Rebaseline of Dialysis Bloodstream Infection (BSI)Rates Used to Calculate the BSI Standardized Infection Ratio

Presented by:

Statistics Team

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Overview of Dialysis BSI & SIR

- In dialysis, bloodstream infection (BSI) rates are monitored & compared to national BSI rates. The 2014 national average BSI rate is used to calculate the SIR
- A dialysis event surveillance bloodstream infection (BSI) is defined as “any positive blood culture,” regardless of the suspected source of the culture.
- The standardized infection ratio (SIR) is a ratio of the number of infections observed at a facility vs the number of infections predicted for that facility.

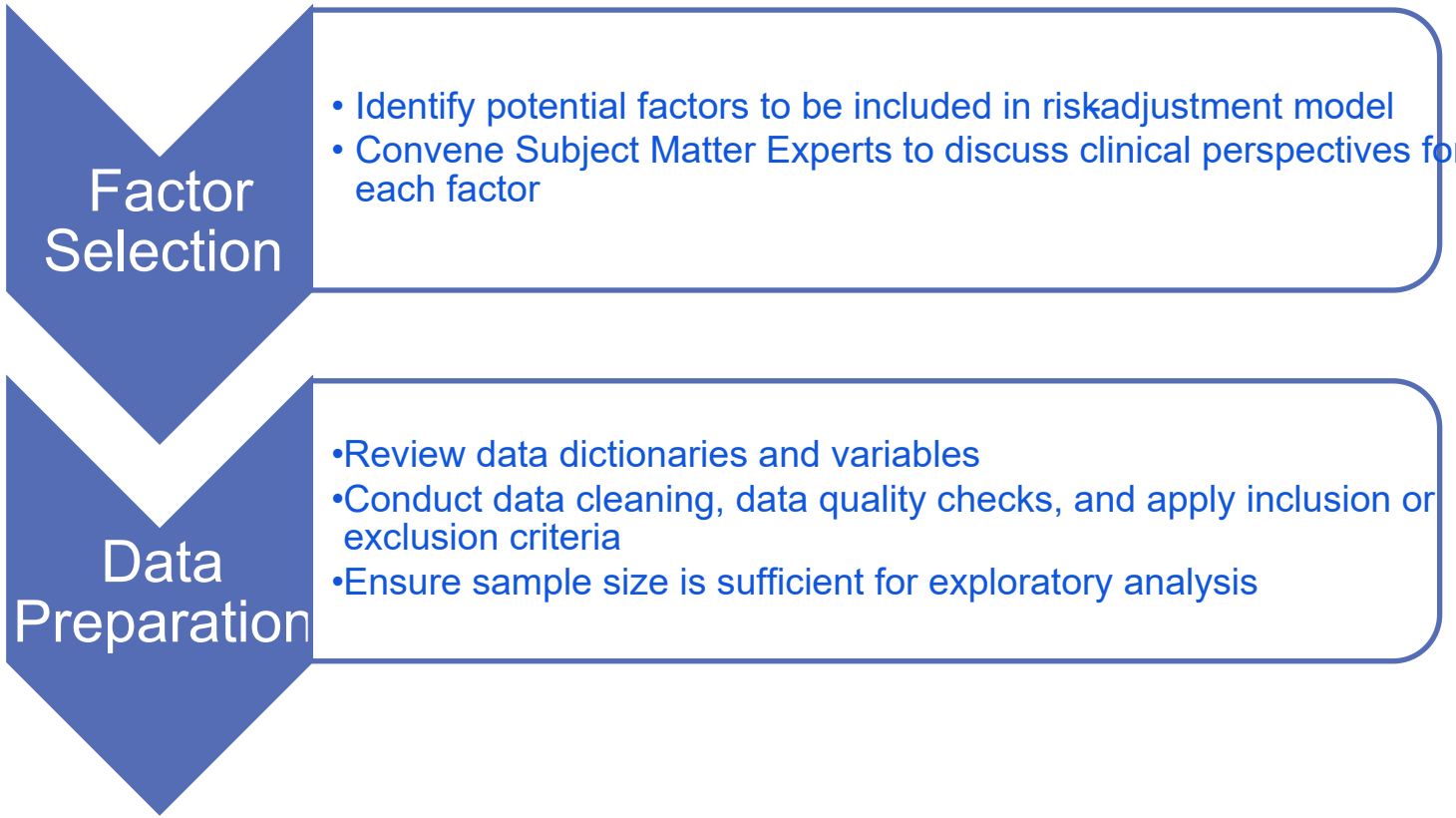
$$SIR = \frac{Number\ of\ Observed\ BSI}{Number\ of\ Predicted\ BSI}$$

