eAppendix A. Facility Claims

Inpatient	Claims with a room and board revenue code[1] (excluding revenue codes for inpatient rehab) occurring in a BCBSM facility considered a Hospital Unit, Hospital, Long-Term Acute Care, or Unknown (excluding claims with revenue codes or DRGs associated with rehab)[2]
SNF	Claims with a revenue code starting with '019' or occurring in a facility designated by BCBSM as a SNF
ED	Claims with a revenue code or CPT code associated with ED service use[3]
HH	Claims with a revenue code or CPT code associated with Home Health[4] or from a facility designated by BCBSM as HHC
IP Rehab	Claims with an IP Rehab revenue code or a rehab DRG or an inpatient claim with a primary dx of rehabilitation[5]
OP Rehab	Claims with either a CPT or revenue code associated with physical, speech, occupational,[6] or cardiac therapy[7]
Outpatient[8]	Remaining outpatient claims

Professional Claims

OP Rehab	CPT codes for physical, speech, occupational services: 92506, 92507, 92508, 92526, 92597, 92605, 92606, 92607, 92608, 92609, 97001, 97002, 97003, 97004, 97010, 97012, 97016, 97018, 97022, 97024, 97026, 97028, 97032, 97033, 97034, 97035, 97036, 97039, 97110, 97112, 97113, 97116, 97124, 97139, 97140, 97150, 97530, 97533, 97535, 97537, 97542, 97750, 97755, 97760, 97761, 97762, 97799, G0281, G0282, G0283, G0329
	CPT Codes for cardiac rehab: 93797, 93798, G0422, G0423
ED	CPT Codes: 99281, 99282, 99283, 99284, 99285
Remaining claims assigned based on Berenson Eggers Type of Service (BETOS)[9] classification.	
Surgical Procedures	BETOS Groups: P1, P2, P3, P4
Anesthesia	BETOS Groups: P0
Other Procedures	BETOS Groups: P5, P6, P7, P8. P9
E&M Office Visit	BETOS Groups: M1
E&M Hospital Visits	BETOS Groups: ED (from above) and M2
E&M Consults and	BETOS Groups: M3, M4, M5, M6

Other	
Imaging	BETOS Groups: I1, I2, I3, I4
Tests	BETOS Groups: T1, T2
DME	BETOS Groups: D1
Ambulance	BETOS Groups: O1
Other	BETOS Groups: Y1, Y2, Z1, Z2, Other

Sources: BCBSM Facility and Professional Claims files; Medicare MedPAR (IP and SNF), OP, Hospice, HHA, Physician/Supplier files

1. Revenue codes starting with: 010, 011, 012, 013, 014, 015, 016, 017, 018, 020 or 021
2. Revenue codes: 0118, 0128, 0138, 0148, 0158. DRGs: 945, 946
3. Revenue codes: 0450, 0451, 0452, 0453, 0454, 0455, 0456, 0457, 0458, 0459. CPT codes: 99281, 99282, 99283, 99284, 99285
4. Revenue codes beginning with: 055, 056, 057, 058, 059, 060. CPT codes: G015X, G0160, G0161, G0162, G0163, G0164
5. Revenue codes: 0118, 0128, 0138, 0148, 0158. ICD-9 Diagnosis Codes: V528, V529, V571, V572, V573, V5789, V579. DRGs: 945, 946. Unlike Medicare, BCBSM provided facility classifications do not specifically identify inpatient rehab facilities
6. CPT codes: 92506, 92507, 92508, 92526, 92597, 92605, 92606, 92607, 92608, 92609, 97001, 97002, 97003, 97004, 97010, 97012, 97016, 97018, 97022, 97024, 97026, 97028, 97032, 97033, 97034, 97035, 97036, 97039, 97110, 97112, 97113, 97116, 97124, 97139, 97140, 97150, 97530, 97533, 97535, 97537, 97542, 97750, 97755, 97760, 97761, 97762, 97799, G0281, G0282, G0283, G0329. Revenue codes: 0420, 0421, 0422, 0423, 0424, 0429, 0430, 0431, 0432, 0433, 0434, 0439, 0440, 0441, 0442, 0443, 0444, 0449
7. CPT codes: 93797, 93798, G0422, G0423. Revenue codes: 0943
8. This group includes a mix of services including: outpatient labs, bloodwork, DME, radiology, outpatient surgical procedures, etc
9. BETOS categorizations and mappings can be found here: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-

