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Medicare Part D's impact on the under- and over-use of medications: a systematic review

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Royalties		X		X		X		X
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Abstract

Objectives—Reducing out-of-pocket drug costs can increase use of essential drugs, but it may also increase inappropriate use of others. Medicare Part D has been shown to reduce patients' out-of-pocket costs and increase overall drug utilization, but its impact on the under- and overuse of specific medications and corresponding health outcomes is unclear.

Design—Systematic review.

Setting—Medline search of the peer-reviewed literature from January 1, 2006-October 8, 2010.

Measurements—Included articles that reported original results describing changes in the utilization of specific drugs or drug classes after implementation of Part D.

Results—Nineteen articles met inclusion criteria. Part D's implementation was associated with increased use of essential medications such as clopidogrel and statins, especially among patients who had been previously uninsured. However, increase in inappropriate antibiotic use for the treatment of acute respiratory tract infections, and increases in claims for the often over-used proton pump inhibitor drug class were also observed. In the Part D transition period, dual-eligible patients' drug use largely remained unchanged. When patient cost-sharing increased in the coverage gap, use of both essential and over-used medications declined.

Conclusion—Increasing drug coverage led to increased use of both under-used essential medications and inappropriate, or over-used, medications under Medicare Part D. Despite efforts to do so, the Part D benefit did not sufficiently discriminate between essential and non-essential medication use.

Keywords

Medicare Part D; systematic review; medication overuse; medication under-use

BACKGROUND

Prescription drugs are among the most useful and cost-effective therapies to prevent and treat disease, and access to essential medications has been recognized as a public health priority. The Medicare Part D drug benefit aimed to improve access to essential medications through reduced cost-sharing, thereby improving Medicare beneficiaries' health.[1, 2] However, Part D drug coverage also introduced moral hazard: patients could fill more unnecessary prescriptions, or use unnecessarily costly medications, because Part D reduced their out-of-pocket costs.[2] Thus, like any government program aiming to maximize the value of taxpayer dollars, Medicare Part D is challenged with encouraging use of essential medications while at the same time limiting the use of non-essential or inappropriate medications that do not maximize healthcare dollars and/or worsen health. The challenge is formidable. Physicians and patients have difficulties determining whether prescriptions are clinically appropriate and pharmacy benefit plans typically do not structure cost-sharing based on the value of a medication for an enrollee's health.[3–5] Physicians and their patients seldom talk about drug costs and cost-related non-adherence[6] and when these discussions occur, prioritize the financial well-being and health of the individual patient at the expense of the health care system.[7]

The 2003 Medicare Part D legislation contained few provisions to influence appropriate use of medications. To ensure broad access, Part D formulary rules required coverage for at least 2 drugs in each approved drug category and class. Coverage of "all or substantially all"

drugs in six protected drug classes (antidepressants, antipsychotics, anticonvulsants, antineoplastics, antiretrovirals, and immunosuppressants) was mandated, as treatment choice might be important and adverse selection into plans might occur based on beneficiaries' need for these medications.[8] Barbiturates and benzodiazepines were excluded from coverage due to over-use and safety concerns.[9] While Medicaid programs could decide to provide benzodiazepine coverage for patients who are dually-eligible for Medicare and Medicaid, such coordination of drug coverage between programs may have been difficult.

In this systematic review, we evaluate the peer-reviewed literature from January 2006 – October 2010 to assess the extent to which Part D's cost-sharing provisions and drug coverage rules impacted the under-use and over-use of specific drugs and classes. We look at three time periods in the Part D benefit when patients' under- and over-use might be most affected by cost-sharing and coverage changes: 1) the year(s) since Part D implementation, when many patients newly obtained drug coverage; 2) the early months of 2006, known as the transition period, during which dual-eligibles faced change as Medicare Part D, not Medicaid, became the primary payor for drugs; and 3) the coverage gap, when beneficiaries became responsible for 100% of drug costs.

METHODS

Data sources

Initial searches were limited to articles published in Medline between January 1, 2006 and October 8, 2010. Our search focused on any term relating to Medicare Part D (e.g., [*Medicare AND drug benefit OR drug plan OR prescription]).* Articles containing at least one search term were included in the review and were reference mined for related articles. Additional articles collected by the authors were also included.

Study selection

Articles were included if they reported original results regarding Part D drug utilization for specific drugs or drug classes, whether drawn from self-report surveys or prescription drug claims. Two reviewers [J.P., E.K.] evaluated titles and abstracts to identify potentially relevant articles. Three reviewers [J.P., E.K., W.S.] assessed complete articles for inclusion.

Data extraction

Three reviewers extracted data from selected articles [J.P., E.K., W.S.], including the key research questions, data sources, characteristics of the patient population, study design, time period assessed, and drug- or drug class-specific results. Two reviewers [J.P., W.S.] used the Newcastle-Ottawa Scale,[10] a checklist to assess the basic methodologic rigor of each cohort study. Nine points across 8 items (1 item offers 2 points) can be assigned to note appropriate methods for exposed and unexposed patient selection, exposure and outcome ascertainment, and follow-up duration and completeness.

Classification of medications

We categorized medications that were evaluated in included studies into 3 categories: 1) likely to be under-used and with clear evidence of clinical benefit in the elderly, 2) likely to be over-used, and 3) both under- and over-used, and often used in patients for whom clinical benefit is unclear. The under-used medications were those used to prevent and treat cardiovascular conditions such as statins, anti-hypertensives, warfarin and clopidogrel.[11–13] Often over-used medications included proton pump inhibitors (PPIs),[14–16] and benzodiazepines.[17, 18] We considered antidepressants and antipsychotics to be medications that may be both under- and over-used, and to have questionable efficacy for treatment of

dementia symptoms, a common reason for prescription in elderly patients,[19–21] Antibiotics were classified as both under- and over-used.[22]

RESULTS

Of 577 potentially relevant abstracts and titles screened, 67 were evaluated in full, and 19 met all inclusion criteria (Figure 1). Eleven articles assessed drug use in the year(s) since implementation,[23–33] five focused on dual-eligibles' experience in the transition period,[9, 34–38] one article examined changes in the coverage gap,[39] and one examined use in the year since implementation and the coverage gap.[40] Most articles evaluated Part D's impact on more than one drug or class. Based on our medication classification system, nine articles focused on under-used, essential medications,[24, 27, 30–32, 34, 35, 39, 40] ten described medications that are commonly over-used or inappropriately used, [9, 23, 26, 29, 33, 35–38, 40] and seven considered both under- and overused medications.[23–25, 28, 36, 38, 39] No study that specifically addressed over- or under-use defined medications differently than we did.

