Supplemental materials for

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Supplemental Table 1. Summary of Continuity Measures Used

Name of Measure	Author, year	Index type*	# of studies that used measure	Key features of measures
Bice-Boxerman COC index	Bice & Boxerman, 1977[24]	Dispersion	38	Measures the concentration of outpatient visits to different providers and accounts for the number of total visits
Usual Provider Index (UPC)	Breslau and Reeb, 1975[25]	Density	27	Measures the proportion of total physician visits to a patient's regular physician
Modified Modified Continuity Index (MMCI)	Magill & Senf, 1987[26]	Dispersion	5	Measures the dispersion of visits to different providers
Sequential Continuity (SECON)	Steinwachs, 1979[27]	Sequence	6	Measures the proportion of visits made out of all visits to the physician the patient saw most recently. The order of visits matters
Herfindahl index(HI)	Zwanziger et al, 1996[28]	Dispersion	3	Originally measured market share. Measures the dispersion of visits to the primary provider, with higher scores representing every visit to the same provider and lower scores indicating every visit to a different provider.
The Most Frequent Provider index(MFPC)	Breslau and Haug, 1996[29]	Density	2	Modification of UPC. Measures the proportion of visits to the provider visited most frequently. Not impacted by distribution/dispersion of visits to other providers.
Fraction of Care Continuity(FCP)	Eriksson and Mattsson, 1983[30]	Density	1	Fraction of visits in specified time period made to current provider
Discounted - Fraction of Care Continuity(DFCP)	Eriksson and Mattsson, 1983[30]	Density	1	Same as FCP, but decreases the value of visits as time passes from that visit to put more weight on recent visits.

Ejlertsson's K Index	Ejlertsson, 1980[31]	Dispersion	1	Measures number of total visits compared to number of providers seen.
Known Provider	Smedby et al, 1986[32]	Density	1	Score of 1 if provider seen currently was seen previously and 0 if not.
Patient-reported COC model	Bentler et al, 2014[33]	None	1	Combines longitudinal and interpersonal continuity through a 13-item patient report on their usual primary provider, place of care, and the quality and duration of their patient–provider relationship.
Developed for individual study only:	Menec et al, 2006[34]	Density	1	Majority-of-care definition: More than 75% of family practice visits to the same family physician defined as high continuity of care, and anything below defined as low
	Hollander & Kadlec, 2015[35]	Density	1	Patient attachment: the percentage of services provided by the practice that provided the most services
	De Maeseneer et al, 2003[36]	Dispersion	1	Patients with only one family physician over the 2 year study period(identified as having provider continuity) vs. patients with more than one family physician
	Meyers et al, 2019[37]	Duration	1	Number of years a patient saw the same provider
	Irigoyen et al, 2004[38]	Duration	1	Child's age in months at the time of the last visit to the initial source of care
	Bradford et al, 2004[39]	None	1	"A child was coded as having continuity of care if the following conditions were met: over 50% of the ambulatory medical visits the child received were with 1 provider, the child received at least 1 visit with that provider per year, and the provider type was a private office or clinic"
	Mendoza-Sassi & Béria, 2003[40]	None	1	Having or not having a regular doctor, defined from responses to 3 interview questions
	Skarshaug et al, 2021[41]	None	1	Measured discontinuity of care: patients who experienced a sudden discontinuity

			that lasted for over 2 months after having 12 months of stable continuity.
Van Loenen et al, 2016[42]	None	1	“Two scales were created for primary care continuity: longitudinal continuity and informational continuity. Longitudinal continuity indicates the long term relationship between primary care providers and patients, and informational continuity refers to the availability of patients’ medical information, such as medical records.”
Holderness et al, 2019[43]	None	1	Being or not being established with a primary care provider, defined as having 2 visits to a provider and Evaluation Management(EM) codes from that provider.
Gudzune et al, 2013[44]	Dispersion	1	"Doctor Shopping": Seeing 5 or more primary care physicians during the 24 month study period.
Solomon et al, 2015[45]	None	1	Patients where their resident primary care physician graduated(discontinuity) vs. patients where their resident primary care physician did not graduate(continuity)
Anderson et al, 2012[46]	Density	1	Continuity to a specific medical group: high continuity if always attributed to the same medical group over 5 years, medium if patient made 1 move between medical groups, and low continuity if more than 1 move.
Barrera et al, 2019[47]	None	1	Being or not being seen by primary care provider
Coleman et al, 2010[48]	None	1	Reassigned or not reassigned to new primary care provider
Koopman et al, 2003[49]	None	1	3 point scale that scored patients from no usual source of care, usual place but no usual provider, to usual place and provider based on individuals' responses to 2 questions.
Liao et al, 2015[50]	Density	1	Consistency of patient to provider and medical setting: high consistency defined as

			100% of a patient's outpatient visits to a single provider. Low consistency defined as less than 70%.
Stein et al, 2002[51]	Dispersion	1	Having or not having a primary care physician: defined as seeing the same physician when you have a problem
Thanh & Rapoport, 2017[52]	None	1	Having or not having a regular doctor assessed by 1 question
Tsai et al, 2010[53]	None	1	Usual source of care assessed with 3 questions: Is there a doctor or place that you usually go if you are sick or need advice about your health? Is there a doctor or place that knows you best as a person? Is there a doctor or place that is most responsible for your health care? Patients who answered positively to any 1 of the 3 questions were considered to have a usual source of care
Pourat et al, 2015[23]	None	1	Adherence to primary care provider - proportion of visits to assigned provider
Glenister et al, 2021	Dispersion	1	Attendance at 0, 1, or multiple general practices in last 12 months
White et al, 2016	Duration	1	Registered with same general practice for 50+ years (high continuity) vs. registered with new general practice in last 2-4 years (low continuity)
Busby et al, 2017	Density	1	“Percentage of patients who respond ‘Always’,’ Almost always’ or ‘A lot of the time’ to the question ‘How often do you see or speak to the GP you prefer?' [among those who have a preferred GP]”
Snyder et al, 2022	None	1	Before vs. after the continuity project intervention, which consisted of empaneling patients to PCPs, reducing provider floating, implementing continuity-promoting scheduling guidelines, scheduling future well-child care (WCC) visits for patients ≤15 months during check-in for their current one, and encouraging online scheduling.

	Donahue et al, 2005	Duration	1	Length of time with same PCP: less than a year, one to two years, three to five years, and more than five years
	Godard-Sebillotte et al, 2021	Density	1	High continuity defined as having had every primary care visit with the same primary care physician during the preceding year
	Jabaaij et al, 2007	Duration	1	Newly enlisted with physician in past year (low continuity) vs. enlisted with same physician for more than 2 years (high continuity)
	Turbitt et al, 2016	None	1	Have or do not have a regular source of primary care: whether the child has a usual place where he/she receives primary care, the type of practice where this care is received, by whom the care is provided, and the last time the place of primary care was changed

*Defined by Jee and Cabana, 2006[54]:

- Duration: measures length of time with a particular provider
- Density: characterizes visits with the same doctor quantified by number or percentage of visits over a defined time period
- Dispersion: quantifies the number or percentage of visits with distinct providers
- Sequence: accounts for the order in which different providers are seen.