Reports/MedicareFeeforSvcPartsAB/downloads/betosdesccodes.pdf;
http://www.cms.gov/Medicare/Coding/HCPCSReleaseCodeSets/BETOS.html

eAppendix B

Michigan Value Collaborative (MVC) Data Validation

Introduction and Aims

The data validation project provided the MVC Coordinating Center (CC) and participating hospitals with an opportunity to examine the level of agreement between services assigned to episodes of care by the MVC claims data algorithms and services identified in clinical data maintained by the hospitals.

The project had three specific aims. First, the results of the project provided detailed information to participating hospitals about the reliability of the MVC data. Second, the clinical data provided by hospitals informed refinements to our inclusion and exclusion algorithms for care occurring after the index hospital stay, thereby enhancing the validity of reports provided to hospitals. Third, the findings confirmed MVC's ability to identify and describe services occurring within an episode that are often not visible in medical records.

Methods Description

As a first step, 1,830 BCBSM PPO cases with index hospitalization admission dates from January 1, 2013 through October 31, 2014 were selected from the following 11 conditions:

- Acute Myocardial Infarction (AMI)
- Congestive Heart Failure (CHF)
- Pneumonia
- Hip Replacement
- Knee Replacement
- Colectomy
- Coronary Artery Bypass Graft (CABG)
- Spine Surgery
- Trauma
- Vaginal Birth
- Caesarean Section

These conditions were selected based on high volumes across hospitals, a high prevalence of associated post-discharge services, and recommendations from clinical experts. In order to identify MVC episodes in their own data, hospitals were provided with the condition, patient date of birth and gender, index hospitalization admission and discharge dates, and provider NPI (when available).

Participating hospitals were provided with a list of 30 patients identified in MVC data and asked to indicate if the patients listed had information in the available clinical data demonstrating that post-discharge services occurred within 90 days of their discharge date. The following post-discharge services were examined:

- 30-day inpatient readmissions
- Home Health visits
- Skilled Nursing Facility (SNF) admissions
- 90-day inpatient readmissions
- Emergency Department (ED) visits
- Rehabilitation services (inpatient & outpatient)

Episode Match Rate Results

Hospitals were able to successfully match 1,812 of the 1,830 episodes within their records, for a **99% match rate**. This rate provides confirmation that these hospital episodes did in fact take place, were attributed to the correct hospital, and were assigned to the correct condition.

Presentation of Post-Discharge Service Validation Results

The results presented in this report summarize the observed level of agreement between the MVC claims data and clinical data provided by hospitals. For each type of post-discharge service, the results are presented initially in a table with the following general structure and format:

Level of Agreement for 30-day Readmissions (Kappa Statistic=X)			
Service identified in MVC claims data	*Service identified in Hospital clinical data*		**Total**
	No (0)	Yes (1)	
No (0)	A	B	
Yes (1)	C	D	
Total			1,812

In this example, cells 'A' and 'D' denote episodes with agreement between MVC and hospital data. Cell 'A' represents readmissions that were identified in neither MVC nor Hospital data. Cell 'D' represents readmissions that were identified in both MVC and hospital data.

Cells 'B' and 'C' denote episodes with disagreement between MVC and hospital data. Specifically, cell 'B' represents episodes with readmissions that were identified in hospital data, but not identified in MVC claims. Cell 'C' represents episodes with readmissions that were identified in MVC data, but not identified in medical records. If there is perfect agreement between MVC and hospital data, then the values in these cells would both be zero.

The 'Kappa Statistic' is a statistic that measures inter-rater agreement (in this case between hospital data and MVC claims), and accounts for agreement occurring merely by chance.[10] We considered several publications when determining an acceptable level of agreement between the two data sources. Landis and Koch[11] consider 0.61-0.80 to be 'substantial agreement' and 0.81-

10. Cohen, Jacob. 1960. "A statistic of agreement for nominal scales". Education and Psychological Measurement: 20-1. doi: 10.1177/001316446002000104.

11. Landis, J. Richard, and Gary G. Koch. 1977. "The Measurement of Observer Agreement for Categorical Data". Biometrics 33 (1). International Biometric Society: 159–74. doi:10.2307/2529310.