The year(s) since Part D implementation

These studies focused on drug utilization among elderly who obtained improved or new drug coverage under Part D.

Under-used medications—In Medicare Advantage beneficiaries with heart failure, Donohue et al. observed increased use of angiotensin-converting enzyme inhibitors (ACEIs)/angiotensin receptor blockers (ARBs), OR=1.28 (95% CI 1.10–1.48) and beta blockers, OR=1.73 (1.46–2.05), among beneficiaries with new Part D drug coverage as compared to retirees with continued coverage (Table 1).[27] Among Medicare Advantage beneficiaries with hyperlipidemia, Zhang et al. noted a 0.21 (0.15–0.27) increase in the number of lipid-lowering prescriptions per month among those with new Part D coverage as compared to retirees.[31] Among those with diabetes, the number of monthly prescriptions for oral anti-diabetic drugs increased by 0.27 (0.19–0.35). Both increases represent a 44% change from the December 2005 pre-Part D levels. A third study showed that Medicare Advantage beneficiaries with hypertension who transitioned from no drug coverage to Part D coverage increased use of any antihypertensive use (OR= 1.40, 1.25–1.56).[30] Larger increases were seen in ARB use compared to other less expensive classes (ACEIs, calcium channel blockers, beta blockers, and diuretics).[30] Medicare Advantage beneficiaries who transitioned to Part D were 2.09 times (1.82–2.40) as likely to have medication possession ratios ≥80% after Part D's implementation than before. This comparison was repeated for patients with hyperlipidemia, OR=1.67 (1.35–2.07) and for patients with diabetes, OR=2.36 (1.81–3.08).[32] Among a population of 114,766 retail pharmacy patients who gained drug insurance under Part D in 2006, defined daily dose increases were observed for statins (22%) and clopidogrel (11%) during the year after Part D implementation (compared to those who did not gain insurance).[40] Warfarin use did not change. A final study based on Medical Expenditure Panel Survey (MEPS) data found no significant changes in antihypertensive or cholesterol-lowering agent use between 2005 and 2006.[24]

Over-used medications—In Medicare Advantage beneficiaries, a study examined the use of HEDIS-classified (Healthcare Effectiveness Data and Information Set) high-risk medications before and after Part D.[26] In comparison with retirees, those who experienced new or improved coverage increased their use of high-risk drugs in the post-Part D period as compared to the pre-Part D period: patients with no prior drug insurance, OR=1.33 (1.21–1.47); with prior quarterly caps of $150, OR=1.10 (1.00–1.22); and with prior quarterly caps of $350, OR=1.08 (1.02–1.14). In contrast, a study of 2005–2006 MEPS data found no differences in use of potentially inappropriate medications (defined using the Beers criteria)

between Part D enrollees and non-enrollees.[29] Schneeweiss et al. observed 37% increases in PPI use among newly insured patients in 2006 as compared to those who did not gain insurance under Part D.[40] Finally, in the Part D-excluded benzodiazepine class, Chen et al. noted a 5% immediate and sustained decline among retail pharmacy patrons following Part D implementation.[23]

Under- and over-used medications—Newly insured Medicare Advantage beneficiaries' use of any antibiotic from December 31, 2005–December 31, 2007 increased 1.58-fold (1.36–1.85) as compared to retirees.[33] Compared to retirees, beneficiaries with new Part D coverage had a 3.07-fold (1.94–4.85) increased odds of antibiotic use for pneumonia but also a 2.32-fold (1.87–2.87) increased odds of inappropriate use for acute respiratory tract infection.

In the Part D-protected antidepressant and antipsychotic classes, Chen et al. observed a 7% increase in antidepressant and an 18% increase in antipsychotic prescriptions in 2006 compared to 2005 among community-dwelling patrons of a large pharmacy chain.[23] However, these results are difficult to interpret because the utilization measure did not adjust for changes in sample size over time. In Medicare Advantage beneficiaries with depression, Part D was associated with increased antidepressant use among newly insured beneficiaries, OR=1.61 (1.41–1.85).[28] Use of older antidepressant agents did not change. Individuals transitioning to Part D had significantly higher odds of having good refill adherence (>80% of days covered with an antidepressant) as compared to retirees: patients with no prior drug insurance, OR=1.86 (1.44–2.39), with prior quarterly caps of $150, OR=1.74 (1.25–3.42); and with prior quarterly caps of $350, OR=1.19 (1.06–1.34).

Two final MEPS-based studies observed divergent results. In the non-institutionalized Medicare population, Donohue et al. observed an increase in the proportion of patients who used antidepressants, from 16% in 2005 to 18.1% in 2006 but no significant changes for antipsychotics or anticonvulsants.[25] In contrast, Domino and Farley observed no changes in antidepressant or antipsychotic utilization.[24] The contrasting results may be due to differences in the researchers' analytic approach to handling data from the MEPS' two overlapping panels: while Donohue et al. averaged the two MEPS panels' data, Domino and Farley treated each panel separately."

The transition period

Studies of the transition period focused on drug use by dual-eligible beneficiaries. New prior authorization requirements, changes in cost-sharing or coverage of specific medications, and the exclusion of benzodiazepines from Part D reimbursement were of particular concern as these beneficiaries moved to Part D coverage.

Under-used medications—Shrank et al. found no significant changes in dual-eligible beneficiaries' use of statins, clopidogrel, and warfarin (Table 1).[35] However, another study examining antiretroviral drug use among patients with HIV found that among 44 dual-eligibles, 60% reported increased costs for antiretrovirals with Part D enrollment.[34] Of 10 who reported treatment interruptions during the first quarter of 2006, 9 (90%) cited coverage or reimbursement restrictions as a cause, even though antiretroviral drugs are in a Part D-protected class.

