

Vermont Blueprint for Health Evaluation Methods

Supplement to the Vermont Blueprint for Health 2017 Annual Report

EVALUATION SUMMARY

The purpose of this report is to provide documentation on the analytic methods used in the annual evaluation of the Vermont Blueprint for Health's Patient-Centered Medical Home (PCMH) initiative. The earliest evaluation of this initiative, conducted in 2010, examined a limited set of pilot practices in St. Johnsbury and Burlington. As the Blueprint PCMH initiative has expanded to incorporate a majority of the primary care practices in Vermont and as the amount of time elapsed since initial implementation has grown, the evaluation has expanded correspondingly. The increase in the number of participating practices and our ability to observe these practices over a greater temporal window has increased the set of available analytic methods to estimate the impact of the Blueprint's PCMH initiative. Discussed in greater detail below, some of the hallmarks of the current evaluation include:

- Multiple years of all-payer data including commercial, Medicaid, Medicare;
- Blueprint-maintained rosters mapping providers to Blueprint practices;
- Consistent member-to-practice attribution methodology applied by Onpoint;
- Serial, cross-sectional study design;
- Data mapped from calendar year to Blueprint stage of program;
- Random assignment of comparison members to program stage;
- Comparison control-weighted results at participant level;
- All-payer model of evaluation with subsets (e.g., Medicaid);
- Risk-adjusted rates to control differences between participants and comparisons;
- Difference-in-difference modeling to determine the impact of initiative participation on the outcomes discussed below.

The methods were developed over time by Onpoint and Blueprint staff. As data sources change and the evaluation period grows, the evaluation design is reviewed and revised to use the best methodology to estimate the effect of PCMH initiatives.

BLUEPRINT MEMBER-YEAR SELECTION

Based on eligibility member-month records submitted by payers and processed in the Vermont Health Care Uniform Reporting and Evaluation System (VHCURES), a Blueprint member-year data set is created. From the Blueprint member-year data set, a measure defining an individual's primary payer is constructed by identifying the payer of the individual's most recent monthly eligibility record within the measurement year. After identifying each individual's primary payer, exclusions are made in a way that is consistent with nearly all Blueprint analytic products to ensure a consistent base of membership. Specifically, retained in the data are claims for all members who:

- A. have a commercial payer as primary insurer and is less than 65 years of age;
- B. have Medicaid as primary insurer and is less than 65 years of age;
- C. have Medicare as primary insurer – either as fee-for-service (e.g., product AB) or Medicare Advantage.

In addition to member-based exclusion criteria, we also exclude claims which satisfy any of the following conditions:

- Medicare supplemental as the commercial data source;

- Member’s eligibility records submitted by behavioral health carve-outs (e.g., CIGNA or United Behavioral Health);
- Members with no medical eligibility coverage (e.g., pharmacy coverage only).

ATTRIBUTION TO A PRIMARY CARE PROVIDER

After constructing the Blueprint member year data set, Onpoint runs a standard primary care attribution process on VHCURES data to attribute each member to a primary care provider for each calendar year, based on a 24-month lookback period. The attribution algorithm is based on the Center for Medicare and Medicaid Services (CMS) list of Evaluation and Management (E&M) codes and assigns a member to the primary care provider who provided the plurality of the individual’s primary care over the 24-month lookback period for each month during the year. A member’s attribution on the last eligibility month of the year is then used to assign that member to a practice. For most members this will be December with a 24-month look-back..

Having attributed each individual to a primary care provider, Blueprint participants are associated with a practice through their primary care provider’s rostering in a Blueprint PCMH. While no statewide mapping of providers to practices exist, Blueprint staff maintain a roster enumerating all primary care providers who provide care in a Blueprint practice to facilitate the identification of Blueprint participants. For a given individual in a given calendar year, if the individual is attributed to a provider in a Blueprint practice that has, or will within a year, receive NCQA recognition, the individual is defined as a Blueprint participant.

The identification of members for inclusion in the comparison group follows a similar approach. First, the results of the attribution to a primary care provider are inspected. For a given individual in a given year, if the individual is attributed to a primary care provider not included on the roster of providers in Blueprint practices, the individual’s data in that year is eligible for inclusion in the comparison group. For more information on this process, please review the document entitled, “*Blueprint Primary Care Practice Attribution.*”

CALENDAR YEAR PARTICIPANTS, COMPARISONS, & EXCLUSIONS

Upon attribution to a primary care provider, additional exclusions are made to member records for the following reasons:

- A. The member was not assigned a Clinical Risk Group (CRG) by the 3M CRG grouping for the measurement year¹;
- B. The member is less than 12 months of age;
- C. The member belonged to a practice with a start date that was after the last calendar year considered in the evaluation;
- D. The member belonged to a practice in a calendar year that is more than two years prior to the practice’s NCQA scoring year²;

¹ The number of individuals removed due to this exclusion restriction has never exceeded thirty in any historical analysis.