Supplemental Table 2. Summary of studies examining continuity and cost outcomes only

Study	Keywords from paper	Study Method	Setting	Continuity of Care Measurement used	Cost Measured	Cost significantly improved?	Findings
Lei et al, 2020[55]	aging/elderly/geriatrics, dementia, health care cost, instrumental variables, primary care, VA health care system	Retrospective Cohort	Veterans Health Administration (VHA) and Medicare data for 102,073 veterans with dementia	Bice-Boxerman COC	1. Cost	1. +	Higher continuity associated with lower inpatient cost, ED cost, and long-stay nursing home cost, but higher medical long-term care (LTC) cost & social LTC cost, & no impact on short-stay nursing home cost. Overall costs decreased with higher continuity
Hollander & Kadlec, 2015[35]	None	Retrospective Cohort	The British Columbia Ministry of Health's administrative databases for 222,779 patients with diabetes, congestive heart failure, chronic obstructive pulmonary disease, hypertension, angina, chronic kidney disease, osteoarthritis, and stroke.	Patient attachment (the percentage of services provided by the practice that provided the most services)	1. Cost	1. +	A higher attachment to practice was associated with lower total health care costs for each condition
De Maeseneer et al, 2003[36]	Community health services; delivery of health care; health services research; provider continuity	Prospective Cohort	Survey of 4,800 adults over the age of 45 in Belgium	Patients with only one family physician over the 2 year study period(identified as having provider continuity) vs. patients with more than one family physician	1. Cost	1. +	Provider continuity was associated with lower healthcare costs

Jacobs et al, 2020 - chapter 7[56]	None	Prospective Cohort	Administrative records for 16,486 patients with serious mental illness(SMI) in the United Kingdom.	Bice-Boxerman COC, UPC, SECON	1. Cost - for primary care consultations, drugs prescribed, and diagnostic tests, and community mental health care, and hospital services	1. +0	Higher general practitioner continuity was associated with lower PC costs (consultations, prescriptions, & diagnostic tests), but not with total costs or costs for other services

*ED = Emergency Department; PC = Primary Care

+=outcome improved with continuity, -=outcome worsened with continuity, 0=no significant association with continuity

Spplemental Table 3. Summary of studies examining continuity and utilization outcomes

Study	Keywords from paper	Study Method	Setting	Continuity of Care Measurement used	Utilization Outcome Measured	Outcome significantly improved?	Findings
Lin et al, 2010[57]	continuity of care, ambulatory care, hospitalization, diabetes	Retrospective Cohort	Claims data from Taiwan's National Health Insurance system for 6,476 diabetic patients	UPC	1. Diabetes-related long-term hospitalization	1. +	Higher continuity was associated with a lower likelihood of long-term hospitalization
Enlow et al, 2017[58]	None	Prospective Cohort	Electronic health records for 17,773 infants at Children's Hospital of Philadelphia clinics	UPC, Bice-Boxerman COC	1. ACSC hospitalization 2. Desirable utilization - vaccinations 3. Desirable utilization - lead and anemia screening 4. Primary care utilization - Frequency and type of primary care visit 5. ED utilization	1. + 2. + 3. + 4. + 5. +	Lower continuity was associated with a lower likelihood of being up to date on immunizations or receiving anemia & lead screening, as well as more ACSC hospitalization, ED visits, and sick visits to PC but less well visits to PC
Reddy et al, 2018[59]	Continuity of care, team-based care, primary care, medical home	Retrospective Cohort	Data from the Veterans Affairs Health Care System(VA) and Medicare claims data for 1,160,365 patients	UPC	1. ACSC hospitalization 2. ED utilization 3. All-cause hospitalization	1. + 2. - 3. +	A 10% increase in the UPC score was associated with less ACSC hospitalizations and all-cause hospitalizations, but more ED visits
Menec et al, 2006[34]	None	Retrospective Cohort	Survey of 1,863 adults over the age of 67 in Manitoba, Canada	More than 75% of family practice visits to the same family physician defined as high continuity of care, and anything below defined as low.	1. ACSC hospitalization 2. Primary care utilization - physician visits 3. All-cause hospitalization 4. Undesirable utilization - total physician visits	1. + 2. 0 3. 0 4. +	Patients with low continuity of care had more visits to all physicians but not to family physicians. High continuity was associated with a lower risk of ACSC hospitalizations, but not hospitalizations for all conditions.
Huang et al, 2016[60]	None	Retrospective Cohort	Data from the Taiwan National Health Insurance Dataset for 29,277 patients with asthma aged 0 to 17 years old	Bice-Boxerman COC	1. Asthma-related ED utilization	1. +0	The risk of ED visits decreased as continuity increased, but the # of ED visits for patients with at least 1 visit did not show any relationship with continuity.

Johnston & Hockenberry, 2016[61]	Patient continuity of care, specialty care, physician division of labor, older adults, chronic disease	Retrospective Cohort	Panel data from the Medicare Current Beneficiary Survey(MCBS) for Medicare patients with type 2 diabetes or heart failure	Bice-Boxerman COC	1. Desirable utilization 2. Undesirable utilization - overuse of cardiac imaging 3. ACSC hospitalization 4. ACSC ED utilization 5. ED utilization - various causes 6. Diabetes-related hospitalization 7. Heart failure-related hospitalization 8. All-cause hospitalization	1. +0 2. +0 3. 0 4. 0 5. 0 6. 0 7. 0 8. 0	Increasing COC index scores were associated with higher guideline-concordant care for some conditions (DM) & 30-day hospital follow up, but not with other quality measures vaccinations. Higher continuity also associated with less cardiac stress tests, but had no relationship to echocardiograms or chest X-rays, with ACSC hospitalizations or ED visits, with diabetes or heart failure-related inpatient stays or ED visits.
Fenton et al, 2008[62]	continuity of care; primary care; cancer screening; multivariate analysis	Prospective Cohort	Automated health and pharmacy data for 67,633 patients aged 50-78 years old in Washington State	UPC	1. Desirable utilization - Cancer testing for colorectal cancer testing(CRC) (fecal occult blood testing(FOBT)and lower endoscopy), mammography, prostate specific antigen(PSA) tests.	1. +-0	Better continuity of care was associated with a higher likelihood of receiving CRC testing through a higher likelihood of FOBT but a lower likelihood of lower endoscopy, and also associated with more PSA testing for men, but had no relationship to mammography for women
Reid et al, 2005[63]	Continuity of patient care, Chlamydia infections, Mass screening, Primary care, Women's health, Health maintenance organizations, United States	Retrospective Cohort - but uses data from clinical trial	Administrative data for 4,117 sexually active women at a large US HMO.	UPC, Bice-Boxerman COC	1. Desirable utilization - chlamydia screening	1. -	Higher continuity was associated with a lower likelihood of chlamydia testing
McDermott et al, 2020[64]	General practice, continuity of care, frequent attenders, retrospective	Retrospective Cohort	Practice record data for 35,296 patients aged >18 years in Bristol, England	UPC	1. Primary care utilization - frequent primary care attendance	1. 0	No relationship was found between a patient's continuity and the likelihood that they would be a

