

Supplement 2: Summary key findings about ACO model from primary studies included in this review

ACO	Quadruple-Aim Outcomes			
	Patient experience of care (including quality of care)	Population health	Per capita costs of care	Provider experience
Medicare Physician Group Practice Demonstration (PGP)	<p><i>Key findings from 2 included studies</i></p> <ul style="list-style-type: none"> Improved quality indicators for diabetes, congestive heart failure, coronary artery disease, and preventive care.(1) Did not limit discretionary use of carotid and coronary imaging or revascularization.(2) No effect on non-discretionary cardiovascular imaging.(2) 	<p><i>Key findings from 1 included study</i></p> <ul style="list-style-type: none"> 5.6% reduction in mortality among cancer patients.(3) 	<p><i>Key findings from 3 included studies</i></p> <ul style="list-style-type: none"> 2% combined savings per assigned beneficiary per year during five-year demonstration.(1) \$114 mean annual savings per beneficiary, with a skewed distribution of savings for those dually eligible for Medicare and Medicaid (\$532 annually per beneficiary versus \$59 annually per beneficiary).(4) \$721 annual spending reductions across 10 PGP sites on cancer patient beneficiaries and 3.9% annual reduction per cancer patient.(3) 	<ul style="list-style-type: none"> No studies included
Alternative Quality Contract (AQC)	<p><i>Key findings from 3 included studies</i></p> <ul style="list-style-type: none"> 3% and 0.7% increase in the proportion of eligible enrollees meeting chronic care management and pediatric care thresholds, respectively.(5) Improvements in five evidence-based performance standards of care were found.(6) Not associated with improvements in quality of care for cardiovascular disease, diabetes-related measures, readmissions or low-density lipoprotein (LDL) testing in year one but results improved 	<ul style="list-style-type: none"> No studies included 	<p><i>Key findings from 6 included studies</i></p> <ul style="list-style-type: none"> No statistically significant cost savings were found.(6) Cost savings ranged between \$34 per beneficiary in year one to \$51 in year two. The greatest savings were found for beneficiaries with five or more conditions compared to those with fewer conditions (\$125 per beneficiary per year versus \$61).(7) \$15.51 decrease in quarterly spending per enrollee and 1.9% savings per quarter, most of which is attributable to reduced cost of procedures, imaging 	<ul style="list-style-type: none"> No studies included

	in year two for both LDL testing and diabetes measures.(7)		and testing. Enrollees with the highest risk attributed 95% of savings.(5) <ul style="list-style-type: none"> • \$62.21 average savings were reported from one AQC group per enrollee per quarter, with savings (4.0% in professional spending) concentrated in the outpatient-facility settings.(8) 	
Medicare Shared Savings Program (MSSP)	<p><i>Key findings from 11 included studies:</i></p> <ul style="list-style-type: none"> • In comparison with low-performing ACOs, high performing ACOs had formed collaborative relationships with local hospitals that enabled access to more timely information about admissions and discharge.(9) • ACOs serving a high proportion of minority patients perform worse than other ACOs on quality performance measures, associations that are not entirely explained by patient characteristics (e.g., higher risk, higher severity of illness, or disadvantaged in other ways).(10) • ACO beneficiaries had more appropriate use of cancer screening than fee-for-service recipients. This included reduction in breast cancer screening for women over the age of 75 who are less likely to benefit, as well as increased colorectal cancer screening.(11) Prostate screening rates were lower among ACO beneficiaries, which may reflect 	<p><i>Key findings from 2 included studies:</i></p> <ul style="list-style-type: none"> • Patients receiving care from ACO-affiliated teams with a greater focus on patient-centered culture were more likely to have fewer depressive symptoms and better physical health scores.(20) 	<p><i>Key findings from 8 included studies:</i></p> <ul style="list-style-type: none"> • No significant change was found for the differential spending per beneficiary of those enrolled in MSSP ACO's when compared to control groups.(21) • Estimated savings among independent primary care groups seen in the 2012 and 2013 MSSP ACO cohorts were significantly greater than savings in hospital-integrated groups.(21) • Estimated savings were significantly higher for ACOs that had baseline spending above local averages than those below, suggesting that providers with more opportunities to reduce spending can do so more easily.(21) • Costs of cancer care for ACO beneficiaries did not differ from non-ACO beneficiaries, for multiple types of cancer(22) and end-of-life care.(23) One study found equal costs for prostate cancer care(11) while another found higher costs.(24) 	<p><i>Key findings from 2 included studies:</i></p> <ul style="list-style-type: none"> • High-performing ACOs were able to effectively integrate care coordinators into the team, however effects on other providers' practice and satisfaction at work was not assessed (9) • Higher scores for team work were not associated with improved patient-reported outcomes (20)

