# Draft Cost of Care Analytic Plan

The overarching goals of this project are to engage state-based stakeholders as well as national experts to help determine (1) what type of data analysis on health care performance should be made transparent to influence purchasing decisions and care delivery reforms and (2) what investments are needed to sustain this type of analysis. Through this work, we aim to increase the impact of health care data in RI such that it is transparent and facilitates better decision making, including decisions pertaining to payment and delivery reform efforts and purchasing decisions. We also aim to establish a sustainable analytic process for future phases of work.

The initial phase of work will analyze claims data from the RI all-payer claims database (APCD) to identify cost trends and drivers of cost in RI. The specific short-term aims of this work are threefold: (1) to assess cost trends in RI, (2) to assess select cost drivers in RI, and (3) to deconstruct total medical expenditures by volume and price.

## *I. Study population, patient attribution, data sources, and outcome definitions*

All three aims will rely on a commonly defined study population, will leverage the same set of data, will apply a consistent patient attribution methodology, and will rely on the same outcome definitions and risk-adjustment methodology.

Study population: Our study population will include commercially-insured, Medicaid-insured, Medicare-insured lives in Rhode Island, inclusive of Medicare Advantage. This includes patients enrolled in BlueCross BlueShield, Neighborhood Health Plan, United Health Care, Tufts Health Plan, Medicaid fee-for-service, and Medicare fee-for-service health plans. Patients enrolled in health plans comprising a small minority of covered lives in Rhode Island (e.g. Cigna, Harvard Pilgrim, Aetna) will be excluded from our analyses. Rhode Island residents who receive the majority of their primary care outside of RI, to the extent that this is identifiable in our data, and non-RI residents receiving care in RI will also be excluded from our analyses. Patients with fewer than 12 months of continuous coverage during the study period will also be excluded from the sample; patients with fewer than 12 months of continuous coverage in any single health plan but at least 12 months of continuous coverage across all health plans will be included. We will use alternative minimum enrollment specifications in sensitivity analyses. Finally, all non-reported self-insured lives will be excluded from our analyses, as they are unavailable in the data.

Data sources: All analyses will use the 2014-2017 RI All-Payer Claims Data (APCD). To ensure data quality and completeness, all APCD data will undergo extensive quality checks for all key variables, including cross-walking denominator counts reported in the APCD with enrollment counts reported by each health plan, to be obtained from each health plan. Where available, managed care organization (MCO) member attribution reports and Accountable Care Organization (ACO) patient attribution reports may be used to link patients to primary care providers (PCP); further details on attribution are described below. Provider directories, such as those provided by the Rhode Island Quality Institute and by RI-based ACOs, will be used to link providers to provider groups based on National Provider Identifiers (NPIs) or Tax Identification Numbers (TINs).

Patient attribution: For each month *m* in the study period, each enrolled patient will be attributed to a payer (e.g., commercial, Medicaid, Medicare, Medicare Advantage, dual eligible), to a health plan, and to a provider group. Both payer and health plan attribution will be done on a monthly basis using enrollment

start and end dates from the APCD member month eligibility files, where a member will be attributed to the payers and health plan in which they had a plurality of member days in the prior month. We will leverage hierarchy rules established by the state and applied within the APCD when assigning members with multiple plan memberships.

To attribute members to provider groups for each month *m*, we will first assign a member to a primary care provider (PCP) based on the PCP in which they received the plurality of their primary care visits within the previous 24 months, with assignment to the most recent PCP in instances of a tie. This will be derived by looking back 24 months from the first day of the month to find all eligible visits. In order to be eligible, a visit must (1) have an outpatient or professional visit claim type, (2) have had a CPT-4 code for evaluation and management services, domiciliary or rest home care, home visit, preventive medicine services, and/or an annual wellness visit, and (3) have been with a PCP whose specialty is listed as family or general practice, internal medicine, nurse practitioner (practicing with PCP), physician's assistant (practicing with PCP), pediatrics, or geriatrics; an FQHC may also serve as a PCP. Each member's PCP will be identified using NPI and/or a TIN. Finally, to assign each member to a provider group, we will link the NPIs and/or TINs to external provider directories, as available. Provider groups will include all ACOs in the state and large medical groups, the latter of which is to be defined. Due to the fluctuating nature of provider participation in ACOs and in medical groups, provider group-level analyses will initially be conducted for 2017 only—our most recent year of complete data.

Outcome definitions:

*Total cost of care*: All health care expenditures will be assessed as total expenditures per person per month, with monthly member expenditures aggregated across each calendar year, weighted by member months.