SIR > 1: more infections than predicted
SIR = 1: same as predicted
SIR < 1: fewer infections than predicted

2024 Dialysis SIR Rebaseline Overview

- In 2024, we initiated process of developing new national baseline based on 2023 data.
- Earlier SIR not based on a risk model and only considered ***access type.***
- New SIR will use a risk adjusted model that includes other factors, as other HAIs do.
- Measure Endorsement Committee endorsed the BSI SIR in 2024 with condition that we rebaseline.
- Dialysis BSI rebaseline completion scheduled for January 2026.

Rebaseline Pre-Modeling Work



Factor Selection Process Overview

- Purpose – identify risk factors to be included in the risk adjustment model.
- Recruited subject matter experts (SMEs) with clinical, research and technical backgrounds relating to dialysis and dialysis data collection.
- Process consisted of:
  1. Initial review by SMEs of entire 2023 Annual Practices Survey and selection of items for further discussion.
  2. Series of 3 meetings to discuss pros and cons of each variable and select variables for potential model inclusion.

Initial Survey Review Process & Results

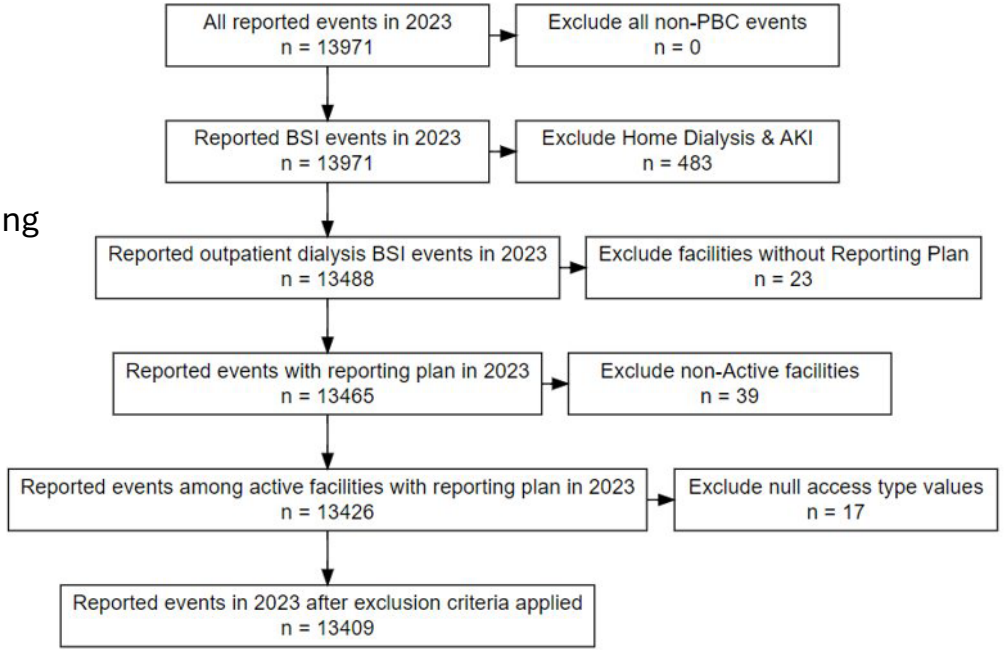
- Initial review of the 2023 80-item Annual Dialysis Practices Survey by SME yielded 38 survey items to discuss.
- Exclude infection control and healthcare practice items so:
  - we could compare facilities that do and do not adopt recommended practices, and so
  - we did not adjust for, and therefore penalize, facilities adopting recommended practices.
- Include only characteristics not under facility's control, like size, location, ownership, etc.
- Explore inclusion of Seasonality, Urbanism, and other variables.
- 38 items were classified into 1. Facility Characteristics (13) and 2. Prevention Practices (25).