Over-used medications—Five studies examined changes in benzodiazepine use among dual-eligibles. Because Part D did not cover benzodiazepines, dual-eligibles would need to obtain benzodiazepine coverage under their Medicaid program. As Part D began, some state Medicaid programs limited or ended benzodiazepine coverage while others enhanced

coverage. For example, Breisacher et al. examined benzodiazepine use and fracture risk in three nursing home populations: those in Medicaid state programs that provided 1) no, 2) partial, or 3) complete benzodiazepine coverage post-Part D.[9] In states with no supplemental coverage, there was an immediate 10% (−11% − −9%) decrease in the proportion of benzodiazepine recipients compared to their 2005 levels. In contrast, Florida created a supplemental drug plan for home-bound dual-eligibles that covered benzodiazepines, and 5% of beneficiaries received ≥1 benzodiazepine prescription.[37]

West et al. used psychiatrists' reports of dual-eligible patients' medication access problems to evaluate psychotropic use post-Part D. In the transition period, 24% of dual-eligibles studied had problems accessing benzodiazepines;[36] that proportion increased to 30% for all of 2006.[38] In contrast, Shrank et al. observed no significant changes in benzodiazepine use among dual-eligibles in a nationally representative claims database of retail pharmacy patrons.[35]

Under- and over-used medications—Based on psychiatrists' reports, dual-eligible patients had difficulties obtaining specific antidepressants, antipsychotics, sedatives, and mood stabilizers in both the transition period and the full year after Part D implementation due to approval difficulties (e.g., prior authorization requirements) or high costs.[36, 38]

The coverage gap

In the coverage gap, Part D beneficiaries who were not dual-eligibles or receiving a low-income subsidy were responsible for 100% of their drug costs. Many were concerned that faced with the sudden responsibility of paying for their drugs, beneficiaries would discontinue use without regard for whether medications were essential or not.

Under-used medications—While Schneeweiss et al. had observed initial increases in drug use at Part D's inception among elderly who newly obtained drug insurance, per month declines in drug use were noted when patients entered the coverage gap: clopidogrel -5%, warfarin -4.8%, and statins -6.3% (Table 1).[40] Comparing Part D beneficiaries responsible for their drug costs in the coverage gap to beneficiaries in non-Part D plans who did not face such a gap, Raebel et al. found greater adherence declines during the gap for anti-hyperlipidemic agents ($p=0.031$) and anti-hypertensives ($p=0.006$).[39] Refill adherence decreased in the gap for anti-hyperlipidemic agents ($p=0.038$), antidepressants ($p<0.001$), anti-hypertensives ($p=0.003$) and diuretics ($p<0.001$), but not for the anti-diabetic drugs or beta blockers.

Over-used medications—In the same population of elderly who newly obtained drug coverage under Part D, Schneeweiss observed significant decreases in PPI use when patients reached the coverage gap period.[40]

DISCUSSION

Our review identified 19 studies that examined how Part D's shifting drug cost-sharing provisions and formulary rules influenced the under- or over-use of specific drugs and drug classes. In the year(s) since Part D's inception, as many previously uninsured elderly gained drug insurance, there was increased use of essential medications in accordance with legislative goals. However, use of often over-used medications also increased. In the transition period, when dual-eligibles had their drug coverage shifted from Medicaid to Medicare, no changes were observed using claims data, but self-report-based studies reported acquisition difficulties for psychotropic and essential antiretroviral medications among the dual-eligible population. In the coverage gap, patients who were suddenly

responsible for 100% of their drug costs decreased use of under- as well as over-used medications. Overall, utilization changes seemed to be influenced by two main factors: 1) shifting out-of-pocket costs and 2) Part D protections or restrictions, if any, for specific drugs or drug classes.

Changing out-of-pocket drug costs affected both under- and over-use. When Part D insurance coverage was available, drug use increased, especially among those patients who previously lacked coverage.[26–28, 31, 40] Conversely, as patients entered the Part D coverage gap and lost financial assistance, utilization rates decreased.[39, 40] These results are not surprising. Many Part D plans use incentive-based formularies with successively more expensive cost sharing tiers, assigned uniformly to all drug classes and enrollees regardless of appropriateness or potential health benefit.[41–43] To align medication use towards improved, essential use, plans could offer under-used and essential medications on the lowest tiers and over-used medications on the highest tiers, and could realign utilization management requirements, for example by requiring documentation of clinical necessity before reimbursement for over-used drugs. Initial prescription of generic or plan-preferred medications has been associated with lower costs and better adherence over time.[44, 45] Value-based insurance designs, in which patients' cost-sharing is reduced for medications that provide high benefits relative to costs, have been shown to modestly improve essential medication adherence.[46, 47]

Part D protections or restrictions for specific drugs or classes also played a role in study findings. While protected class status mandated that "all or substantially all" chemically distinct products be offered in 6 drug classes, it did not prohibit plans from employing utilization management tools or high cost-sharing requirements for individual drugs.[25] This may explain the self-reported patient difficulties in obtaining specific psychotropic[36, 38] and antiretroviral medications.[34] Benzodiazepines were excluded from Part D coverage. Breisacher et al. observed reduced use in state Medicaid programs that excluded benzodiazepines,[9] but use was not affected in Medicaid programs that continued reimbursement.[35, 37]

Dual-eligible-focused studies of self-reported data noted medication access difficulties[34, 36, 38] whereas a claims-based study showed no changes for overall drug classes in the transition period.[35] Differences may be due to the classes studied, or to focus on specific drugs rather than use across a class. Alternatively, the claims-based study may have been unable to identify medication access problems because claims reflected only successfully filled prescriptions, not attempted fills.

Our systematic review was limited by the modest number of studies that examined specific drugs or classes. Eight studies occurred within the same single Medicare Advantage plan. While methodologically rigorous, their results may not be generalizable to the 70%[48] of all Part D beneficiaries enrolled in stand-alone Part D plans: unlike stand-alone plans, Medicare Advantage plans manage Parts A, B and D benefits, and so may have greater incentive to encourage appropriate medication use that could offset medical costs and may attract patients with different characteristics.. While we classified medications into three categories (under-used, often over-used, and both under- and over-used) a priori, clinical information is essential to evaluating whether use of a particular drug is appropriate in any patient, and our categories are only useful as broad generalizations and for evaluating use at an aggregate, policy level. For example, while the PPIs are widely regarded as over-used, they are clinically indicated for the treatment of a number of acute and chronic gastrointestinal conditions, and in these instances would be appropriate. The most helpful future studies will use longitudinal diagnostic, clinical, and prescription data to consider the appropriateness of individual drugs and drug classes for patients, compare changes in the use of drugs against

evidence-based guidelines, and quantify health benefits and/or harms resulting from under- and over-use across multiple Part D cost-sharing structures, time periods, plan types and patient populations.