	<p>the lack of evidence-based guidelines for prostate screening.(12, 13)</p> <ul style="list-style-type: none"> • Rates of prostate cancer treatment for those unlikely to benefit were lower among ACO beneficiaries than FFS patients.(11) • Improved appropriateness of end-of-life care for ischemic stroke(14), but mixed findings for end-of-life cancer care(15) • ACO hospitals had reduced 30-day readmissions for heart failure and pneumonia.(16, 17) • No difference for acute myocardial infarction (AMI) readmissions between ACO-attributed patients and other patients was found in one study,(16) while another found that ACO hospitals achieved greater reductions in readmission rates for AMI than non-ACOs.(17) • ACO hospitals were more likely to discharge patients to highly-rated (five star) skilled nursing facilities, but equally likely to discharge patients to low-rated (one star) skilled-nursing facilities.(18) • ACO beneficiaries had minimal or no difference in their use of and adherence to diabetic and cardiovascular medications when compared with fee-for-service beneficiaries.(19) 		<ul style="list-style-type: none"> • No significant differences were found for spending on post-acute care when comparing MSSP and non-ACO hospitals.(25) • Rural Health Clinics had higher costs of care per visit in the first two years of ACO implementation, with an increase of \$11.41-\$15.33 in the per-visit cost.(26) 	
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Advanced Payment ACO	No studies were found that evaluated the Quadruple Aim in Advance Payment models on their own, but this model was included in studies that evaluated multiple types of ACO (see below).			
Pioneer ACO model	<p><i>Key findings from 4 included studies</i></p> <ul style="list-style-type: none"> • Similar satisfaction of care was found between Pioneer ACO and fee-for-service beneficiaries, but ACO report higher satisfaction with clinician communication.(27) • 10% of survey respondents identified the need for more focus on patient activation and/or patient skills for self-managing chronic conditions and 29% indicated that there is too much focus on quality metrics and not enough on patient needs.(28) • Significant reduction of hospital admissions related to chronic obstructive pulmonary disease, older adult asthma, and heart failure and increased rates for post discharge follow-up in the week following discharge across 32 ACOs between 2012-2013.(29) • Survey of patient experience in 32 ACOs reported little change over initial two-year period based on Consumer Assessment of Health care Providers and Systems (CAHPS) surveys.(29) • Pioneer ACO hospitals did not differ from other Medicare hospitals in their total performance score under the Medicare Value-Based 	<p><i>Key findings from 2 included studies</i></p> <ul style="list-style-type: none"> • Two phases on an evaluation of 32 Pioneer ACOs identified gaps in current data collection that limit the ability to analyze beneficiary data from a population perspective.(29, 31) 	<p><i>Key findings from 7 included studies</i></p> <ul style="list-style-type: none"> • 4.5% reduction in spending on low-value were found after the first year of operation of a Pioneer ACO.(32) • Cost savings of \$384 million was found in the first two-years of operation across 32 Pioneer ACO's.(29) • A sample of Pioneer ACOs increased their spending by \$385 million in the first two years, although this total was less than increases in traditional fee-for-service models.(27) • Pioneer ACOs have been found to produce additional savings of: reduced spending of \$29.2 per beneficiary per quarter; a 1.2% reduction in total costs per beneficiary per quarter in 2012; and smaller increase per beneficiary per month when compared to fee-for-service comparison.(32) • 36% of physicians sampled at a Pioneer ACO found the compensation model too complex and felt that patients' lifestyle behaviors, which they cannot control, influenced their salary.(28) 	<p><i>Key findings from 1 included study</i></p> <ul style="list-style-type: none"> • Primary care providers expressed feeling that quality targets hinder their focus on patient needs, and that pay-for-performance unfairly penalized providers for their patients' choices (28)