Meeting Series Process & Results

- Process
  - Meeting 1: Voted on 38 items from Initial Review, leaving 23 items.
  - Meeting 2: Discussions continued, additional analyses requested, leaving 18 items.
  - Meeting 3: Results of additional analyses presented, determinations finalized.
- Results
  - ✓ Location (Freestanding vs Hospital Based/Affiliated)
  - ✓ Access Type
  - ✓ # of stations in the clinic

Data Preparation

- Event dataset cleaning
- Denominator dataset cleaning
- Dataset restructuring
- Event and Denominator dataset merging



2023
Risk Adjusted Model to Predict BSI Events

2023 BSI SIR Risk-Adjusted Modeling Methods

Pre–modeling

- Determine best parameterization of predictors
- Check for multi-collinearity
- Determine order of entry

Modeling

- Enter one predictor at a time
- Assess model fit
- Update parameterization
- [Repeat]

Validating

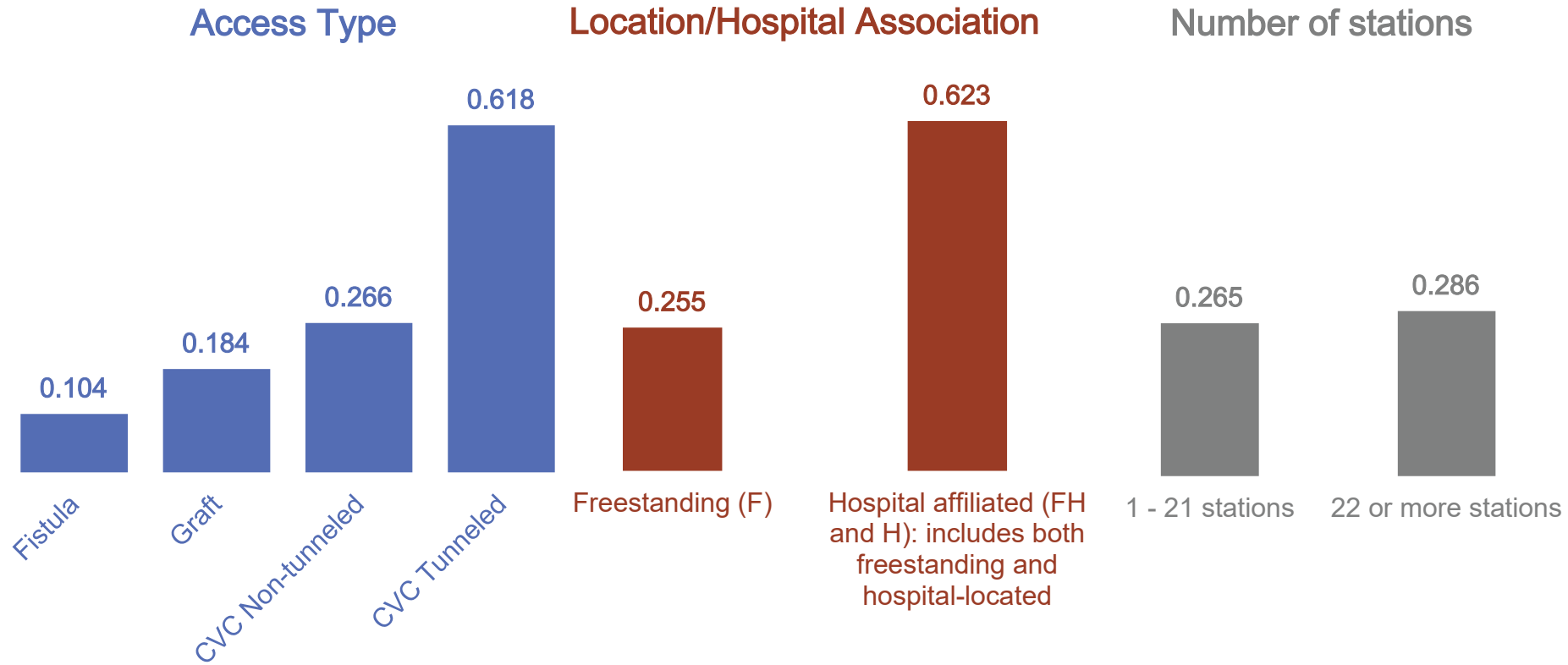
- Review potential outliers
- Bootstrap validation