Our systematic review suggests that the increased use of specific drugs and classes after Part D implementation often occurred with little regard for the appropriateness of therapy. Rather, changes in medication use were more strongly correlated with shifting out-of-pocket costs and protections/restrictions for specific drugs and classes. The 2010 Patient Protection and Affordable Care Act expands government-funded medical and prescription drug coverage to 32 million additional patients.[49] The Part D benefit provides a model in which to evaluate the impact of shifting cost-sharing and formulary structures on medication under- and over-use and can be used to inform and modify health reform efforts going forward.

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References

1. Centers for Medicare and Medicaid Services. Federal Register. 2005. Medicare Program; Medicare Prescription Drug Benefit; Final Rule, 42 CFR 70, no. 18, 4460.
2. Pauly MV. Medicare drug coverage and moral hazard. Health Aff. 2004; 23(1):113–122.
3. Keeler, EB.; Buchanan, JL.; Rolph, JE.; Hanley, JM.; Reboussin, DM. The demand for episodes of medical treatment in the Health Insurance Experiment. Santa Monica, CA: 1988.
4. Federman AD, Adams AS, Ross-Degnan D, Soumerai SB, Ayanian JZ. Supplemental insurance and use of effective cardiovascular drugs among elderly medicare beneficiaries with coronary heart disease. JAMA. 2001; 286(14):1732–1739. [PubMed: 11594898]
5. Tamblyn R. The impact of pharmacotherapy policy: a case study. Can J Clin Pharmacol. 2001; 8 (Suppl A):39A–44A.
6. Shrank WH, Asch SM, Joseph GJ, et al. Physicians' perceived knowledge of and responsibility for managing patients' out-of-pocket costs for prescription drugs. Ann Pharmacother. 2006; 40(9): 1534–1540. [PubMed: 16912246]
7. Shrank WH, Joseph GJ, Choudhry NK, et al. Physicians' perceptions of relevant prescription drug costs: do costs to the individual patient or to the population matter most? Am J Manag Care. 2006; 12(9):545–551. [PubMed: 16961443]
8. Huskamp HA, Stevenson DG, Donohue JM, Newhouse JP, Keating NL. Coverage and prior authorization of psychotropic drugs under Medicare Part D. Psych Serv. 2007; 58(3):308–310.
9. Breisacher BA, Soumerai SB, Field TS, Fouayzi H, Gurwitz J. Medicare Part D's exclusion of benzodiazepines and fracture risk in nursing homes. Arch Intern Med. 2010; 170(8):693–698. [PubMed: 20421554]
10. Wells, G.; Shea, B.; O'Connell, D., et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. Paper presented at: Proceedings of the 3rd Symposium on Systematic Reviews. Beyond the basics: improving quality and impact; 2000; Oxford.
11. Pfisterer M, Buser P, Rickli H, et al. BNP-guided vs symptom-guided heart failure therapy: the Trial of Intensified vs Standard Medical Therapy in Elderly Patients With Congestive Heart Failure (TIME-CHF) randomized trial. JAMA. 2009; 301(4):383–392. [PubMed: 19176440]
12. Lewis WR, Ellrodt AG, Peterson E, et al. Trends in the use of evidence-based treatments for coronary artery disease among women and the elderly: findings from the get with the guidelines quality-improvement program. Circ Cardio Qual Outcomes. 2009; 2(6):633–641.

13. Bonde L, Sorensen R, Fosbol EL, et al. Increased mortality associated with low use of clopidogrel in patients with heart failure and acute myocardial infarction not undergoing percutaneous coronary intervention: a nationwide study. J Am Coll Cardiol. 2010; 55(13):1300–1307. [PubMed: 20338489]
14. Lee TJ, Fennerty MB, Howden CW. Systematic review: is there excessive use of proton pump inhibitors in gastro-oesophageal reflux disease? Aliment Pharmacol Ther. 2004; 20(11–12):1241–1251. [PubMed: 15606386]
15. Gill SS, Bronskill SE, Normand SL, et al. Antipsychotic drug use and mortality in older adults with dementia. Ann Intern Med. 2007; 146(11):775–786. [PubMed: 17548409]
16. Gupta R, Garg P, Kottoor R, et al. Overuse of acid suppression therapy in hospitalized patients. South Med J. 2010; 103(3):207–211. [PubMed: 20134378]
17. Hanlon JT, Schmader KE, Boult C, et al. Use of inappropriate prescription drugs by older people. J Am Geriatr Soc. 2002; 50(1):26–34. [PubMed: 12028243]
18. Shrank WH, Polinski JM, Avorn J. Quality indicators for medication use in vulnerable elders. J Am Geriatr Soc. 2007; 55 (Suppl 2):S373–382. [PubMed: 17910560]
19. American Psychiatric Association. [Accessed December 9, 2008.] Practice guideline: Treatment of Patients With Alzheimer's Disease and Other Dementias. http://www.psychiatryonline.com/pracGuide/pracGuideTopic_3.aspx
20. Schneider LS, Tariot PN, Dagerman KS, et al. Effectiveness of atypical antipsychotic drugs in patients with Alzheimer's disease. N Engl J Med. 2006; 355(15):1525–1538. [PubMed: 17035647]
21. Jureidini J, Tonkin A. Overuse of antidepressant drugs for the treatment of depression. CNS Drugs. 2006; 20(8):623–632. [PubMed: 16863268]
22. Gonzales R, Steiner JF, Sande MA. Antibiotic prescribing for adults with colds, upper respiratory tract infections, and bronchitis by ambulatory care physicians. JAMA. 1997; 278(11):901–904. [PubMed: 9302241]
23. Chen H, Nwangwu A, Aparasu R, Essien E, Sun S, Lee K. The impact of Medicare Part D on psychotropic utilization and financial burden for community-based seniors. Psych Serv. 2008; 59(10):1191–1197.
24. Domino ME, Farley JF. Did Medicare Part D improve access to medications? Psych Serv. 2010; 62(2):118–120.
25. Donohue JM, Huskamp HA, Zuvekas SH. Dual eligibles with mental disorders and Medicare part D: how are they faring? Health Aff. 2009; 28(3):746–759.
26. Donohue, JM.; Marcum, ZA.; Zhang, Y., et al. Acad Health. Boston, MA: 2010. Medicare Part D's impact on the use of high risk medications among older adults.
27. Donohue JM, Zhang Y, Lave JR, et al. The Medicare drug benefit (Part D) and treatment of heart failure in older adults. Am Heart J. 2010; 160(1):159–165. [PubMed: 20598987]
28. Donohue JM, Zhang Y, Men A, et al. Impact of Medicare Part D on Antidepressant Treatment, Medication Choice and Adherence among Older Adults with Depression. Am J Geriatr Psychiatr. 2010 in press.
29. Fu AZ, Tang AS, Wang N, Du D, Jiang JZ. Effect of Medicare Part D on potentially inappropriate medication use by older adults. J Amer Geriatr Soc. 2010; 58:944–949. [PubMed: 20406314]
30. Zhang Y, Donohue JM, Lave JR, Gellad WF. The impact of Medicare Part D on medication treatment of hypertension. Health Serv Res. 2010
31. Zhang Y, Donohue JM, Lave JR, O'Donnell GO, Newhouse JP. The effect of Medicare Part D on drug and medical spending. N Engl J Med. 2009; 363(1):52–61. [PubMed: 19571283]
32. Zhang Y, Lave JR, Donohue JM, Fischer MA, Chernew ME, Newhouse JP. The impact of Medicare Part D on medication adherence among onlder adults enrolled in Medicare-Advantage products. Med Care. 2010; 48(5):409–417. [PubMed: 20393360]
33. Zhang Y, Lee BY, Donohue JM. Ambulatory antibiotic use and prescription drug coverage in older adults. Arch Intern Med. 2010; 170(15):1308–1314. [PubMed: 20696953]
34. Das-Douglas M, Riley ED, Ragland K, et al. Implementation of the Medicare Part D prescription drug benefit is associated with antiretroviral therapy interruptions. AIDS Behavior. 2009; 13:1–9.