	studies, primary health care						frequent attender of primary care.
Meyers et al, 2019[37]	adherence; Medicaid; providers; hierarchical modeling; practices; generalists	Retrospective cohort	Medicaid Analytic Extract claims for 60,496 patients aged 18-64 with HIV in the US	# of years a patient saw the same provider	1. Desirable utilization - HIV Anti-Retroviral Therapy adherence	1. +	Each additional year a patient saw the same provider was associated in a 6% increase in percent of year of ART adherence
Irigoyen et al, 2004[38]	continuity of care; immunization coverage; low-income children	Prospective cohort	Medical records and the New York City Department of Health Citywide Immunization Registry for 641 randomly selected children at 3 months of age	Child's age in months at the time of the last visit to the initial source of care	1. Desirable utilization - immunizations	1. +	Children who retained their initial source of care were 17.5 more likely to be up to date in their immunizations at 18 months (UTD18) than children in care for less time.
Warren et al, 2015[65]	None	Retrospective cohort	36,144 patients from the cohort 45 and Up study which includes 260,000 people aged 45 and older in New South Wales, Australia.	UPC, Bice-Boxerman COC	1. Desirable utilization - medication/statin adherence	1. +	Medication adherence was positively associated with continuity of care.
Bradford et al, 2004[39]	continuity of patient care; insurance; dental health services; dental care; child nutrition; child development	Retrospective cohort	8,285 Caucasian and African-American mothers surveyed in National Maternal and Infant Health Survey	Children were coded as either having or not having continuity of care based on their provider visit behaviors	1. Desirable Utilization - receiving medical advice about child nutrition, development, and dental health	1. +0	Mothers with children with continuity of care were more likely to receive advice/counseling on nutrition and development but not dental advice
Flores et al, 2008[66]	Continuity of care, Medicaid, screening, early childhood, urban	Prospective cohort	Hospital chart reviews and maternal interviews for 1,564 Medicaid-enrolled infants in Philadelphia, PA.	UPC, Bice-Boxerman COC, SECON	1. Desirable utilization - screening for lead, anemia, and tuberculosis	1. +	Better continuity of care was associated with a greater likelihood of receiving all 3 types of screening.
Mendoza-Sassi & Béria, 2003[40]	Health Services Accessibility; Continuity of Patient Care; Regular Doctor	Retrospective cohort	Interviews of 1,260 people >15 years of age in Brazil in 540 households.	Having or not having a regular doctor, defined from responses to 3 interview questions	1. Desirable utilization - Various medical screenings	1. +	Continuity of care was associated with a higher odds of clinical breast examination, cervical cancer screening, prostate cancer screening, and visiting a doctor over the past year for all patients over 15. A non-significant association was

							observed for breast-self-examination and mammography.
Skarshaug et al, 2021[41]	None	Retrospective cohort	National registrars data for 2,409,409 Norwegian patients.	Discontinuity of care: patients who experienced a sudden discontinuity that lasted for over 2 months after having 12 months of stable continuity.	1. Primary care utilization - monthly GP consultations 2. Primary care utilization - out-of-hours GP consultations 3. Acute hospitalization 4. ACSC hospitalization	1. + 2. + 3. 0 4. +0	Compared to the 12 months before discontinuity, in the 12 months after discontinuity, patients had lower odds of monthly GP consultations, higher odds of monthly out-of-hours consultation, more ACSC hospitalizations for patients aged 65-79 only, and no change in acute hospital admissions.
Van Loenen et al, 2016[42]	Avoidable hospitalization, diabetes, general practice, health services research, primary care, The Netherlands	Retrospective Cohort	Data from the OECD Healthcare Quality Indicators Project and Quality and Costs of Primary Care in Europe(QUALPIOC) study for primary care systems in 23 different countries	2 separate scales for longitudinal and interpersonal continuity	1. Diabetes-related hospitalization	1. +	Countries with better continuity had less hospitalizations for diabetes.
Brousseau et al, 2004[67]	emergency department, continuity of care, child	Prospective cohort	181 children were followed from the 8th through 19 months of life in Wisconsin	Bice-Boxerman COC	1. ED utilization	1. +	Better continuity reduced ED utilization for the children.
Ionescu-Ittu et al, 2007[68]	None	Retrospective cohort	Database of 95,173 patients aged 65 years or older in Quebec, Canada.	UPC	1. ED utilization	1. +	Lower levels of continuity or a lack of any primary care physician was associated with more ED use.
Burge et al, 2003[69]	Continuity of patient care, Palliative care, Family practice, Health services	Retrospective cohort	Data for 8,702 patients who made at least 3 visits to a family physician during their last 6 months of life before dying of cancer from 4 administrative health databases in Canada	MMCI	1. ED utilization	1. +	Cancer patients with lower continuity had greater odds of having any ED visits and made more ED visits than patients with higher continuity of care