Calculate SIRs

- Use model results to predict # of BSI events
- Calculate SIR (observed / predicted)

Potential predictors of BSI events

Rates of BSI in 2023 facilities, per 100 patient months (N=6,961)



Final BSI Event Model Parameter Estimates

Parameter	Category	Parameter Estimate
Intercept		-6.9888
Access Type	Fistula	REF
	Graft	0.6168
	CVC Nontunneled	0.9552
	CVC Tunneled	1.8175
Location and Hospital Association	Freestanding (F)	REF
	Hospital affiliated (FH and H): includes both freestanding and hospital-located	0.8731
Number of in-center hemodialysis stations	1 – 21 stations	REF
	22 or more stations	0.0785

Negative binomial model

- Predicting BSI events
- Patient days offset

Data is 2023 facilities

- N facilities: 6,961
- N facility-access types: 23,090

Calculate 2023 SIR with 2023 risk-adjusted model

SIR = # observed BSI events / # predicted BSI events

The # predicted BSI events is estimated using the new 2023 risk-adjusted model.

 # predicted BSI events =

***Exp*[**−6.9888 *(Intercept)* +

0.6168 *(Access type = Graft)* +

0.9552 *(Access type = Non-tunneled)* +

1.8175 *(Access type = Tunneled)* +

0.8731 (*Location type = "H" or "FH"*) +

0.0785 (*Number of stations >= 22*)**]** * *patient-months*

2023 facility-level SIRs using 2023 risk-adjusted model

Note: An SIR is not calculated for any facilities with # predicted BSI events < 1

N 2023 facilities	5,566
Median SIR (IQR)	0.706 (0.000 – 1.437)
Mean SIR (SD)	0.988 (1.145)
SIR Range	0.000 – 18.023

The 2023 rebaseline can be thought of as a re-centering of the facility-level SIRs around 1.

Comparing SIR baseline methods: 2014 vs. 2023

Delta Model Methods

The Delta Model is the method that contrasts facility-level SIRs calculated using methods from the 2014 vs. 2023 national baselines.

All SIRs reported in this section use the 2023 facility data. Facilities with less than 1 predicted BSI event (in either method) are excluded. N=5,566 facilities.

Methods:

1) **Calculate 2023 SIRs using both 2014 and 2023 method**
2) **Bin ranking analysis – examine how the ranking of facilities changed**
3) **Descriptive statistics and histograms – evaluation overall change in SIR**

Calculating the SIRs

2014 SIR Calculation:

 # observed BSI events / # predicted BSI events

 # predicted calculation: stratified-rate-based

predicted BSI events per access type =
Patient-months * BSI Rate/100 patient-months

predicted BSI events =
Sum of predicted BSI across access types

BSI Rates by Access Type (2014 data):
Fistula: 0.26
Graft: 0.39
Other: 0.67
Any CVC: 2.16

2023 SIR Calculation:

 # observed BSI events / # predicted BSI events

 # predicted calculation: model-based

predicted BSI events =
***Exp*[**−6.9888 +
0.6168 (*Graft*) +
0.9552 (*Non-tunneled*) +
1.8175 (*Tunneled*) +
0.8731 (*Location type = "H" or "FH"*) + 0.0785 (*Number of stations* >= 22)**]** * *patient-months*

