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AND EYEGLASSES SPENDING AMONG
DUAL-ELIGIBLE MEDICARE ENROLLEES

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When Medicaid Pays the Bill: Routine Vision Benefits, Eye Care Use, and Eyeglasses Spending
Among Dual-eligible Medicare Enrollees

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ABSTRACT

Vision problems are prevalent among Medicare beneficiaries, with the majority having treatable conditions including uncorrected refractive error and cataracts. However, traditional Medicare does not cover routine eye exams or eyeglasses, and Medicare Advantage supplemental vision benefits often include low annual limits. We examine the effects of Medicaid routine vision benefits among adults dually eligible for Medicare and Medicaid, a population with high rates of vision impairment, morbidity, and disability. Using 2002-2019 Medicare Current Beneficiary Survey data and a difference-in-differences design, we estimate that Medicaid routine vision benefits increase past-year eye exams, eyeglasses purchases, and Medicaid spending on eyeglasses while reducing out-of-pocket spending. We also find suggestive evidence of spillovers to Medicare Advantage spending on eyeglasses, consistent with Medicaid routine vision coverage inducing additional eyeglasses purchases among Medicare Advantage enrollees with supplemental vision benefits, although estimates are modest.

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1. INTRODUCTION

Uncorrected refractive error is the leading cause of visual impairment in the United States (Vitale et al., 2006; Varma et al. 2016). Vision loss is associated with adverse consequences including loneliness and depression (e.g., Zhang et al., 2008; Coyle et al., 2017), cognitive impairment (e.g., Swenor et al., 2019; Zheng et al., 2018), falls and hip fractures (e.g., Ehrlich et al., 2019), and increased mortality (e.g., Karpa et al., 2009). Appropriate refractive correction could lead to clinically meaningful improvements in vision for 72 percent of people with visual impairment and 22 percent of those with blindness (Varma et al., 2016),¹ yet two in five adults with vision difficulties do not see an eye care professional (Saydah et al., 2020) with cost among the most commonly cited barriers to care (Elam and Lee, 2014).

This issue is particularly salient for Medicare beneficiaries, for whom vision problems are common but coverage for routine vision care is limited. Although 92% of Medicare beneficiaries ages 65 and older use vision correction, 39% of Medicare enrollees who use vision correction report trouble seeing even when wearing eyeglasses, and 42% of Medicare enrollees who report trouble seeing had not had an eye exam in the past 12 months (e.g., Otte et al., 2018; Willink et al. 2020). Medicare enrollees are also less likely to have routine vision coverage: 26 percent of Medicare beneficiaries have vision benefits compared with 32 percent of adults overall (Willink et al., 2020).²

In this paper, we focus on a subset of Medicare beneficiaries—those who are dually eligible for Medicare and Medicaid (“dual eligibles”). Dual eligibles experience higher rates of functional limitations than the general Medicare population, including quadruple the rate of vision impairment (Hamedani et al., 2020). Full-benefit dual eligibles may receive Medicaid-covered services that are

¹ Visual impairment, generally defined as distance visual acuity of worse than 20/40 in the better-seeing eye, affects about 10% of people ages 65-75 and 20% of people ages 75 and older (Wang et al. 2014).

² Healthsure Hub. “Vision Insurance Statistics: Coverage Rates, Costs, and Trends.” <https://healthsurehub.com/vision-insurance-statistics/>. Viewed June 19, 2026.

not covered by Medicare, including routine vision services in some states. In 2022, 30 state Medicaid programs covered routine eye exams and eyeglasses for adults (Lipton et al., 2024). At the same time, a growing share of dual eligibles are enrolled in Medicare Advantage (MA), where nearly all plans currently provide some supplemental vision coverage, albeit often with limitations such as annual spending maximums.³ Little is known about how state Medicaid benefit design affects healthcare utilization and spending among dual eligibles, or the extent to which these state-level decisions interact with MA supplemental benefits.

We examine the impacts of state-level Medicaid routine vision benefits among dual eligibles using difference-in-differences methods and 2002-2019 data from the Medicare Current Beneficiary Survey (MCBS). We assess eye care visits, use and purchases of eyeglasses, and spending on eyeglasses by payer source, including out-of-pocket, Medicaid, traditional Medicare, and MA spending. We also examine whether Medicaid vision benefits affect enrollment in MA plans, including MA plans with supplemental vision benefits.

State-level Medicaid coverage of routine vision benefits is expected to increase eye care use.⁴ Prior evidence from other settings and populations shows that gaining routine vision coverage increases eye exams and reduces unmet need for eyeglasses (e.g., Lurie et al., 1989; Lipton and Decker, 2016). We provide the first evidence of the effects of routine vision coverage for dual eligibles. We find that Medicaid routine vision benefits increase the likelihood of having an eye exam in the past year by 6.4 percentage points, or 13%, and increase the likelihood of having an office visit with an optometrist by 4.2 percentage points, or 33%. Medicaid vision benefits also increase self-reported current use of eyeglasses by 4.7 percentage points, or 6%, and past-year eyeglasses

³ The average dollar limit on vision coverage in MA plans was \$160 in 2021; and 45 percent of MA enrollees were in a MA plan with an annual maximum of \$100 or less (KFF 2021).

⁴ According to data from KFF, Medicare enrollees who used vision services in 2018 had average out-of-pocket spending of \$230 (KFF 2021). Since Medicaid generally offers low or no cost sharing for covered services, out-of-pocket costs could decline considerably among full-benefit dual eligibles when states offer routine vision benefits.

purchases by 5.9 percentage points, or 32%. In analyses by benefit generosity, point estimates are consistently larger in states that cover eye exams and eyeglasses more frequently, defined as less than two years between covered services, than in states with less frequent coverage. These findings indicate that Medicaid routine vision benefits meaningfully increase access to routine eye care and eyeglasses among dual eligibles.

We also consider the effect of Medicaid routine vision coverage on the incidence and amount of eyeglasses spending by source; eyeglasses comprise 80 percent of the cost of refraction (Vitale et al., 2006). Medicaid spending should increase when states add benefits, while effects on out-of-pocket spending are theoretically ambiguous. Out-of-pocket spending should fall among enrollees who would have purchased similarly priced eyeglasses even in the absence of the policy. On the other hand, out-of-pocket spending may increase if enrollees upgrade to more expensive lenses or frames or if some eyeglasses purchases occur among enrollees who would not have purchased them in the absence of the policy.⁵ We find that Medicaid vision benefits increase Medicaid spending on eyeglasses and reduce out-of-pocket spending, including both the likelihood of any spending and continuous spending. Medicaid vision benefits are associated with a 4.4 percentage point increase in any Medicaid spending on eyeglasses and a marginally significant 1.6 percentage point reduction in any out-of-pocket spending. The smaller decline in any out-of-pocket spending is consistent with offsetting effects among enrollees whose spending declines and those newly induced to purchase eyeglasses. We also estimate that Medicaid vision benefits increase continuous Medicaid spending by 184%, reduce out-of-pocket spending by 25%, and increase total

⁵ Most state Medicaid programs that cover eyeglasses include a small copayment (Lipton et al., 2024). Since Medicaid cost sharing is typically very low, between \$1 and \$3 for eyeglasses, Medicaid routine vision benefits may increase the likelihood of any out-of-pocket spending among some enrollees with more modest effects on out-of-pocket spending amounts. However, as noted, if Medicaid vision benefits induce enrollees to purchase lenses or frames beyond what Medicaid fully covers, effects on out-of-pocket spending amounts could be larger. To our knowledge, this paper provides the first evidence on the relationship between Medicaid routine vision benefits and spending outcomes.

spending from all sources by 35%. Although Medicaid spending on eyeglasses increases substantially in relative terms, average Medicaid spending per enrollee remains modest, reflecting relatively low rates of Medicaid-paid eyeglasses purchases.

While Medicaid routine vision coverage is expected to have direct effects on Medicaid and out-of-pocket spending on eyeglasses, there could also be cross-program spillovers to traditional Medicare and MA. Traditional Medicare only covers eyeglasses following cataract surgery with an intraocular lens implant, and we find no evidence of increases in such spending.⁶ Expected effects on MA spending are theoretically ambiguous. Since MA supplemental benefits often do not cover the entire cost of an eye exam and eyeglasses, Medicaid routine vision benefits could increase use by reducing enrollee costs, leading to higher MA spending.⁷ Alternatively, MA supplemental benefits may become less valuable to dual eligibles when similar benefits are offered through Medicaid, which may reduce MA enrollment and thus MA spending. Across models, we estimate a modest, 0.4-0.5 percentage point increase in the likelihood of any MA spending on eyeglasses, which is statistically significant in models without time-varying state controls ($p < 0.01$), and marginally significant in our preferred model with all controls ($p < 0.10$). However, we note that only 27% of duals were enrolled in MA during our study period and only 1.3% had any MA spending on eyeglasses on average. We find no evidence that dual eligibles are less likely to enroll in MA or MA plans with supplemental vision benefits when states offer Medicaid routine vision coverage. These findings are consistent with changes in use among MA-enrolled beneficiaries rather than selection into MA.

⁶ Medicaid vision benefits could increase traditional Medicare spending on eyeglasses by increasing screening and diagnosis of cataracts, thereby increasing cataract surgeries. However, we note that we may be underpowered to detect such an effect given the relatively low prevalence of cataract surgery in any given year. Though cataract surgery is the most commonly performed surgical procedure covered by Medicare, only about 6 percent of Medicare beneficiaries have cataract surgery in a given year (Schein et al., 2012).

⁷ MA spending would be expected to increase in this case since Medicaid acts as a payer of last resort. See for example: <https://www.macpac.gov/subtopic/third-party-liability/>

Event study analyses generally support the interpretation of our main utilization and spending findings and do not provide evidence of violations of the parallel trends assumption for most primary outcomes. Sensitivity analyses that vary the study period, use alternative difference-in-differences estimators that are robust to dynamic and heterogeneous treatment effects, and conduct leave-one-out analyses, among others, are also supportive of our main results. Finally, in an exploratory extension analysis, we also find positive point estimates for diagnoses of selected systemic health conditions that may present with ocular signs, including hypertension, hypercholesterolemia, and cardiovascular disease.⁸

This paper contributes to several strands of literature. First, our work builds on previous research on the impacts of vision insurance on healthcare use and health (Lurie et al., 1989; Lipton & Decker, 2015; Lipton & Decker, 2016; Boudreaux & Lipton, 2021; Chen et al., 2020) by providing the first evidence on the effects of Medicaid routine vision benefits among dual eligibles, a high-need population with complex coverage. Second, we contribute to literature that examines the impacts of Medicaid eligibility and reimbursement policies on healthcare use and spending among the Medicare-enrolled population (McInerney et al., 2017; Barkowski et al., 2025; Carey et al., 2020; McInerney et al., 2022; Mellor et al., 2023; Cabral et al., 2025; Hayford et al., 2025) by examining how optional Medicaid benefits shape access to services that remain largely outside of traditional Medicare coverage. Finally, we contribute to research examining spillovers between MA and other insurers (Baicker et al., 2015; Chen et al., 2022; Atherly and Dowd, 2005) by examining how Medicaid benefits interact with MA supplemental benefits in the dual-eligible population.

⁸ For example, recent work shows that analyzing retinal images can help providers diagnose vascular health conditions because the blood vessels in the retina are susceptible to changes arising from cardiovascular disease and can be early predictors of systemic vascular conditions (Singh et al., 2020). Retinal imaging has been shown to predict whether a patient will experience a heart attack (Reddy et al., 2025). The appearance of the veins and arteries in the eye can identify high blood pressure (Bhargava et al., 2011), and high cholesterol can present as a white or gray ring around the iris (Ozbilgin and Kurnaz, 2022).