1.00 to be 'almost perfect' agreement. Similarly, Altman[12] regards 0.61-0.80 as 'good' agreement and 0.81-1.00 as 'very good' agreement. Finally, Fleiss[13] considers 0.40-0.75 to be 'fair to good' agreement and 0.75-1.00 to be 'excellent' agreement. Based on these guidelines, we decided *a priori* that a Kappa Statistic of 0.80 represents an acceptable level of agreement for confirming validity of the MVC claims algorithms.

The key lessons from the validation process came from examining the episodes in the discordant cells (i.e., cells B and C in the table above). Using readmissions as an example, the diagrams below summarize the logic used by the MVC CC to deconstruct and understand these discordant cells, as well as the steps we will take to improve the classification and identification of services based on this information.

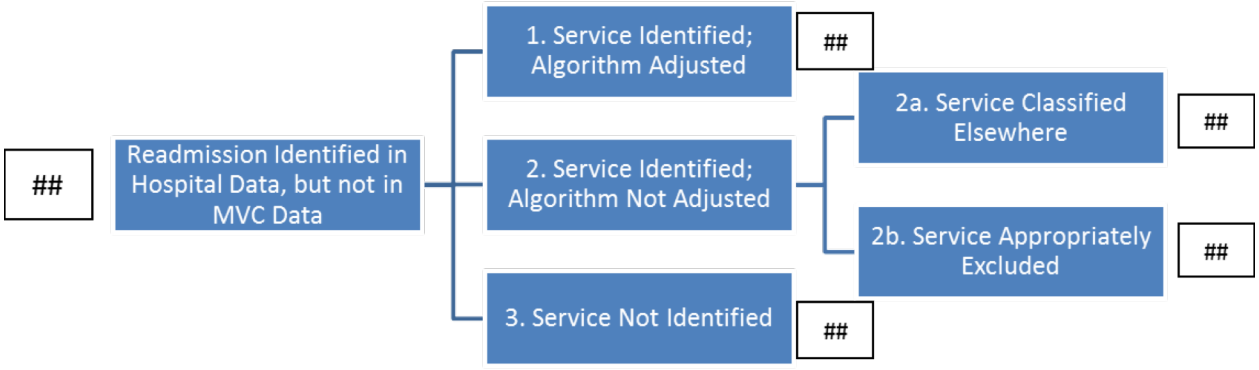
The flow diagram below represents our general approach in reconciling discordant episodes in Cell B (service identified by hospital but not MVC) for each of the services examined.

Box 1 refers to readmissions MVC was able to identify in additional claims data and should have been captured by the MVC algorithm. The MVC algorithm will be adjusted to capture these claims in the future.

Box 2a refers to claims that MVC was already capturing but were classified in a different cost category, such as outpatient surgery or an ED or observation stay visit.

Box 2b refers to claims that MVC had excluded from the episode. Additional review of those claims confirmed that they were appropriately excluded from the episode.

Box 3 refers to readmissions that could not be identified by MVC despite a thorough evaluation of all available claims for that patient.

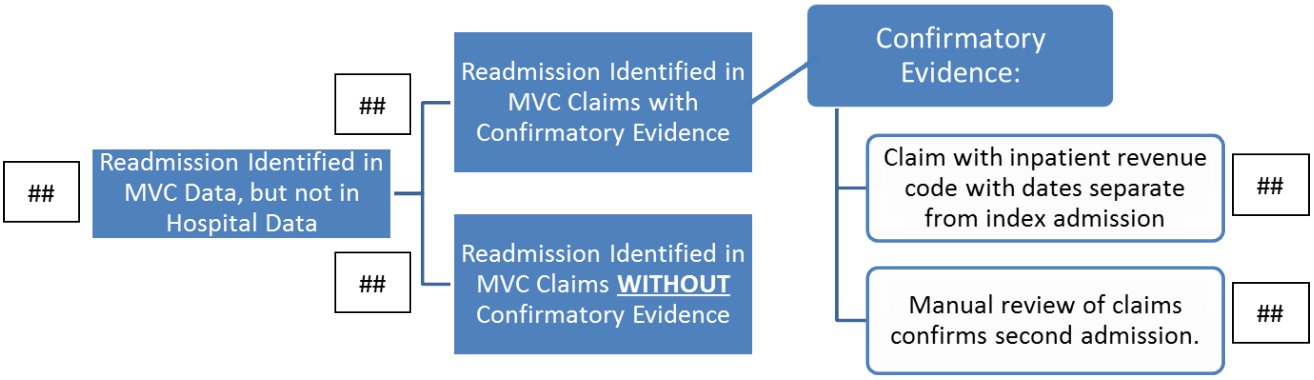


The flow diagram below pertains to the discordant episodes found in Cell C (services identified by MVC but not by hospitals). For services that were identified in MVC claims but not in

