443.17
Observations	**561**	

Note: State clustered Standard Errors reported in parentheses. Significance at 10% (*), 5% (**), and 1% (***).

5. Table A1 shows the results of my econometric model for the years 2009 – 2019 using states with low opioid marketing as the reference group. The estimation results are consistent with Dennett and Gonsalves (2023) as well as the ARCOS shipment data presented in Figure 1 of my report. Relative to states with low marketing exposure, medium and high exposure states are correlated with higher shipments of MME per capita. The year and exposure interaction coefficients show that the inverse-U time trend of MMEs per capita holds for medium and high exposure states, with high exposure states having higher MMEs shipments at all points during the analysis period.

6. I then use the estimated coefficients for the medium and high exposure levels, the year variables, and the interactions to estimate an adjusted MMEs per capita series for each year and state. Specifically, I add the exposure, year, year-exposure interaction coefficients to the adjusted mean[2] 2009 MMEs per capita for low exposure states together, by exposure category. The adjusted MMEs per capita are presented in Table A2.

Table A2 - Adjusted MMEs per Capita

Year	Adjusted Low Exposure MME's per Capita	Adjusted Medium Exposure MME's per Capita	Adjusted High Exposure MME's per Capita
2009	737.7	788.3	946.3
2010	744.5	846.9	1029.6
2011	772.8	898.8	1065.2
2012	791.7	944.5	1060.4
2013	778.0	939.1	1048.8
2014	790.2	959.6	1087.4
2015	811.5	966.1	1113.9
2016	815.3	961.8	1125.9
2017	792.9	940.1	1107.9
2018	764.3	899.0	1062.3
2019	765.8	927.4	1075.9

[2] I calculate the adjusted mean MMEs per capita for 2009 in low exposure states by using the predict function in Stata after running the model described above and resetting the data so that all observations reflect 2009 and low exposure.

7. I then compute the ratio of adjusted MMEs per capita in medium and high exposure states as compared to low exposure states, resulting in the ratios seen in Table 1 of my report. Exposure groups and their respective states are presented in Table A3.

Table A3 – Exposure Groups

Low Exposure	Medium Exposure	High Exposure
Alaska	Connecticut	Alabama
Arizona	Indiana	Arkansas
California	Kansas	Delaware
Colorado	Louisiana	Florida
Georgia	Maryland	Iowa
Hawaii	Michigan	Kentucky
Idaho	Mississippi	Maine
Illinois	Montana	Massachusetts
Minnesota	Nebraska	Missouri
Nevada	New Hampshire	New Jersey
New Mexico	North Carolina	Ohio
New York	North Dakota	Oklahoma
South Carolina	Oregon	Pennsylvania
Texas	South Dakota	Rhode Island
Utah	Wisconsin	Tennessee
Vermont		Washington D.C.
Virginia		West Virginia
Washington		
Wyoming		