² For example, suppose an individual is attributed every year to the same provider in a Blueprint practice that received NCQA recognition in 2012. This individual is in the NCQA Implementation Year stage in 2011 and in the

- E. The member was attributed to an organization, but the member’s Blueprint practice could not be determined due to limitations in the payer-submitted data³.

ASSIGNMENT TO STAGE OF PROGRAM

One challenge faced in the evaluation of the Blueprint PCMH initiative is that practice onboarding and transformation efforts are staggered across the period from the initiation of the initiative to the present. To overcome this challenge, this evaluation uses NCQA Scoring Year to assign practices and their associated members to a stage of program for each calendar year. These stages include:

- Pre-Year;
- Implementation Year;
- NCQA Scoring Year;
- Post-Year 1;
- Post-Year 2;
- Post-Year 3;
- Post-Year 4;
- Post-Year 5.

A practice’s stage of program is anchored by the year the practice received NCQA recognition – it’s NCQA Scoring Year. The year prior to the year in which the practice received NCQA recognition is defined to be the Implementation Year and the year prior to the Implementation Year is defined to be the Pre-Year. Post-Year 1 is defined to be the year after the NCQA scoring year, and the number of post-years varies as a function of NCQA scoring year. The following are two examples to help illustrate the program stage assignment:

Member Example One

Member 1234 was attributed to practice VTABC for calendar years 2008-2014. For that member, 2008 is more than two years prior to the practice’s NCQA scoring year and is, therefore, excluded from the analysis. Member 1234 was attributed to a different practice (e.g., VTDEF) in the calendar year 2015, with a different NCQA scoring year (e.g., 2014), for which 2015 is that practice’s Post-Year 1.

Member	Practice	Calendar Year	NCQA Scoring Year	Stage of Program
1234	VTABC	2008	2011	Excluded
1234	VTABC	2009	2011	Pre-Year
1234	VTABC	2010	2011	Implementation
1234	VTABC	2011	2011	NCQA Scoring
1234	VTABC	2012	2011	Post-Year 1
1234	VTABC	2013	2011	Post-Year 2
1234	VTABC	2014	2011	Post-Year 3
1234	VTDEF	2015	2014	Post-Year 1

pre-year in 2010. This individual’s data from calendar years 2008 and 2009 are excluded from the analysis. More discussion is provided below.

³ This is a relatively small percentage of members. These members are excluded from this, and other, Blueprint reports.

Member Example Two

Member 5678 is an example of a non-Blueprint primary care practice between 2008-2011. This member then switched to a Blueprint practice in 2012 that had an NCQA scoring year of 2011. For this member, they are assigned to the comparison group (e.g., VT999) for 2008-2011, and then to the appropriate stage of the program (e.g., Post-Year 1) for that practice’s NCQA scoring year.

Member	Practice	Calendar Year	NCQA Scoring Year	Stage of Program
5678	VT999	2008		Comparison
5678	VT999	2009		Comparison
5678	VT999	2010		Comparison
5678	VT999	2011		Comparison
5678	VTABC	2012	2011	Post-Year 1
5678	VTABC	2013	2011	Post-Year 2
5678	VTABC	2014	2011	Post-Year 3
5678	VTABC	2015	2011	Post-Year 4
5678	VTABC	2015	2011	Post-Year 5

Initially, no stage of the program is available for comparisons because non-Blueprint primary care providers do not have NCQA scoring from which to derive stage of program. Comparison group member records are randomly assigned to a stage of the program within each calendar year based on the distribution of participant members across each stage within that year. Here is an example of the participant distribution across program stages for calendar year 2012:

	Pre-Year	Implementation Year	NCQA Scoring Year	Post-Year 1	Post-Year 2
2012	<i>Percent of 2012 participants in the pre-year</i>	<i>Percent of 2012 participants in the implementation year</i>	<i>Percent of 2012 participants in the scoring year</i>	<i>Percent of 2012 participants in the post-year 1</i>	<i>Percent of 2012 participants in the post-year 2</i>

WEIGHTING OF COMPARISONS

The Blueprint medical homes rolled out over the course of several years at a differential rate by health service area (HSA). To adjust for potential geographical variation, the comparison group was weighted to match the average membership of the participant group by HSA and stage of the program.