12. Altman, Douglas G. *Practical statistics for medical research*. London New York: Chapman and Hall, 1991.

13. Fleiss, Joseph L. *Statistical methods for rates and proportions* (2nd ed.). New York: Wiley, 1981.

hospital data, we required that at least two confirmatory criteria were met to conclude that the services were actually provided.



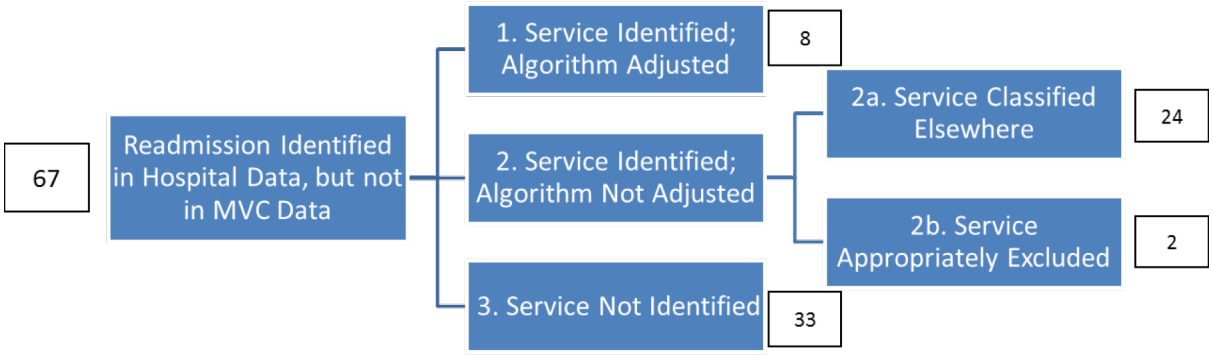
30-DAY READMISSIONS

Among patients with a 30-day readmission identified in the MVC data, only those who were readmitted to the same facility as their index hospitalization were sent to hospitals for the validation analyses.

Level of Agreement for 30-day Readmissions (Kappa Statistic=0.78)			
Service identified in MVC claims data	*Service identified in Hospital clinical data*		**Total**
	No (0)	Yes (1)	
No (0)	1,562	67	1,629
Yes (1)	15	168	183
Total	1,577	235	1,812

Investigation of Discordance

Cell B: There were 67 cases in which a hospital observed a 30-day readmission that was not evident in the MVC data.



Box 1: Of the 67 episodes with discordant data, 8 had claims with ICD-9 diagnosis codes that should reasonably be attributed to the index hospitalization episode but were excluded based on the current MVC algorithm. As a consequence, the algorithm was adjusted to include these codes.

Box 2: In 26 of the discordant cases, a readmission or related service was identified in MVC, but was either classified elsewhere in the episode or was appropriately excluded.

a. The large proportion of the 24 cases that were classified elsewhere in the MVC episodes did not have inpatient claims related to a readmission, but instead had claims indicating an observation unit stay following an ED visit, outpatient operating room services, or time spent in a recovery room. In the remaining cases, there were multiple readmissions identified by hospitals that occurred beyond the 30-day window, and are therefore classified elsewhere as 90-day readmissions.

