



# HHS Public Access

Author manuscript

*Cancer J.* Author manuscript; available in PMC 2018 May 01.

Published in final edited form as:

*Cancer J.* 2017 ; 23(3): 151–162. doi:10.1097/PPO.0000000000000261.

## The ACA and Cancer Screening and Diagnosis

**Lindsay M. Sabik, PhD\*** and

Associate Professor, Department of Health Policy and Management, University of Pittsburgh Graduate School of Public Health, 130 De Soto St., Pittsburgh, PA 15261, Phone: (412) 624-0273, Fax: (412) 624-3146

**Georges Adunlin, PhD**

Cancer Prevention and Control Postdoctoral Fellow, Department of Health Behavior and Policy, Virginia Commonwealth University School of Medicine, 830 E Main St 9th Floor, Richmond, VA 23298-0430, Phone: (804) 628-7529, Fax: (804) 828-5440

### Abstract

The Affordable Care Act (ACA) included multiple provisions expected to increase cancer screening and subsequently early diagnosis of cancer. Key provisions included new coverage options for low-income adults and young adults, as well as elimination of cost-sharing for recommended preventive services across most health insurance plans. This paper reviews relevant quantitative studies published since the ACA's passage to assess whether the goal of increasing access to preventive services has been met. Due to lags in data availability, most studies examined only a short time period post-ACA. Findings on changes in screening in the general population were mixed, though impacts were greatest among those with lower education and income, as well as groups that previously faced the highest cost-barriers to screening. Further, multiple studies found evidence of increases in early stage diagnoses for certain cancers. Thus, certain targeted populations appear to have better access to cancer screening after the ACA.

### Keywords

Patient Protection and Affordable Care Act; health care reform; cancer care; screening; diagnosis

---

There is broad agreement among key organizations that population-wide screening for certain cancers is an important strategy to improve population health.<sup>1</sup> One of the objectives of the Healthy People 2020 initiative is to “reduce the number of new cancer cases, as well as the illness, disability, and death caused by cancer.”<sup>2</sup> Yet, historically, levels of screening have been far below goals such as those set by Healthy People 2020, and there have been disparities in screening by socioeconomic status, race and ethnicity.<sup>3</sup> Disparities in receipt of cancer screening are caused by a complex interplay of factors, with access to care playing a key role.<sup>3</sup> Lack of insurance coverage has been one important barrier leading to underscreening and disparities in screening.<sup>4</sup> The United States (US) has long had a rate of uninsurance that is considerably higher than that of industrialized peer nations.<sup>5</sup> The

---

\*corresponding author.

Affordable Care Act (ACA) responded to this need by aiming to substantially expand access to health insurance coverage in the US.

The ACA is expected to affect receipt of cancer screening and subsequent diagnosis primarily through two mechanisms: expanded health insurance coverage options and coverage requirements for clinical preventive services for most types of public and private health insurance. First, a key feature of the ACA was the expansion of Medicaid to adults with incomes at or below 138% of the federal poverty level. Low-income childless adults were typically ineligible for Medicaid and had relatively low rates of health insurance coverage prior to the ACA. While a 2012 Supreme Court decision made the Medicaid expansion optional for states, a total of 32 states, including the District of Columbia, had expanded Medicaid by 2017.<sup>6</sup> Second, the ACA established health insurance marketplaces to allow individuals to shop for health insurance coverage, apply for financial assistance, and purchase coverage without medical underwriting.<sup>7</sup> Third, the law required plans and insurers offering dependent coverage to allow young adult dependents to remain on a parent's plan until the age of 26.<sup>8</sup> Finally, the ACA required Medicare and non-grandfathered private health insurance policies to provide coverage for preventive care services with a grade of A or B by the United States Preventive Services Task Force (USPSTF) without cost-sharing.<sup>9</sup> Recommended services at the time of the ACA implementation included screening for colon, breast and cervical cancer. Prior to the ACA, Medicare enrollees without supplemental insurance coverage were responsible for up to 20% of the cost of screening services, and privately insured individuals could be responsible for various forms of cost-sharing, including co-payments, co-insurance, and meeting plan deductibles; this could amount to substantial out-of-pocket costs for some screening services.<sup>10</sup> Of note, annual screening mammography represents a unique example where the ACA's provisions requiring first dollar coverage for services extend beyond biennial screening that is currently recommended by the USPSTF.

The ACA offered new opportunities for access to care, and to cancer screening services in particular, as a result of the law's provisions implementing new options for insurance coverage and removing potential cost barriers to preventive services. In this paper, we review existing evidence of the ACA's impact on cancer screening and diagnosis. Evidence on the ACA's impact highlights considerations for how future changes to the ACA and US health policy more generally are likely to impact access to cancer screening, diagnoses of cancer, and disparities in prevention and outcomes.

## METHODS

We performed a literature search to identify published papers examining the impact of the ACA on cancer screening and diagnosis. Inclusion criteria applied were: (1) English language articles; (2) studies published in a peer-reviewed journal; (3) studies based on US populations; (4) studies published from March 2010 (when the ACA was signed into law) to January 2017; (5) studies that focus on the impacts of the ACA; (6) empirical studies using quantitative data (excluding, e.g., review papers, editorial or comment papers, case reports, and case series); (7) studies that examine selected impact measures (screening or diagnosis)

and focus on USPSTF recommendations for screening (e.g., mammography, colonoscopy). Details on the search strategy may be found in Appendix A, Supplemental Digital Content 1.