The following is an example of the weight factor calculation for Barre members in Pre-Year:

$WeightFactor_{Barre\ Pre-Year} = \frac{Sum\ Barre\ Pre-Year\ Participant\ Avg.\ Members}{Sum\ Barre\ Pre-Year\ Comparison\ Avg.\ Members}$

$MemberWeight_{BP\ Pre-Year} = \frac{AverageMembership_{BP\ Pre-Year}}$

$$\text{MemberWeight}_{\text{NonBP Pre-Year}} = \text{AverageMembership}_{\text{NonBP2012}} * \text{WeightFactor}_{\text{Barre Pre-Year}}$$

RISK-ADJUSTED RATE TRENDS & DIFFERENCE-IN-DIFFERENCES

In observational examinations such as this, care must be taken to ensure the comparability of the groups across which inferences are to be drawn. In this work, we use a regression-based risk-adjustment procedure to adjust outcome measures to reflect the underlying differences between those seen in a Blueprint practice and those seen elsewhere. Prior to supplying the data for regression-based adjustment, we first cap outcome measures at the 99th percentile within each major payer, year, and age group. We then estimate the following regression using either ordinary least squares or Poisson regression, as appropriate for outcome measure.⁴

Combined Model:

$$y = \alpha + (F_AGE0104)\beta_1 + (M_AGE0104)\beta_2 + (M_AGE0511)\beta_3 + (F_AGE0511)\beta_4 + (F_AGE1217)\beta_5 + (M_AGE1217)\beta_6 + (M_AGE1834)\beta_7 + (F_AGE3544)\beta_8 + (F_AGE4554)\beta_9 + (F_AGE5564)\beta_{10} + (F_AGE6574)\beta_{11} + (F_AGE7584)\beta_{12} + (F_AGE85PLUS)\beta_{13} + (M_AGE3544)\beta_{14} + (M_AGE4554)\beta_{15} + (M_AGE5564)\beta_{16} + (M_AGE6574)\beta_{17} + (M_AGE7584)\beta_{18} + (M_AGE85PLUS)\beta_{19} + (MEDICAID)\beta_{20} + (MEDICARE)\beta_{21} + (DUAL_ELIGIBILITY)\beta_{22} + (DISABLED)\beta_{23} + (ESRD)\beta_{24} + (CHRONIC)\beta_{25} + (CRG_ACUTE_MINOR)\beta_{26} + (CRG_CHRONIC)\beta_{27} + (CRG_SIGNIFICANT_CHRONIC)\beta_{28} + (CRG_CANCER_CATASTROPHIC)\beta_{29} + (MATERNITY)\beta_{30} + (MATERNITY * MEDICAID)\beta_{31} + \varepsilon$$

Females age 18-34 is the reference group for age-gender, healthy is the reference group for CRGs, and commercial payer is the reference group for major payers.

The risk adjustment process outputs a person-level file including the member's risk-adjusted-rate for each stage of the program and for each outcome measure evaluated in the trend analysis. This data file becomes the input for our difference-in-differences (DID) analysis. The summarization of this file, by stage of program and treatment group, is exported to our trending graphics.

The DID analysis is computed using SAS 9.3 GENMOD procedure. We apply the weight value as calculated above and the class variable is limited only to the pre-year and the most recently added stage of the program. See the below model statement for the DID calculation where "y" is the adjusted person-level outcome measure:

$$y = \gamma_0 + (POST * BLUEPRINT_PATIENT)\alpha_1 + (POST)\gamma_2 + (BLUEPRINT_PATIENT)\gamma_3 + \varepsilon$$

This model, in combination with the stage-of-program-class-variable, the calculated-weight-variable, and the *waldcl* option, produces our DID estimate -- $\hat{\alpha}_1$. The Wald Chi-Square option is used to test the

⁴ The risk adjustment methodology is identical to the Blueprint practice profiles with exception of a few minor differences in risk adjustment variables—since this analysis combines the entire population and does not separate pediatric members from adults. For more information on the risk adjustment procedure, please see <http://blueprintforhealth.vermont.gov/sites/bfh/files/Onpoint%20-%20Supporting%20Documentation%20for%20Blueprint%20HSA%20Profiles%20%28November%202017%29%2020171120.pdf>.

independence of the parameter estimates in the class variable (pre- and post-year) for each of the independent variables. The Wald CL option also computes the confidence intervals of the resulting parameter estimates.⁵ The parameter estimate of the interaction term provides the DID result, along with the Wald confidence limits and the Chi-Square test for significance.