Arthur et al, 2018[70]	children with medical complexity, continuity of care, quality measurement	Retrospective cohort	Administrative data from Minnesota and Washington state Medicaid agencies for 1,477 children with medical complexities(CMC).	Bice-Boxerman COC	1. ED utilization	1. +	A 0.1 improvement in COC score was associated with 4% decrease in odds of having at least 1 ED visit.
Holderness et al, 2019[43]	Affordable Care Act, Medicaid, primary care, insurance	Retrospective cohort	Oregon Medicaid enrollment and administrative claims for 212,541 patients aged 19-64.	Being or not being established with a primary care provider, defined as having 2 visits to a provider and Evaluation Management(EM) codes from that provider.	1. ED utilization	1. +	Patients established with a primary care provider had a lower likelihood and rate of using the ED than patients without an established provider
Chaiyachati et al, 2014[71]	None	Retrospective cohort	Electronic medical health records of 13,495 patients in West Haven, CT	UPC	1. ED utilization	1. +	Improved continuity of care was found to reduce ED utilization by lowering the rate of ED visits and the likelihood of going to the ED
Nyweide & Bynum, 2017[72]	None	Prospective cohort	Medicare data for 3,200,158 patients over 65 years of age.	Bice-Boxerman COC, UPC	1. ED utilization	1. +	A 0.1 increase in the continuity score was associated with a 1%-2% decrease in ED visit rate, depending on the index used.
Jacobs et al, 2020 - chapter 4[73]	None	Prospective cohort	Administrative records for 19,324 patients with serious mental illness(SMI) in the United Kingdom.	Bice-Boxerman COC, UPC, SECON	1. ED utilization 2. ACSC hospitalization 3. SMI hospitalization	1. +0 2. + 3. 0	Higher continuity was associated with a lower likelihood of ACSC hospitalization for all patients, less ED visits for patients with moderate visit frequency but not frequent visit frequency, & had no association to SMI hospitalizations
Cree et al, 2006[74]	None	Retrospective cohort	Administrative health datasets for 2,774 patients with asthma in Alberta, Canada.	UPC	1. ED utilization 2. All-cause hospitalization	1. + 2. +0	High continuity of care was associated with less hospitalizations, a half as long length of stay in hospitalizations, lower chance of an ED visit, & a lower total number of ED visits among patients with at least one visit. No association between continuity & the likelihood of ever

							being hospitalized was found
Ride et al, 2019[75]	continuity of care, family practice, hospital care, serious mental illness	Prospective cohort	Family practice data and hospital administrative data for 19,324 patients with serious mental illness(SMI) in England	Bice-Boxerman COC, UPC, SECON	1. ED utilization 2. SMI hospitalization 3. ACSC hospitalization	1. + 2. 0 3. +	Higher continuity was associated with lower ED visit & a lower risk of ACSC hospitalizations, but no association with SMI hospitalizations
Bentler et al, 2014[76]	None	Prospective cohort	National Health and Health Services Use Questionnaire for 1,219 Medicare beneficiaries.	Patient reported measures, Current Provider of Care, Current Provider of Care – discounted, UPC,, Inverse Number of Providers, HI, MMCI, Bice-Boxerman COC Ejlertsson's K Index, Modified Continuity Index, Known Provider, SECON	1. ED utilization 2. All-cause hospitalizations 3. ACSC hospitalization	1. + 2. +- 3. +-	Better COC scores across 3 indices & 2 patient report scales were associated with less ED visits However, total hospitalizations were not associated with patient-reported COC measures. Further, less hospitalizations were associated with higher continuity for 2 indices, but more hospitalizations were associated with higher continuity for 4 indices. More ACSC hospitalizations were associated with higher patient-reported continuity but lower continuity for 4 indices.
Cheng et al, 2010[77]	None	Retrospective cohort	Claims data for 30,830 patients in Taiwan	Bice-Boxerman COC	1. ACSC hospitalization	1. +	Better continuity was correlated with a lower likelihood of avoidable hospitalizations.
Knight et al, 2009[78]	None	Retrospective cohort	The National Diabetes Surveillance System(NDSS) in Newfoundland and Labrador, Canada for 1,143 patients aged 65 or older with diabetes.	UPC, Bice-Boxerman COC, SECON	1. All-cause hospitalization	1. +	Patients with high continuity had 18-25% less hospitalizations and a higher likelihood of having 0 hospitalizations compared to patients without high continuity.

Wang et al, 2020[79]	chronic conditions, cohort study, continuity of care, frequent users of outpatient	Retrospective cohort	333,294 internal medicine patients from the National Health Insurance Research Database in Taiwan	Bice-Boxerman COC	1. All-cause hospitalization 2. ED utilization 3. Primary care utilization - outpatient internal medicine visits	1. + 2. + 3. -	Higher continuity of care was associated with less hospitalizations, ED visits, and medical utilization, defined as the number of outpatient internal medicine visits
Gudzune et al, 2013[44]	None	Retrospective cohort	Claims data for 20,726 non-underweight(BMI<18.5) patients in the United States.	"Doctor Shopping": Seeing 5 or more primary care physicians during the 24 month study period.	1. All-cause hospitalization 2. ED utilization	1. 0 2. +	Doctor shoppers were associated with statistically significant higher rates of ED visits than non-shoppers for all weight groups. No association with hospitalizations found.
Katz et al, 2015[80]	continuity of care, primary care, emergency medical services, hospitalization, elderly	Retrospective cohort	Veteran Affairs(VA) administrative data of 243,881 Medicare-eligible veterans aged 65 and older.	UPC, MMCI	1. All-cause hospitalization 2. ED utilization 3. ACSC hospitalization	1. + 2. + 3. +	Having higher continuity was associated with less ED visits, all-cause hospitalizations, and ACSC related hospitalizations and ED visits.
Bayliss et al, 2015[81]	multimorbidity, comorbidity, continuity of care, utilization, older adults, physician-patient relations	Retrospective cohort	12,200 adult patients in Colorado with at least 3 chronic conditions pertaining to hypertension, congestive heart failure, hyperlipidemia, diabetes, coronary artery disease, chronic obstructive pulmonary disease, osteoarthritis, osteoporosis, depression, or obesity.	Bice-Boxerman COC	1. All-cause hospitalization 2. ED utilization	1. +0 2. +	Higher PC continuity was associated with a lower risk of hospitalizations & less ED visits. Subgroup analysis of patients with 3 or more PC visits and 3 or more specialty care visits in the last 2-3 years found PC continuity was associated with less ED visits but not with hospitalizations.

Chen et al, 2019[82]	breast cancer, survivors, continuity of care, care continuity, follow-up care, surveillance, health outcome, hospitalization, emergency department use	Retrospective cohort	Data from the Taiwan Cancer Registry for 18,031 patients over the age of 20 who have survived at least 2 years after a stage I-III breast cancer diagnosis.	Bice-Boxerman COC	1. All-cause hospitalization 2. ED utilization 3. Undesirable Utilization - annual surveillance mammograms, breast ultrasounds, advanced imaging tests for metastatic disease(chest X-rays, bone scans, liver ultrasound, computed tomography (CT) scans, positron emission tomography (PET) scans, and breast magnetic resonance imaging (MRI)	1. + 2. + 3. 0	Higher PC continuity was associated with a lower likelihood of hospitalization or ED use, but had no association with the use of the various follow-up testing services
Barker et al, 2017[83]	None	Retrospective cohort	Primary and secondary care records for 230,472 patients aged 62-82 in England	UPC	1. ACSC hospitalization	1. +	Higher continuity of care was associated with fewer ACSC hospitalizations
Nyweide et al, 2013[84]	None	Retrospective cohort	Claims and enrollment data for 3,276,635 fee-for-service Medicare beneficiaries over age 65.	HI, UPC	1. ACSC hospitalization	1. +	An increase in continuity was associated with a reduction in preventable hospitalizations
Solomon et al, 2015[45]	continuity of care; care transitions; medical education systems based practice; medical education-graduate; ambulatory care; utilization	Retrospective cohort	Billing and electronic health record data for 4,018 patients of 90 internal medicine junior and senior residents at a practice at Brigham and Women's Hospital in Boston, MA.	Patients where their resident primary care physician graduated vs. patients where their resident primary care physician did not graduate(continuity)	1. Primary care utilization - clinic visits 2. ED utilization 3. ACSC hospitalization	1. 0 2. 0 3. 0	Patients transitioning to a different resident were found to be at no increased risk of clinic visits, hospitalizations for ambulatory care sensitive conditions, or ED visits.