## RESULTS

Figure 1 illustrates the study identification, screening, and selection process. Details on study approaches and quality are presented in Appendix B, Supplemental Digital Content 1. Reflecting all their differences, the methodological scoring for the studies was highly varied (quality scores ranged from 0.33 to 0.83 on a scale from 0 to 1). We identified 14 studies that estimated the effect of one or more provisions of the ACA on cancer screening or diagnosis (Table 1). A few studies considered the impacts of new insurance coverage pathways. One national study specifically examined the effect of the 2014 state-level Medicaid expansions on use of preventive services, including Pap tests, breast exams, and mammograms for women using data from the Behavioral Risk Factor Surveillance System (BRFSS) survey.<sup>11</sup> The authors did not find evidence of an impact of Medicaid expansions on screening, though given that the relevant questions are only included in the BRFSS in even years, they had just one post-implementation year of data on screening outcomes. Two studies considered the impact of the dependent coverage mandate on young adults targeted by the provision compared to control adults not affected and found evidence of increases in early stage diagnoses for cancer sites detectable by screening or clinical exam.<sup>12,13</sup>

A number of studies considered screening among both the privately insured and Medicare enrollees in recommended age ranges. In a pre/post analysis using National Health Interview Survey (NHIS) data that pooled privately insured and Medicare enrolled adults, increases in colorectal cancer screening were observed, driven by changes among low-SES and Medicare-insured individuals, though no changes in breast cancer screening were observed.<sup>14</sup> In contrast, a study that considered changes in receipt of preventive services between 2009 and 2012 for both non-elderly and elderly adults using the Medical Expenditure Panel Survey (MEPS) did not find evidence of statistically significant increases in breast, cervical, or colorectal cancer screening.<sup>15</sup> Analysis of colorectal cancer screening based on MEPS data similarly found no evidence of increases in overall screening in either population, but did find that colonoscopy increased among Medicare enrollees with no additional insurance and those living in poverty.<sup>16</sup> Another study that pooled administrative data on mammography from a large community-based health system found evidence that the ACA increased mammography among women in the recommended age range based on intervention analysis with time series data.<sup>17</sup>

Other studies focused exclusively on changes in screening for Medicare enrollees similarly found some evidence of increases, particularly for subgroups expected to benefit most, but mixed results depending on screening modality and sub-population. Specifically, research using BRFSS survey data found increases in colonoscopy among Medicare enrolled men with largest increases among low-SES men, but no increase among women.<sup>18</sup> Similarly, data on colorectal cancer screening rates from rural health clinics indicate screening increased after the ACA.<sup>19</sup> In contrast, administrative Medicare data for enrollees ages 70 and over showed an increase in screening mammography but no increase in screening or surveillance colonoscopy after the ACA.<sup>20</sup> Another study found that among women with Medicare, there

was a modest increase in mammography screening after the elimination of cost-sharing.<sup>21</sup> Notably, none of the studies considering the impact of cost-sharing elimination for Medicare beneficiaries were able to compare changes in screening to a valid control group, limiting the ability to draw robust conclusions regarding causality. Nonetheless, there is evidence from multiple studies of increases in screening in the Medicare population after the ACA was implemented.<sup>14,16,18–21</sup> Further, a recent study considering changes in early stage diagnoses of cancer among Medicare-aged individuals compared to younger cohorts and found a significant increase in early-stage colorectal cancer diagnoses (and decrease in late-stage diagnoses among men) though no evidence of changes in breast cancer stage.<sup>22</sup>

Finally, two studies considered how screening changed for different groups of privately insured individuals after the ACA eliminated cost-sharing, and results again were mixed. A natural experiment using data from a large national insurer compared individuals from non-grandfathered plans who were impacted by the policy change to a control group in grandfathered plans and found no changes in mammography or colonoscopy in the treatment group relative to the controls.<sup>23</sup> In contrast, individuals who switched into a high-deductible health plan before the elimination of cost-sharing for screening reduced their colorectal cancer screening, while those who switched after the ACA increased screening, suggesting a substantial relative difference as a result of the ACA.<sup>24</sup>

Table 2 summarizes studies published after the passage of the ACA that drew implications regarding the likely impact of the ACA's provisions on screening and diagnosis but did not directly evaluate the effects of the law. Overall, these studies suggest that insurance coverage<sup>25,26</sup> and cost-sharing reductions<sup>27,28</sup> are generally associated with increased use of screening services, though methodology and study quality vary and not all results support this conclusion.<sup>29</sup> One identified study also suggests that increased coverage options for young adults with cancer may improve outcomes given insurance coverage was associated with improved stage at diagnosis, treatment and mortality outcomes.<sup>30</sup> While the studies generally suggest that the ACA is likely to lead to improvements in screening and early diagnosis, they also highlight that given variation in Medicaid expansion across states, existing disparities in screening may be expected to widen nationally after ACA implementation.<sup>31,32</sup> Further, given remaining gaps in insurance coverage under the ACA's provisions, projections of the number of women likely to remain uninsured highlight the potential continued need for support of screening services for uninsured women through the CDC's Breast and Cervical Cancer Early Detection Program.<sup>33,34</sup>

Finally, Table 3 summarizes key studies considering the impact of the 2006 Massachusetts health reform on cancer screening. The ACA was modeled in large part on the Massachusetts legislation, so evidence of the impacts of Massachusetts reform can shed light on potential longer-term impacts of the ACA. Results from these studies generally indicate that Massachusetts health reform increased access to various screening services.<sup>35–39</sup> While one early study did not find an association between Massachusetts reform and increased rates of mammography or changes in stage at breast cancer diagnosis,<sup>40</sup> other studies that used a longer time period post-expansion suggest a significant impact on screening.<sup>36–39</sup> Despite similarities between the Massachusetts health reform and the ACA, the experience in Massachusetts may not generalize to other states, particularly given the very low

uninsurance rate in Massachusetts before insurance expansion. Even so, the success of the Massachusetts health reform is an indication that over time federal reform may impact cancer related outcomes beyond what the current literature suggests.