	Purchasing Program, nor for any of the component parts (process, patient experience, outcome, or efficiency).(30)			
Studies including multiple types of ACO's	<p><i>Key findings from 13 included studies</i></p> <ul style="list-style-type: none"> • In one study, overall ratings of care and interactions with physicians did not change significantly between the ACO and control groups.(26) In another study, Pioneer ACO hospitals were associated with better ratings for provider communication compared to non-ACO hospitals, and high-quality Pioneer ACOs had better scores for patient recommendation, while MSSP hospitals were not significantly associated with any domain of patient experience.(33) • Improvements were seen in self-reports of timely access to care among complex beneficiaries with seven or more chronic conditions.(34) • The majority of physicians at a range of ACOs were implementing some patient-engagement strategies. The majority also reported there was more to do to increase participation in supporting shared decision-making.(35) • The size of an ACO was not found to determine the level of patient and family activation and engagement. (34) • No difference was found between Pioneer, MSSP and 	<p><i>Key findings from three included studies</i></p> <ul style="list-style-type: none"> • Hospitals that became more centralized through a Pioneer or Advance Payment ACO model had significantly larger reductions in mortality compared to those that remained free standing.(43) • ACOs with tightly integrated physician-hospital linkages were associated with increased mortality.(43) • MSSP and Pioneer ACO pneumonia patients had marginally reduced 30- (-0.584%) and 120-day (-0.262%) mortality relative to fee-for-service beneficiaries; and no change in mortality for hip fracture or stroke.(39) • Maternal and neonatal health outcomes in states with Medicaid ACOs did not differ from other states.(44) 	<p><i>Key findings from 10 included studies</i></p> <ul style="list-style-type: none"> • Growth of per member cost per month in a pediatric ACO was less (\$2.40) per year compared to Medicaid fee-for-service (\$16.15) and managed care (\$6.47).(38) • Of diverse ACOs, 26% calculated a return on investment from targeted patient and family activation and engagement, reporting ratios of between 2:1 and 4:1 based primarily on reduced emergency-room visits and hospitalizations.(35) • Pioneer ACO contracts were associated with a reduction of \$170 per beneficiary in total mental health spending in 2012 as compared to MSSP contracts, with the reduction largely a result of a reduction in inpatient spending on admissions for mental illness.(37) • No difference was found across MSSP, Pioneer, or control fee-for-service enrollees in Part D Medicare spending, total prescriptions filled, or percent of claims for brand-name drugs, however these models were associated with significant savings in Part 	<p><i>Key findings from 2 included studies</i></p> <ul style="list-style-type: none"> • ACOs implemented approaches including interdisciplinary teamwork, care coordinators, and provider training in motivational interviewing to address provider barriers including lack of provider time (35) • Collaboration (which in some instances was enabled through co-location) between primary care and behavioural health providers was well received by health providers as it eased the process of coordinating care (41)

	<p>fee-for-service models on measures of quality.(36)</p> <ul style="list-style-type: none"> • Practices participating in an ACO were more likely to have care-transition management processes including notification of hospital admission, and follow up within 2 days of hospital discharge.(20) • No difference was found between Pioneer and MSSP ACOs across three quality measures of mental health services or in-patient-reported mental health status.(37) • Mixed results were found on the quality of care of children in pediatric ACOs, with significant improvements in five quality measures and significant declines on three measures.(38) • Hospitals participating in CMS ACOs had better Prevention Quality Indicator scores for COPD and asthma, but equal for CHF and all-cause 30-day readmissions, relative to non-participating hospitals.(39) • Pioneer and MSSP ACO patients had reduced length of stay in skilled nursing facilities for hip fractures, stroke, and pneumonia compared to pre-ACO and non-ACO patients. 30-day readmission rates did not vary for stroke or pneumonia, and were marginally reduced for hip fracture.(39) 		<p>A and Part B spending (\$345 per beneficiary).(45)</p> <ul style="list-style-type: none"> • Expenditures for ACO beneficiaries with mental health conditions increased less than non-ACO beneficiaries in two states, and was not significantly different in a third during the first three years of implementation.(41) • There was no significant difference in spending for ACO (MSSP/Pioneer) and non-ACO patients for hip fracture or stroke, but spending was lower for ACO pneumonia patients (by \$512/120 day episode).(46) • Mothers enrolled in Medicaid in three states with Medicaid ACOs had lower costs for birth (-\$366 per birth). This was driven primarily by reductions in costs in one state; another state had higher costs per birth than states without Medicaid ACOs.(44) • Expenditures for non-elderly ACO-attributed patients did not differ significantly from non-ACO patients.(42) • FFS beneficiaries treated by ACO-affiliated providers for a major clinical episode did not have lower expenditures than those treated by non-ACO providers, with the exception of marginally significant cost savings for three age-associated conditions.(47) 	
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	<ul style="list-style-type: none"> Both recommended and non-recommended cancer screening rates were higher in patients attributed to Medicare ACOs than fee-for-service beneficiaries.(40) ACO-attributed patients with behavioural health conditions had equal rates of hospital readmission and post-discharge follow-up when compared with fee-for-service beneficiaries in three states implementing integrated behavioural health services. Findings for inpatient admissions were mixed, but emergency room visits declined more for ACO than non-ACO patients with behavioural health conditions in all three states.(41) Findings on antidepressant use and adherence in ACO beneficiaries are mixed.(37, 41) ACO attribution was not associated with satisfaction with care or use of preventive care for non-elderly patients.(42) 		<ul style="list-style-type: none"> Early (index admission-90 day) cardiovascular spending did not differ significantly between ACO and non-ACO beneficiaries. Late (91-365 day) spending was reduced by \$889 for CHF and \$680 for AMI. Savings were driven by reduced readmissions relative to non-ACO beneficiaries.(48) High-quality Pioneer and MSSP ACOs achieved cost savings in the first year of implementation, while low-quality ACOs experienced financial losses.(49) 	
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