2. BACKGROUND

2.1 Medicare and Medicaid Vision Benefits

Table 1 provides a summary of coverage for routine eye care and cataract surgery in traditional Medicare, MA, and Medicaid. Traditional Medicare offers no coverage for routine eye exams, refraction, corrective lenses, or low vision devices (e.g., video magnifiers, loupes), but most MA plans do currently cover these services with differences in plan limits and cost-sharing requirements across plans. Most (93%) MA plans include both eye exams and eyeglasses/contacts (KFF, 2021), although the proportion of plans offering these benefits has grown over time (McCormack et al., 2023).

Among MA enrollees with supplemental vision benefits, 99% are in plans with annual dollar limits, and just under half are subject to an annual limit of \$100 or less (KFF, 2021). Among Medicare enrollees with any use of vision services, average out-of-pocket spending was lower among MA enrollees than among traditional Medicare enrollees, yet still substantial (\$194 vs. \$242) (KFF, 2021). One analysis found that MA enrollees were no more likely to use vision services than enrollees in traditional Medicare (Cai et al., 2025), and about 62% of the total costs of vision care are paid out of pocket, even among Medicare beneficiaries with some form of vision coverage (Willink et al., 2020).

While all state Medicaid programs are required to cover eye exams and eyeglasses for Medicaid enrollees up to age 20 under the Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) benefit, coverage for adults ages 21 and older is an optional benefit. In 2022, 30 state Medicaid programs covered routine eye exams and eyeglasses for adults (Lipton et al., 2024). States vary in

how often Medicaid covers services, whether beneficiaries are responsible for any out-of-pocket costs, and whether lost or broken eyeglasses are replaced.⁹

Traditional Medicare and MA both cover cataract surgery and post-surgery eyeglasses after an intraocular lens transplant, which includes the majority of surgeries (Javitt and Steinert 2000). Traditional Medicare covers 80 percent of Medicare-approved costs. MA also covers these benefits, but cost-sharing amounts differ by plan. In terms of dual eligibles, state Medicaid programs cover Medicare Part B cost sharing amounts for Medicare-covered services, although the amount that Medicaid is responsible for depends on Medicaid reimbursement rates and whether the state has a “lesser of” policy in place (Roberts 2020).

2.2 Previous Evidence on the Impacts of Vision Coverage and Related Policies

Research indicates that vision insurance is associated with increases in the use of vision care and improved vision. Some of the most compelling evidence comes from the RAND Health Insurance experiment, a randomized controlled trial of the effects of cost sharing conducted between 1971 and 1982. The results suggested that the likelihood of an annual eye exam was about 32% higher for low-income participants with free eye care compared to those subject to cost sharing (Lurie et al. 1989). Further, participants with free eye care experienced significant improvements in both distance and near vision, with vision being one of the few health outcomes that was found to respond to lower cost sharing (Lurie et al. 1989). In terms of more recent, quasi-experimental research, one

⁹ Medicaid managed care plans are generally required to provide at least the same level of services as in the state fee-for-service plan, unless benefits are carved out of managed care and provided directly by the state. Some plans may provide additional benefits that exceed the state’s coverage. In our recent analysis of the largest Medicaid managed care plans in each state (Lipton et al. 2024), we found that some managed care plans in states with no fee-for-service eyeglasses coverage provided benefits, although eyeglasses coverage was generally not uniform across plans and/or only partially covered typical costs (e.g., \$100 toward the costs of refraction).

analysis found that the ACA's Medicaid expansion was associated with an increase in dilated eye exams among adults with diabetes (Chen et al. 2020).

A small number of papers examine the impacts of state-level Medicaid routine vision benefits using quasi-experimental research methods. This research suggests that routine vision benefits are associated with a 4.4 percentage point, or 17%, increase in past-year eye exams, 5.3 percentage point, or 28%, reduction in unmet needs for eyeglasses due to cost, and improvements in self-reported vision difficulties and exam-based measures of distance visual acuity (Lipton & Decker 2015; Lipton & Decker 2016). There is also evidence to suggest that increased access to Medicaid-covered vision correction increases usual hours worked by about 6% and leads to a shift toward higher-skilled occupations among Medicaid-enrolled adults (Boudreaux & Lipton 2021). Finally, research indicates that when states add routine vision benefits for adults, there are small spillovers to children's eye care use among those with Medicaid-enrolled parents (Lipton 2021). This prior research focuses on younger adults without Medicare-qualifying disabilities and children.

We contribute to this relatively small body of work by examining the dual eligible population. We are also among the first to examine how Medicaid routine vision benefits affect eyeglasses spending and the distribution of spending across payers. Given the high prevalence of vision problems, morbidity, and disability among dual eligibles, and supplemental vision benefits for many MA enrollees, the magnitude of impacts on eye care use is an empirical question. Moreover, while dual eligibles differ from non-dual Medicare enrollees in important ways, these estimates may contribute to our understanding of the potential impacts of including routine vision benefits in traditional Medicare.

3. DATA AND METHODS

3.1 State Medicaid Routine Vision Coverage Policies

We collected information on state Medicaid coverage of routine vision benefits during our analysis period from several sources including: WestLaw’s state codes and regulations, state plan amendments submitted to the Centers for Medicare and Medicaid Services, state Medicaid provider manuals and websites, and KFF databases and semiannual reports based on surveys of state Medicaid administrators. Our focus was on coverage of routine eye exams that included refraction and eyeglasses for correction of refractive error including the frequency with which coverage was provided.¹⁰ We generally prioritized administrative and legal sources where there were inconsistencies, but we made exceptions if language was ambiguous and/or if multiple sources were in disagreement with a given administrative source.

We obtained policy effective dates from state plan amendments, which were available in most states in 2010 and later years. We also used dates reported in KFF’s twice yearly reports and other resources where available. When an exact date was not available, we assumed that policies were implemented at the beginning or in the middle of each state’s fiscal year, depending on source publication dates. Similar to previous research, we classified states as providing coverage if they covered routine eye exams and eyeglasses, and as not providing coverage if they covered exams only or neither service.¹¹ We included exam only coverage with no routine coverage because eyeglasses comprise the majority of the costs of refraction. In sensitivity analyses, we consider alternative specifications that categorize exam only coverage with exam and eyeglasses coverage, control for exam only coverage, or exclude exam only coverage state-years. In extension analyses, we also

¹⁰ We also collected information on replacements for lost or broken eyeglasses, minimum diopter correction thresholds for eyeglasses coverage, copays for exams and/or eyeglasses, and low vision aids coverage, where available. However, information on these parameters was more sparse and we generally were not able to precisely identify the timing of within-state changes.

¹¹ One exception is Maine where eyeglasses are covered once per lifetime for Medicaid-enrolled adults, which we classify as not offering coverage. This policy is consistent throughout our study period and therefore Maine only serves as a control state in our analysis.

distinguish between states with more frequent coverage, defined as coverage more often than every two years, and less frequent coverage, defined as coverage every two years or less often. States that limited benefits to children and adults up to age 20, enrollees with symptoms of eye disease or eye injury, or specific priority groups, such as pregnant people or nursing home residents, were not considered as providing routine coverage.

Figure 1 illustrates changes in Medicaid routine vision benefits during 2002-2019. We exclude the District of Columbia in all analyses because it is the only jurisdiction that covers eyeglasses but not exams. In 2002, 35 states covered exams and eyeglasses, 7 states covered exams only, and 8 states covered neither service. The majority of states that cover exams and eyeglasses only provide coverage every 2 or more years (e.g., in 2002, 25 states only offered benefits every two or more years and ten states offered more frequent coverage).

States both added and dropped benefits during this period, particularly during 2002-2012. Table 2 lists the dates of each policy change. In total, 13 states changed their policies between 2002-2019, although we do not consider the brief, less than one-year duration coverage drop in Kansas as a policy change in any of our analyses and exclude observations from Kansas in the year 2003 (and include Kansas in the control group in all analyses).

3.2 The Medicare Current Beneficiary Survey

The Medicare Current Beneficiary Survey (MCBS) is a national, four-year rotating panel that is representative of Medicare enrollees. The survey measures sources of health insurance coverage, healthcare access, expenditures, and sources of payment. The sample is drawn from enrollees as of January of the year prior to the survey, with a supplemental sample added each year to account for growth in the Medicare population and to replace respondents who left the survey during the previous year. Respondents include Medicare enrollees of all ages, which is important for capturing

the dual eligible population since 35 percent of dual eligibles are under age 65 (MedPAC and MACPAC, 2025). MCBS data can be analyzed as repeated cross sections or longitudinally using weights provided by MCBS. We analyze the data as repeated cross sections because respondents participate for a maximum of four years and because relatively few respondents are observed both before and after policy changes in treatment states.

MCBS underwent a redesign and was not fielded in 2014, although most content from previous years was retained and considered to be comparable over time. During 2002-2013, MCBS consisted of two main files: access and cost and use. Similarly, during 2015 and later years, MCBS consisted of a survey file and a cost supplement file. Respondents in the cost and use/cost supplement files are a subset of all access/survey file respondents. While comparable measures are available across the two periods in both files, consistent cross-sectional weights are only available for the access/survey file. For this reason, we restrict our main analysis to the 2002-2019 access/survey files and 2002-2013 cost and use files. The years 2002 through 2013 capture most of our identifying variation in Medicaid routine vision coverage policies (Table 2).

The cost and use files combine fee-for-service Medicare claims, self-reported information, and imputation to identify spending on outpatient, inpatient, and facility events. Fee-for-service Medicare payments are extracted from claims. Respondents are asked to report out-of-pocket payment amounts and amounts covered by other insurers, and MCBS uses logical imputation to assign payment sources and amounts where this information is not available. More details can be found in official MCBS documentation.¹²

Our primary outcomes include survey-reported and claims-enhanced measures of eye care use and spending. Survey-reported outcomes from the access (2013 and earlier years) and survey files (2015 and later years) include past-year eye exam, and current eyeglasses use. Claims-enhanced

¹² <https://www.cms.gov/data-research/research/medicare-current-beneficiary-survey>. Viewed April 12, 2026.

outcomes from the cost and use files include optometrist visits; eyeglasses purchases; fee-for-service Medicare, Medicare Advantage, Medicaid, out-of-pocket, and total payments for eyeglasses, measured as both any and continuous spending. We include imputed spending amounts, but exclude a small number of observations with spending source imputation in our main analysis.

In extension and sensitivity analyses, we consider several other outcomes and definitions included in the survey/access file. We disaggregate eye exams into visits with optometrists and ophthalmologists using information available beginning in 2010 on provider type. We also examine self-reported trouble seeing with usual vision correction, including any and severe difficulty, since increased access to eyeglasses may improve vision. However, we include these results in an appendix because prior work shows that self-reported vision is limited in its prediction of objective visual acuity (e.g., Potter et al., 2024).

Finally, we examine whether respondents reported being told in the past year¹³ that they had selected systemic health conditions that often present with characteristic changes to retinal blood vessels, the iris, or the cornea. Blood vessels in the retina are susceptible to changes arising from cardiovascular disease and can be early predictors of systemic vascular conditions (Singh et al., 2020). Therefore, we examine the outcomes of hypertension (2002-2013), hypercholesterolemia (2006-2013), and heart disease (2002-2013). We selected these conditions based on consistent availability in MCBS and the fact that they had past-year reference periods (instead of some variables in the MCBS which ask if the respondent was “ever told”).

3.3 Sample

The main analysis sample includes MCBS respondents ages 21 and older who are dually enrolled in Medicare and Medicaid. We use an administrative flag for Medicaid enrollment at any time during

¹³ These questions refer to the past year but do not necessarily capture first time diagnoses.

the previous year to define dual status. We exclude participants under age 21 because all states cover routine vision services for Medicaid enrollees ages 20 years and younger under the Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) benefit. We include dual eligibles under age 65 given that they comprise 35 percent of the total dual population and also have high rates of vision impairment.¹⁴ Only full-benefit dual eligibles are entitled to Medicaid routine vision benefits in states that offer them. However, full-benefit dual status cannot be identified in MCBS until 2009. We therefore include all dual eligibles in our main analysis and restrict to full-benefit dual eligibles observed in 2009 and later years in a sensitivity analysis. About 74% of all dual eligibles are full-benefit dual eligibles (MedPAC and MacPAC, 2025). We also restrict the sample to community-dwelling adults. Only community-dwelling adults were asked our main access/survey file questions. We also limit our main analysis of the cost and use files to community-dwelling individuals for consistency since facility-dwelling dual eligibles may have different utilization responses, access, or Medicaid benefit rules for optional services.