Cheng & Chen, 2014[85]	continuity of care, medication duplication, multiple chronic conditions, elderly	Prospective cohort	Data from the Taiwan National Health Insurance Dataset for 55,573 patients 65 years of age and older with multiple chronic conditions.	Bice-Boxerman COC	1. Undesirable utilization - duplicated medication, defined as being prescribed drugs in the same pharmacotherapeutic subgroups by separate physicians with overlapping prescription days.	1. +	Patients with higher physician or site level continuity of care were less likely to have duplicate medications regardless of the number of chronic conditions they had
Romano et al, 2015[86]	None	Retrospective cohort	Medicare fee-for-service claims for 1,208,250 patients aged 65 and older.	Bice-Boxerman COC	1. Undesirable utilization - overuse of medical procedures(13 diagnostic, 3 therapeutic, 2 screening, and 1 monitoring procedures).	1. +-	Patients who had an overused procedure had lower continuity of care than patients who did not for 15 of the 19 procedures. Regression models found that higher continuity was associated with lower odds of 9 procedures, higher odds of 3 procedures, & no association for 7 procedures.
Barrera et al, 2019[47]	Otitis media, antibiotic, continuity of care, watch and wait, demographics	Retrospective cohort	Outpatient primary care records for 277 patients under the age of 25 in the United States.	Seen or not seen by primary care provider	1. Undesirable utilization - antibiotic prescriptions	1. +	Patients who were seen by their PC provider were less likely to receive an antibiotic prescription than patients who weren't seen
Coleman et al, 2010[48]	Patient-centered medical home, primary health care, continuity of patient care, physician-patient relations, patient-centered care	Prospective cohort - sub-analysis of other study	Data of 8,005 patients that were part of an initiative that resulted in 1,817 patients being reassigned to a new physician.	Bice-Boxerman COC, reassigned or not reassigned	1. Primary care utilization 2. ED utilization	1. + 2. 0	Reassigned patients were found to utilize PC visits less than non-reassigned patients, but had no significant difference in ED visits
Koopman et al, 2003[49]	None	Retrospective cohort	Data from the National Health and Nutrition Examination survey for 18,162 adult patients in the United States.	3 point scale that scored patients from no usual source of care, usual place but no usual provider, to usual place and provider based on individuals'	1. Desirable utilization - recognition of chronic disease-diabetes, hypertension, and hypercholesterolemia	1. +0	Unadjusted analysis showed that greater level of continuity was associated with a lower likelihood of having unrecognized diabetes & hypertension, but not hypercholesterolemia. Logistic regression

				responses to 2 questions.			showed no difference between a usual site of care without a usual provider of care and not having either a usual site or provider. Regression analysis contrasted with the unadjusted analysis & found that continuity was not associated with recognition of hypertension.
Liao et al, 2015[50]	None	Retrospective and Prospective cohort	89,428 patients newly diagnosed with type 2 diabetes from the National Health Insurance database in Taiwan	Consistency of patient to provider and medical setting: high consistency defined as 100% of a patient's outpatient visits to a single provider. Low consistency defined as less than 70%.	1. Diabetes-related hospitalization	1. +	The likelihood of hospitalization was found to decrease with increasing consistency
Stein et al, 2002[51]	Continuity of care, emergency, epidemiology, primary health care	Retrospective cohort	Interview of 438 patients of the emergency service of the Conceição Hospital in Brazil.	Having or not having a primary care physician: defined as seeing the same physician when you have a problem	1. ED utilization	1. +	ED visits were classified as appropriate(emergency and urgent cases) and inappropriate(elective cases). Patients with a PC physician were more likely to present to the emergency department appropriately.
Thanh & Rapoport, 2017[52]	family doctor, health services utilization, Canada	Retrospective cohort	Data from the Canadian Community Health Surveys for 62,909 patients over age 12 from the 2010 survey and 131,061 patients from 2007/2008.	Having a regular doctor	1. Hospitalization - number of nights in hospital, nursing home, or convalescent home 2. Primary care utilization - Number of specialist contacts 3. Primary care utilization -Number of general practitioner(GP) contacts	1. - 2. - 3. +	Having a regular doctor was associated with more utilization for all forms of health service utilization: hospitalization, specialist services, and GP services.

Tsai et al, 2010[53]	usual source of care, quality care, ambulatory care	Retrospective cohort	Survey of approximately 750 randomly sampled patients in Taichung County, Taiwan	Usual source of care(USC), assessed with 3 survey questions	1. Primary care utilization - first contact utilization - utilization of primary care services for each new problem or new episode of a problem	1. +	Patients with a usual source of care were more likely to utilize their primary care provider first and not other health services.
Pourat et al, 2015[23]	None	Retrospective cohort	Enrollment and claims data for 8,162 patients aged 21-64 enrolled in the Health Care Coverage Initiative in Orange County, California	Adherence to primary care provider	1. All-cause hospitalization 2. ED utilization	1. + 2. +	Patients who were adherent to their PC provider had their rate of ED visits and hospitalizations decline & had a greater chance of having no ED visits or hospitalizations compared to patients who were never adherent.
Glenister et al, 2021	General practice, Continuity of care, Rural, Preventative health, Screening, Lifestyle	Retrospective cohort	Survey of 2,657 adults over the age of 16 in Victoria, Australia	Attendance at 0, 1, or multiple general practices in last 12 months	1. ED utilization	1. +	Respondents who attended 1 general practice in the last 12 months were less likely to have presented to the ED than respondents who attended 0 or multiple general practices
Hetlevik et al, 2021	organisation of health services; primary care; quality in health care	Prospective Cohort	Data from Norway's healthcare registries for 757,873 patients aged 60-90 years old	UPC and alternative UPC	1. All-cause hospitalization 2. ACSC hospitalization	1. + 2. +	All forms of hospitalization decreased as continuity increased, but the relationship was stronger for the original UPC scale
Chong et al, 2022	ambulatory care; chronic kidney disease; continuity of primary care; hospitalization; relational continuity; primary health care	Retrospective cohort	86,475 adults with stage 3-4 chronic kidney disease (CKD) in Alberta, Canada	UPC	1. ACSC hospitalization 2. All-cause hospitalization 3. ED utilization 4. ACSC ED utilization	1. + 2. + 3. + 4. +	Rates of ACSC and all-cause hospitalizations and ED utilizations increased with decreasing continuity
Tranmer et al, 2022	Chronic obstructive pulmonary disease, Chronic disease management, Continuity of care	Retrospective cohort	Ontario, Canada health administrative data for 450,837 patients over age 35 with chronic obstructive pulmonary disease (COPD)	Bice-Boxerman COC	1. All-cause hospitalization 2. ED utilization	1. + 2. +	Patients with low continuity of care had a higher risk of hospital or ED admission

