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Provider and Organizational Factors Impacting Routine Cancer Screening Among Older Medicaid Enrollees

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ABSTRACT

Objective: To analyze the conditional association between provider and organizational factors and routine cancer screening for older Medicaid enrollees before and during the COVID-19 pandemic.

Study Setting and Design: This study analyzed pre-pandemic (2018/2019; $n = 110{,}882$) and pandemic (2020/2021; $n = 107{,}451$) cohorts of New Jersey (NJ) Medicaid enrollees aged 50–75. Using linear probability models, we evaluated how provider and organizational characteristics, including interactions with pandemic years, influenced screening for breast, cervical, colorectal, and lung cancers. Models controlled for enrollees' demographic and clinical characteristics and geographic factors.

Data Sources and Analytic Sample: Claims data from the 2016–2021 NJ Medicaid Management Information System were linked to Medicare Provider and Specialty files. The sample included Medicaid enrollees with an assigned primary care provider and no prior cancer diagnosis.

Principal Findings: Higher patient panel sizes were consistently associated with increased screening for breast (20.4%, 95% confidence interval (CI): 13.9%–26.8%), cervical (24.1%, 95% CI: 16.6%–31.5%), and lung cancer (63.1%; 95% CI: 17.4%–108.6%) during the pandemic. Obstetrician-gynecologist providers were linked to higher screening rates for breast (50.6%, 95% CI: 41.6%–59.5%) and cervical cancers (70.5%, 95% CI: 52.3%–88.9%), even during the pandemic. Female providers improved screening rates for breast (7.6%, 95% CI: 2.8%–12.3%), cervical (3.8%, 95% CI: 0.10%–7.5%), and colorectal cancer (5.8%, 95% CI: −2.7%–14.4%) among female enrollees. Provider age was unrelated to breast, cervical, or colorectal screening; however, in 2021, lung cancer screening was 23% lower for patients of clinicians aged 62 and above.

Conclusions: Large group practices effectively maintained breast and cervical cancer screening during the pandemic while exhibiting mixed results for colorectal and lung cancers. Provider characteristics such as gender and specialty also significantly impacted screening rates. Supporting large practices and addressing barriers in smaller practices are key to improving cancer prevention, especially during crises.

Summary

- What is known on this topic
  - Previous literature links provider sex and medical specialty to cancer screening rates. These studies relied on self-reports, predate COVID-19, and do not adjust for patient, provider, and plan differences.
  - COVID-19 disproportionally impacted Medicaid enrollees, but prior evidence on the relationship between provider and organizational factors and cancer screening among this population is scarce.
- What this study adds
  - Using individual-level Medicaid claims linked to provider and organizational data, this study finds that larger practices and medical specialty are the strongest correlates of breast and cervical cancer screening.
  - Female providers and obstetrician-gynecologists were associated with higher cancer screening rates for breast, cervical, and colorectal cancers among female enrollees.
  - Organizational capacity and specialty focus helped sustain screening during the pandemic, but mixed colorectal screening results suggest these factors' impact may differ by cancer type.

1 | Introduction

The COVID-19 pandemic directly impacted cancer prevention efforts, resulting in an estimated deficit of 9.4 million screening exams [1]. This disruption resulted in fewer new cancer diagnoses, more cancers diagnosed at advanced stages, delays in treatment, and more years of life lost [1–12]. Individuals who face greater barriers to healthcare and cancer screening, such as low-income individuals and Medicaid enrollees, were disproportionately impacted by the pandemic [2, 13]. Multilevel factors at the individual, community, provider, clinic, and system levels have been documented to impact screening referral and follow-up to abnormal screening results among medically underserved, underinsured groups. Patients in safety-net healthcare settings, such as those with Medicaid coverage, rely heavily on primary care physicians for the identification of screening eligibility, referrals, and follow-ups. Yet, these primary care physicians are facing increasing complexity in Medicaid coverage, Medicaid managed care organization networks, and other payer-related factors. Further, referral options from federally qualified health centers (FQHCs) to specialty care for cancer screening follow-up and treatment have also become more complex and limited [14–16]. Provider and organizational factors can have significant and varying effects on the cancer screening process, with some providers and organizations being more effective than others at maintaining screening efforts under major disruptions and resolving backlogs.

Resource dependency theory offers a useful lens for understanding these differences. The theory argues that organizations able to secure and mobilize critical resources—personnel, equipment, and information systems—are better positioned to sustain core functions and survive external shocks [17, 18]. In the context of a pandemic, we expect resource-rich group practices to have an advantage in preserving routine services such as cancer screening.

In this study, we analyzed administrative data on 155,662 New Jersey (NJ) Medicaid enrollees from 2016 to 2021 to identify provider and organizational factors associated with a higher likelihood of being screened for cancer before and during the pandemic. NJ is among the top 10 states with high rates of new cancer cases [19], many of which can be detected through routine screening. Moreover, Medicaid enrollees in the state were less likely to undergo cancer screening, with pre-pandemic screening rates falling below both state and national averages [20]. To close this gap, NJ launched ScreenNJ in 2018—a statewide program that now collaborates with 375 organizations at 522 sites to deliver outreach, education, and navigation services, particularly in underserved communities—an infrastructure that likely helped screening rebound after the initial pandemic shock.