We use data through 2019 in our analysis of survey file outcomes to avoid confounding due to the COVID-19 pandemic given evidence of depressed eye care utilization in these years (Li et al., 2023), although we include 2020 and 2021 in a sensitivity analysis. Since we only identified one instance where eyeglasses were covered but eye exams were not in the District of Columbia (DC), we exclude DC from our estimates. We also exclude respondents with missing information on any of the control variables used in our analysis. After making these exclusions, our main samples consist of 42,672 and 20,875 unweighted observations in the survey and cost and use files, respectively.

¹⁴ <https://www.cms.gov/medicare-medicare-coordination/medicare-and-medicare-coordination/medicare-medicare-coordination-office/downloads/2008nationalsummary.pdf>. Viewed June 19, 2026.

We examine results by subgroup including by age (under vs. over 65 years), sex (male vs. female), race and ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic), marital status (married, widowed/divorced/separated, never married), by whether the respondent reported ever being diagnosed with diabetes, and by whether the respondent reported that they ever had cataract surgery. We focus on access/survey file outcomes for subgroup analyses given larger sample sizes relative to the cost and use file.

Sample characteristics for the access/survey file and cost and use file are shown in Table 3. We also provide summary characteristics for all Medicare enrollees that participated in 2002-2019 access/survey interviews for comparison. First, we compare demographic characteristics for the duals in our main analysis sample (column 2) with all Medicare beneficiaries in the MCBS (column 1). Duals are younger, more likely to be female, less likely to be white, less likely to be married, and have lower levels of education than Medicare beneficiaries more generally. Comparing columns (2) and (3) shows that there are few notable differences in observable demographic characteristics among the duals in the two files, but since the cost and use variables are only available in the years 2002-2013, there are meaningful differences in state-level characteristics. In the earlier years, there are lower rates of Medicaid managed care penetration, MA penetration, and states had not yet implemented the ACA's Medicaid expansion.

3.4 Empirical Approach

To estimate the effects of Medicaid vision benefits on outcomes, our main analysis uses the following two-way fixed effects (TWFE) difference-in-differences regression model:

$$Y_{ist} = \beta_1 \text{VisionPolicy}_{st} + \beta_2 X_{ist} + \gamma_s + \tau_t + \varepsilon_{ist} \quad (1)$$

Where Y_{ist} represents the outcome of interest for individual i residing in state s during year t , and $VisionPolicy_{st}$ is equal to the share of the year in which the state covers routine vision benefits. X_{ist} represents individual demographic characteristics and time-varying state-level characteristics, γ_s represents state fixed effects, τ_t represents year fixed effects, and ε_{ist} is an error term. Individual demographic characteristics included in X_{ist} are age, sex, race and ethnicity, marital status, and educational attainment. Time-varying state-level variables include Medicaid managed care penetration rates (Centers for Medicare and Medicaid Services (CMS), KFF), Medicare Advantage penetration rates (CMS), unemployment rates (Bureau of Labor Statistics), ophthalmologists per capita (Area Health Resources File (AHRF)), federally qualified health centers per capita (Health Resources and Services Administration), state lesser of policies (Roberts 2020), and an indicator for the ACA's Medicaid expansion (KFF). State fixed effects account for time-invariant state-level factors that could be correlated with Medicaid vision benefits and outcomes and year fixed effects account for national outcome trends. We estimate ordinary least squares regressions for binary outcomes and Poisson pseudo-maximum likelihood regressions for continuous spending outcomes (Correia et al. 2019). We estimate models stratified by each subgroup characteristic to examine subgroup differences. All estimates are weighted using MCBS sampling weights and errors are clustered at the state level to account for serial correlation in the policy variable.

Our primary parameter of interest in equation (1) is $\widehat{\beta}_1$, which represents the impact of Medicaid routine vision benefits on outcomes and is interpreted in terms of benefit adoption. Our main analysis assumes that the impacts of adding and dropping benefits are symmetric, although we relax this assumption in an extension analysis. A critical assumption for a causal interpretation of the difference-in-differences estimate, $\widehat{\beta}_1$, is that outcome trends would have evolved similarly in treatment and control states in the absence of policy changes (i.e., parallel trends). We assess the

plausibility of this assumption by estimating event study models that replace the vision benefit policy indicator with a set of leads and lags of policy changes:

$$Y_{ist} = \sum_{j \neq j_r} \varphi_j I_{st}^j + \beta_1 X_{ist} + \gamma_s + \tau_t + \varepsilon_{ist} \quad (2)$$

Where j indexes event time (i.e., the number of years before and after a change in Medicaid routine vision benefits) and φ_j are event study coefficients on each of the leads ($j < 0$) and lags ($j \geq 0$). The reference period (j_r) includes 1-2 years prior to state policy changes. If estimates of φ_j for $j < 0$ in Equation (2) are statistically indistinguishable from zero, this would be supportive of the parallel trends assumption.

We group event study coefficients into two-year bins in all analyses to preserve power, particularly in our cost and use files analysis. Because states both added and dropped Medicaid routine vision benefits during the study period, we code event study indicators (I_{st}^j) so that positive coefficients correspond to benefit adoption. Specifically, event time indicators are coded as +1 for states adding benefits and -1 for states dropping benefits (Boudreaux & Lipton 2021; Lipton 2021), imposing symmetry between benefit additions and reductions, as is done in Equation (1). This approach preserves the timing of policy changes while allowing estimates to be interpreted in terms of coverage adoption.

Some states change their policies multiple times during our analysis period. In the event study analyses, we focus on the first and/or longest duration policy change. This serves both to ensure an adequate period of observation prior to policy changes and to avoid attributing post-policy effects to the pre-policy period for subsequent changes. Specific states and policy dates included in our analysis are indicated in Table 2. For example, Michigan had vision coverage in 2002, dropped it in July 2009, and added it back again in October 2012. In the event study, we consider

only the 2009 policy change and include the years 2002 through 2011. We exclude two states (Missouri and Utah) with multiple and relatively brief changes that would not allow for adequate pre- and post-policy assessment in an event study framework. We include two states with coverage additions (Florida and Massachusetts in 2006) and eight states with coverage reductions (Table 2). We include the remaining 38 states as controls.

Given that TWFE estimates may be biased in settings such as ours that involve staggered treatment timing (Goodman-Bacon, 2021; Sun and Abraham, 2021; de Chaisemartin and D'Haultfouille, 2020), we estimate alternative event study models that are robust to treatment effect heterogeneity using Gardner's two-stage difference-in-differences method (Gardner 2022). This approach regresses each outcome against controls including state and year fixed effects in the untreated sample in the first stage and then regresses the residuals from the first stage against the vision benefit indicator and controls in the second stage. In this analysis, we restrict our attention to the eight treatment states that dropped coverage during 2002-2018 (California, Idaho, Michigan, Nevada, North Carolina, Oregon, Texas, and Washington) and all control states. Since the treatment is a coverage drop in all of these instances, the untreated period includes years with routine vision coverage. All eight treatment states have adequate untreated periods, which is required for the first stage of estimation. We also replicate TWFE event study estimates on the same sample, which additionally serves as an event study analysis that only includes treatment states that dropped coverage.

We conduct several sensitivity and extension analyses including: examining the association between Medicaid routine vision benefits and MA enrollment including MA plans with supplemental vision benefits; replacing the single vision benefit indicator in Equation (1) with separate indicators for more frequent coverage, defined as coverage more frequent than every two years, and less frequent coverage, defined as coverage every two years or less frequently; examining states with

coverage reductions and coverage additions separately; including 2020 and 2021 data or alternatively limiting the analysis to 2002-2013; considering unweighted results; excluding control states that had Medicaid routine vision benefits throughout the entire study period (“always treated” states); limiting the analysis to full-benefit dual eligibles, whom we can identify beginning in 2009; conducting an intent-to-treat analysis by expanding the sample to all Medicare enrollees with a high school diploma/GED or less education; omitting each treatment state in turn in a leave-one-out analysis; and considering alternative ways of incorporating exam-only coverage.

4. RESULTS

4.1 Past-year eye exams and eyeglasses purchases

Table 4 presents difference-in-differences estimates from Equation (1) for the utilization outcomes. We focus on results including all demographic and time-varying state-level controls (third column), though results are generally similar with and without these controls. We first consider eye care visits. In the survey/access file, we estimate that Medicaid routine vision benefits are associated with a 6.4 percentage point increase in self-reported past-year eye exams, representing about a 13% increase relative to the average rate (50%). In the cost and use file, we estimate a 4.2 percentage point increase in the likelihood of having an optometrist event in the past calendar year, a 33% increase relative to the average rate (13%).

We next consider eyeglasses use and purchases. Medicaid routine vision benefits are associated with a 4.7 percentage point increase in self-reported current use of eyeglasses, or a 6% increase relative to the average rate of 76%. This outcome is a stock measure as it does not distinguish between recent and earlier eyeglasses purchases. In the cost and use files, we estimate that Medicaid vision benefits increase past-year eyeglasses purchases by 5.9 percentage points, or 32% relative to the average rate of 18%. The larger effect on past-year purchases than on current eyeglasses use

suggests that some dual eligibles who already had eyeglasses responded to the policy, likely by obtaining an updated prescription to replace existing eyeglasses. Finally, we consider whether respondents had either an optometrist or eyeglasses-related event in the past year to capture beneficiaries with any observed routine vision events in the cost and use files. We estimate a 7.7 percentage point increase in this measure, representing a 31% increase relative to the average rate of 25%.

Figure 2 presents event study estimates from Equation (2). Estimates are shown in terms of Medicaid routine vision coverage adoption, where we would expect increases in utilization. We do not find evidence of violations of the parallel trends assumption for any of these outcomes. All pre-policy implementation estimates are statistically indistinguishable from zero and F-tests cannot reject the null hypothesis that they are jointly equal to zero. In the post-policy period, there is a clear pattern of increase across all utilization measures. Effects are statistically significant within the first year of policy implementation for all outcomes except current use of eyeglasses, which is consistent with this outcome being a stock measure that may adjust more gradually. Effects on utilization generally grow or remain stable, with no evidence of attenuation five years after policy implementation.

Figure 3 presents event study estimates using the Gardner two-stage difference-in-differences estimator, with estimates also shown in terms of Medicaid routine vision coverage adoption. These alternative estimates are consistent with those from our main two-way-fixed-effects event studies and generally do not suggest violations of the parallel trends assumption.¹⁵

¹⁵ One pre-policy coefficient for optometry events, corresponding to 7 to 8 years before policy implementation, is statistically significant in the Gardner event study specification. However, we do not estimate statistically significant coefficients for more proximate pre-policy periods, and the broader pattern of estimates does not suggest differential pre-trends.

Our main analysis considers the impact of Medicaid coverage of both routine eye exams and eyeglasses at any frequency, relative to coverage of exams only or coverage of neither service. In Table 5, we examine whether impacts on eye care use are larger in states with more frequent coverage, defined as coverage more often than every two years, than in states with less frequent coverage. Estimates are positive and statistically significant for each frequency category and all outcome measures. Point estimates for more frequent coverage are consistently between three and six percentage points larger than for less frequent coverage, although we only detect a statistically significant difference for self-report of past-year eye exams (i.e., 9.7 vs. 6.0 percentage points, $p < 0.01$ for the difference).¹⁶

Since we estimate increases in eyeglasses use, we also examine self-reported trouble seeing with usual vision correction (any and severe) in Appendix Table S1. Estimates for these outcomes are not statistically significant at conventional levels, which may reflect known limitations of self-reported visual difficulty measures (e.g., Potter et al., 2024).