Surbhi et al, 2022	Continuity of care; Emergency department visits; Hospitalizations; Meta-analysis; Obesity	Retrospective cohort	Data from 4 practice-based research networks in Southern USA 111,437 patients with Obesity-associated chronic conditions (OCC) and 47,071 patients with OCC and type 2 diabtes (OCC+T2M)	Bice-Boxerman COC	1. All-cause hospitalization 2. ED utilization	1. + 2. +	Greater continuity of care was associated with lower likelihood of hospitalizations and ED utilization for both groups
Lavergne et al, 2022	accident & emergency medicine; mental health; substance misuse	Retrospective cohort	72,363 patients who made ED visits for mental and substance use disorders (MSUD) in British Columbia, Canada during the study period	Bice-Boxerman COC	1. ED utilization	1. +	People with more frequent ED visits had lower PC continuity of care
White et al, 2016	Continuity of care; doctor–patient relationship; family practice; general practice; longitudinal studies; primary care	Retrospective cohort	335 patients from a United Kingdom general practice's health records	Registered with same general practice for 50+ years (high continuity) vs. registered with new general practice in last 2-4 years (low continuity)	1. All-cause hospitalization 2. Undesirable utilization - repeated medications 3. Primary care utilization - GP consultation rate	1. + 2. + 3. +	No significant difference was found in the number of hospitalizations, repeated medications, or GP consultations between the 2 groups despite the high continuity group having a higher prevalence of depression and diabetes
Busby et al, 2017	Ambulatory care; General practice; Patient admission; Primary health care	Retrospective cohort	Practice data for 8,029 general practices in England	"Percentage of patients who respond 'Always',' Almost always' or 'A lot of the time' to the question 'How often do you see or speak to the GP you prefer?' [among those who have a preferred GP]"	1. ACSC hospitalization	1. +	GP practices with low continuity had more ACSC admissions than practices with high continuity
Gill et al, 2003	Continuity of patient care, primary health care, quality of health care, diabetes mellitus	Retrospective cohort	Administrative claims data for 1,795 patients with diabetes mellitius in a private health plan in the US.	MMCI	1. Desirable utilization - diabetes screening	1. 0	PC provider continuity had no effect on prevalence of diabetes monitoring tests: a glycosylated hemoglobin test, a lipid profile, or an eye examination.
Snyder et al, 2022	continuity of patient care; primary health care; quality improvement	Other - quality improvement project	Data from more than 120,000 Medicaid-enrolled patients at Nationwide Children's Hospital Primary Care Network in the US.	Before vs. after the continuity project intervention	1. ED utilization	1. +	Increased continuity of WCC visits for a patient to their PCP, through the project intervention, was associated with decreased ED

							utilization
Donahue et al, 2005	None	Other - telephone survey	Telephone survey of 3,176 respondents in rural areas of 8 Southern states in the US.	Length of time with same PCP: less than a year, one to two years, three to five years, and more than five years	1. Desirable utilization - mammogram, Pap smear, flexible sigmoidoscopy/colonoscopy, influenza vaccine and cholesterol level check	1. 0	No relationship found between continuity and use of preventative services
Godard-Sebillotte et al, 2021	dementia; health service research; potentially avoidable hospitalization; primary care continuity; propensity score	Retrospective cohort	22,060 patients with dementia in the Quebec, Canada health administrative database	High continuity defined as having had every primary care visit with the same primary care physician during the preceding year	1. ACSC hospitalization 2. All-cause hospitalization 3. ED utilization	1. + 2. + 3. +	Patients in the lower continuity group were found to be at an increased risk of ACSC and all-cause hospitalizations, and ED attendance
Jabaaij et al, 2007	None	Retrospective cohort	Electronic health record for 10,102 patients from 104 general practices in the Netherlands	Newly enlisted with physician in past year (low continuity) vs. enlisted with same physician for more than 2 years (high continuity)	1. Undesirable utilization - antibiotic and other types of prescriptions	1. +	Patients with lower continuity (new physician) were more likely to receive a prescription
Turbitt et al, 2016	child health service; emergency medicine; parent; primary health care	Other - electronic survey	Survey of 1,146 parents of children who have been to the ED in Melbourne, Australia	Have or do not have a regular source of primary care	1. ED utilization	1. 0	No observed association between having a regular source of primary care and likelihood of presenting to the ED
Schuettig & Sundmacher, 2022	Germany, Ambulatory care, Health care costs, Hospitalizations, Continuity of care	Retrospective cohort	Insurance claims data for 55,924 patients with type 2 diabetes in Germany	Bice-Boxerman COC	1. ACSC hospitalization	1. +	Higher continuity was associated with less ACSC hospitalizations
Weir et al, 2016	multimorbidity; diabetes; continuity of care; mortality; hospitalization	Prospective cohort	285,231 patients with an incident diagnosis of diabetes from a US claims database	UPC	1. All-cause hospitalizations 2. Undesirable utilization - total physician visits	1. + 2. +	Patients with high continuity of care (UPC>75%) had less physician visits and were less likely to be hospitalized
Fogelman et al, 2022	Continuity of care; Health care organization; Healthcare	Retrospective cohort	208,226 patients over age 20 in an Israeli health maintenence organization (HMO)	UPC	1. All-cause hospitalizations 2. Primary care utilization - PCP visits	1. + 2. 0	Higher continuity was associated with a lower likelihood of hospitalization and no difference in the

	costs; Primary care physician						number of visits to PCP.