We recommend that total medical expenditures per person be calculated in the following way:

$$Y_{it} = \sum ([\text{Total Medical Expenditures + out of pocket spending}] / \text{Medical Member Months}) + ([\text{Total Pharmacy Expenditures + out of pocket spending}] / \text{Pharmacy Member Months})$$

where *Y* denotes the sum of total expenditures for member *i* in calendar year *t*. Medical expenditures will be measured using claim total paid amounts, or rather, the amount paid by insurers to providers, including all health plan payments and excluding all member payments and withholds from providers. For capitation payments and bundled payments, this is captured in the APCD as the "fee-for-service equivalent" that would have been paid by the insurer for a specific service if the service had not been capitated or paid under a bundled arrangement; while we recognize that such a measure is subject to measurement error, it is likely this will comprise a small percentage of total payments. Out-of-pocket spending includes the sum of all paid copays, coinsurance, and/or deductibles. Medical expenditures will be inclusive of all claim types, including professional, inpatient, outpatient, lab, radiology, ancillary, and behavioral health services. Expenditures will be inflated by price adjustment factor based on 2018 dollars and will be truncated at $125,000 per member, per HealthPartner's Total Cost of Care methodology.[1]

This methodology (i.e. the sum of paid amounts and out of pocked amounts) aligns with expenditure methodologies used by AHRQ's Medical Expenditures Survey (MEPS),[2, 3] with that of the Integrated Healthcare Association (IHA),[4] and with much published literature.[5, 6, 7, 8, 9, 10] Some other literature has used price standardizing methodologies,[11,12,13,14] such as Optum's normalized pricing software or HealthPartner's Total Cost of Care, but this would likely not be suitable for the objectives of our analyses.

Other studies have omitted cost sharing when such information was not available.[15] States such as Massachusetts have collected their own data to estimate total cost of care, rather than using claims, and thus such methodologies cannot be replicated in the APCD. However, the proposed summary expenditure measure captures much of what is included in the Massachusetts total medical expenses (TME) measure, including all medical expenses to providers (i.e. paid amounts) and all cost-sharing amounts; unlike the TME measures, it does not include non-claims payments to providers or the net cost of private health insurance (such as administrative expenses), as these data are unavailable in claims. In addition, the RI APCD includes an analogous measure of total cost, based on the IHA definition.

*Adjustment for patient characteristics and health status*: All calculations will be risk-adjusted and account for number of days of member enrollment within the measurement period via application of member-month weights. To generate risk-adjusted expenditures per person, we will use validated statistical methods.[i] Covariates will include a patient's age, sex, health status as measured by 3M Clinical Risk Groups (CRGs), presence of select chronic conditions (asthma, chronic obstructive pulmonary disorder, congestive heart failure, depression, diabetes, hypertension, ischemic heart disease), an indicator for pregnancy or childbirth, zip code index (based on median income in zip code), and area deprivation index; race/ethnicity will be included depending on the level of completeness in the APCD, though race/ethnicity has not been included in adjustments done by other states such as MA. Risk-adjusted expenditures will then be calculated at the person-level and reported as mean risk-adjusted expenditures per person for each calendar year, with further stratifications as described below.

We recommend use of CGRs in adjusting for health status because they are applicable to all ages and payer types, are intended to be used with claims data, and are calculated using an algorithm that is transparent and easily understood. They are based on a hierarchy of 1080 different clinical groups and nine major clinical CRG statuses, using patient diagnoses. The state of Vermont has used CGRs in its risk-adjustment methodology when comparing costs across payers in its Blueprints for Health program, using its APCD.[16] We are in the process of applying for a researcher license for 3M CRG software, available free of charge to researchers.

## *II. Aim 1: Cost Trends – Analytic Approach*

To calculate aggregate cost trends, or mean annual risk-adjusted medical expenditures per person per year, we will use appropriate statistical methods.[ii] Our primary independent variable will be an indicator for calendar year and our primary outcome variable will be risk-adjusted medical expenditures per person. The unit of analysis will be the person-year. To report on annual expenditures, we will estimate marginal expenditures by year. Here, for each individual year (2014-2017), reported data will include mean annual medical expenditures per person and total member enrollment per year; median expenditures per person and expenditures by quintile will also be reported. All data will be reported in aggregate as well as stratified by payer type.

[i] A gamma regression with a log link function will be used to generate expected values of expenditures, adjusting for the specified covariates. Risk-adjusted expenditures will then be calculated at the person-year-level as the ratio of observed expenditures to expected expenditures, multiplied by the population mean.

[ii] This uses generalized estimating equations (GEEs) with outcome-appropriate model specifications. All observations will be clustered at the person-level to account for repeated measures.