Previous literature suggests that higher staffing ratios [16, 17], female providers [21], and patient-provider concordance were associated with higher cancer screening rates before the pandemic [22]. Obstetrician-gynecologists (OB-GYNs) have also been found to be more likely to screen for breast and cervical cancer compared to other provider specialty types, although the evidence is mixed [21]. However, most existing research relies on survey responses [21] or focuses on specific settings (e.g., Veterans Affairs and community health centers) [16, 17, 23]. Our study makes three contributions to the existing literature on the role of providers and organizations in cancer screening. First, we use administrative data to measure screening instead of relying on self-reported measures, which may be susceptible to recall bias. Second, because we use data from Medicare Data on Provider Practice and Specialty (MD-PPAS) linked to Medicaid administrative data, we can identify clinician characteristics for 6993 providers offering primary care to older Medicaid enrollees in our sample. This comprehensive data gives us the statistical power to separate the effect of the provider's sex from other correlated characteristics like medical specialty. Third, MD-PPAS provides a reliable source for identifying group practices and their size [24], which may be crucial under capacity constraints and for which there is no good publicly available data.

2 | Methods

The NJ Medicaid Management Information System (NJMMIS) was our primary data source, providing Medicaid fee-for-service claims and managed care encounter records from 2016 to 2021. This comprehensive dataset offers detailed information on Medicaid enrollees' birth year, race, sex, eligibility category, managed care plan, zip code of residence, and medical information on procedures, diagnoses, national provider identifier, and provider servicing zip code for all Medicaid-paid encounters. To define healthcare provider and organizational factors, we linked the NJMMIS data with the MD-PPAS, which includes the provider's specialty, birth year, sex, number of Medicare patients, and tax identification number of the provider's group practice. We excluded beneficiaries covered by both Medicare and Medicaid—called dual-eligibles—because we lack comprehensive Medicare claims information and thus cannot observe screening paid by Medicare.

We created two baseline cohorts: a pre-pandemic cohort of enrollees aged 50–75 in 2017 and a pandemic cohort aged 50–75 in 2019. To address concerns about patients switching their primary care provider (PCP) in response to the pandemic, we predetermined the PCP assignment. Specifically, we assigned a PCP to each person based on their primary-care-related claims in a 24-month period, using their visits from 2016 to 2017 for the pre-pandemic group and 2018–2019 for the pandemic group. The assigned provider was the one the person visited the most during the 24-month period. If a person saw more than one PCP an equal number of times, we assigned the provider they saw most recently in the lookback period. We identified primary care visits using a combination of evaluation and management codes, claim type, provider type, place of service, and specialty codes. Specific inclusion criteria are listed in Table SA1.

We imposed additional restrictions to identify enrollees eligible for routine recommended cancer screening. First, we excluded enrollees with a cancer-specific diagnosis in the 24-month look-back period, as they would not need preventive cancer screening. Second, we aligned the cancer-specific sample with US Preventive Services Task Force (USPSTF) recommendations, restricting the age ranges to 50–74 years for breast cancer, 50–65 years for cervical cancer, 50–75 years for colorectal cancer, and 55–75 years for lung cancer. In addition, we only included previous or current tobacco users for lung cancer because only enrollees with a history of high tobacco use are eligible for preventive lung cancer screening. See Table SA2 for a list of International Classification of Diseases, 10th Revision (ICD-10), and Healthcare Common Procedure Coding System (HCPCS) codes used to flag tobacco users.

Primary outcomes were constructed at the enrollee-year level using 2018 and 2019 NJMMIS claims for the pre-pandemic group and from 2020 and 2021 NJMMIS claims for the pandemic group. We defined breast cancer screening as any claim for mammography or tomography; cervical cancer screening as any claim for Pap smear or human papillomavirus test; colorectal cancer screening as any claim for colonoscopy, sigmoidoscopy, colonography, fecal immunochemical test (FIT), fecal occult blood test, colonography, or enema; and lung cancer screening as any claim for low-dose computed tomography. For additional technical notes and the list of claims codes—namely, ICD-10, HCPCS, and Current Procedural Terminology—refer to Table SA3.

We used information from the MD-PPAS to create our independent variables. In particular, we considered the provider's primary specialty, sex, birth date, the number of unique Medicare patients, and tax identification number. The last variable was used to group providers sharing the same tax number into practices. For each cancer type, we estimated a linear probability model following this specification:

$$Y_{ict} = \sum_{f\in[1,13]} \alpha_f \cdot P\&O_i^f + \sum_{f\in[1,13]} \beta_{2020,f} \cdot (t=2020) \cdot P\&O_i^f + \sum_{f\in[1,13]} \beta_{2021,f} \cdot (t=2021) \cdot P\&O_i^f + \Gamma X_i + \gamma_{ct} + \epsilon_{ict} \quad (1)$$

where Y_{ict} is an indicator denoting whether enrollee i residing in county c was screened for cancer in year t, $P\&O$ is a full set of 13 provider and organizational variables, and γ_{ct} are county-by-year fixed effects. As controls, we included a vector of enrollee characteristics, including comorbidity index, Medicaid eligibility category, managed care plan, distance to provider, and demographic controls outlined in Table SA4 Panel (c) (X_i). Standard errors were clustered at the county level.