CALCULATION OF PROGRAM RETURN ON INVESTMENT

The analytic methods discussed to this point were developed to understand the effect of Blueprint’s PCMH initiative on healthcare expenditures and utilization. While understanding the effect of the PCMH initiative on expenditures and utilization is an essential first step in the evaluation, it does not provide a systematic way to measure these results against the financial outlays used to drive the change. The return on investment examination is designed to provide this insight. The return on investment is driven by two key pieces of information: 1.) the aggregate averted expenditures associated with the PCMH initiative, and 2.) the financial outflows used to avert this spending.

The first component, aggregate averted spending attributable to PCMH participation, is generated using the following approach. First, we run a sequence of DID regressions. For every programmatic year from the NCQA scoring year through the last post year, a DID regression is run using the pre-year as the reference period and the given programmatic year as the post period. From each regression we retain the DID estimate as well as the 95% confidence intervals for the estimate.

Put more formally, for the n-th post year, we define:

$$POST = \begin{cases} 1 & \text{if the observation occurred during post – year } n \\ 0 & \text{if the observation occurred during the pre – year} \end{cases}$$

And estimate the regression:

$$y = \gamma_{PYn} + (POST * BLUEPRINT_PATIENT) \alpha_{PYn} + (POST) \gamma_{PYn} + (BLUEPRINT_PATIENT) \gamma_{PYn} + \varepsilon$$

The DID estimate ($\hat{\alpha}_{PYn}$) and its confidence interval ($\hat{\alpha}_{PYn}^{LCL}, \hat{\alpha}_{PYn}^{UCL}$) are retained, and after running the sequence of DID regressions, we use the estimates to populate the following table.

POST=	Estimate	LCL	UCL
NCQA Scoring Year	$\hat{\alpha}_{PY0}$	$\hat{\alpha}_{PY0}^{LCL}$	$\hat{\alpha}_{PY0}^{UCL}$
Post Year 1	$\hat{\alpha}_{PY1}$	$\hat{\alpha}_{PY1}^{LCL}$	$\hat{\alpha}_{PY1}^{UCL}$
Post Year 2	$\hat{\alpha}_{PY2}$	$\hat{\alpha}_{PY2}^{LCL}$	$\hat{\alpha}_{PY2}^{UCL}$
Post Year 3	$\hat{\alpha}_{PY3}$	$\hat{\alpha}_{PY3}^{LCL}$	$\hat{\alpha}_{PY3}^{UCL}$
⋮	⋮	⋮	⋮
Post Year n	$\hat{\alpha}_{PYn}$	$\hat{\alpha}_{PYn}^{LCL}$	$\hat{\alpha}_{PYn}^{UCL}$

⁵ Site SAS documentation: "MODEL Statement." SAS/STAT(R) 9.22 User's Guide. Accessed November 10, 2017. https://support.sas.com/documentation/cdl/en/statug/63347/HTML/default/viewer.htm#statug_genmod_sect026.htm.

The DID estimate from each regression provides information on how the per-capita change in expenditures in the PCMH group differed from the per-capita change in expenditures for the comparison group across the programmatic period from the pre-year to the post-year. Put differently, if we view the change in expenditures in the comparison group as the per-capita change in expenditures that would have been expected for the PCMH group in the absence of the PCMH intervention, this DID estimate is the level of averted spending for a typical PCMH patient. The estimate of α_1 is our best estimate of the individual-level averted expenditures, but we retain the 95% confidence interval in recognition of statistical uncertainty. By retaining the confidence interval, we identify a range of values that, conditional on the model, capture the true expected individual-level averted expenditures with a probability of at least 0.95.

While the DID estimates allow us to capture the expected individual-level annual expenditures for each programmatic stage, they do not capture aggregate averted expenditures. To recover aggregate averted spend, we first multiply the expected individual-level averted spend for a given programmatic stage (i.e., $\hat{\alpha}_{PYn}$) by the number of individuals attributed to a Blueprint practice currently in that stage of program (i.e., $\#_{PYn}$). We then sum this quantity across programmatic years (i.e., $\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}$) to recover aggregate averted spending.