35. Shrank WH, Patrick AR, Pedan A, et al. The Effect of Transitioning to Medicare Part D Drug Coverage In Seniors Dually Eligible for Medicare and Medicaid. J Amer Geriatr Soc. 2008; 56(12):2304–2310. [PubMed: 19093930]
36. West JC, Wilk JE, Muszynski IL, et al. Medication access and continuity: the experiences of dual-eligible psychiatric patients during the first 4 months of the Medicare prescription drug benefit. [see comment]. Am J Psychiatr. 2007; 164(5):789–796. [PubMed: 17475738]
37. Golden A, Roos BA, Beers MH. The unintended outcome of a supplemental formulary in homebound seniors. J Amer Geriatr Soc. 2009; 57(5):927–929. [PubMed: 19470018]
38. West JC, Wilk JE, Rae DS, et al. First-year Medicare Part D prescription drug benefits: medication access and continuity among dual eligible psychiatric patients. J Clin Psychiatr. 2010; 71(4):400–410.
39. Raebel MA, Delate T, Ellis JL, Bayliss EA. Effects of reaching the drug benefit threshold on Medicare members' healthcare utilization during the first year of Medicare Part D. Med Care. 2008; 46(10):1116–1122. [PubMed: 18815534]
40. Schneeweiss S, Patrick AR, Pedan A, et al. The effect of Medicare Part D drug coverage on drug use and cost-sharing in seniors without prior drug benefits. Health Aff. 2009; 28(2):w305–316.
41. Hargrave, E.; Hoadley, J.; Summer, L.; Cubanski, J.; Neumann, T. Medicare Part D 2010 Data Spotlight: Benefit Design and Cost-Sharing. Kaiser Family Foundation; 2010.
42. Goldman DP, Joyce GF, Zheng Y. Prescription drug cost sharing: associations with medication and medical utilization and spending and health. JAMA. 2007; 298(1):61–69. [PubMed: 17609491]
43. Tamblyn R, Laprise R, Hanley JA, et al. Adverse events associated with prescription drug cost-sharing among poor and elderly persons. JAMA. 2001; 285(4):421–429. [PubMed: 11242426]
44. Shrank WH, Hoang T, Ettner SL, et al. The implications of choice: prescribing generic or preferred pharmaceuticals improves medication adherence for chronic conditions. Arch Intern Med. 2006; 166(3):332–337. [PubMed: 16476874]
45. Schneeweiss S, Walker AM, Glynn RJ, Maclure M, Dormuth C, Soumerai SB. Outcomes of reference pricing for angiotensin-converting-enzyme inhibitors. N Engl J Med. 2002; 346(11): 822–829. [PubMed: 11893794]
46. Chernew ME, Shah MR, Wegh A, et al. Impact of decreasing copayments on medication adherence within a disease management environment. Health Aff. 2008; 27(1):103–112.
47. Choudhry NK, Fischer MA, Avorn J, et al. At Pitney Bowes, value-based insurance design cut copayments and increased drug adherence. Health Aff. 2010; 29(11):1995–2001.
48. Cubanski J, Neuman P. Status report on Medicare Part D enrollment in 2006: analysis of plan-specific market share and coverage. Health Aff. 2007; 26(1):w1–12.
49. Patient Protection and Affordable Care Act. P.L. No. 111–148: 111 Congress, second session.