Our coefficients of interest are α_f, $\beta_{2020,f}$, and $\beta_{2021,f}$, and they capture the difference in the likelihood that enrollees who visit a provider with characteristic f are screened for cancer compared to enrollees who visit a reference group of providers without this characteristic. In the pre-pandemic cohort, α_f captures the relative difference in screening, while in 2020 and 2021, the difference is captured by $\alpha_f + \beta_{2020,f}$ and $\alpha_f + \beta_{2021,f}$, respectively. We differentiated the pandemic effects between 2020 and 2021 to assess the responses in the absence and presence of vaccines. Coefficients for 2020 will be referred as "pandemic" and coefficients for 2021 as "vaccine rollout."

Analysis of restricted data was approved by the Institutional Review Board at Rutgers University under protocol Pro20220000341; and a limited dataset for this study was made available under a data use agreement with the NJ Division of Medical Assistance and Health Services.

3 | Results

Table SA4 contains summary statistics for both the pre-pandemic and pandemic cohorts. In the pre-pandemic period (Panel [a]), annual screening rates were highest for breast cancer (36.6%) and cervical cancer (18.7%), and markedly lower for colorectal (12.7%) and lung cancer (3.2%). These percentages capture the share of enrollees screened within a single calendar year and reflect differences in guideline intervals (e.g., biennial for breast cancer and every 3–5 years for cervical cancer). By contrast, survey benchmarks aggregate over longer guideline-based intervals. For example, the 2018 NJ Behavioral Risk Factor Survey (NJBRFS) found that 81.1% of women reported a mammogram in the past 2 years. When we apply the same 2-year window to our Medicaid sample, the cumulative breast cancer screening rate rises to 58.9%. This underscores the importance of accounting for differences in measurement windows (1 year versus multi-year cumulative screening), eligibility criteria, and payer mix when comparing screening rates across studies and surveys. Still, even after harmonizing intervals, routine cancer screening among Medicaid adults in NJ is lower than the statewide average and the Health NJ 2020 biennial mammography target of 87.5%, consistent with previous evidence of lower screening rates in Medicaid populations [20]. Finally, the 3.2% annual lung-cancer screening rate among Medicaid tobacco users is comparable to the 2.7% rate reported for high-risk adults in NJ [25].

Provider and practice characteristics are shown in Table SA4 panel (b). Providers who are medical doctors, those in the top tercile of Medicare patient size, in group practices, and male providers are more likely to see Medicaid patients in our sample. As shown in panel (c), the pre-pandemic and pandemic cohorts differ in their demographic characteristics. In particular, the pandemic cohort is older, more likely to be female, and less likely to live within the same zip code as their provider's office, although up to 60% still live within 8 miles. Table SA5 demonstrates that adjusting our estimates for these observable differences in enrollees' characteristics increases the R^2 for all cancer types by at least 1.3 times. As for the coefficients, the difference in screening rates by provider and organizational factor changes between the unadjusted and fully controlled specifications, as shown in columns 3, 6, 9, and 12. The estimates that follow correspond to the fully controlled specification.

Because baseline screening rates range widely—from 36.6% for breast cancer to 3.2% for lung cancer—we show the relative (percent) difference of each factor in Figures 1–5. Each relative difference is calculated by dividing the estimated coefficients from Equation (1) (Table SA6) by the screening rate for that factor's reference group (Table SA7). Reference groups were selected to maximize interpretability and align with theory and previous literature. Specifically, nurse practitioners serve as the specialty baseline because they are the only non-physician clinicians in the sample; "low patient volume" and "solo practice" benchmarks capture the most likely capacity-constrained providers central to the resource dependency theory hypothesis; and male, younger physicians are retained as baselines to match earlier studies that estimate gender- and age-related differences. For example, the relative screening difference in 2020 for OB-GYNs equals $(\alpha_{\text{OBGYN}} + \beta_{2020,\text{OBGYN}})/\text{screening rate}_{2020,\ \text{NURSE PRACTITIONER}}$. This scaling makes results comparable across models and ensures that our inference is unaffected by level difference among cancer types.

Figure 1 explores the conditional association between medical specialty and relative screening differences among female enrollees. After adjusting for patient sociodemographic characteristics and specialty-related factors (including provider gender), female patients whose PCP was an OB-GYN were 35.1% (p-value <0.001), 71.6% (p-value <0.001), and 15.3% (p-value $=0.04$) more likely to receive breast, cervical, and colorectal cancer screening, respectively, than women whose provider was a nurse practitioner. The pandemic increased the conditional association of OB-GYNs with breast cancer screening from 35.1% to 50.6% (p-value <0.001), but it shrank the OB-GYNs relative importance from 15.3% to 0.42% (p-value $=0.96$) for colorectal cancer. As for lung cancer, panel (d) shows that, in the pre-pandemic period, tobacco users experienced no statistically significant difference in screening whether their PCP was a medical doctor or a nurse practitioner. That pattern shifted with COVID-19. During the pandemic year (2020) and again in the vaccine rollout year (2021), the specialty coefficients for medical doctors are jointly significant (Prob > F: 0.016 and Prob > F: 0.0015, respectively), indicating that, taken together, medical doctors were associated with higher screening probabilities for lung cancer than nurse practitioners. Figure SA1 shows the relative screening differences by medical specialty for male enrollees. In this specification, we excluded OB-GYNs as a factor because they do not see male patients. As can be seen, there is no statistically significant difference across specialties for colorectal cancer,