## DISCUSSION

While the ACA substantially decreased uninsurance and improved access to health care,<sup>41</sup> the evidence of the impact of the ACA on cancer screening is more mixed. The lack of strong consensus conclusions from literature up to this point is at least in part the result of the limited number of studies, methodological limitations, and the fact that current data only allow assessment of the short-term impact of the reform. Despite mixed findings, evidence to date suggests that impacts on screening were greatest among those with lower education and income, as well as groups that faced the highest cost-barriers to screening prior to the ACA.<sup>14,16,18,24</sup> Thus, key populations targeted by the ACA's provisions appear to have benefited the most in terms of access to cancer screening. The ACA has not removed all barriers to cancer screening. Nonfinancial barriers, such as provider availability and lack of awareness, require alignment of insurance coverage reforms with prevention and public health efforts.

In addition to the need for research that tracks longer-term effects of the ACA on screening, there are a number of areas where more research on the law's impact on cancer screening and diagnosis is needed. The studies we reviewed do not address changes in racial/ethnic disparities in cancer screening and diagnosis after the ACA. While disparities in health insurance coverage declined during the initial years of the ACA,<sup>42</sup> we do not know how this has impacted long-standing racial, ethnic and geographic disparities in screening.<sup>43-45</sup> Further, access to healthcare and insurance coverage are closely related to the issues of overscreening and overdiagnosis.<sup>46</sup> Literature on the early impact of the ACA has not assessed whether the law increased likelihood of overscreening and overdiagnosis for certain cancers. Existing research on screening changes under the ACA generally assumes either implicitly or explicitly that increases in screening will only improve population health. However, policy changes may also incentivize screenings that carry more risks than benefits.

Taken altogether, the reviewed studies suggest that the ACA had an impact on cancer screening and supported earlier diagnosis, though findings differ across populations and screening modalities. Multiple studies found evidence of substantial impacts among populations expected to benefit most, including low-SES groups and groups subject to high cost-sharing prior to the ACA. At the time of this writing, the ACA is at the center of political debate over healthcare reform and multiple plans for repeal or revision of the law have been proposed. Development of a comprehensive alternative to the ACA should take into account the likely impact of changes on cancer prevention and early detection, as well as health disparities. Evidence indicates that the preventive services mandate and the dependent coverage expansion have increased screening and early diagnosis of some cancers in certain populations; thus, these or similar provisions may be central to continued efforts to reach national screening rate targets and reduce disparities in cancer screening and diagnosis.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

Dr. Sabik was supported in part by a grant from the National Institutes of Health (R01CA178980, co-funded by the National Cancer Institute and the Office of Behavioral and Social Sciences Research). Dr. Adunlin was supported by the Virginia Commonwealth University Massey Cancer Center under a Postdoctoral fellowship in cancer prevention and control.