4.2 Spending on eyeglasses

Table 6 presents difference-in-differences estimates from Equation (1) for the eyeglasses spending outcomes. Results for binary any spending outcomes are shown in terms of percentage points while those for continuous spending are coefficient estimates from Poisson models. We provide results for continuous spending in terms of percent changes in the text. We first consider direct effects on Medicaid, total, and out-of-pocket spending. In models including all controls, we estimate that Medicaid routine vision benefits increase any Medicaid spending on eyeglasses by 4.4 percentage points, more than doubling the average rate of 3.8%. This estimate is similar in

¹⁶ We note that we are not able to separately estimate effects for very low frequency coverage (e.g., every five years), because most treatment states in our analysis covered vision services more frequently. We may also lack power to detect statistically significant differences between coverage-frequency categories for some outcomes.

magnitude to the estimated increase in current eyeglasses use and slightly smaller than the estimated increase in past-year eyeglasses purchases. Medicaid routine vision benefits also increase continuous Medicaid spending by 184%. Although this represents a large relative increase, average Medicaid spending per enrollee remains modest because Medicaid-paid eyeglasses purchases are relatively uncommon.¹⁷ Consistent with increased eyeglasses purchases (Table 4), we also estimate a significant increase in total spending from all sources of 35%.

In terms of any out-of-pocket spending, we estimate that Medicaid routine vision benefits are associated with a marginally significant, 1.6 percentage point decline in any out-of-pocket spending and a significant 34% reduction in continuous out-of-pocket spending. This finding is consistent with declines in out-of-pocket spending among enrollees who would have purchased eyeglasses even in the absence of the policy outweighing any increases among marginal purchasers subject to Medicaid cost sharing or costs above Medicaid coverage limits. Average out-of-pocket spending on eyeglasses is \$17.31 per enrollee in 2013 dollars, indicating that among those with any out-of-pocket spending, costs were about \$153 ($=17.31/0.113$), or \$212 in terms of 2025 dollars.

We next examine potential spillovers of Medicaid routine vision benefits on traditional Medicare and MA spending on eyeglasses (Table 6). Traditional Medicare covers eyeglasses only following cataract surgery with an intraocular lens implant. Point estimates for any traditional Medicare spending are positive, but small in magnitude and statistically indistinguishable from zero. We estimate a non-significant, 18% reduction in continuous traditional Medicare spending.¹⁸

¹⁷ Average Medicaid spending on eyeglasses was \$7.16 per enrollee in 2013 dollars, while 3.8% of enrollees had any Medicaid spending on eyeglasses, implying average spending of approximately \$188 among enrollees with a Medicaid-paid eyeglasses event.

¹⁸ We may be underpowered to detect effects on traditional Medicare eyeglasses spending because traditional Medicare coverage is limited to post-cataract surgery eyeglasses, cataract surgery is relatively uncommon on an annual basis, and any effects through increased detection and treatment would likely occur for a small subset of enrollees.

We estimate that Medicaid routine vision benefits increase any MA spending on eyeglasses by 0.4-0.5 percentage points, depending on the model (Table 6). Estimates are statistically significant in models that do not include time-varying state controls, and marginally significant in our preferred model that includes all controls (0.4 percentage point increase, 32% relative effect, $p < 0.10$). We estimate a non-significant, 9% increase in continuous MA spending. Taken together, these findings indicate that Medicaid routine vision benefits may have indirect impacts on MA spending on eyeglasses. About 27% of dual eligibles were enrolled in an MA plan during our analysis period, and only about 17% were enrolled in an MA plan with vision benefits. As a result, estimates for all dual eligibles likely understate effects among beneficiaries enrolled in MA plans with supplemental vision benefits.

Figures 4 and 5 present event study estimates from Equation (2) for any and continuous spending, respectively. Results are again shown in terms of a coverage adoption. These models generally do not suggest violations of the parallel trends assumption and support the directionality of our estimates from Equation (1). F-tests cannot reject the null hypothesis that pre-policy estimates are jointly equal to zero for any outcome except for continuous Medicaid spending. However, none of the individual lead estimates for continuous Medicaid spending are statistically significant and the pre-policy pattern appears relatively flat.¹⁹

4.3 Enrollment in Medicare Advantage

We now turn to examining the possibility that Medicaid routine vision benefits affect enrollment decisions among dual eligibles and Medicare enrollees likely to meet the criteria for Medicaid eligibility. Table 7 shows the results of estimating Equation (1) for our dual eligible sample with

¹⁹ We also note that while none of the pre-policy coefficients are statistically distinguishable from zero, there is a declining pattern during the pre-period for continuous Medicare Advantage spending. However, we do not estimate a statistically significant association for this outcome in Table 6.

outcomes of (1) enrollment in any MA plan, and (2) enrollment in an MA plan with vision benefits (first and second columns, respectively). Point estimates are positive, relatively modest, and are not statistically significant at conventional levels. We replicate this analysis for a sample of Medicare enrollees with a high school diploma/GED or less education (Table 7, third and fourth columns). Among this population, we again find no evidence that Medicaid routine vision benefits affect enrollment in MA plans, including those with supplemental vision benefits. These results suggest that Medicaid routine vision benefits do not induce meaningful shifts between MA and traditional Medicare, supporting the interpretation that changes in eyeglasses spending are more likely to reflect changes in use among MA enrollees than changes in MA enrollment.

4.4 Extensions

We consider several extensions to our main analysis. First, Table 8 presents results for past-year systemic health diagnoses. Point estimates are positive for all three conditions, though in models with all controls, we only estimate significant increases for high blood pressure (3.4 percentage point increase, $p < 0.05$) and any heart condition (2.3 percentage point increase, $p < 0.10$) (Table 8, fifth column). Event study estimates are somewhat noisy for the high blood pressure outcome and do not provide support for parallel trends, but pre-policy patterns appear relatively flat for any heart condition and estimates appear to increase during the post-policy period (Appendix Figure S1).²⁰ Overall, we view this as suggestive evidence that Medicaid routine vision benefits may increase detection, patient-provider discussion, or reporting of some systemic health conditions that may present with ocular changes or visual symptoms during an eye exam. In particular, the pattern of results for any heart condition is suggestive of such an effect.

²⁰ The high cholesterol outcome is available for a more limited set of years than the other systemic diagnosis outcomes, so we do not estimate event study models for this outcome.

Second, while our main analysis considers eye care visits with any type of eye care professional, we examine whether Medicaid routine vision benefits have differential impacts on visits with optometrists compared with ophthalmologists in Appendix Table S2. Effects may differ based on geographic availability or Medicaid acceptance rates. We replicate our analysis in Equation (1) with modified exam outcomes for 2010 and later since information on eye care professional type is only available in those years. Point estimates are positive for both types of visits, although the point estimate for ophthalmologist visits is larger in magnitude and statistically significant (5.3 percentage point increase, $p < 0.05$), while the estimate for optometrist visits is smaller and not statistically significant (4.0 percentage point increase). However, 95% confidence intervals overlap and we cannot rule out similarly sized effects across provider types.

Third, we present the results of stratified analyses to assess subgroup differences in past-year eye exams (Figure 6) and current eyeglasses use (Appendix Figure S2).²¹ Estimates for past-year eye exams are positive and statistically significant for all subgroups with the exception of those who had never been married, for whom confidence intervals are wide. All 95% confidence intervals overlap, although point estimates are larger for duals under age 65 than for those ages 65 and older, and for non-Hispanic Black and Hispanic dual eligibles than for non-Hispanic white dual eligibles. Non-Hispanic Black and Hispanic Medicare enrollees receive Medicare-covered glaucoma screenings if they meet age criteria (Table 1), but not routine eye exams. These results suggest that Medicaid routine vision benefits nonetheless increase eye care visits for these groups. Estimates for current eyeglasses use are also generally positive across subgroups, although several are not statistically significant at conventional levels. While some of these null findings likely reflect limited power, the non-significant estimate among those who ever had cataract surgery is noteworthy as it may reflect less unmet need for refractive correction in this group.

²¹ We focus on survey outcomes given larger sample sizes for these stratified analyses.

In a final extension of our main analysis, we examine whether effects differ for states adding versus dropping Medicaid routine vision benefits (Appendix Table S3). We find evidence that both benefit expansions and contractions affect utilization, with no strong evidence that effect magnitudes differ substantially across the two types of policy changes.

4.5 Sensitivity Analyses

We conduct several robustness checks to assess the sensitivity of our main results, focusing primarily on the survey file utilization outcomes. Results are generally similar when we do not use survey weights, include 2020 and 2021, limit the sample to 2002-2013 before the MCBS redesign, or exclude states with Medicaid routine vision benefits throughout the study period (“always treated” states) (Appendix Table S4). We also restrict the sample to full-benefit dual eligibles, who can be identified beginning in 2009. In this sample, we estimate a larger increase in past-year eye exams (13.2 percentage points), although estimates for all dual eligibles over the same period are also larger than our main estimate (10.7 percentage points) (Appendix Table S4). These results suggest that the main effects are likely attributable to full-benefit dual eligibles, as expected. In an intent-to-treat analysis among Medicare enrollees with lower education levels, Medicaid routine vision benefits are associated with statistically significant increases in past-year eye exams and current eyeglasses use of 2.0 and 2.6 percentage points, respectively (Appendix Table S4). As expected, these point estimates are smaller than among our main sample of dual eligibles who are directly affected by Medicaid vision benefit policies. In leave one out analyses, no single treatment state appears to drive the results (Appendix Table S5). Finally, results are generally consistent when we use alternative approaches to classifying exam-only coverage (Appendix Table S6).

5. CONCLUSIONS

This paper provides the first estimates of the impact of Medicaid routine vision benefits among dual-eligible Medicare enrollees. We find that Medicaid routine vision benefits increase access to routine eye care and eyeglasses among dual eligibles. In our preferred models, we estimate a 6.4 percentage point (13%) increase in past-year eye exams and a 4.2 percentage point (33%) increase in optometrist events. Medicaid vision benefits also increase current eyeglasses use and past-year eyeglasses purchases. The magnitude of these utilization effects is broadly consistent with prior evidence from other settings, including past work on Medicaid routine vision benefits among younger Medicaid enrollees and evidence from the RAND Health Insurance Experiment. Nonetheless, these effects may be clinically meaningful among the dual eligible population. A National Academies report identifies uncorrected refractive error as one of the leading sources of vision loss that is relatively inexpensively and effectively treated, noting that “...treatment of uncorrected refractive error and cataract would likely achieve large economic savings” (Wittenborn and Rein, 2016).

We also provide new evidence of how Medicaid routine vision benefits affect eyeglasses spending and the distribution of spending across payers. Medicaid routine vision benefits increase Medicaid spending on eyeglasses and reduce out-of-pocket spending, suggesting that these benefits both increase the use of a service largely excluded from traditional Medicare while also shifting some costs from enrollees to Medicaid. Consistent with relatively limited coverage of post-cataract surgery eyeglasses, we find no evidence of spillovers to traditional Medicare spending on eyeglasses. However, we find some evidence of a modest increase in the likelihood of any MA eyeglasses spending, which is in line with the fact that only a small subset of dual eligibles are enrolled in MA and only 17% of all dual eligibles have MA supplemental vision benefits during our analysis period. MA supplemental vision benefits have become nearly universal in recent years, and simultaneously, MA enrollment has grown. Therefore, cross-program spillovers may be larger in the current context.

In exploratory analyses, we also find some suggestive evidence that Medicaid routine vision benefits may increase detection or patient awareness of selected systemic health conditions that can present with ocular changes, with the pattern of results most suggestive for heart conditions. While suggestive, these findings warrant further attention as an important potential indirect benefit of offering routine vision coverage to dual eligibles.