To ensure results are robust to specifications, we will conduct a series of sensitivity analyses. First, we will restrict our sample to patients with at least 6, 18, and 24 months of continuous enrollment in the study period, as compared to the 12 month requirement in our primary analyses. Second, we will exclude pharmacy expenditures from our total cost of care calculations. Third, we will further exclude mental health, vision, chemical dependency, chiropractic, dental, acupuncture, and maternity services from our total cost of care calculations, as benefit coverage for such services varies and is often not subject to provider or payer control. Fourth, we will omit the $125,000 expenditure cap from our total cost of care calculations. Finally, we will calculate unadjusted cost trends without the use of risk adjustment.

## *III. Aim 2: Cost Drivers – Analytic Approach*

The observed expenditures within a year and expenditure growth between years, estimated in Aim 1, may be explained by particular subgroups driving costs or by particular subcategories of medical spending. Therefore, to assess differential trends and cost drivers, we propose a set of 2-4 additional analyses that we will prioritize based on findings from Aim 1 and initial findings from Aim 2, as well as through discussions with stakeholder groups. Other proposed analyses outlined below may be completed beyond the initial year of this project.

First, we will first calculate annual expenditures by category of medical spending, stratified by payer type, health plan, and provider group. Proposed categories of medical spending will include inpatient hospital, medical/surgical, and maternity; inpatient post-acute care, rehabilitation, and nursing facility; outpatient care; outpatient care behavioral health; primary care; primary care behavioral health; all other physician and professional services; long-term services and supports; pharmacy; and other medical.

Second, to assess subgroup differences in expenditures, for each year, we will examine annual expenditures by health risk score, age group, gender, and county; these will be calculated in aggregate and stratified by payer type, health plan, and provider group.

To conduct all subgroup analyses, we will use the same risk-adjusted medical expenditure measure as constructed in Aim 1. Similar statistical methods will be used as under Aim 1, with modifications to account for the subgroups of interest.[iii]

All sensitivity analyses performed under Aim 1 will be repeated under Aim 2.

## *IV. Aim 3: Deconstructing total medical expenditures by volume and price – Analytic Approach*

To further deconstruct cost drivers, we propose to explore two additional areas that collectively contribute to cost: service volume and price.

To assess service volume, we will estimate yearly rates of select measures of utilization, to be prioritized. This may include inpatient days, nursing facility days, ED visits, outpatient visits, other

[iii] To estimate expenditures for each year and each subgroup, we will add interaction terms to our GEE model that interact calendar year with an indicator for each subgroup. For instance, to examine annual expenditures per person by age group by payer, we will include a three-way interaction term that interacts calendar year with an indicator for payer with an indicator for age group, then estimate marginal effects by year, payer, and age group.

professional or primary care visits, and number filled prescriptions per 1000 patients. To do so, we will use similar statistical methods as employed in Aims 1 and 2.[iv]

To assess price, which has also been referred to as a "price and intensity" measure,[17] we will estimate the price per day/visit/prescription for inpatient days, nursing facility days, ED visits, outpatient visits, other professional or primary care visits, and filled prescriptions. To do so, we will use similar statistical methods as noted above. These proposed volume, price, and intensity measures were used in a recent JAMA study that assessed factors associated with increases in US health care spending across a 28 year period.[17]

All measures of volume and price will be separately reported for each year by payer, health plan, and provider group.

Finally, to further assess price and volume, we propose to assess total medical expenditures per episode and total episodes per 1000 covered lives, based on select episodes of care that have been developed by the Altarum Institute for the state. These analyses are limited to the Medicaid and commercial populations and to a time period of July 2016 to June 2017. Examples of available episodes include cardiac/vascular, ophthalmology, otolaryngology (ENT), endocrine, pulmonary/lung, gastrointestinal/liver, cancer, behavioral health, women's health, maternity, men's health, and orthopedic/neurosurgery episodes, with sub-episodes available within each episode. Specific methodologies for assessing these episodes will be developed in accordance with data availability and data structure.

Other states have descriptively examined select episodes of care as well. For example, Colorado has assessed hospital payments for knee replacement, pulmonary embolism, spinal fusion, simple pneumonia, heart stent, and heart arrhythmia. In Massachusetts, examples of select procedures examined for inpatient versus outpatient settings have included knee MRI, colonoscopy, upper GI endoscopy, evaluation & management visits, MRI scan of brain, and echo-cardiogram. Ultimately, priority episodes of interest will be identified based on findings from Aim 2 and in accordance with input from stakeholders.

[iv] We will use GEE models with outcome-dependent specifications, with errors clusters at the patient-level to account for repeated measures.

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