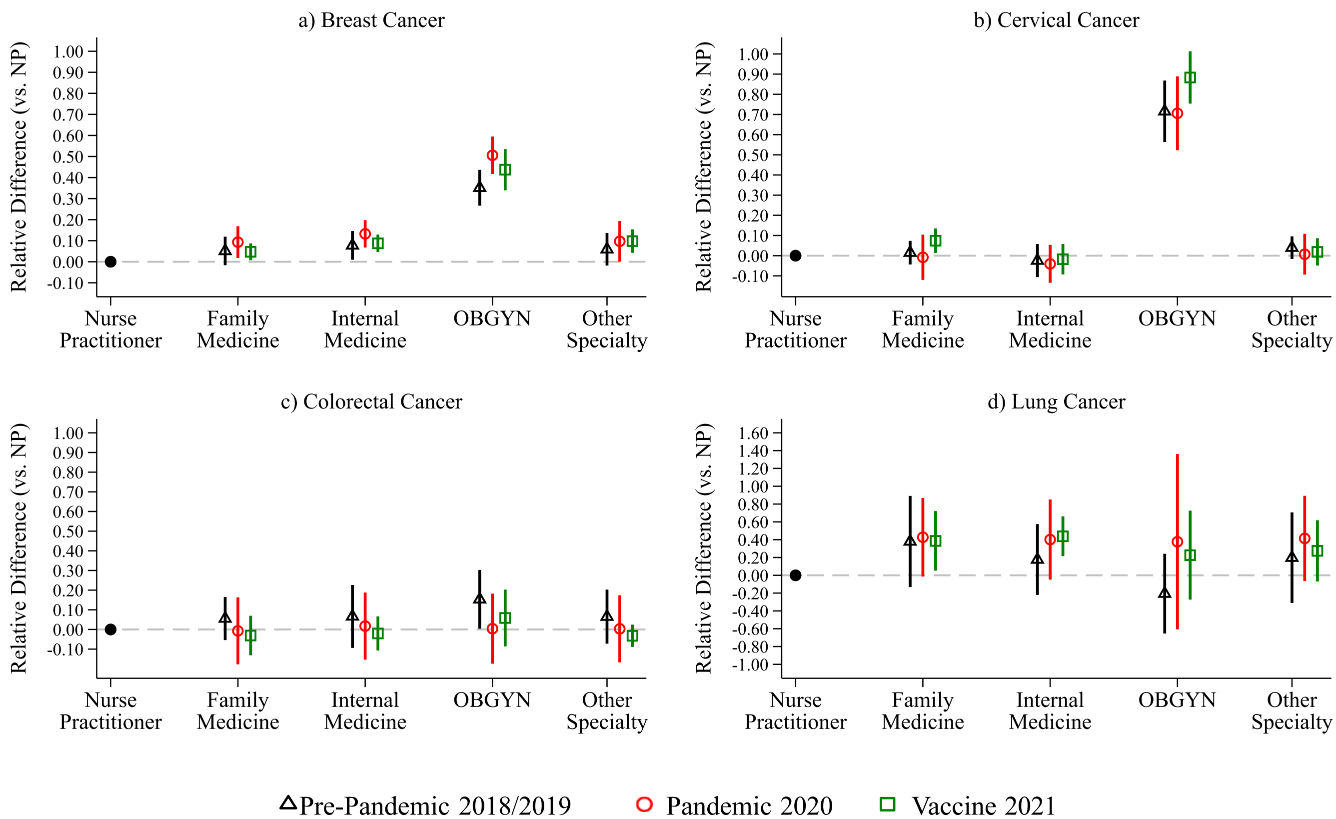

FIGURE 1 | Relative screening rate by medical specialty in female enrollees. The above figure shows the relative screening difference between medical specialties and nurse practitioners -the reference group. The markers denote the point estimate, and the bars the associated 95% confidence intervals. Only females are included in these regressions, and the outcome is an indicator for whether the enrollee was screened for the respective cancer. The relative difference is calculated by dividing the estimated coefficient on Equation (1) and shown in Table SA6 by the relevant mean among nurse practitioners. Data come from the NJ Medicaid Management Information System and cover the period 2018–2021. NP: Nurse practitioner.