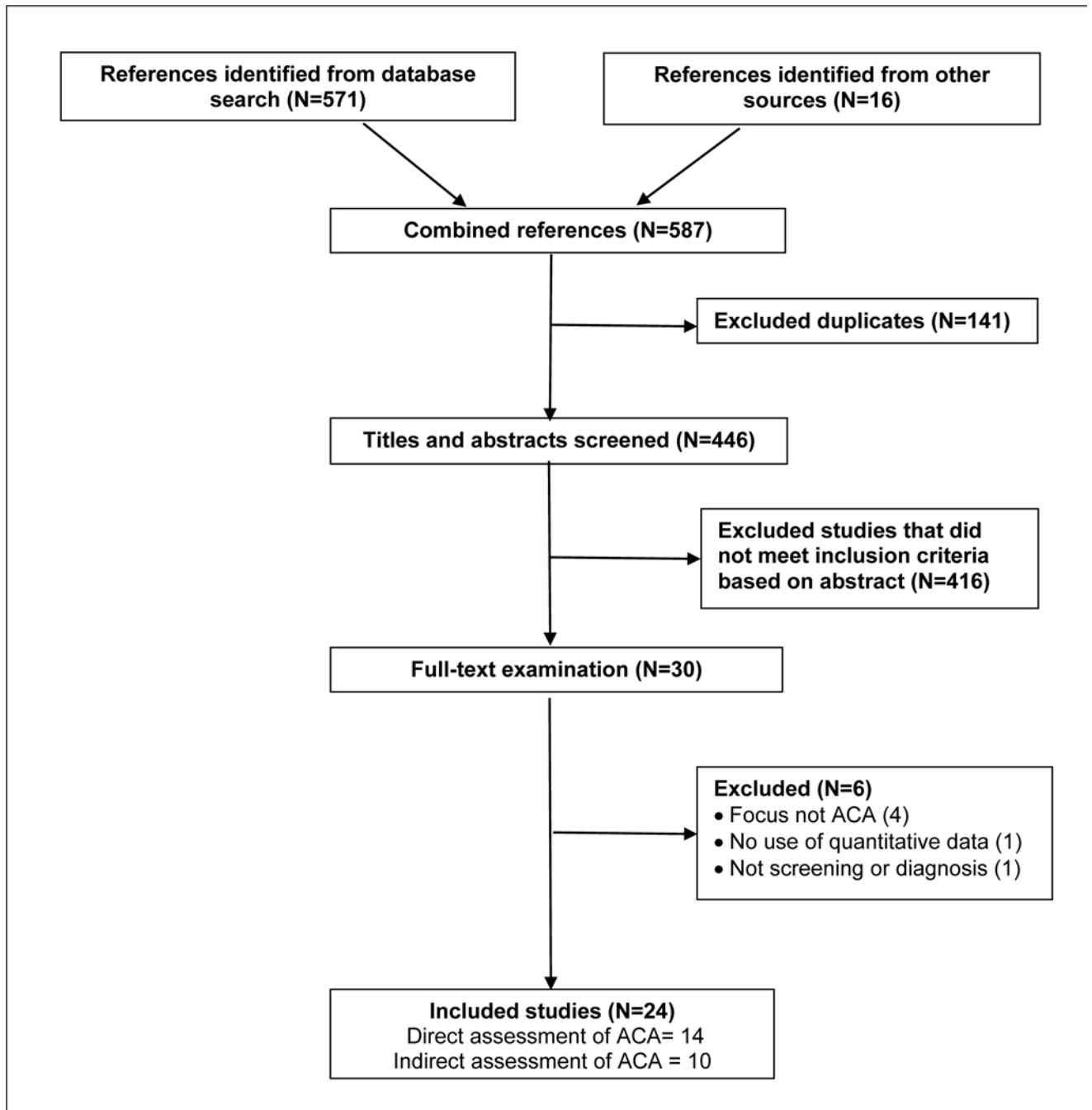
## References

1. World Health Organization Early Detection of Cancer. 2017. (Accessed January 30, 2017, at <http://www.who.int/cancer/detection/en/>.)
2. Healthy People 2020 Topics and Objectives-Cancer. (Accessed November 19, 2016, at <https://www.healthypeople.gov/2020/topics-objectives/topic/cancer>.)
3. Zonderman AB, Ejiogu N, Norbeck J, Evans MK. The influence of health disparities on targeting cancer prevention efforts. *American Journal of Preventive Medicine*. 2014; 46:S87–97. [PubMed: 24512936]
4. DeVoe JE, Fryer GE, Phillips R, Green L. Receipt of preventive care among adults: insurance status and usual source of care. *American Journal of Public Health*. 2003; 93:786–91. [PubMed: 12721145]
5. Schoen C, Osborn R, Squires D, Doty MM. Access, affordability, and insurance complexity are often worse in the United States compared to ten other countries. *Health Affairs*. 2013; 32:2205–15. [PubMed: 24226092]
6. Status of State Action on the Medicaid Expansion Decision. 2017. (Accessed August 15, 2016, at <http://kff.org/health-reform/state-indicator/state-activity-around-expanding-medicare-under-the-affordable-care-act/>.)
7. Burke A, Misra A, Sheingold S. Premium Affordability, Competition, and Choice in the Health Insurance Marketplace. 2014 ASPE Research Brief 2014.
8. Blumenthal D, Collins SR. Health care coverage under the Affordable Care Act—a progress report. *New England Journal of Medicine*. 2014; 371:275–81. [PubMed: 24988300]
9. The Affordable Care Act, Section by Section. 2015. (Accessed August 24, 2016, at <http://www.hhs.gov/healthcare/about-the-law/read-the-law/>.)
10. Pyenson B, Scammell C, Broulette J. Costs and repeat rates associated with colonoscopy observed in medical claims for commercial and Medicare populations. *BMC Health Services Research*. 2014; 14:92. [PubMed: 24572047]
11. Simon K, Soni A, Cawley J. The impact of health insurance on preventive care and health behaviors: evidence from the first two years of the ACA Medicaid expansions. *Journal of Policy Analysis and Management*. 2017; doi: 10.1002/pam.21972
12. Robbins AS, Han X, Ward EM, Simard EP, Zheng Z, Jemal A. Association between the Affordable Care Act dependent coverage expansion and cervical cancer stage and treatment in young women. *JAMA*. 2015; 314:2189–91. [PubMed: 26599188]
13. Han X, Zang Xiong K, Kramer MR, Jemal A. The Affordable Care Act and cancer stage at diagnosis among young adults. *Journal of the National Cancer Institute*. 2016; 108:10.1093.
14. Fedewa SA, Goodman M, Flanders WD, et al. Elimination of cost-sharing and receipt of screening for colorectal and breast cancer. *Cancer*. 2015; 121:3272–80. [PubMed: 26042576]
15. Han X, Robin Yabroff K, Guy GP Jr, Zheng Z, Jemal A. Has recommended preventive service use increased after elimination of cost-sharing as part of the Affordable Care Act in the United States? *Preventive Medicine*. 2015; 78:85–91. [PubMed: 26209914]
16. Richman I, Asch SM, Bhattacharya J, Owens DK. Colorectal cancer screening in the era of the Affordable Care Act. *Journal of General Internal Medicine*. 2016; 31:315–20. [PubMed: 26349953]