*PC – Primary Care; ART – Antiretroviral Therapy; ACSC – Ambulatory Care Sensitive Condition; ED = Emergency Department; WCC – Well Child Care

Supplemental Table 4. Summary of studies examining continuity and both utilization and cost outcomes

Study	Keywords from paper	Study Method	Setting	Continuity of Care Measurement used	Cost and Utilization Outcomes Measured	Outcome significantly improved?	Findings
Langton et al, 2020[87]	Primary care, Performance measurement, Population segmentation, Risk adjustment, Health care costs, Administrative data	Retrospective cohort	Administrative data from British Columbia for 3,441,393 people classified into 4 segments: low need, multiple morbidities, medically complex, or frail.	UPC	1. Cost - fee-for-service costs for family physician (FP) care, inpatient hospital care, emergency department (ED) visits, prescription medicine costs, fee-for-service costs for medical and surgical specialist care, and day surgeries. 2. Primary care utilization - family physician utilization outside of regular office hours	1. +0 2. 0	Continuity of care was associated with lower costs for the frail segment only, defined as patients older than 65 years of age and receiving frailty-based care, but not for the other three segments. No difference was found in the frequency of utilization of family physicians outside of regular office hours due to different levels in continuity of care
Romaire et al, 2014[88]	primary care, continuity of care, Medicare, health utilization, health expenditures	Retrospective cohort	Medicare enrollment data for 613,471 community-residing beneficiaries	Bice-Boxerman COC, UPC	1. Cost 2. ACSC hospitalization rate 3. All-cause hospitalization 4. ED utilization 5. ACSC ED utilization	1. + 2. - 3. + 4. + 5. +	Better continuity of care led to a lower rate of hospitalizations, ACSC ED visits, and ED visits, and lower hospitalization, ED, & total costs. However, higher continuity was associated with higher rates of ACSC hospitalizations
Robles & Anderson, 2011[89]	continuity of care; primary care; Medicare; adherence; hypertension	Retrospective cohort	Medicare data for 5,590 patients aged 67 and older with hypertension.	Bice-Boxerman COC	1. Cost 2. Desirable utilization - medication adherence	1. - 2. 0	The higher continuity groups purchased more classes of drugs than the correspondingly lower groups, resulting in higher costs. Continuity showed no association with adherence to antihypertensive drugs
Jung et al, 2018[90]	Continuity of care (COC), Most frequent provider continuity (MFPC),	Retrospective cohort	Claims data from the Korean National Health Insurance system for 121,566 patients with knee osteoarthritis in Korea.	Bice-Boxerman COC, MFPC, MMCI	1. Cost 2. All-cause hospitalization	1. + 2. +	Higher continuity of care was associated with less hospitalization and lower medical expenses

	Modified modified, Medical cost						
Hong & Kang, 2013[91]	Continuity of patient care, Hospitalization, Healthcare costs, Type 2 diabetes	Retrospective cohort	Korean National Health Insurance claims data for 68,469 patients 20 years of age or older diagnosed with type 2 diabetes the year the study began.	Bice-Boxerman COC	1. Cost 2. All-cause hospitalization	1. + 2. +	Better continuity of care was found to decrease the risk of hospitalization. Total, hospitalization, and ambulatory care costs all reduced as continuity of care increased.
Amjad, 2016[92]	None	Retrospective cohort	Claims data for 1,416,369 Medicare beneficiaries aged 65 and older with dementia.	Bice-Boxerman COC	1. Cost 2. All-cause hospitalization 3. ACSC hospitalization 4. ED utilization 5. Undesirable utilization - computed tomography(CT) of the brain, chest x-ray, and urinalysis	1. + 2. + 3. 0 4. + 5. +0	The highest continuity group had a lower rate of hospitalizations, less ED visits, less CT and urinalysis, and lower inpatient and outpatient costs, but no significant association was found for ACSC hospitalizations or chest x-rays
Hussey et al, 2014[21]	None	Retrospective cohort	Insurance claims data from 53,488 Medicare patients with congestive heart failure(CHF), 76,520 with chronic obstructive pulmonary disease(COPD), and 166,654 with diabetes mellitus(DM)	Bice-Boxerman COC	1. Cost 2. All-cause hospitalization 3. ED utilization	1. + 2. + 3. +	Higher continuity was associated with lower odds of hospitalization, ED visits, lower total episode costs for all three conditions, & lower costs for hospitalizations, emergency department visits, and complications
Shin et al, 2014[93]	continuity of care, mortality, cardiovascular diseases, health care costs	Prospective cohort	Data from Korean National Health Insurance(KNHI) for 47,433 patients newly diagnosed with hypertension, diabetes, or hypercholesterolemia	MFPC, MMCI, Bice-Boxerman COC	1. Cost 2. Undesirable Utilization - total inpatient and outpatient days	1. + 2. +	Patients with higher continuity had less healthcare utilization than patients with lower COC as indicated by fewer total inpatient & outpatient days, & consequently lower inpatient and outpatient costs.
Bazemore et al, 2018[19]	continuity, primary care, measurement	Retrospective cohort	Medicare claims data for 1,448,952 beneficiaries from 6,551 primary care physicians.	Bice-Boxerman COC, UPC, MMCI, HI	1. Cost - natural log of total spending 2. All-cause hospitalization	1. + 2. +	Spending of beneficiaries was lower for patients cared for by physicians in the

							highest continuity quintile compared to the lowest quintile, & the odds of hospitalization for any condition were lower for the highest quintile
Dreiher et al, 2012[94]	Continuity of care, quality measures, healthcare services utilization, primary medicine, preventive medicine	Retrospective cohort	Clalit health services database for 1,713 patients over the age of 18 in Israel.	UPC, MMCI, Bice-Boxerman COC, SECON	1. Cost of ED visits 2. ED utilization 3. All-cause hospitalization 4. Hospitalization costs 5. Primary care utilization - consultive physicians and outpatient clinic visits 6. Cost of medications	1. + 2. + 3. 0 4. 0 5. +- 6. -	Higher continuity of care was associated with more visits to consultative physicians and outpatient clinics, higher costs for those services, higher costs of medications, but less visits and lower costs to the ED, and no relationship to hospitalizations or its costs, outpatient clinic visits, or medication purchases
McBurney et al, 2004[95]	continuity, cost savings, pediatric medical home	Economic Modeling Study	An economic modeling study to estimate the cost of emergency department visits for 2 hypothetical pediatric medical homes in the United States	Bice-Boxerman COC	1. Cost 2. ED utilization	1. + 2. +	Increasing continuity of the practice by 10% resulted in 72 less ED visits per practice per year and consequently $19,905 less ED charges per 2000 pediatric patients.
Anderson et al, 2012[46]	None	Retrospective cohort	Administrative data over 5 years for 121,780 patients in a Minnesota health plan.	Continuity to a specific medical group: high continuity if always attributed to same medical group over 5 years, medium if patient made 1 move between medical groups, and low continuity if more than 1 move.	1. Cost 2. ED utilization	1. + 2. +	High continuity patients had lower costs and a lower likelihood of ED visits than the lower or medium continuity patients