Our work has several limitations. First, some outcomes, including past-year eye exams, current eyeglasses use, trouble seeing, and systemic health diagnoses are self-reported. Second, spending outcomes in the MCBS cost and use files combine claims, self-reported information, and imputation, which may introduce measurement error. Third, some extension and subgroup analyses are likely underpowered, limiting our ability to detect differences across populations, provider types, or benefit generosity. Finally, our analysis focuses on dual eligibles, a high-need population with access to Medicaid-covered services that are not available to most Medicare enrollees; effects may differ for the broader Medicare population.

Overall, our findings suggest that Medicaid routine vision benefits have meaningful effects on access to routine eye care and the distribution of eyeglasses spending across payers. They also raise broader questions about the interaction between state Medicaid program design and Medicare Advantage where benefits often overlap.

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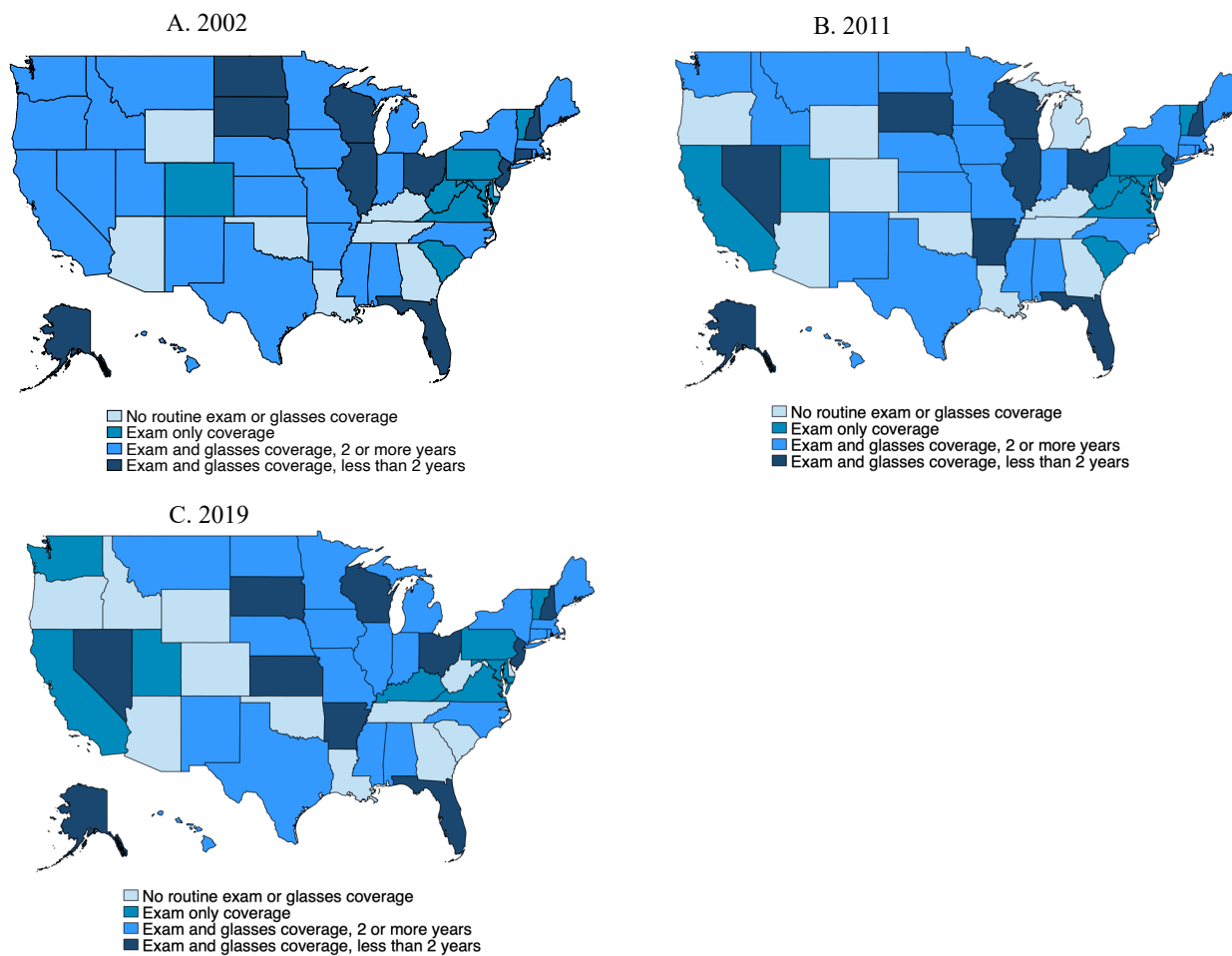
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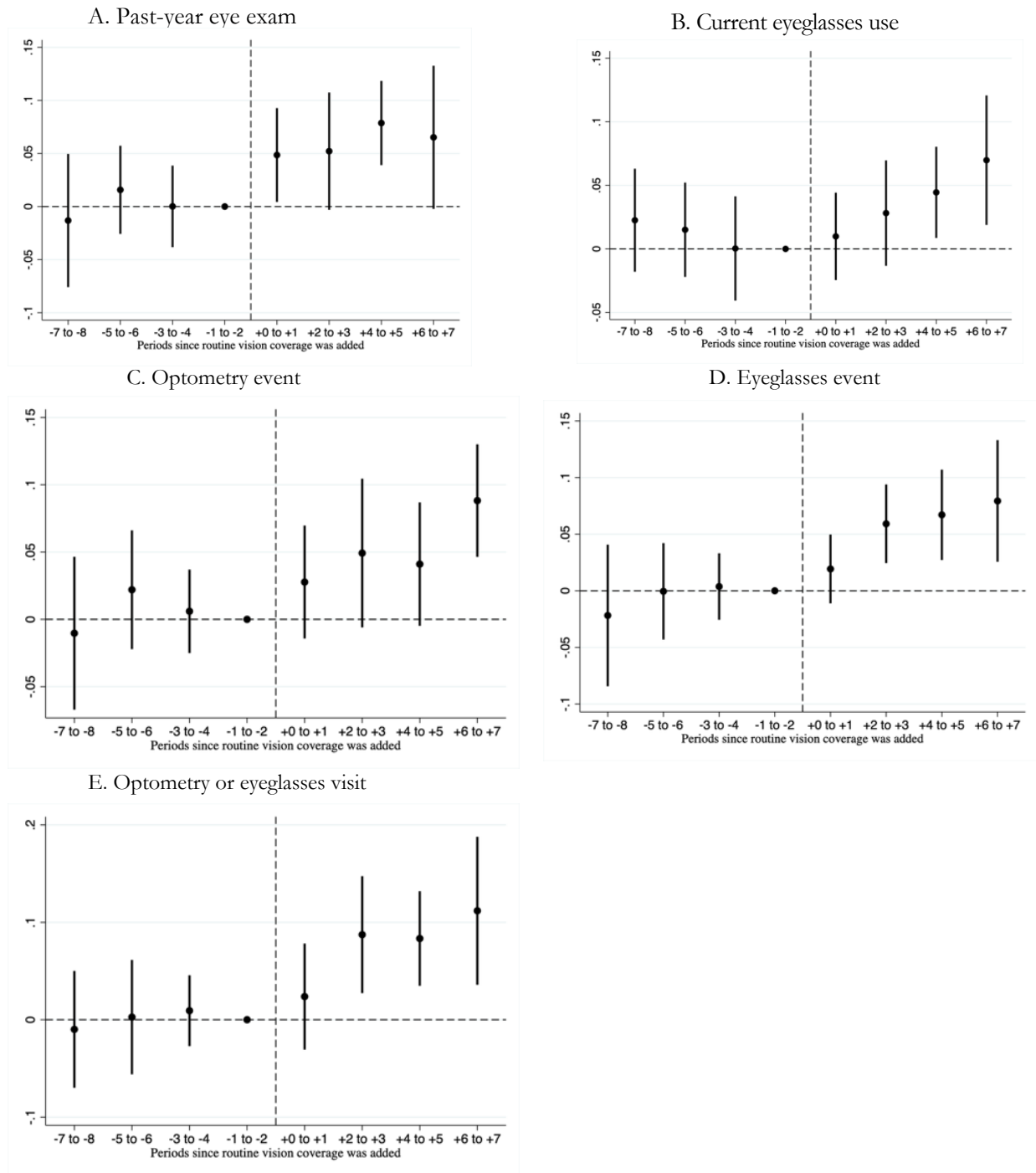
Figures

Figure 1. Medicaid Routine Vision Benefit Policies in 2002, 2011, and 2019



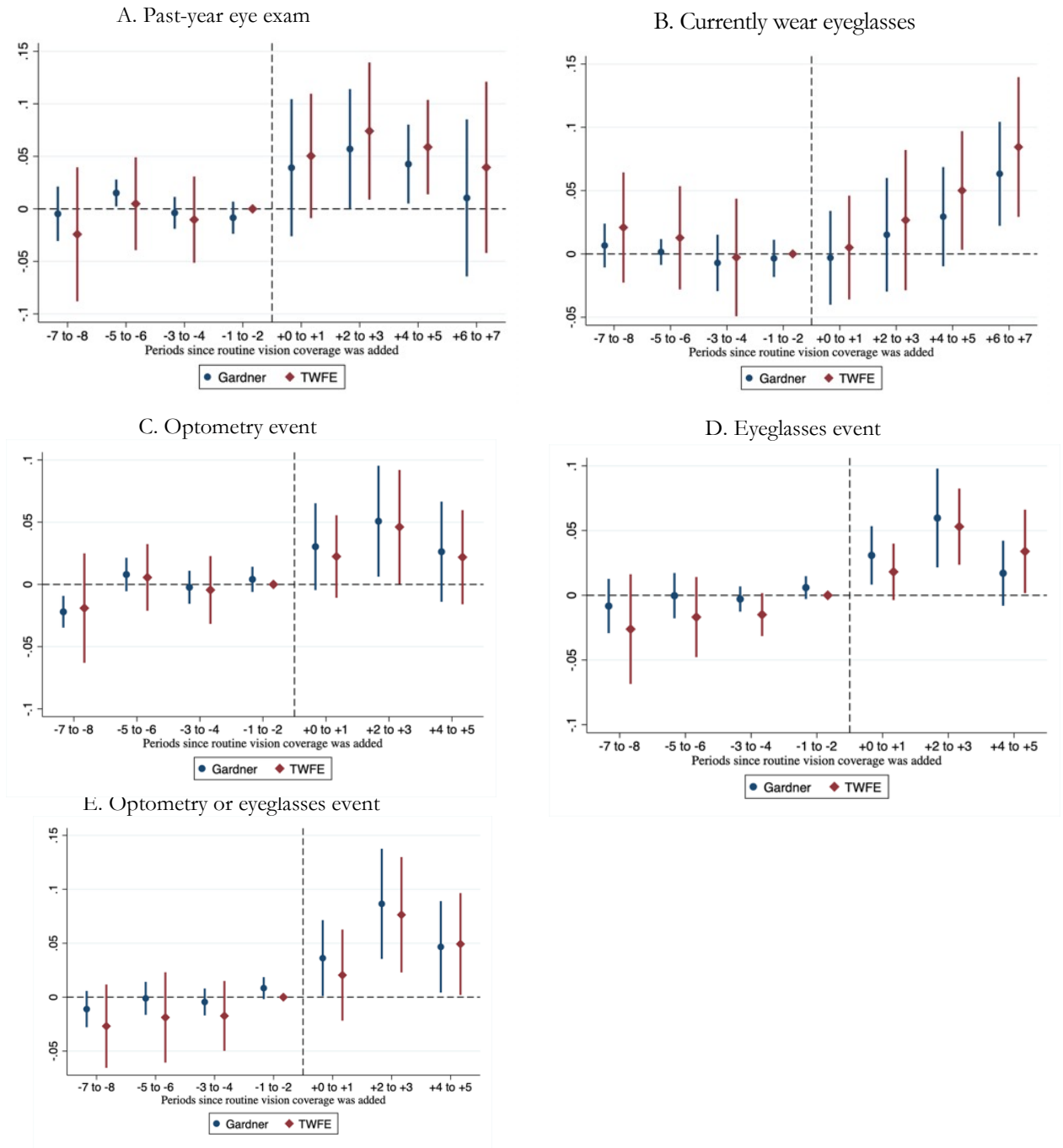
Notes: State-by-year Medicaid coverage of routine eye exams and eyeglasses collected by the research team, as described in the text.