17. Nelson HD, Weerasinghe R, Wang L, Grunkemeier G. Mammography screening in a large health system following the U.S. Preventive Services Task Force recommendations and the Affordable Care Act. *PLoS ONE*. 2015; 10:e0131903. [PubMed: 26121485]
18. Hamman MK, Kapinos KA. Affordable Care Act provision lowered out-of-pocket cost and increased colonoscopy rates among men in Medicare. *Health Affairs*. 2015; 34:2069–76. [PubMed: 26643627]
19. Wan TT, Ortiz J, Berzon R, Lin YL. Variations in colorectal cancer screening of Medicare beneficiaries served by rural health clinics. *Health Services Research and Managerial Epidemiology*. 2015; 2:1–7.
20. Cooper GS, Kou TD, Schluchter MD, Dor A, Koroukian SM. Changes in receipt of cancer screening in Medicare beneficiaries following the Affordable Care Act. *Journal of the National Cancer Institute*. 2016; 108:1–8.
21. Sabatino SA, Thompson TD, Guy GP Jr, de Moor JS, Tangka FK. Mammography use among Medicare beneficiaries after elimination of cost sharing. *Medical Care*. 2016; 54:394–9. [PubMed: 26759983]
22. Lissenden B, Yao N. Affordable Care Act changes To Medicare led To increased diagnoses of early-stage colorectal cancer among seniors. *Health Affairs*. 2017; 36:101–7. [PubMed: 28069852]
23. Mehta SJ, Polsky D, Zhu J, et al. ACA-mandated elimination of cost sharing for preventive screening has had limited early impact. *The American Journal of Managed Care*. 2015; 21:511–7. [PubMed: 26247741]
24. Wharam JF, Zhang F, Landon BE, LeCates R, Soumerai S, Ross-Degnan D. Colorectal cancer screening in a nationwide high-deductible health plan before and after the Affordable Care Act. *Medical Care*. 2016; 54:466–73. [PubMed: 27078821]
25. Wright BJ, Conlin AK, Allen HL, Tsui J, Carlson MJ, Li HF. What does Medicaid expansion mean for cancer screening and prevention? results from a randomized trial on the impacts of acquiring Medicaid coverage. *Cancer*. 2016; 122:791–7. [PubMed: 26650571]
26. Mahal BA, Aizer AA, Ziehr DR, et al. The association between insurance status and prostate cancer outcomes: implications for the Affordable Care Act. *Prostate Cancer and Prostatic Diseases*. 2014; 17:273–9. [PubMed: 24980272]
27. Jena AB, Huang J, Fireman B, et al. Screening Mammography for Free: Impact of Eliminating Cost Sharing on Cancer Screening Rates. *Health Services Research*. 2016; 52:191–206. [PubMed: 26990550]
28. Khatami S, Xuan L, Roman R, et al. Modestly increased use of colonoscopy when copayments are waived. *Clinical Gastroenterology and Hepatology*. 2012; 10:761–6. [PubMed: 22401903]
29. Atherly A, Mortensen K. Medicaid primary care physician fees and the use of preventive services among Medicaid enrollees. *Health Services Research*. 2014; 49:1306–28. [PubMed: 24628495]
30. Aizer AA, Falit B, Mendu ML, et al. Cancer-specific outcomes among young adults without health insurance. *Journal of Clinical*. 2014; 32:2025–30.
31. Choi SK, Adams SA, Eberth JM, et al. Medicaid coverage expansion and implications for cancer disparities. *American Journal of Public Health*. 2015; 105:S706–S12. [PubMed: 26447909]
32. Sabik LM, Tarazi WW, Bradley CJ. State Medicaid expansion decisions and disparities in women’s cancer screening. *American Journal of Preventive Medicine*. 2015; 48:98–103. [PubMed: 25441234]
33. Ku L, Bysshe T, Steinmetz E, Bruen BK. Health reform, Medicaid expansions, and women’s cancer screening. *Women’s Health Issues*. 2016; 26:256–61. [PubMed: 26926159]
34. Levy AR, Bruen BK, Ku L. Health care reform and women’s insurance coverage for breast and cervical cancer screening. *Preventing Chronic Disease*. 2012; 9:E159. [PubMed: 23098646]
35. Clark CR, Soukup J, Govindarajulu U, Riden HE, Tovar DA, Johnson PA. Lack of access due to costs remains a problem for some in Massachusetts despite the state’s health reforms. *Health Affairs*. 2011; 30:247–55. [PubMed: 21289346]
36. Clark CR, Soukup J, Riden H, et al. Preventive care for low-income women in massachusetts post-health reform. *Journal of Women’s Health*. 2014; 23:493–8.

37. Okoro CA, Dhingra SS, Coates RJ, Zack M, Simoes EJ. Effects of Massachusetts health reform on the use of clinical preventive services. *Journal of General Internal Medicine*. 2014; 29:1287–95. [PubMed: 24789625]
38. Sabik LM, Bradley CJ. The impact of near-universal insurance coverage on breast and cervical cancer screening: evidence from Massachusetts. *Health Economics*. 2016; 4:391–407.
39. Wees PJ, Zaslavsky AM, Ayanian JZ. Improvements in health status after Massachusetts health care reform. *Milbank Quarterly*. 2013; 91:663–89. [PubMed: 24320165]
40. Keating NL, Kouri EM, He Y, West DW, Winer EP. Effect of Massachusetts health insurance reform on mammography use and breast cancer stage at diagnosis. *Cancer*. 2013; 119:250–8. [PubMed: 22833148]
41. Sommers BD, Gunja MZ, Finegold K, Musco T. Changes in self-reported insurance coverage, access to care, and health under the Affordable Care Act. *JAMA*. 2015; 314:366–74. [PubMed: 26219054]
42. Chen J, Vargas-Bustamante A, Mortensen K, Ortega AN. Racial and ethnic disparities in health care access and utilization under the Affordable Care Act. *Medical Care*. 2016; 54:140. [PubMed: 26595227]
43. Liss DT, Baker DW. Understanding current racial/ethnic disparities in colorectal cancer screening in the United States: the contribution of socioeconomic status and access to care. *American Journal of Preventive Medicine*. 2014; 46:228–36. [PubMed: 24512861]
44. Tatalovich Z, Zhu L, Rolin A, Lewis DR, Harlan LC, Winn DM. Geographic disparities in late stage breast cancer incidence: results from eight states in the United States. *International Journal of Health Geographics*. 2015; 14:1–11. [PubMed: 25563056]
45. Khan-Gates JA, Ersek JL, Eberth JM, Adams SA, Pruitt SL. Geographic access to mammography and its relationship to breast cancer screening and stage at diagnosis: a systematic review. *Women's Health Issues*. 2015; 25:482–93. [PubMed: 26219677]
46. Morris LG, Sikora AG, Tosteson TD, Davies L. The increasing incidence of thyroid cancer: the influence of access to care. *Thyroid*. 2013; 23:885–91. [PubMed: 23517343]