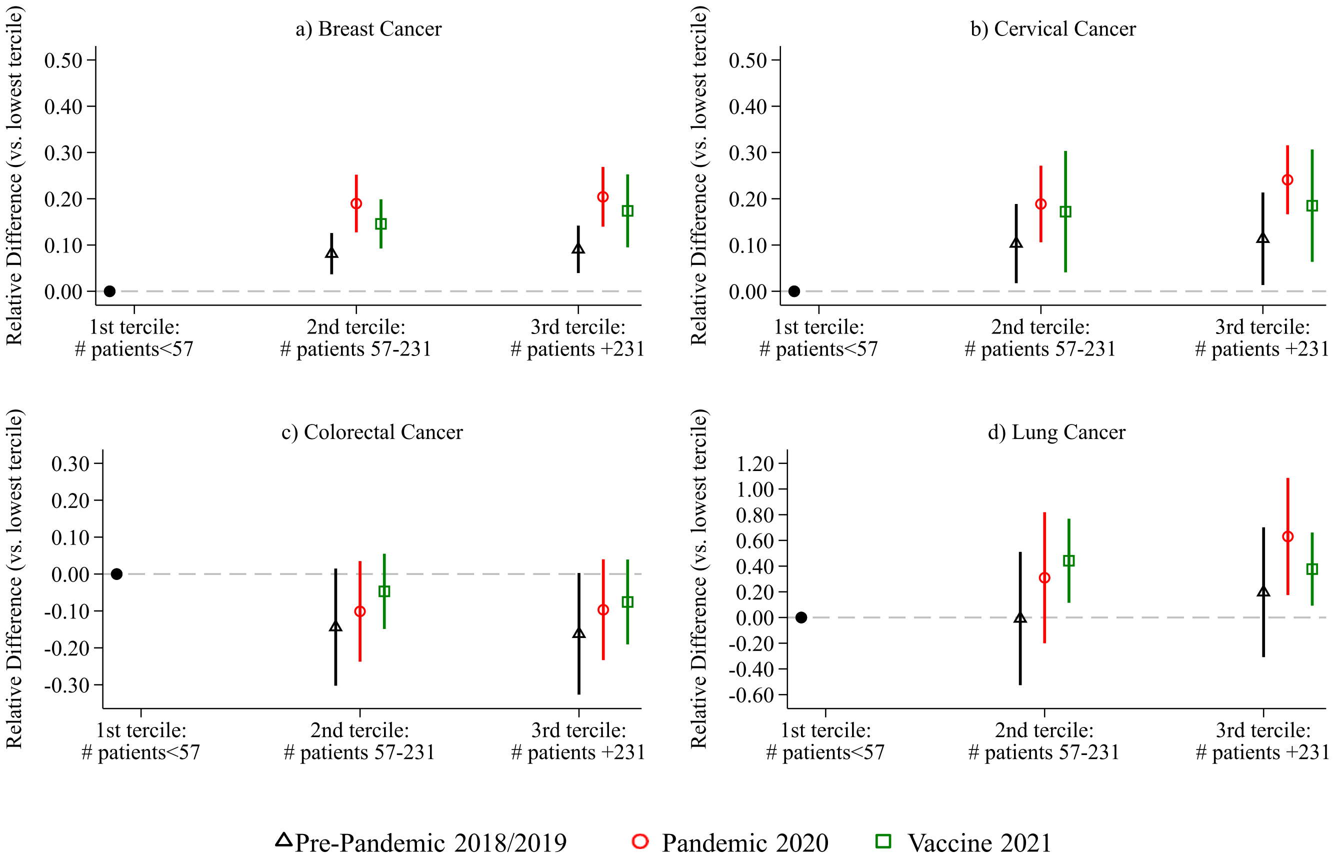

FIGURE 2 | Relative screening rates by patient volume. The above figure shows the relative screening difference between medium and top patient size and the first tercile-the reference group. The markers denote the point estimate, and the bars the associated 95% confidence intervals. The outcome is an indicator for whether the enrollee was screened for the respective cancer. The relative difference is calculated by dividing the estimated coefficient on Equation (1) and shown in Table SA6 by the relevant mean among the first tercile. Data come from the NJ Medicaid Management Information System and cover the period 2018–2021.

but, like female enrollees, male tobacco users were more likely to be screened for lung cancer during the vaccine rollout year by medical doctors compared to nurse practitioners by 55.8% (Prob > F: 0.0001).

Figure 2 displays the relative screening difference between clinicians with high and low practice sizes, measured by the unique number of Medicare patients. A higher practice size is linked to a greater likelihood of being screened for breast and cervical cancers in all periods. Notably, during the pandemic, the screening difference widened between high- and low-practice-size clinicians. For breast cancer and PCPs in the 2nd tercile of patient volume, the difference increased from 8.2% (p-value <0.01) to 18.9% (p-value <0.01); for cervical cancer, it increased from 10.3% (p-value $=0.021$) to 18.8% (p-value <0.01). As for lung cancer, there was also an increase in the relative screening probability between low- and high-practice-size clinicians during the pandemic and vaccine rollout year. In contrast, colorectal cancer exhibits the opposite relationship, with PCPs with larger patient volumes being associated with a lower probability of screening for colorectal cancer.

Figure 3 shows that, in the pre-pandemic, patients treated in a group practice—an indicator of greater provider capacity—were more likely to receive breast and cervical cancer screening than those seen in solo practices. This advantage became even more pronounced during the pandemic year, when mid-sized groups (11–20 providers) recorded the highest screening probabilities: they were 19% (p-value <0.01) more likely to receive breast cancer screening and 20.5% (p-value <0.01) more likely to receive cervical cancer screening than patients of solo practitioners. The same general pattern persisted during the 2021 vaccine rollout year. Findings are mixed for colorectal and lung cancers. Before COVID-19, mid-sized groups were associated with a 27.7% (p-value <0.01) higher screening probability than solo practitioners, but that difference shrank during both pandemic and vaccine rollout years and is no longer statistically significant. However, lung cancer screening shows the opposite trend: large practices with more than 20 providers registered an improvement, with screening among their patients rising by at least 52.6% (p-value $=0.05$) during the pandemic and vaccine rollout years.