Program Stage	PCMH-Attributed Patients	DID in Expenditure Measure per Person			Subtotals for Relative Differences in Annual Expenditures		
		Estimate	LCL	UCL	Estimate	LCL	UCL
Pre Year							
Implementation Year							
NCQA Scoring Year	$\#_{PY0}$	$\hat{\alpha}_{PY0}$	$\hat{\alpha}_{PY0}^{LCL}$	$\hat{\alpha}_{PY0}^{UCL}$	$\#_{PY0} \times \hat{\alpha}_{PY0}$	$\#_{PY0} \times \hat{\alpha}_{PY0}^{LCL}$	$\#_{PY0} \times \hat{\alpha}_{PY0}^{UCL}$
Post Year 1	$\#_{PY1}$	$\hat{\alpha}_{PY1}$	$\hat{\alpha}_{PY1}^{LCL}$	$\hat{\alpha}_{PY1}^{UCL}$	$\#_{PY1} \times \hat{\alpha}_{PY1}$	$\#_{PY1} \times \hat{\alpha}_{PY1}^{LCL}$	$\#_{PY1} \times \hat{\alpha}_{PY1}^{UCL}$
Post Year 2	$\#_{PY2}$	$\hat{\alpha}_{PY2}$	$\hat{\alpha}_{PY2}^{LCL}$	$\hat{\alpha}_{PY2}^{UCL}$	$\#_{PY2} \times \hat{\alpha}_{PY2}$	$\#_{PY2} \times \hat{\alpha}_{PY2}^{LCL}$	$\#_{PY2} \times \hat{\alpha}_{PY2}^{UCL}$
Post Year 3	$\#_{PY3}$	$\hat{\alpha}_{PY3}$	$\hat{\alpha}_{PY3}^{LCL}$	$\hat{\alpha}_{PY3}^{UCL}$	$\#_{PY3} \times \hat{\alpha}_{PY3}$	$\#_{PY3} \times \hat{\alpha}_{PY3}^{LCL}$	$\#_{PY3} \times \hat{\alpha}_{PY3}^{UCL}$
:	:	:	:	:	:	:	:
Post Year n	$\#_{PYn}$	$\hat{\alpha}_{PYn}$	$\hat{\alpha}_{PYn}^{LCL}$	$\hat{\alpha}_{PYn}^{UCL}$	$\#_{PYn} \times \hat{\alpha}_{PYn}$	$\#_{PYn} \times \hat{\alpha}_{PYn}^{LCL}$	$\#_{PYn} \times \hat{\alpha}_{PYn}^{UCL}$
Total					$\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}$	$\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}^{LCL}$	$\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}^{UCL}$

Having generated an estimate of aggregate healthcare savings associated with Blueprint participation, we then calculate the number of dollars used to drive this savings. To do so, we tally spending in the following areas. First, we calculate the total outflows from all payers to support per-member per-month

payments made to Blueprint practices (i.e., b). Second, we calculate the total outflows from all insurers to support the Community Health Teams (i.e., c). Third, we calculate the total cost of the Blueprint Program Budget (i.e., d). Included in the Blueprint Program Budget is all grants and contracts issued by the Blueprint to support its work, the total cost of Blueprint personnel salary and benefits, and the operating costs⁶ associated with Blueprint work. These expense categories are then summed to arrive at the Total Investment (i.e., $b + c + d$).

	Investment	Reduction in Total Expenditures	Confidence Interval (95%) for Reduction in Total Expenditures	
			Lower Limit	Upper Limit
Reduction in expenditures		$\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}$	$\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}^{LCL}$	$\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}^{UCL}$
PCMH Payments	b			
Core CHT Payments	c			
Total Payments	$b + c$			
Blueprint Program Budget	d			
Total investment	$b + c + d$			
Return on Investment		$\frac{\sum \#_{PYi} \times \hat{\alpha}_{PYi}}{b + c + d}$	$\frac{\sum \#_{PYi} \times \hat{\alpha}_{PYi}}{b + c + d}$	$\frac{\sum \#_{PYi} \times \hat{\alpha}_{PYi}}{b + c + d}$

Finally, we calculate return on investment by taking the ratio of aggregate averted expenditure (i.e., $\sum_{i=0}^n \#_{PYi} \times \hat{\alpha}_{PYi}$) to total expenditures (i.e., $b + c + d$).

⁶ Operating costs capture indirect cost elements such as allocated rent, allocated utility expense, allocated overhead, etc.