**Figure 1.**  
Flow diagram of study identification and selection process

Table 1

## Studies Examining Direct Impact of ACA on Screening and Diagnosis

Authors, year	Outcome	Cancer type	Objective	Population of interest	Years examined	Data source(s)	Study design	Major findings	Major limitations
Simon et al. (2017) <sup>11</sup>	Screening	BCA, CRC	Estimate effect of ACA Medicaid expansions on health insurance access and preventive care	Low-income, non-elderly, non-disabled childless adults	2010–2015	BRFSS	Pre/post design; DiD	No change in receipt of recommended screenings for childless adults or women in general.	1. Short-term effects measured only 2. Self-reported data
Robbins et al. (2015) <sup>12</sup>	Diagnosis and treatment	CVC	Compare changes in cervical cancer stage and initial treatment for women aged 21 to 25 years (DCE-eligible) vs. 26 to 34 years (non-DCE-eligible)	Young adults affected by dependent coverage mandate	2007–2009, 2011–2012	NCDB	DiD	Younger DCE-eligible women more likely to be diagnosed at early stage and receive fertility-sparing treatments after policy change than older non-DCE-eligible group.	Potential selection bias since NCDB collects data only from Commission on Cancer approved facilities
Han et al. (2016) <sup>13</sup>	Diagnosis	Multisites	Determine ACA–DCE effect on cancer stage at diagnosis for young adults	Young adults (ages 19 to 25) affected by dependent coverage	2007–2012	SEER	Pre/post design; DiD	Increase in early state diagnosis for young adults.	Only 2 years post ACA-DCE considered
Fedewa et al. (2015) <sup>14</sup>	Screening	BCA, CRC	Investigate whether colorectal cancer and breast cancer screening prevalence among privately and Medicare-insured adults by SES changed before and after the ACA	Individuals aged 50 to 75 years with Medicare and/or private insurance	2008–2013	NHIS	Pre/post design with weighted prevalence estimates; Adjusted prevalence difference	Low SES respondents had increased CRC screening (2008 through 2013); BCA screening unchanged.	1. Considered only 2-year period after ACA cost-sharing implemented 2. Self-reported data. 3. No data on benefit structures for privately-insured individuals 4. No comparison group
Han et al. (2015) <sup>15</sup>	Screening	CVC, BCA, CRC	Compare changes in use of recommended preventive services before ACA's cost-sharing provision to after implementation	Adults ages 18 and older	2009, 2011/2012	MEPS	Pre/post design; multivariate logistic regression	Rate of recommended preventive cancer screening did not increase during first 2 years after ACA.	1. Self-reported data 2. No comparison group 3. No information on grandfathered health plans
Richman et al. (2016) <sup>16</sup>	Screening	CRC	Examine colorectal screening before and after ACA	Adults 50–64 with private health insurance and adults 65–75 with Medicare.	2009–2012	MEPS	Repeated cross-sectional analysis; DiD	Eliminating cost-sharing for CRC screening has not changed CRC screening for many, although use may have increased for some Medicare beneficiaries.	1. Follow-up period limited 2. Self-reported data. 3. Not able to identify participants who experienced changes in cost-sharing
Nelson et al. (2015) <sup>17</sup>	Screening	BCA	Examine mammography screening changes after ACA	249,803 screening mammograms	2008–2012	Providence Health & Services	Patient-level time-series	Following ACA, volume of screening mammograms increased.	1. Use of data for women actually screened without considering the pool of candidates that was not screened 2. No comparison group
Hamman & Kapinos (2015) <sup>18</sup>	Screening	CRC	Investigate whether reduction in out-of-pocket costs for colonoscopy under ACA was associated with screening behavior changes	Insured individuals ages 66–75 (Medicare eligible)	2008, 2010, 2012	BRFSS	Pre/post design; logistic regression	Annual colonoscopy rates for men ages 66–75 increased significantly (4.0 percentage points) after ACA with even larger among socioeconomically disadvantaged men. No significant increases among women.	1. Self-reported data. 2. No comparison group. 3. Could not distinguish screening and surveillance or therapeutic colonoscopies

Authors, year	Outcome	Cancer type	Objective	Population of interest	Years examined	Data source(s)	Study design	Major findings	Major limitations
Wan et al. (2015) <sup>19</sup>	Screening	CRC	Before and after ACA, examine patterns of colorectal cancer screening for Medicare beneficiaries in rural areas by state and year	Rural Health Clinics Medicare beneficiaries	2007–2012	CMS Chronic Condition Data; Institutional Outpatient Claims File; AHRF; Provider of Services File	Pre/post design; Autocorrelation and Latent Growth Curve Modeling; regression	ACA and percentage of female patients positively affected colorectal cancer screening rates, but location, years of RHC certification, and patient age negatively affected rates.	1. Screening rate construct may underestimate screenings 2. No comparison group
Cooper et al. (2016) <sup>20</sup>	Screening	BCA, CRC	Examine cancer screening (mammography and colonoscopy) after ACA	Medicare beneficiaries age $\geq 70$	2009–2012	Medicare claims	Pre/post design; GEE logistic regression	After ACA removal of cost-sharing, statistically significant increase in mammography, but not colonoscopy.	1. No comparison group. 2. Omitted non-colonoscopy CRC screening tests 3. Omitted Medicare Advantage enrollees 3. Older patients only
Sabatino et al. (2016) <sup>21</sup>	Screening	BCA	Examine mammography use before and after Medicare eliminated cost sharing for screening mam-mography in January 2011	Women (Medicare beneficiaries) aged 65–74 years old	2010–2013	NHIS	Multivariable logistic regression	Modest increase in mammography 2010–2013 possibly related to eliminating Medicare cost-sharing.	1. No comparison group 2. Did not distinguish women with Medicare Part A only 3. Self-reported data
Lissenden & Yao (2017) <sup>22</sup>	Diagnosis	BCA, CRC	Estimate impact of ACA for seniors on stage at diagnosis for multiple cancer sites compared with younger group	Birth-year cohorts ages 65–90 in 2010 vs. controls ages 50–64	2008–2013	SEER	DiD	Increase in early stage CRC diagnoses; no effect on early-stage BCA diagnoses	Younger control group also potentially impacted by ACA cost-sharing changes
Mehra et al. (2015) <sup>23</sup>	Screening	BCA, CRC	Examine impact of cost-sharing elimination on screening, compared with grandfathered plans	Men and women 50–64 years of age	2008–2012	Humana health plan data	Interrupted time series analysis with comparison group	No significant change in level/slope of mammography or colonoscopy between groups.	1. Follow-up period limited 2. Cannot account for test appropriateness or prior screenings
Wharam et al. (2016) <sup>24</sup>	Screening	CRC	Determine ACA's impact on colorectal cancer screening for HDHP members	Commercially insured members aged 50–64 with at least 2 years of continuous enrollment	2003–2012	Optum data (administrative claims)	Pre/post design; DiD	ACA was associated with increased colorectal cancer screening rates and screening colonoscopies among HDHP members.	1. Exact colorectal cancer screening coverage details for each employer not available 2. Not representative of very low SES, newly insured, and large deductible patients