Figure 4 shows the relationship between the provider's age and cancer screening. The provider's age did not have a statistically significant impact on cancer screening, except for lung cancer during the vaccine rollout year. Relative to patients whose PCP was younger than 46 years (the reference category), those whose clinicians were aged 46–53 experienced a 22.4% (p-value $=0.03$) lower likelihood of lung cancer screening, while patients of

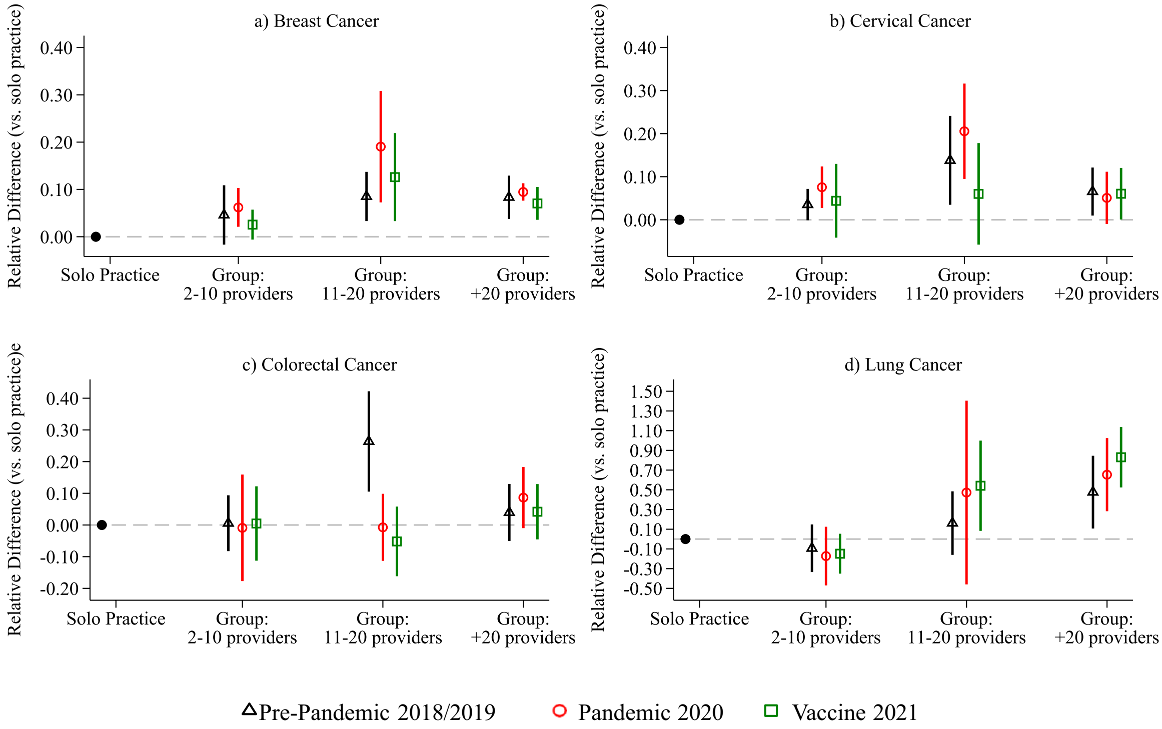

FIGURE 3 | Relative screening rates by group practice size. The above figure shows the relative screening difference between group practices and clinicians in a solo practice-the reference group. The markers denote the point estimate, and the bars the associated 95% confidence intervals. The outcome is an indicator for whether the enrollee was screened for the respective cancer. The relative difference is calculated by dividing the estimated coefficient on Equation (1) and shown in Table SA6 by the relevant mean among solo practice. Data come from the NJ Medicaid Management Information System and cover the period 2018–2021.