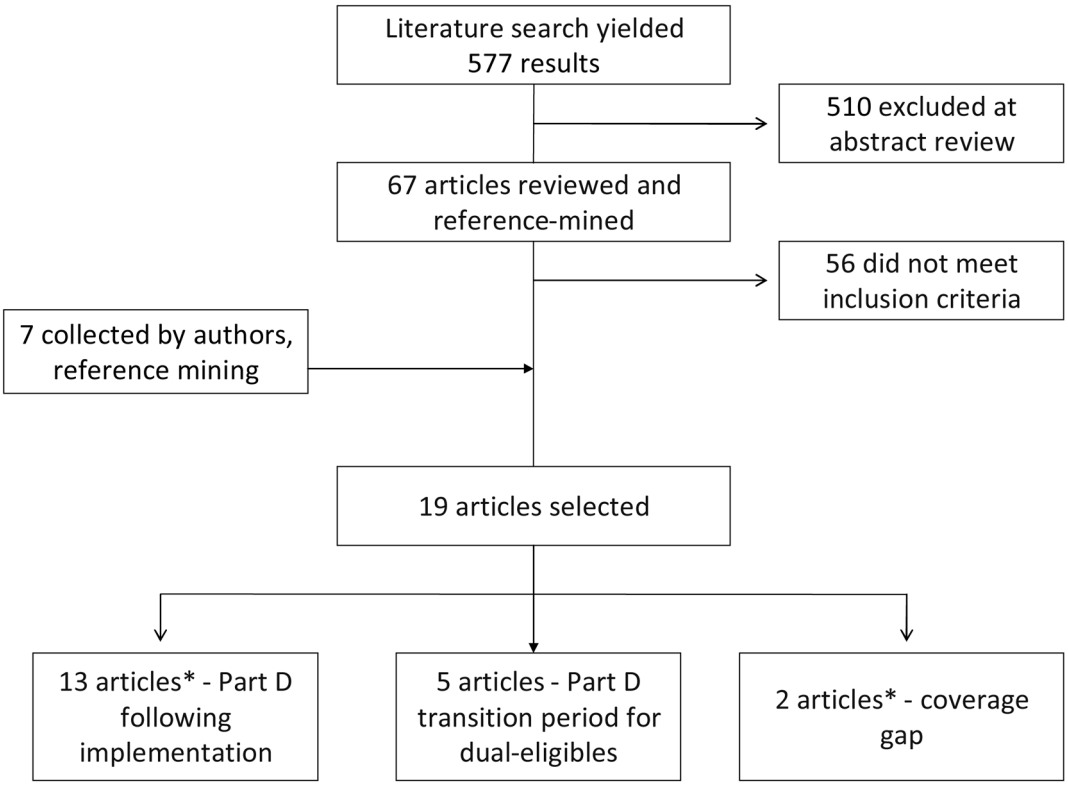

Figure 1. Study selection

*One article discussed both Part D implementation and the coverage gap

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Table 1

	Reference	Research question	Data sources and patient characteristics	Design	Drugs/drug classes studied	Results	Newcastle-Ottawa scale score
Year(s) since implementation							
1	Breisacher et al.[18]	To assess whether the exclusion of benzodiazepines under Part D decreased the risk of fractures among elderly individuals living in nursing homes	1,068,104 long-stay Medicare enrollees in nursing homes nationwide from January 1, 2005 – June 30, 2007. Comparison of residents in states that offered complete, partial, or no supplemental coverage of benzodiazepines post-Part D. A sub-sample of 50,874 newly admitted nursing home residents with MDS records were evaluated for falls and fracture outcomes	Time series analysis of any dispensing and number of dispensings per month of the study medications; prospective cohort study for fall and fracture outcomes	• Benzo-diazepines • Other anxiolytics • Sedatives • Anti-psychotics	In the state that did not provide supplemental coverage of benzodiazepines post-Part D, with comparison to 2005: • 10% decrease in the proportion of benzodiazepine recipients (−11% – −9%). • # prescriptions for potential substitute medications increased: other anxiolytics, 0.57 (0.55–0.58); antipsychotics, 0.66 (0.65–0.67) • Increased likelihood of hip fracture: 1.6 (1.05–2.45) as compared to patients in states with complete coverage	9
2	Chen et al.[19]	What was the impact of Medicare Part D on psychotropic drug use in the elderly population?	Data collected from Walgreen's retail pharmacy chain. 1.19 million patients in 2005, 1.28 million in 2006.	Interrupted time-series 2005–2006. Assessed number of prescriptions dispensed per month.	• Anti-depressants • Anti-psychotics • Benzo-diazepines	In 2006, as compared to 2005: • Antidepressants use increased 7% • Antipsychotic use increased 18% • Benzodiazepine use decreased 5%	7
3	Domino and Farley[20]	What was Part D's impact on the use of antidepressant, antipsychotic, lipid-lowering, and antihypertensive agents?	2004 – 2006 Medical Expenditure Panel Survey (MEPS) data for Medicare beneficiaries and dually eligible Medicare/ Medicaid beneficiaries.	Descriptive analyses, difference in difference models	• Anti-depressants • Anti-psychotics • Cholesterol-lowering agents • Antihypertensive agents	Results apply to both Medicare beneficiary and dually eligible beneficiary groups: • Patients in the 2005 – 2006 MEPS panel had non-significant, slightly higher rates of medication use than patients in the 2004 – 2005 MEPS panel • Neither rates of new medication starts nor the prevalence of repeat use were significantly different between the 2 panels	NA
4	Donohue et al.[22]	How has Medicare Part D's implementation influenced use of medications considered "high risk" according to the Healthcare Effectiveness Data and Information Set (HEDIS)?	Pharmacy claims for 34,679 individuals aged 65+ enrolled in a Medicare managed care organization from 2004–2007. 4 groups: control group of "retirees" with no changes in insurance, 3 intervention groups who obtained improved coverage after January	Pre- post-Part D design with a comparison group	• HEDIS "high risk" drugs	Effects of Part D on likelihood of use of any HEDIS high risk drug, in comparison to the control group of retirees: • No coverage group: OR=1.33 (95% CI, 1.21 – 1.47) • $150 drug cap group: OR=1.10 (95% CI, 1.00 –1.22) • $350 drug cap group: OR=1.08 (95% CI, 1.02 – 1.14)	9

	Reference	Research question	Data sources and patient characteristics	Design	Drugs/drug classes studied	Results	Newcastle-Ottawa scale score
			2006 enrollment in Part D: pre-Part D, 2 groups had quarterly caps on plan payment for drugs of "$150" or "$350"; 1 group had "no coverage"				
5	Donohue et al.[21]	How has utilization of psychotropic medications changed among the Medicare population and the dually-eligible, non-institutionalized population?	2005 and 2006 MEPS data for Medicare beneficiaries and dually-eligible beneficiaries	Descriptive analyses from panel data	• All anti-depressants • All anti-psychotics • Anti-convulsants	**1** In the non-institutionalized Medicare population: • 18.1% of patients used antidepressants in 2006 versus 16% in 2005, p=0.05 • 16.1% of patients used SSRI, SNRI, or newer antidepressants in 2006 versus 13.7% in 2005, p = 0.05 • No changes in antipsychotics or anticonvulsants use in 2006 v. 2005 **2** In the non-institutionalized, dually-eligible population, no differences in antidepressants, antipsychotics, or anticonvulsants in 2006 versus 2005	NA
6	Donohue et al.[23]	Did Part D implementation improve utilization of and adherence to medications for heart failure?	Pharmacy claims for 6,950 individuals aged 65+ with heart failure enrolled in a Medicare managed care organization from 2004–2007. For a description of the 4 groups examined, please see study #4.	Longitudinal cohort study. Outcomes included prescription counts as well as dichotomous use and dichotomous adherence.	• Angiotensin-converting enzyme inhibitors (ACEI) • Angiotensin II receptor blockers (ARB) • Beta blockers • Digoxin • Aldosterone-inhibiting diuretics	Comparing no coverage group to retirees: **1** Impact of Part D on likelihood of filling a prescription: • ACEI/ARB: OR=1.28 (95% CI, 1.10–1.48) • Beta blockers: OR=1.73 (1.46–2.05) • No differences between groups for aldosterone-inhibiting diuretics, digoxin **2** Impact of Part D on adherence (≥80% of days covered): • ACEI/ARBs: OR=1.91 (1.49–2.45) • Beta blockers: OR=1.55 (1.18–2.05) • No differences between groups for aldosterone-inhibiting diuretics, digoxin	9