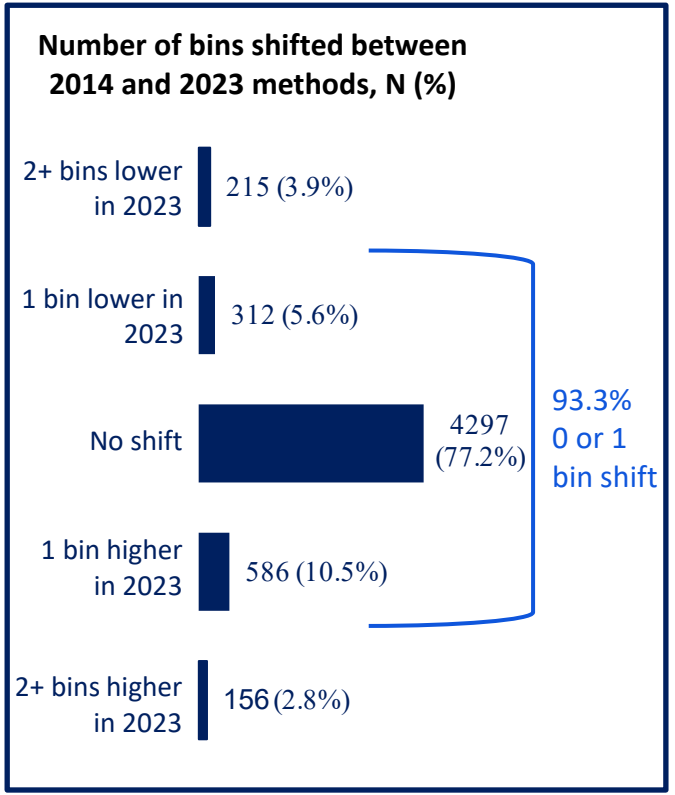
Bin ranking results: did facilities change position?

Outpatient dialysis facilities, 2023 data (N=5,566)

Bin rank using 2023 Method

Bin rank using 2014 Method	1	2	3	4	5	6	7	8	9	10	Total
1	1579	0	0	0	0	0	0	0	0	0	1579
2	0	372	48	6	14	0	0	0	0	0	440
3	0	35	327	68	8	5	2	2	0	0	447
4	0	6	36	305	67	16	8	4	0	0	442
5	0	14	1	34	285	79	20	6	1	0	440
6	0	15	14	4	41	278	68	19	7	0	446
7	0	1	16	7	2	40	267	82	25	2	442
8	0	0	1	18	11	7	42	261	91	11	442
9	0	0	0	1	15	16	13	41	276	83	445
10	0	0	0	0	0	2	23	28	43	347	443
Total	1579	443	443	443	443	443	443	443	443	443	5566