**Abbreviations:**

Breast Cancer: BC; Colorectal Cancer: CRC; Cervical Cancer: CVC; Central Nervous System Tumors: CNS; Area Health Resource File: AHRF; Behavioral Risk Factor Surveillance System: BRFSS; Centers for Medicare & Medicaid Services: CMS; Dependent-coverage expansion: DCE; Difference-in-difference: DiD; Generalized estimating equation: GEE; High-deductible health plan: HDHP; Medical Expenditure Panel Survey: MEPS; National Cancer Data Base: NCDB; National Health Interview Survey: NHIS; Socioeconomic status: SES; Surveillance, Epidemiology, and End Results: SEER

Table 2

## Studies Providing Indirect Evidence of ACA Impact on Screening and Diagnosis

Authors, year	Outcome	Cancer type	Objective	Population of interest	Years examined	Data source(s)	Study design	Major findings	Major limitations
Wright et al. (2016) <sup>25</sup>	Screening	BCA, CVC, CRC, PCA	Assess impact of acquiring Medicaid coverage on cancer screening rates as well as preventive behaviors and services	Individuals aged 18 to 64 years	2012–2013	Oregon Medicaid lottery reservation list	Prospective, longitudinal panel study design	Medicaid coverage resulted in significantly higher rates of several common cancer screenings, especially for women, as well as better primary care connections and self-reported health outcomes.	1. Oregon's low-income population differs from other states (e.g. less ethnically diverse) 2. Self-reported data
Mahal et al. (2014) <sup>26</sup>	Diagnosis, treatment, mortality	PCA	Examine associations between insurance coverage and prostate cancer outcomes	Men age < 65 ineligible for Medicare.	2007–2010	SEER	Multivariable logistic regression	Insurance coverage was associated with earlier diagnosis, more definitive treatment, and lower mortality for men with prostate cancer ineligible for Medicare.	1. Limited health insurance data 2. Short follow-up
Jena et al. (2016) <sup>27</sup>	Screening	BCA	Study impact of eliminating cost-sharing on mammography rates in large Medicare Advantage plan	Women 65+ enrolled in Kaiser Permanente Medicare Advantage plan	2007–2012	Kaiser Permanente Health Medicare Advantage Health Maintenance Organization Plan	DiD	Eliminating cost-sharing for screening mammography was associated with modestly lower decline in screening rates for women with low screening adherence.	1. Changes in USPSTF breast cancer screening guidelines during study period may have led to overall declines in screening 2. Study sample had higher rates of screening at baseline
Khatami et al. (2012) <sup>28</sup>	Screening	CRC	Examine effects of removing cost-sharing on colonoscopy use	Beneficiaries of University of Texas employee, retiree, and dependent health plan, ages 50–64 years	2002–2009	University of Texas employee, retiree, dependent health plan	Retrospective study; Cox proportional hazards; Standardized incidence ratio (SIR)	Waiving copay for colonoscopy resulted in statistically significant (though modest) increase in use.	1. Used data for only 1 year after 2009 copay waiver. 2. Did not use formal validated algorithms to separate screening from diagnostic examinations
Atherly & Mortensen (2014) <sup>29</sup>	Screening	BCA, CVC, CRC	Model relationship between Medicaid preventive care payment rates and use of USPSTF recommended preventive care for Medicaid enrollees	Medicaid populations targeted for USPSTF recommended services (vs. privately insured controls)	2003 and 2008	MEPS	Probit/DiD	No statistically significant relationships between Medicaid enrollment or Medicaid primary care payment rates and use of preventive services.	1. Analysis limited to only 10 largest states 2. Data limited to individuals with physician visits. 4. DiD model assumes no other significant changes correlated with payment changes 5. Self-reported data
Aizer et al. (2014) <sup>30</sup>	Diagnosis, treatment, and mortality	Not Specific	Examine the association between insurance status and cancer-specific outcomes for young adults	Young adults (ages 20 to 40) diagnosed with malignant neoplasm	2007–2009	SEER	Univariable, multivariable logistic regression, cox proportional hazards	Association between insurance coverage and decreased likelihood of presentation with metastatic disease, increased receipt of definitive treatment, and decreased death-rate from any cause.	1. Limited information on insurance coverage 2. Short follow-up 3. Income and educational status covariates at county, not individual-level
Choi et al. (2015) <sup>31</sup>	Screening, mortality-to-incidence ratio	BCA, CVC, CRC	Examine cancer disparities in light of US states' choices about Medicaid expansion following ACA	FQHC patients	2007–2013	USD; BRFSS; US Cancer Statistics; Kaiser Family Foundation	State-level cancer screening rates; ArcMap mapping	States that had not expanded Medicaid as of September 2014 had lower cancer screening rates at baseline, especially for FQHC patients. Cancer mortality-to-incidence ratios were not significantly different by Medicaid expansion status.	1. Self-reported data 2. Screening rates of FQHC patients may be underestimated