	Reference	Research question	Data sources and patient characteristics	Design	Drugs/drug classes studied	Results	Newcastle-Ottawa scale score
7	Donohue et al.[30]	How did Medicare Part D's implementation impact the use of antidepressants, antidepressant medication choice, and adherence?	Claims for 15,080 individuals aged 65+ with a depression diagnosis enrolled in a Medicare managed care organization from 2004–2007. For a description of the 4 groups examined, please see study #4.	Longitudinal pre- and post-Part D analysis with comparison group	• Anti-depressants and subclasses	Compared to retiree group: **1** Odds of any antidepressant use: • No coverage: OR=1.61 (95% CI 1.41–1.85) • No differences for $150, $350 drug cap groups **2** Odds of having ≥ 80% days covered with an antidepressant: • No coverage: 1.86 (1.44–2.39) • $150 drug cap: 1.74 (1.25–3.42) • $350 drug cap: 1.19 (1.06–1.34)	9
8	Fu et al.[24]	What was Part D's impact on the use of potentially inappropriate medications?	1,774 adults aged 65+ in the 2005 and 2006 Medical Expenditure Panel Surveys (MEPS)	Difference in difference design to compare 2005 with 2006 use of potential inappropriate medications (PIM) according to the 2002 Beers criteria for inappropriate medication use in the elderly	Beers criteria drugs, (including anti-cholinergics, antihistamines, propoxyphene, digoxin, NSAIDs, doxazosin, muscle relaxants/anti-spasmodics, others)	• No difference in likelihood of PIM use between Part D enrollees and non-enrollees in 3 MEPS interviews: Interview #3 OR=0.91 (0.53–1.56); #4 OR=0.89 (0.64–1.25); #5 OR=1.42 (0.99–2.04). • When comparing the number of PIM prescriptions, Interview 5 Part D enrollees had 1.56 times the number of PIM prescriptions as compared to non-enrollees (1.08–2.25)	9
9	Schneeweiss et al. [36]	What was Part D's effect on the use of selected essential drugs among seniors who previously lacked drug coverage?	114,766 patients with no drug insurance in 2005 who were continuous users of a pharmacy chain	Time-trend analysis using segmented linear regression from January 1, 2005 – December 31, 2006. Defined daily doses (DDDs) were assessed.	• Statins • Warfarin • Clopidogrel • PPIs	**1** As compared with pre-Part D period, during stable Part D period, May–Dec 2006: • Statin use increased 22% • Clopidogrel use increased 11% • Warfarin use did not change • PPI use increased 37%	9
10	Zhang et al. [29]	What was Part D's impact on likelihood of use of any oral antibiotic? How did use differ for pneumonia (appropriate use) versus acute respiratory tract infections (inappropriate use)?	Random sample of 36,858 patients continuously enrolled in a Medicare Advantage organization from 2004–2007. For a description of the 4 groups examined, please see study #4.	Comparison group analysis 2 years before and after implementation of Part D	All antibiotics and major subclasses	Effects of Part D on likelihood of use of antibiotics in comparison with retirees: • No coverage group: all antibiotics OR=1.58 (95% CI, 1.36–1.85); more likely to fill prescription for each of the subclasses except sulfonamides • $150 cap group: all antibiotics OR=1.27 (1.06–1.53); quinolones, OR=1.48 (1.14–1.93); macrolides, OR=1.20 (1.00–1.56)	9

	Reference	Research question	Data sources and patient characteristics	Design	Drugs/drug classes studied	Results	Newcastle-Ottawa scale score
						• $350 cap group: all antibiotics OR=1.19 (1.10–1.30); quinolones, OR=1.16 (1.04–1.31); macrolides, OR=1.17 (1.03–1.31)	
11	Zhang et al. [26]	What was Part D's impact on the use of antihypertensive medications among seniors with hypertension?	4 groups of elderly beneficiaries with hypertension who were continuously enrolled in Medicare managed care organization from 2004–2007. For a description of the 4 groups examined, please see study #4.	Comparison group analysis 2 years before and after implementation of Part D	• Angiotensin-converting enzyme inhibitors (ACEI) • Angiotensin II receptor blockers (ARBs) • Beta blockers • Diuretics • Calcium channel blockers (CCBs)	Effects of Part D on likelihood of use post-Part D, compared to retirees: • No coverage group: Antihypertensives: OR=1.40 (1.25 – 1.56) ACE: OR=1.34 (1.20 – 1.49) ARB: OR=1.53 (1.35 – 1.75) CCB: OR=1.21 (1.10 – 1.33) Beta blockers: OR=1.44 (1.30 – 1.59) • $150 cap group: Antihypertensives: OR=1.08 (0.95 – 1.23) ACE: OR=1.08 (0.98 – 1.18) ARB: OR=1.05 (0.96 – 1.15) CCB: OR=1.02 (0.94 – 1.11) Beta blockers: OR=1.13 (1.04 – 1.22) • $350 cap group: Antihypertensives:OR=0.97 (0.89–1.05) ACE: OR=1.05 (1.00 – 1.10) ARB: OR=0.99 (0.95 – 1.04) CCB: OR=1.03 (0.98 – 1.08) Beta blockers: OR=1.07 (1.02 – 1.12)	9
12	Zhang et al. [28]	What was Part D's effect on medication adherence among beneficiaries with hyperlipidemia, hypertension, and/or diabetes enrolled in Medicare Advantage Part D plans?	Elderly beneficiaries who had at least 2 or more claims for hypertension, hyperlipidemia, and/or diabetes who were continuously enrolled in Medicare managed care organization from 2004–2007. For a description of the 4 groups examined, please see study #4.	Prospective cohort study of 2 years pre- and 2 years post- Part D measures of adherence	• Anti-hypertensives • Oral anti-diabetics • Lipid-lowering medications	Part D's impact on proportion of patients with MPR ≥80%, compared with retirees: • No coverage group: Hypertension: OR=2.09 (1.82–2.40) Hyperlipidemia: OR=1.67 (1.35–2.07) Diabetes: OR=2.36 (1.81–3.08) • $150 cap group: Hypertension: OR=1.13 (0.99–1.29) Hyperlipidemia: OR=1.22 (1.04–1.43)	9