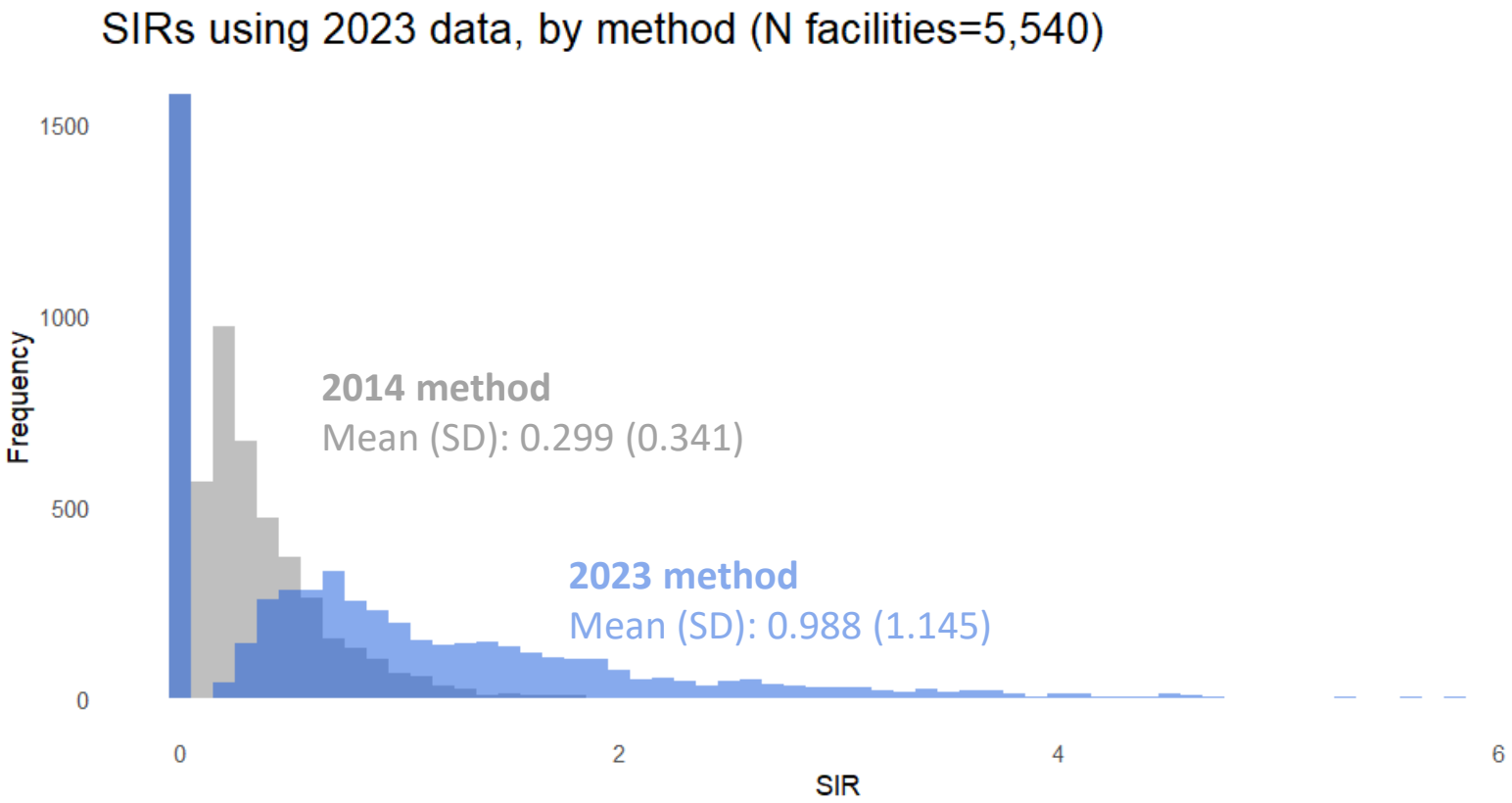
Note: Bin 1 contains only those with 0 events



Overall comparison of SIRs in 2023 data: 2014 vs. 2023

	2014 Method	2023 Method
N facilities	5,566	5,566
Median	0.215	0.706
IQR	0.000–0.430	0.000–1.437
Mean (SD)	0.299 (0.341)	0.988 (1.145)
Range	0.000–4.493	0.000–18.023
N facilities with SIR=0 (%)	1,579 (28.7%)	1,579 (28.7%)

Overall comparison of SIRs in 2023 data: 2014 vs. 2023



Note: Graph is truncated to SIR <=6 (N=5,540); all descriptives include full data (N=5,566). N = 26 facilities had SIRs >6 using 2023 method.

Implications, Significance, and Rollout

Significance & Rollout Plan

- Important to measure performance under standards in current healthcare environment.
- Project team is preparing educational resources (trainings, website) for NHSN users on what the rebaseline is, why it's important, and anticipated changes.
- CMS will determine whether to adopt new rebaseline and project team will work with CMS to help them understand changes occurring with rebaseline.
- Project team is actively working on specific rollout plan to be shared when finalized.
- Most prominent partners likely to be interested in therebaselineinclude CMS, SHDs, LDOs, ESRD networks, etc.

Thank you!

Questions?