Figure 2. Event Study Analysis of Medicaid Routine Vision Benefit Adoption and Eye Care Utilization Outcomes



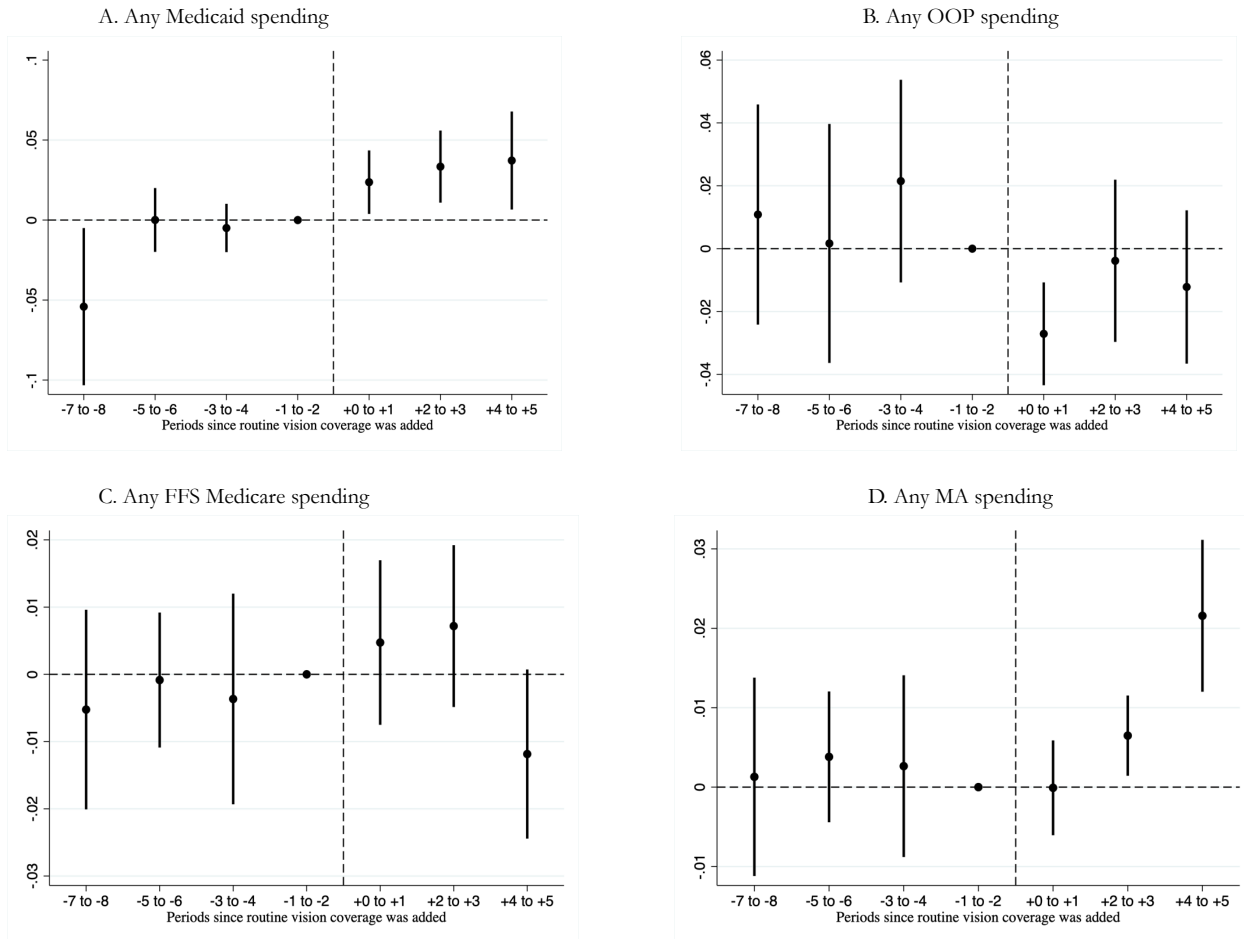
Notes: Two-way fixed effects event study estimates with control as described in the text. Estimates are in terms of percentage points and 95% confidence bars are shown. Panels A and B come from the 2002-2019 survey/access files and Panels C, D, and E come from the 2002-2013 cost and use files. P-values for joint significance of the lead coefficients are as follows: 0.13, 0.62, 0.27, 0.86, and 0.91 for A, B, C, D, and E respectively.

Figure 3. Two-stage DiD Event Study Analysis of Medicaid Routine Vision Benefit Adoption and Eye Care Utilization Outcomes



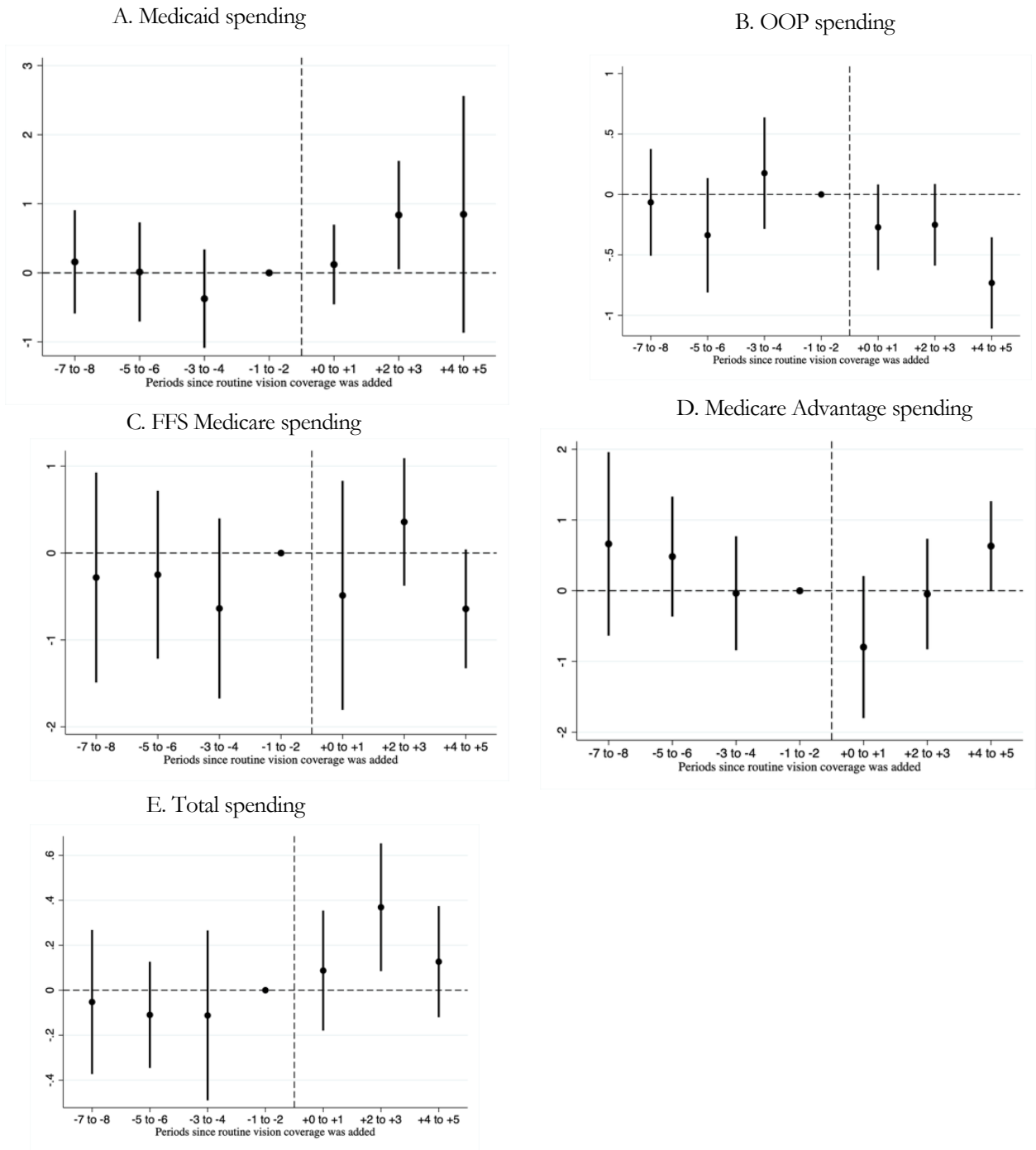
Notes: Gardner two-stage difference-in-differences and two-way fixed effects event study estimates with controls as described in the text. Estimates are in terms of percentage points and 95% confidence bars are shown. Panels A and B come from the 2002-2019 survey/access files and Panels C, D, and E come from the 2002-2013 cost and use files. The Gardner (2022) event study estimator does not have an omitted category; all coefficient estimates are implicitly normalized to the pre-period average.

Figure 4. Event Study Analysis of Medicaid Routine Vision Benefit Adoption and Any Spending on Eyeglasses by Source



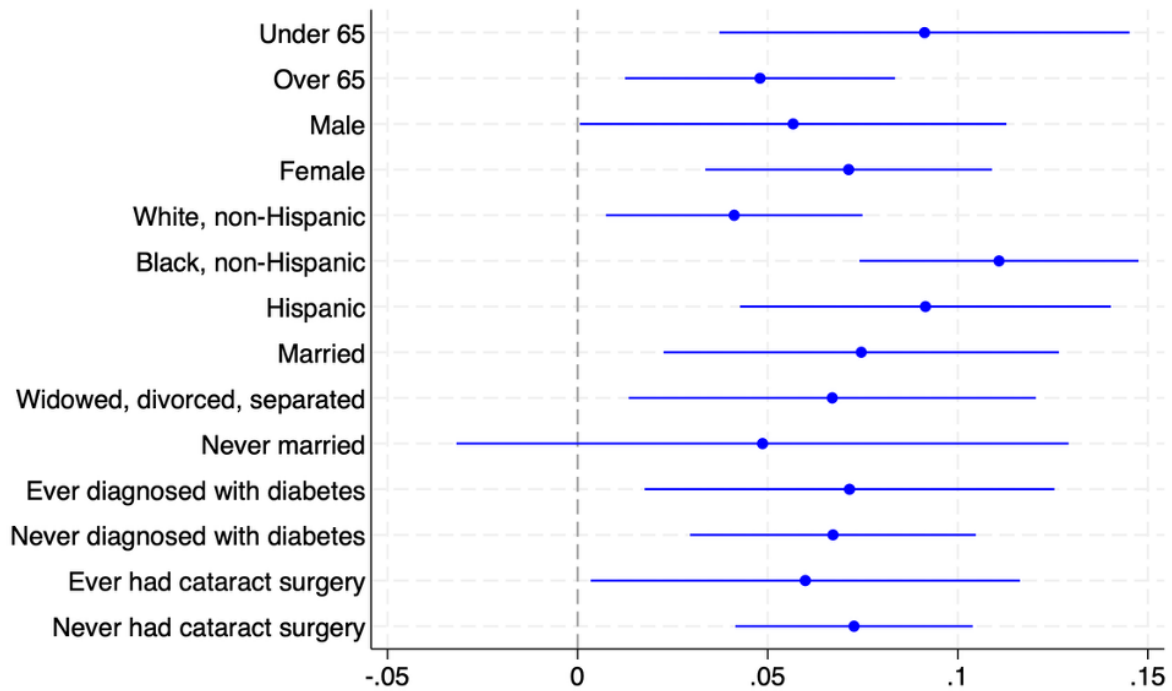
Notes: Two-way fixed effects event study estimates with control as described in the text. Estimates are in terms of percentage points and 95% confidence bars are shown. All analyses are from the 2002-2013 cost and use files. P-values for joint significance of the lead coefficients are as follows: 0.14, 0.42, 0.89, 0.41 for A, B, C, and D, respectively.