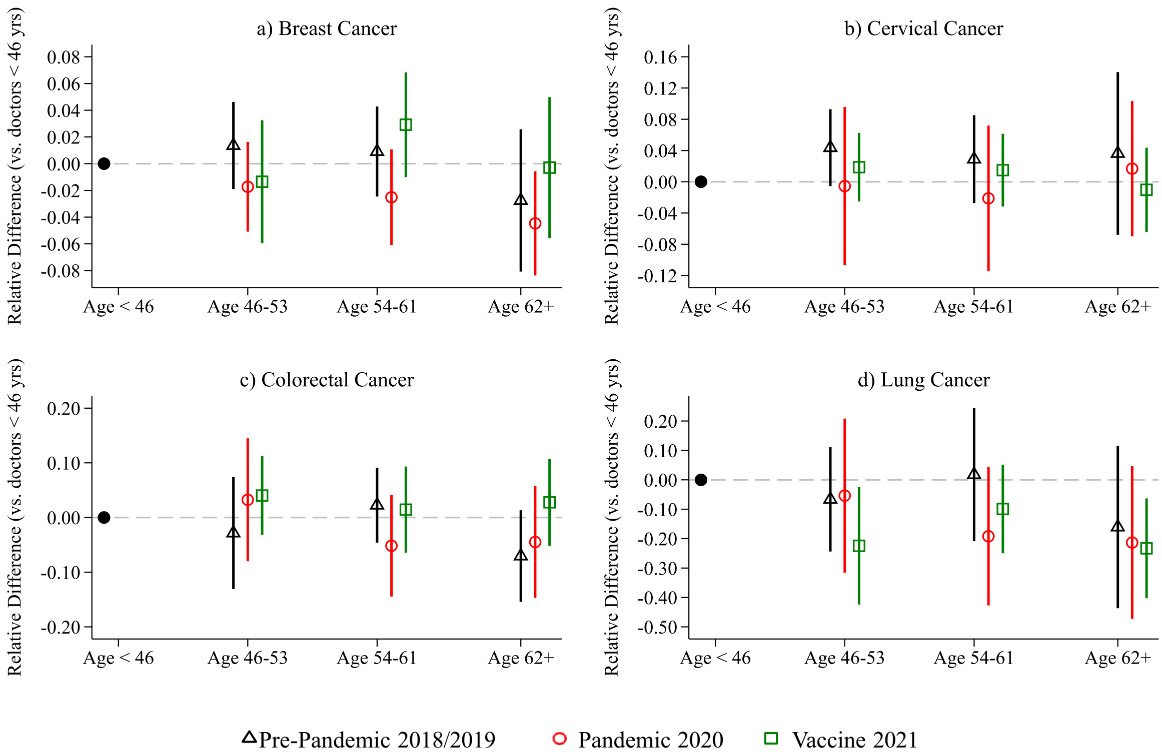

FIGURE 4 | Relative screening rates by provider age group. The above figure shows the relative screening difference between clinicians' age group and young clinicians (age < 46 years old)—the reference group. The markers denote the point estimate, and the bars the associated 95% confidence intervals. The outcome is an indicator for whether the enrollee was screened for the respective cancer. The relative difference is calculated by dividing the estimated coefficient in Equation (1) and shown in Table SA6 by the relevant mean among young clinicians. Data come from the NJ Medicaid Management Information System and cover the period 2018–2021.