	Reference	Research question	Data sources and patient characteristics	Design	Drugs/drug classes studied	Results	Newcastle-Ottawa scale score
						Diabetes: OR=1.17 (0.90–1.51) • $350 cap group: Hypertension: OR=1.14 (1.05–1.23) Hyperlipidemia: OR=1.14 (1.06–1.24) Diabetes: OR=1.21 (1.06–1.39)	
13	Zhang et al.[15]	How did drug use change after the implementation of Part D among patients with hyperlipidemia or diabetes?	Random sample of 36,858 elderly beneficiaries who were continuously enrolled in Medicare managed care organization from 2004–2007. For a description of the 4 groups examined, please see study #4.	Time series analysis using segmented linear regression with comparison group, from 2004 – 2007.	• Lipid-lowering medications • Oral anti-diabetics medications	Effects on number of monthly prescriptions, compared to retirees, since Dec 2005: <u>Lipid-lowering drugs:</u> • No coverage: +0.21 (1.5–2.7), +44% • $150 cap: +0.18 (0.13–0.23), +31% • $350 cap: +0.11 (0.05–0.17), +17% <u>Oral anti-diabetic drugs:</u> • No coverage: + 0.27 (0.19–0.35), +44% • $150 cap: +0.11 (0.03–0.19), +13% • $350 cap: no significant change	9
Transition period							
1	Das-Douglas et al.[31]	What was Part D's impact on the likelihood of anti-retroviral treatment interruptions among patients with HIV?	125 homeless and marginally housed individuals in a longitudinal cohort study (Research on Access to Care in the Homeless-REACH)	Cross-sectional questionnaire	Antiretroviral medications	• 14 (11.2%) reported treatment interruptions • 10 of the 14 (71.4%) were insured under Medicare Part D	NA
2	Golden et al.[34]	What were the experiences of Part D dual-eligibles who also had a supplemental pharmacy benefit?	2,959 dual-eligible, home-bound Florida beneficiaries. All patients were enrolled in a Medicaid Waiver Program and in Part D.	Descriptive study	Benzo-diazepines	• Benzodiazepines accounted for 70.1% of all prescriptions filled • Of 134 clients receiving a benzodiazepine, 95.4% of prescriptions were refills	NA
3	Shrank et al.[32]	What were the medication use and drug switching experiences of dual-eligible beneficiaries during the transition to Medicare Part D?	13,302 dually-eligible beneficiaries who were patrons of 1 large pharmacy chain operating in 34 states	Time-trend analysis using segmented linear regression. Outcomes included days' supply of medication per month.	• Statins • Clopidogrel • Warfarin • PPIs	• No significant changes in use with the transition to Part D. • PPIs: 2.99% greater rate (95% CI, 1.34–4.65%) of switching from one brand to another, from brand to generic, or from generic to brand	9

	Reference	Research question	Data sources and patient characteristics	Design	Drugs/drug classes studied	Results	Newcastle-Ottawa scale score
4	West et al.[33]	How did medication access change among dual eligible patients treated by psychiatrists during the first four months of Part D benefit?	1,193 randomly sampled psychiatrists from the American Medical Association's Physician Masterfile who saw at least one dual-eligible patient during their last typical work week	Mailed-in, practice-based survey conducted in January – April 2006. Each psychiatrist was asked to report on the experiences of the next dual-eligible patient he/she treated.	• Anti-psychotics • Anti-depressants • Benzo-diazepines • Anti-convulsants	• 233 (20%) patients were not prescribed clinically indicated/preferred drugs • Of these, 21.9% of the prescriptions were for an atypical antipsychotic, 20.7% SSRIs, 16.5% other antidepressants, 13.7% benzo-diazepines, and 9.5% anticonvulsants/mood stabilizers	NA
5	West et al. [25]	How did medication access change among dual eligible patients treated by psychiatrists during the first year of Part D benefit?	Data collection in 3 assessments: January–April 2006, May–August 2006, September–December 2006. Across all 3 phases: 1,490 physicians provided data on selected sample of 2,941 dual eligible psychiatric patients	Cross-sectional survey design	• Anti-psychotics • Anti-depressants • Sedatives • Benzo-diazepines • Mood stabilizers	• Nearly 30% were reported to have had problems accessing benzodiazepines • For 1/3 of patients, access difficulties due to Part D plan restrictions, approval issues, or high copayments: atypical antipsychotics=23.8% (SE=3.3%), SSRI=21.5% (2.9%), sedatives=16.5% (2.8%), other antidepressants=13.2% (2.5%), benzodiazepines=8.5% (2.2%), mood stabilizers=5% (1.3%)	NA
Coverage gap							
1	Schneeweiss et al.[36]	What was Part D's effect on the use of selected essential drugs among seniors who previously lacked drug coverage during the coverage gap?	114,766 patients with no drug insurance in 2005 who were continuous users of a pharmacy chain	Time-trend analysis using segmented linear regression from January 1, 2005 – December 31, 2006. Defined daily doses (DDDs) were assessed.	• Statins • Warfarin • Clopidogrel • PPIs	Changes per month among patients who reached coverage gap, compared with the baseline trend: • Statins: 6.3% decrease (4.8%–7.8%) • Clopidogrel: 5% decrease (3.2%–6.8%) • Warfarin: 4.8% decrease (3.8%–5.7%) • PPIs: decrease, numbers not reported	9
2	Raebel et al. [35]	How did the Part D coverage gap impact healthcare utilization and medication adherence?	Beneficiaries who self-enrolled in one of two Medicare Advantage plans or who are retirees in employer-based plans administered by Kaiser Permanente Colorado. Beneficiaries were aged 65+ and survived during the two year period 2005–2006.	Retrospective cohort study	• Anti-hypertensives • Anti-hyperlipidemics • Anti-depressants • Oral anti-diabetics	Comparing Part D enrollees who were responsible for their drug costs in the coverage gap to beneficiaries in non-Part D plans who did not face such a gap: • Anti-hyperlipidemics (p=0.031) and antihypertensives (p=0.006) use declined • Medication refill adherence decreased among those who reached the coverage gap: anti-hyperlipidemics (p=0.038), antidepressants (p<0.001), antihypertensives (p=0.003), diuretics (p<0.001)	9