Figure 5. Event Study Analysis of Medicaid Routine Vision Benefit Adoption and Continuous Spending on Eyeglasses by Source



Notes: Two-way fixed effects event study estimates with control as described in the text. Estimates are coefficients from Poisson regressions and 95% confidence bars are shown. All analyses are from the 2002-2013 cost and use files. P-values for joint significance of the lead coefficients are as follows: 0.02, 0.08, 0.66, 0.54, and 0.79 for A, B, C, D, and E, respectively.

Figure 6. Subgroup estimates of the impacts of Medicaid vision benefit adoption on past-year eye exams



Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression stratified by the characteristics noted in the figure. Estimates are in terms of percentage points and 95% confidence bars are shown. Controls are as described in the text. The sample includes dual Medicare-Medicaid enrollees interviewed in 2002-2019 MCBS access/survey files. Estimates are weighted.

Tables

Table 1. Summary of Medicare and Medicaid eye care coverage for persons ages 21 and older

Service	Traditional Medicare	Medicare Advantage	Medicaid
Routine exams, glasses for refraction, low vision devices	None	Varies by plan; many plans provide some coverage of routine eye exams and glasses for refraction ^a	No federal requirements; Services covered with low or no cost sharing in some states.
Screening for cataracts	None	Varies by plan	No federal requirements; Service covered with low or no cost sharing in some states.
Screening for glaucoma	Annual screening for enrollees who meet any of the following criteria: diagnosed diabetes, family history of glaucoma, African American ages 50+, Hispanic ages 65+; covers 80% of Medicare-approved costs ^b	Medicare-covered screenings; additional screenings vary by plan	Medicare Part B cost sharing covered for dual enrollees that meet Medicare criteria for screening in all states. No federal requirement to cover other adults; service may be covered with low or no cost sharing in some states.
Screening for diabetic retinopathy	Annual screening for enrollees with diagnosed diabetes; covers 80% of Medicare-approved costs ^b	Medicare-covered screenings; additional screenings vary by plan	Medicare Part B cost sharing covered for dual enrollees that meet Medicare criteria for screening in all states.
Screening for age-related macular degeneration	Screening for age-related macular degeneration if medically necessary; covers 80% of Medicare-approved costs ^b	Medicare-covered screenings; additional screenings vary by plan	Medicare Part B cost sharing covered for dual enrollees in all states.
Surgical procedures and treatments for eye disease	Covered if medically necessary; covers 80% of Medicare-approved costs ^b	Covered if medically necessary; cost-sharing varies by plan	Medicare Part B cost sharing covered for dual enrollees in all states.

Notes: Authors' analysis of information from the Centers for Medicare and Medicaid Services and other sources

^a <https://www.kff.org/medicare/medicare-advantage-2026-spotlight-a-first-look-at-plan-offerings/>. Viewed April 12, 2026.

^b <https://www.medicare.gov/coverage/cataract-surgery>. Viewed April 12, 2026.

Table 2. Dates of Changes to Medicaid Routine Vision Benefits and Inclusion in Analysis

State	Policy changes, 2002-2019	Years included in TWFE event study	Included in Gardner event study?
California	dropped in July 2009	2002-2019	Yes
Florida	dropped July 2003; added July 2006	2004-2019	No
Idaho	dropped July 2011	2002-2019	Yes
Kansas ^a	dropped Jan. 2003; added June 2003	<i>see note</i>	<i>see note</i>
Massachusetts	dropped July 2002; added July 2006	2003-2019	No
Michigan	dropped July 2009, added October 2012	2002-2011	Yes
Missouri	dropped July 2002; added July 2003; dropped July 2005; added July 2006	Excl.	No
Nevada	dropped July 2008; added July 2009	2002-2008	Yes
North Carolina	dropped in Oct. 2011; added in Jan. 2019	2002-2018	Yes
Oregon	dropped in Jan. 2010	2002-2019	Yes
Texas	dropped in Sept. 2004; added in Sept. 2006	2002-2005	Yes
Utah	dropped in Feb. 2003; added July 2005; dropped July 2006	Excl.	No
Washington	dropped in July 2011	2002-2019	Yes

Notes: Medicaid coverage of routine eye exams and eyeglasses collected by the research team. The treatment group is the 13 states listed above. The control group is comprised of the 38 states that have no change to Medicaid vision coverage. 16 states never adopt Medicaid vision coverage; 21 states always have Medicaid vision coverage between 2002 and 2019; and we only include the years for which Kansas had coverage (2002, 2004-2019). The following 8 states have no Medicaid routine vision coverage for eye exams or glasses between 2002 and 2019: Arizona, Delaware, Georgia, Kentucky, Louisiana, Oklahoma, Tennessee, and Wyoming. The following 7 states had coverage of exams only, which we code as no coverage: Colorado, Maryland, Pennsylvania, South Carolina, Virginia, Vermont, and West Virginia. We also code Maine as having no coverage since they only provide glasses once per lifetime and only to persons with extremely high diopters (≤ -10). The following 21 states have vision benefits (exams and glasses) throughout the entire period: Alabama, Alaska, Arkansas, Connecticut, Hawaii, Illinois, Indiana, Iowa, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Rhode Island, South Dakota, and Wisconsin. We exclude the District of Columbia from all analyses since they cover glasses but not exams. ^aKansas is included in all analyses, but given the very brief, <6 month lapse in benefits, they are considered a control state in event study analyses.

Table 3. Summary Characteristics, Survey and Cost and Use Files, MCBS 2002-2019

Sociodemographics	All MCBS Survey File (2002-2019)	Dual Sample Survey File (2002-2019)	Dual Sample Cost File (2002-2013)
Age (%)			
21-44	0.0337	0.1353	0.1381
45-64	0.1203	0.2826	0.2658
65-74	0.4546	0.3008	0.2801
75-84	0.2873	0.2009	0.2280
85 and older	0.1041	0.0804	0.0880
Male	0.4511	0.3752	0.3727
Hispanic	0.0742	0.1745	0.1621
Non-Hispanic white	0.7755	0.5110	0.5454
Non-Hispanic Black	0.0965	0.2102	0.2137
Non-Hispanic Asian	0.0210	0.0505	0.0541
Non-Hispanic AIAN/NHPI	0.0110	0.0239	---
Non-Hispanic other/multiple races	0.0217	0.0299	0.0246
Married	0.5304	0.2138	0.2128
Widowed, separated, divorced	0.3952	0.5627	0.5839
Never married	0.0744	0.2235	0.2033
Less than high school diploma/GED	0.2126	0.4656	0.5152
High school diploma/GED	0.3594	0.3323	0.3042
Some college/Associate's degree	0.2121	0.1437	0.1276
College or more education	0.2159	0.0583	0.0530
State-level characteristics			
Medicaid managed care penetration	0.5233	0.5034	0.4231
Medicare Advantage penetration	0.2579	0.2659	0.2136
ACA Medicaid expansion	0.2152	0.2006	---
State unemployment rate	0.0603	0.0616	0.0702
Ophthalmologists per capita	5.0840	5.1086	5.210
FQHCs per capita	2.9340	2.927	2.5010
Lesser of policy	0.8410	0.8633	0.8102
N	231,407	42672	20875

Notes: Estimates represent weighted percents from the 2002-2019 MCBS Survey/Access files and the 2002-2013 Cost and Use files. Sample sizes are unweighted.

Table 4. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and eye care utilization, MCBS 2002-2019

Outcome	Mean Y	Coefficient (SE)			N
		Model 1	Model 2	Model 3	
<i>Survey File</i>					
Past-year eye exam	0.4954	0.0533* (0.0275)	0.0496* (0.0287)	0.0644*** (0.0198)	42672
Wear glasses	0.7639	0.0438*** (0.0131)	0.0344** (0.0129)	0.0470** (0.0183)	42672
<i>Cost and Use File</i>					
Optometry event, CY	0.1283	0.0420** (0.0169)	0.0417** (0.0160)	0.0418*** (0.0127)	20875
Glasses event, CY	0.1842	0.0597**** (0.0115)	0.0586**** (0.0103)	0.0589**** (0.0093)	20875
Optometry or glasses event, CY	0.2507	0.0782**** (0.0204)	0.0765**** (0.0187)	0.0771**** (0.0168)	20875
Demographics		No	Yes	Yes	
Time-varying state variables		No	No	Yes	

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with controls as indicated in the table and described in the text. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table 5. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and eye care utilization, by coverage frequency, MCBS 2002-2019

	Outcome				
	Past-year eye exam (Mean Y = 0.4954)	Wear glasses (Mean Y = 0.7639)	Optometry event (Mean Y = 0.1283)	Glasses event (Mean Y = 0.1842)	Optometry or glasses event (Mean Y = 0.2507)
Vision benefits, <2 years	0.0965**** (0.0166)	0.0975** (0.0425)	0.0656** (0.0279)	0.0898*** (0.0264)	0.1099*** (0.0301)
Vision benefits, ≥ 2 years	0.0596*** (0.0166)	0.0397** (0.0182)	0.0363*** (0.0149)	0.0518**** (0.0264)	0.0695*** (0.0193)
P-value for difference	0.007	0.16	0.35	0.11	0.16

Notes: Estimates are from a modified version of Equation (1) that replaces the single vision benefit indicator with mutually exclusive indicators for providing routine vision coverage more frequently than every two years vs. every two year or less frequently. Each column represents the results from separate TWFE regressions with all controls, including state-by-year controls, as described in the text. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. P-values test for statistical differences between the coverage coefficients. All estimates are weighted and standard errors are clustered at the state level. * p<0.10, ** p<0.05, *** p<0.01, **** p<0.001.

Table 6. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and spending on eyeglasses, MCBS 2002-2013

Outcome	Mean Y (%)	Coefficient, percentage points (SE)			
		Model 1	Model 2	Model 3	N
Any Medicaid spending	0.0379	0.0474**** (0.0138)	0.0466**** (0.0135)	0.0444**** (0.0107)	20,065
Any OOP spending	0.1127	-0.0175* (0.0096)	-0.0173* (0.0096)	-0.01605* (0.0081)	19,769
Any FFS Medicare spending	0.0262	0.0021 (0.0027)	0.0017 (0.0026)	0.0017 (0.0030)	20,285
Any Medicare HMO spending	0.0126	0.0054*** (0.0017)	0.0053*** (0.0018)	0.0040* (0.0022)	20234
<i>Outcome</i>	Mean Y (\$)	Poisson Coefficient (SE)			N
Medicaid spending	7.16	1.2477** (0.4890)	1.2312** (0.4877)	1.0433*** (0.4021)	20,065
OOP spending	17.31	-0.2961*** (0.1155)	-0.3060*** (0.1124)	-0.2902*** (0.0998)	19,769
FFS Medicare spending	4.92	-0.1374 (0.1699)	-0.113 (0.1829)	-0.1948 (0.2695)	20,285
Medicare HMO spending	2.40	0.1035 (0.1626)	0.0872 (0.1538)	0.0859 (0.2302)	20234
Total spending, all sources	39.86	0.3145**** (0.0717)	0.3100**** (0.0761)	0.2996**** (0.0832)	20875
Demographics		No	Yes	Yes	
Time-varying state variables		No	No	Yes	

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with controls as indicated in the table and described in the text. All outcomes are from the MCBS cost and use files. Estimates in the top panel are in terms of percentage points and estimates in the bottom panel are coefficients from Poisson models. Standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table 7. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and enrollment in Medicare Advantage, MCBS 2002-2019

	Outcome			
	MA enrollment (Mean Y = 0.27)	MA vision benefits (Mean Y= 0.18)	MA enrollment (Mean Y = 0.29)	MA vision benefits (Mean Y= 0.17)
Vision benefits	0.01863 (0.0295)	0.0215 (0.0230)	-0.0037 (0.0083)	0.0130 (0.0089)
Sample	Duals	Duals	All low education	All low education
N	42672	41467	140,432	136,957