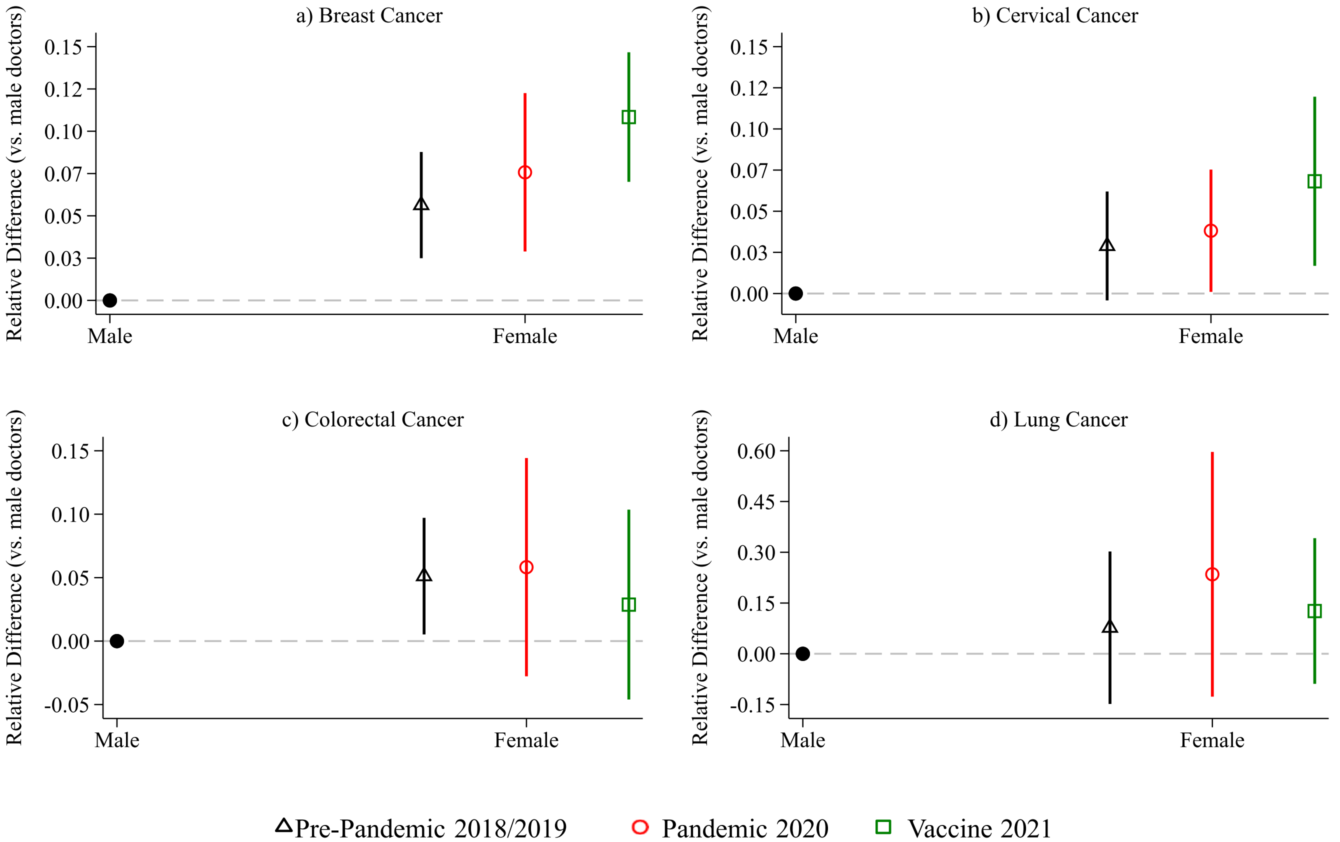

FIGURE 5 | Relative screening rate by provider's sex in female enrollees. The above figure shows the relative screening difference between female clinicians and male clinicians—the reference group. The markers denote the point estimate, and the bars the associated 95% confidence intervals. The outcome is an indicator for whether the enrollee was screened for the respective cancer. The relative difference is calculated by dividing the estimated coefficient in Equation (1) and shown in Table SA6 by the relevant mean among male clinicians. Data come from the NJ Medicaid Management Information System and cover the period 2018–2021.

clinicians aged 62 and older were 23.2% (p-value <0.01) less likely to be screened.

Finally, Figure 5 compares screening outcomes by provider gender for female enrollees. Female physicians are consistently associated with higher breast, cervical, and colorectal screening both in the pre-pandemic and pandemic 2020 years. During the initial pandemic year, the female-versus-male difference was 7.5% (p-value <0.01) for breast cancer, 3.8% (p-value $=0.04$) for cervical cancer, and 5.8% (p-value $=0.17$) for colorectal cancer. Lung cancer screening shows a different pattern, with female PCPs increasing the likelihood of being screened from 7.7% (p-value $=0.49$) to 23.5% in 2021 (p-value $=0.19$).

To distinguish the female-physician effect from gender concordance, we re-estimated the colorectal and lung cancer models on a pooled male and female patient sample. Figure SA3 illustrates that gender concordance increased the likelihood of screening for colorectal cancer from 2.7% (p-value $=0.36$) pre-pandemic to 5.6% (p-value $=0.10$) during the pandemic; however, it had no influence on lung-cancer screening. It is important to note that less than 28% of the enrollees in the sample shared gender concordance with their provider (Table SA1, panel [b]), which presents challenges for accurate estimation of the gender concordance coefficient.

4 | Discussion

This study found distinct factors that predicted higher cancer screening rates for Medicaid enrollees during the pandemic: the group practice model, larger practice size, being a female clinician, and being an OB-GYN. Previous literature suggests that female clinicians were more likely to screen for breast cancer [21]. Further, patient-provider gender discordance was associated with lower rates of breast, cervical, and colorectal cancer screening [26]. Evidence on OB-GYNs and gynecological exams is mixed, but some studies found that OB/GYNs perform more screening than other specialties [21].

Our study has some limitations. Our analysis is restricted to Medicaid enrollees in NJ. Still, the state has a large and diverse population, and we can look at differences in screening rates conditional on having the same insurance coverage and plan. While we had access to a wealth of observable demographic characteristics of enrollees and their distance to the clinician and assigned clinicians using a 2-year look-back period, we cannot fully disentangle patient self-selection from provider effects. In particular, enrollees who are more likely to adhere to screening recommendations may have chosen clinicians and practices of a specific type. Thus, our findings represent conditional associations, not causal effects. Nonetheless, the linked claims and clinician and practice data offer an advantage over other studies that use self-reported screening, include a limited number of clinician variables, and lack key control variables such as insurance plan, distance to provider, and county of residency.

These findings are not surprising when considering resource dependency theory [17, 27], a widely referenced healthcare management theory [18], which posits that organizations that acquire resources are more likely to survive. In other words, larger healthcare organizations are inherently in a greater position to succeed, including sustaining routine functions such as cancer screenings through a pandemic, because they have greater control of their resources. Resources may include personnel (e.g., providers, nurses, patient navigators), equipment (magnetic resonance imaging, computed tomography), and screening supplies (e.g., FIT kits) [28]. Further, large organizations are more likely to have systems in place to identify and track patients eligible for screening as well as personnel to monitor regulation changes (e.g., social distancing protocols). Future work should investigate essential resources that help sustain cancer screenings through a pandemic, drawing from organizational theory to guide hypotheses and variable selection.

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Conflicts of Interest

We acknowledge funding from a New Jersey state appropriation for the Rutgers Cancer Institute (MGMT23GIA001 and MGMT23GIA002) allocated to support Colorectal and Lung Cancer, Service Expansion and ScreenNJ, which supported this study. The funder had no role in the design and conduct of the study. The authors declare no conflicts of interest. Further, we thank the leadership and staff of the New Jersey Division of Medical Assistance and Health Services (DMAHS) for their assistance and guidance on working with Medicaid data. DMAHS did not have influence on the content of the manuscript or the right to publish.

Data Availability Statement

The data that support the findings of this study are available from NJ Division of Medical Assistance and Health Services (Medicaid). Restrictions apply to the availability of these data, which were used under license for this study.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supporting Information.