Chen & Cheng, 2011[96]	None	Retrospective cohort	Data from the National Health Research Institute in Taiwan for adult patients with type 1 or type 2 diabetes	Bice-Boxerman COC	1. Costs - pharmaceutical and total healthcare expenses 2. Diabetes-related Hospitalization 3. Diabetes-related ED utilization	1. + 2. + 3. +	Patients with high or medium continuity of care were less likely to be hospitalized or have an ED visit for diabetes-related conditions compared to low continuity patients, and had lower pharmaceutical & total healthcare expenses
Chen et al, 2020[97]	None	Retrospective cohort	Data from the National Health Research Database in Taiwan for 29,095 elderly patients with end-stage renal disease(ESRD) who died from 2005-2013	Bice-Boxerman COC	1. Costs 2. ED utilization 3. Undesirable utilization - intensive care unit utilization and mechanical ventilation, continuous renal replacement therapy, nasogastric intubation, and surgical intervention	1. + 2. + 3. +	Better continuity was associated with less total health costs in the last 3-6 months of life, a lower likelihood of intensive care unit utilization, ED utilization, & utilization of mechanical ventilation, continuous renal replacement therapy, nasogastric intubation, & surgical intervention

*PC – Primary Care; ED – Emergency Department; CT – Computed Tomography Scan

Supplemental Table 5. Summary of reviews examining continuity and utilization or cost outcomes

Review	Keywords from paper	Overview of search	Papers found	Continuity of care measurements used	Findings
Kao et al, 2019[98]	None	PubMed and MEDLINE search for continuity of care and hospitalizations or admissions	15 - 8 included already in our review	Bice-Boxerman COC, UPC, SECON, the Modified Continuity Index, and MMCI	9 studies showed that better continuity of care was associated with a reduced risk in ACSC hospitalizations. 3 studies showed that there may be an association, but the results were inconsistent.
Health Quality Ontario, 2013[99]	None	MEDLINE, EMBASE, CINAHL, the Cochrane Library, and the Centre for Reviews and Dissemination database for continuity of care and chronic disease	8 systematic reviews and 13 studies, though not all are relevant to our search	Bice-Boxerman COC, UPC, SECON, the Modified Continuity Index, and MMCI	5 reviews on continuity & utilization found association between continuity and better utilization, but with a weak literature base. 3/3 studies that analyzed it found an association between continuity & ED visits for patients with any condition. 2/3 studies that analyzed it found an association between continuity and hospitalizations for patients with any condition. 4/5 studies found that better continuity was associated with less hospitalizations for patients with diabetes, and 3/3 studies found that better continuity was associated with less ED visits for patients with diabetes. 1 study found that better continuity was associated in less hospitalizations and ED visits in patients with COPD
Facchinetti et al, 2020[100]	Aged, Continuity of patient care, Chronic disease, Meta-Analysis, Patient readmissio n	PubMed, Medline, CINAHL, and EMBASE search for studies examining a continuity of care interventions, defined as "focusing on the connection and coordination between patients and providers across time and settings and classified in informational, management, and relational continuity interventions", in order to perform a meta-analysis on continuity and hospital readmissions.	Meta-analysis of 30 studies, totalling 8,920 patients 65 years of age and older	before and after continuity intervention	Continuity of care was shown to reduce readmission rates in the short term, defined as less than 6 months after discharge, for older people with chronic diseases, but the results for long term readmission were inconclusive.
Cabana & Jee, 2004	None	Searched Medline, the Educational Resources Information Center (ERIC), and PSYCH INFO for 'continuity of care,' 'continuity of patient care,' and MeSH subheadings	18 studies, 7 of which focused on healthcare utilization via hospitalization s and ED visits and 2 of which focused on healthcare costs. All studies were from before our search range (2002).	number of visits, dispersion of providers, and number of visits to a particular provider	All studies that assessed utilization found that increased continuity decreased hospitalizations and/or ED visits. 1 of the 2 studies that examined cost found that continuity decreased healthcare costs, while the other study found no significant relationship

Supplemental Table 6. Summary of findings for each outcome assessed

Outcome			Number of studies	Number of outcomes assessed	Positive outcome*	Negative outcome	No relationship or conflicting findings	Location of studies	Type of study			Study samples/outcomes assessed
									Retrospective cohort	Prospective cohort	Other	
Cost			18	18	14	1	3	8 - United States 3 - Korea 2 - Canada 2 - Taiwan 1 - Belgium 1 - Israel 1 - United Kingdom	14	3	1	General adults or children, patients with dementia, diabetes, congestive heart failure, chronic obstructive pulmonary disease, hypertension, angina, chronic kidney disease, osteoarthritis, end-stage renal disease, hypercholesterolemia, stroke, knee osteoarthritis, or serious mental illness.
Utilization	Total		79	142	95	4	43	38 - United States 10 - Taiwan 10 - Canada 6 - United Kingdom 3 - Korea 3 - Australia 2 - Brazil 2 - Israel 2 - Norway 1 - Netherlands 1 - Germany 1 - Europe	60	13	6	general population, children, adults, elderly patients, infants, or sexually active women, as well as disease groups including patients with diabetes, cancer, hypertension, knee osteoarthritis, dementia, congestive heart failure(CHF), chronic obstructive pulmonary disease(COPD), hypercholesterolemia, serious mental illness, HIV, asthma, hyperlipidemia, end-stage renal disease, coronary artery disease, osteoarthritis, osteoporosis, depression, obesity, and children with medical complexities
	Hospitalization		42	57	38	1	18	-	-	-	-	
		ACSC		20	14	1	5	-	-	-	-	
		All-cause		27	20	0	7	-	-	-	-	

		Other	10	4	0	6	-	-	-	-	
	Emergency Department utilization	40	43	35	1	7	-	-	-	-	
	Desirable utilization	14	15	7	1	7	-	-	-	-	Guideline concordant receipt of vaccinations, lead, anemia, and tuberculosis screening, prescription drug use, hemoglobin a1c (HbA1c) screening, low-density level cholesterol annual screening, annual nephropathy screening, serum creatine annual screening, annual left ventricular function for patients with heart failure, colorectal cancer testing(CRC – including fecal occult blood testing and lower endoscopy), mammography, prostate specific antigen(PSA) screening, chlamydia screening, recognition of chronic disease, HIV antiretroviral therapy adherence, mediation/statin adherence, receiving medical advice about child nutrition, development, and dental health, clinical breast examination, cervical cancer screening, and prostate cancer screening and primary care follow ups within 30 days of inpatient stay.
	Undesirable utilization	12	12	8	0	4	-	-	-	-	Computed tomography(CT) of the brain, chest x-ray, and urinalysis, total inpatient and outpatient days, duplicated medication, defined as being prescribed drugs in the same pharmacotherapeutic subgroups by separate physicians with overlapping prescription days, utilization and overuse of various medical procedures, antibiotic prescriptions, and intensive care unit utilization.
	Primary care	13	15	7	0	8	-	-	-	-	

	utilization										

*Positive outcome = greater continuity associated with more desirable utilization/lower costs