Authors, year	Outcome	Cancer type	Objective	Population of interest	Years examined	Data source(s)	Study design	Major findings	Major limitations
Sabik et al. (2015) <sup>32</sup>	Screening	BCA, CVC	Assess pre-ACA breast and cervical cancer screening by income and insurance across states currently expanding (or not) Medicaid to these patients	Low-income women for whom screening is recommended	2012	BRFSS	Multivariable logistic regression	Women in states not expanding Medicaid had significantly lower odds of receiving recommended mammograms or Pap tests.	Self-reported data
Ku et al. (2016) <sup>33</sup>	Screening	BCA, CVC	Estimate number of women who will be uninsured in 2017 with and without Medicaid expansion	Women 21–64	2012–2013	ACS, BRFSS	Multivariate logit models	Number of uninsured low-income population to stay much larger than number of women screened under National Breast and Cervical Cancer Early Detection Program in 2013.	1. Estimates largely based on analyses of insurance in Massachusetts 2. Self-reported data
Levy et al. (2012) <sup>34</sup>	Screening	BCA, CVC	Estimate number of low-income women who would gain health insurance after ACA implementation	Women aged 18 to 64	2009	ACS-PUMS	Simulation model; Multivariate logistic regression	Demand for breast cancer screening will increase by 500,000 women in first year of ACA implementation and by up to 1 million more over 2 years. An additional 1.3 million women will obtain Pap test first year, and up to 3.8 million more will be tested over 3 years.	1. Forecasts based on assumptions 2. Model assumed that economic and social circumstances in 2014 will be like those in 2009

**Abbreviations:**

Breast Cancer: BC; Colorectal Cancer: CRC; Cervical Cancer: CVC; Prostate Cancer: PCA; American Community Survey: ACS; Behavioral Risk Factor Surveillance System: BRFSS; Difference-in-difference: DID; Federally qualified health centers: FQHCs; Medical Expenditure Panel Survey: MEPS; Public Use Microdata Sample: PUMS; Surveillance, Epidemiology, and End Results: SEER; U.S. Preventive Services Task Force: USPSTF

Table 3

## Studies Examining Impact of Massachusetts Health Care Reform on Screening and Diagnosis

Authors, year	Outcome	Cancer type	Objective	Population of interest	Years examined	Data source(s)	Study design	Major findings	Major limitations
Clark et al. (2011) <sup>35</sup>	Screening	BC, CVC, CRC	Examine health care access trends and preventive health care use for elderly adults in Massachusetts before and after 2006 reforms	Adults aged 18–64	1996–2008	Massachusetts BRFSS	Multivariable logistic regression	The prevalence of colorectal cancer screening improved significantly among both men and Women. People with the lowest incomes were much less likely than those with the highest incomes to obtain age appropriate mammography, Pap smears, colorectal cancer screening.	1. Self-reported data. 2. No control group.
Clark et al. (2014) <sup>36</sup>	Screening	BC, CVC	Following health reform legislation, investigate changes in cancer screening for Women's Health Network (WHN) participants.	Low-income uninsured women through the WHN	2004–2010	WHN	Pre-reform, post-reform, GEE	High prevalence of recommended mammograms, and pap tests during post-reform. Mammography significantly increased for women with state-subsidized private insurance. Women with unsubsidized private insurance or Medicare had decreased Pap test use post-reform.	1. No control groups outside WHN. 2. Only monitored care received within CHC and omitted data on women who possibly left CHC.
Okoro et al. (2014) <sup>37</sup>	Screening	BC, CVC, CRC	To assess whether Massachusetts health reform was associated with changes in healthcare access and use of clinical preventive services.	Adults aged 18–64 years in Massachusetts and other New England states (ONES)	2002–2010	BRFSS	DiD, pre-reform, post-reform	Colorectal cancer screening increased significantly more in Massachusetts than in states in ONES. Prevalence of cervical cancer screening in Massachusetts increased relative to ONES. Breast cancer screening did not improve more in Massachusetts than in ONES.	Self-reported data.
Sabik & Bradley (2016) <sup>38</sup>	Screening	BC, CVC	Investigate effect of expansion to near-universal health insurance coverage in Massachusetts on breast and cervical cancer screening.	Women aged 21–64 years old in Massachusetts and ONES, also low-income women in MA and ONES	2002–2010	BRFSS	DiD, pre-reform, post-reform,	Annual increase in mammograms and Pap tests as a result of MA reform. Increases in both breast and cervical cancer screening larger 3 years after reform than in year immediately following. Low-income women experience greater increases in breast and cervical cancer screening.	1. Self-reported data. 2. BRFSS does not include data on type of health insurance coverage, only whether individual had any coverage, precluding analyses of insurance types.
Wees et al. (2013) <sup>39</sup>	Screening	BC, CVC, CRC	Compare trends in health status and use of ambulatory health services before and after implementation of health reform in Massachusetts relative to that in ONES	Adults aged 18–64 years old in MA and ONES	2001–2011	BRFSS	Logistic regression, DiD	Massachusetts residents reported significant relative increases in rates of Pap screening (2.3%), colonoscopy (5.5%).	Self-reported data.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Authors, year	Outcome	Cancer type	Objective	Population of interest	Years examined	Data source(s)	Study design	Major findings	Major limitations
Keating et al. (2013) <sup>40</sup>	Screening and diagnosis	BC	Assess whether health insurance expansion associated with mammography and earlier stage breast cancer diagnosis.	Women aged 41–64 years old in Massachusetts and California (control group)	2004–2008	Massachusetts Cancer Registry, California Cancer Registry, BRFSS	DiD, pre-reform, post-reform	Health insurance reform in Massachusetts was not associated with increased rates of mammography or earlier stage at diagnosis compared with California.	1. Self-reported data. 2. California may not be optimal control state

**Abbreviations:**

Breast Cancer: BC; Colorectal Cancer: CRC; Cervical Cancer: CVC; Behavioral Risk Factor Surveillance System: BRFSS; Community health centers: CHCs; Difference-in-difference: DiD; Generalized estimating equation: GEE; Women’s Health Network: WHN