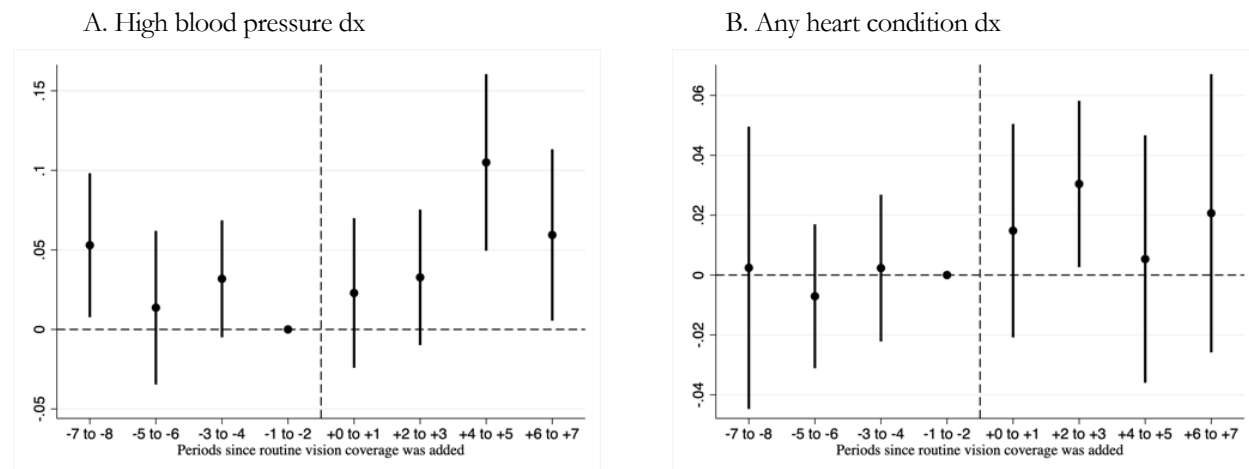
Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with all controls as described in the text, including state-by-year controls, and the sample as indicated in the table. The low education sample includes Medicare enrollees with a high school diploma, GED, or less education. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table 8. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and respondent reports they were told they had selected systemic health conditions in the past year, MCBS 2002-2013

Outcome	Mean Y	N	Model 1	Model 2	Model 3
High blood pressure dx	0.529	30469	0.0400** (0.0154)	0.0299** (0.0137)	0.0340** (0.0160)
High cholesterol dx	0.3729	20517	0.0356 (0.0240)	0.0298 (0.0268)	0.0376 (0.0258)
Any heart condition dx	0.1736	30278	0.0217*** (0.0076)	0.0201** (0.0086)	0.0227* (0.0113)
Demographics			No	Yes	Yes
Time-varying state variables			No	No	Yes

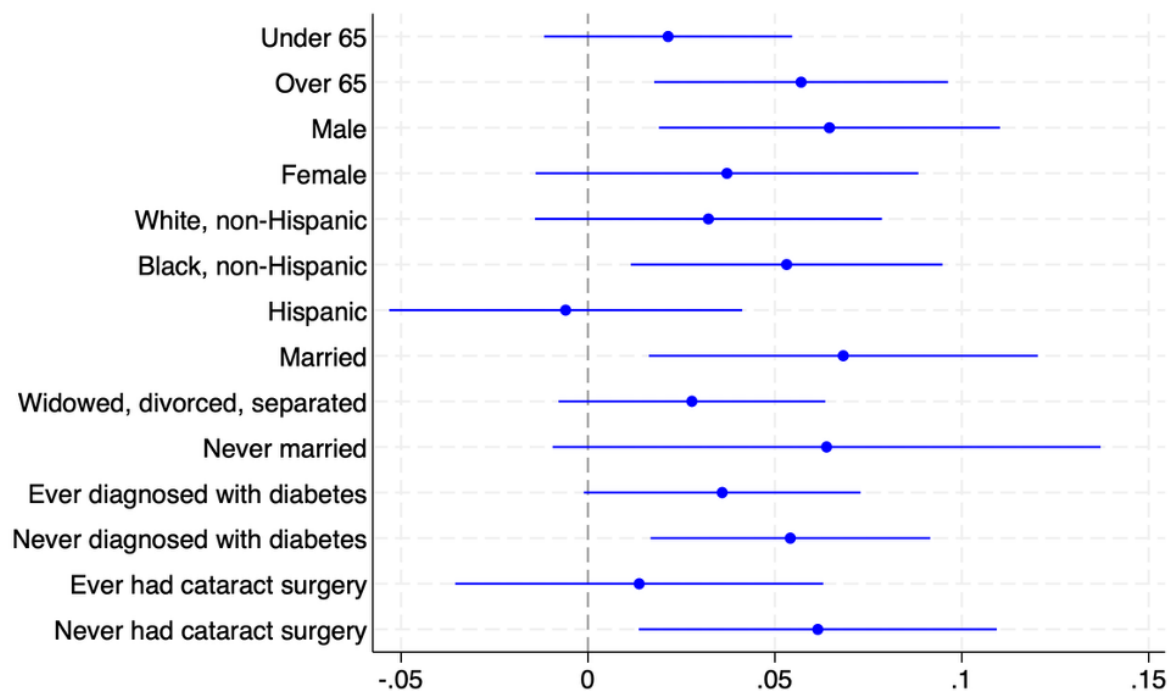
Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with controls as indicated in the table and as described in the text. All outcomes are from the MCBS access/survey files. Respondents were asked if they had been told that they had each condition within the past year. Questions about high blood pressure and any heart condition were available during 2002-2013, while the question about high cholesterol was available during 2006-2013. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

APPENDIX

Figure S1. Event Study Analysis of Medicaid Routine Vision Benefit Adoption and Systemic Health Diagnoses

Notes: Two-way fixed effects event study estimates with control as described in the text. Estimates are in terms of percentage points and 95% confidence bars are shown. All analyses are from the 2002-2013 Survey/access files. P-values for joint significance of the lead coefficients are 0.03 for Panel A and 0.90 for Panel B.

Figure S2. Subgroup estimates of the impacts of Medicaid vision benefit adoption on current eyeglasses use



Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression stratified by the characteristics noted in the figure. Estimates are in terms of percentage points and 95% confidence bars are shown. Controls are as described in the text, including state-by-year controls. The sample includes dual Medicare-Medicaid enrollees interviewed in 2002-2019 MCBS access/survey files. Estimates are weighted.

Table S1. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and self-reported difficulty seeing, MCBS 2002-2019

Outcome	Mean Y	N	Model 1	Model 2	Model 3
Any difficulty seeing	0.4338	42270	0.0219 (0.0189)	0.0213 (0.0200)	0.0229 (0.0225)
Severe trouble seeing	0.0982	42270	0.0123 (0.0085)	0.0128 (0.0101)	0.0113 (0.0091)
Demographics			No	Yes	Yes
Time-varying state variables			No	No	Yes

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with controls as indicated in the table and described in the text. All analyses are from the 2002-2019 survey/access files. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table S2. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and optometrist and ophthalmologist visits, MCBS 2010-2019

Outcome	Mean Y	N	Est.
Any eye exam	0.4644	21696	0.1013**** (0.01816)
Optometrist visit	0.2496	21696	0.0404 (0.0378)
Ophthalmologist visit	0.2083	21696	0.0534** (0.0209)

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with all controls described in the text, including state-by-year controls. All analyses are from the 2010-2019 Survey/access files. Any eye exam represents a past-year eye exam with any type of eye care professional. Optometrist and Ophthalmologist visits are equal to one if a respondent had a past-year eye care visit and they indicated that their most recent visit was with that type of eye care professional. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * p<0.10, ** p<0.05, *** p<0.01, **** p<0.001.

Table S3. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and eye care utilization, adding vs. dropping, MCBS 2002-2019

Panel A: Medicaid routine vision benefit adoption			
Outcome	Mean Y	N	Est.
Past-year eye exam	0.4864	31690	0.0855**** (0.0180)
Wear glasses	0.7619	31690	0.0274* (0.0158)
Panel B: Medicaid routine vision benefit reduction			
Outcome	Mean Y	N	Est.
Past-year eye exam	0.4903	34929	-0.0618*** (0.0209)
Wear glasses	0.7578	34929	-0.0416** (0.0187)

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with all controls described in the text, including state-by-year controls. All analyses are from the 2002-2019 Survey/access files. In Panel A, the sample includes states with coverage adoptions and control states, including states with multiple changes where the period around coverage drops is excluded. In Panel B, the sample includes states with coverage reductions and control states, including states with multiple changes where the period around coverage additions is excluded. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table S4. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and eye care utilization, alternative samples, MCBS 2002-2019

Panel A. Past-year eye exams		
Sample	N	Est.
Main	42672	0.0644***
Unweighted	42672	0.0547***
2002-2021	47507	0.0480*
2002-2013	30702	0.0699****
No always treated states	29847	0.0697***
Full-benefit duals (2009-2019)	16722	0.1318****
All low education	140432	0.0202**
Panel B. Current eyeglasses use		
Sample	N	Est.
Main	42672	0.0470**
Unweighted	42672	0.0403**
2002-2021	47507	0.0411***
2002-2013	30702	0.0253
No always treated states	29847	0.0521**
Full-benefit duals (2009-2019)	16722	0.0507**
All low education	140432	0.0261**

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with all controls described in the text, including state-by-year controls. All analyses are from the 2002-2019 Survey/access files. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. The low education sample includes all Medicare enrollees with a high school diploma/GED or less education. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table S5. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and eye care utilization, leave-one-out estimates, MCBS 2002-2019

Omitted state	N	Past-year eye exams	Wear eyeglasses
Main/none	42672	0.0644*** (0.0198)	0.0470** (0.0183)
California	38184	0.0893**** (0.0164)	0.0291 (0.0192)
Florida	39195	0.0565** (0.0220)	0.0462** (0.0210)
Idaho	42660	0.0643*** (0.0198)	0.0471** (0.0184)
Massachusetts	41899	0.0739**** (0.0182)	0.0552*** (0.0189)
Michigan	40910	0.0598*** (0.0200)	0.0498** (0.0190)
Missouri	41527	0.0647*** (0.0200)	0.0456** (0.0184)
Nevada	41938	0.0655*** (0.0206)	0.0374** (0.0151)
North Carolina	39742	0.0445** (0.0171)	0.0387 (0.0233)
Oregon	42670	0.0644*** (0.0198)	0.0470** (0.0183)
Texas	40280	0.0698*** (0.0197)	0.0514*** (0.0187)
Utah	42669	0.0644*** (0.0198)	0.0472** (0.0183)
Washington	41595	0.0614*** (0.0215)	0.0592**** (0.0150)

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with all controls described in the text, including state-by-year controls. The sample includes all states in the main analysis with the exception of one treatment state, as indicated in the sample. All analyses are from the 2002-2019 Survey/access files. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table S6. Difference-in-differences regression estimates of the association between Medicaid routine vision benefits and eye care utilization, alternative treatments of exam only coverage, MCBS 2002-2019

Panel A. Past-year eye exams		
Sample	N	Est.
Main	42672	0.0644*** (0.0198)
Control for exam only coverage	42672	0.0638*** (0.0209)
Exclude exam only coverage	18829	0.0613*** (0.0220)
Vision benefits = at least exam only	42672	0.0646*** (0.0206)
Panel B. Current eyeglasses use		
Sample	N	Est.
Main	42672	0.0470** (0.0183)
Control for exam only coverage	42672	0.0451** (0.0194)
Exclude exam only coverage	18829	0.0243 (0.0225)
Vision benefits = at least exam only	42672	0.0457** (0.0180)

Notes: Each estimate represents the coefficient on the vision benefit indicator from a separate TWFE regression with all controls described in the text, including state-by-year controls. All analyses are from the 2002-2019 Survey/access files. Estimates are in terms of percentage points and standard errors are shown below estimates in parentheses. All estimates are weighted and standard errors are clustered at the state level. * p<0.10, ** p<0.05, *** p<0.01, **** p<0.001.