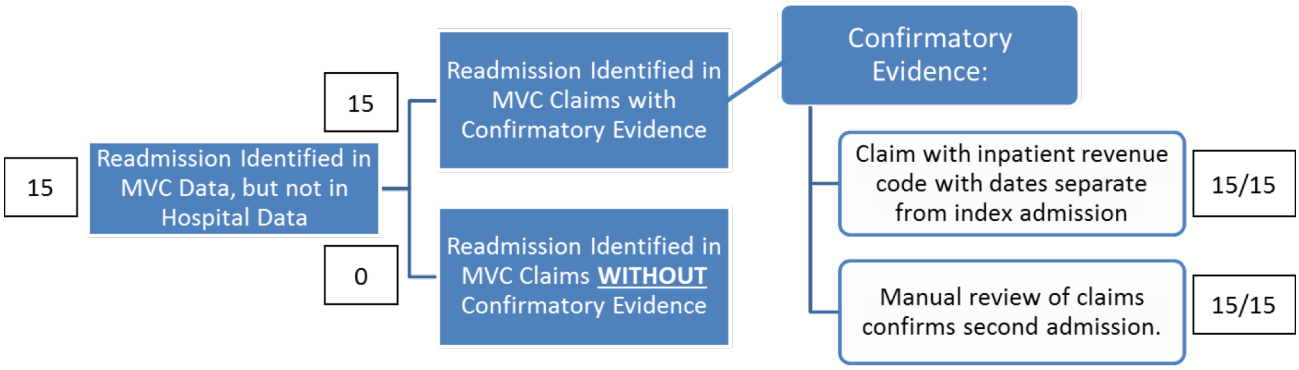
b. There were 2 cases in which a readmission was evident in the MVC claims, but was being appropriately excluded from the episode based on the ICD-9 diagnosis codes present on the claims.

The following table lists the relevant condition(s), ICD-9 diagnosis code, and code description.

Condition	ICD-9 Diagnosis Code	Code Description
Knee Replacement	5770	Acute pancreatitis
Knee Replacement	57400	Calculus of gall bladder with acute cholecystitis without obstruction

Box 3: There were 33 cases in which we found no evidence of a readmission in the MVC claims data despite an exhaustive search of all available claims for that patient.

Cell C: There were 15 cases in which MVC observed a 30-day readmission that was not evident in the hospital data.



Among the 15 discordant cases, each had confirmatory evidence in the MVC claims of a valid readmission. The relevant confirmatory evidence included claims with inpatient revenue codes with dates separate from the index admission and within 30 days of the discharge date.

Additionally, these readmissions were confirmed following a manual review of the facility claims.

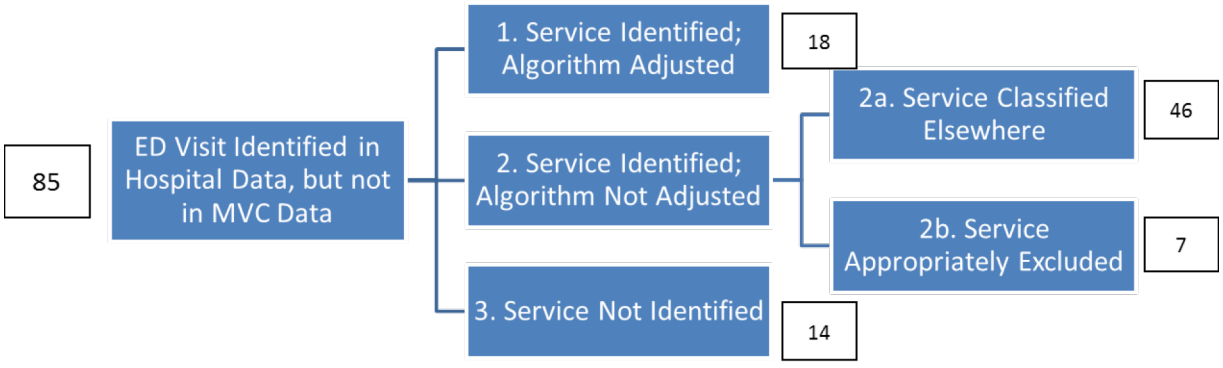
After accounting for these findings and making the appropriate adjustments, the Kappa Statistic for 30-day readmissions would increase from 0.78 to 0.91.

EMERGENCY DEPARTMENT VISITS

Level of Agreement for ED Visits (Kappa Statistic=0.62)			
Service identified in MVC claims data	*Service identified in Hospital clinical data*		**Total**
	No (0)	Yes (1)	
No (0)	1,274	85	1,359
Yes (1)	160	292	452
Total	1,434	377	1,811

Investigation of Discordance

Cell B: There were 85 cases in which a hospital observed an ED visit that was not evident in the MVC data.



Box 1: Of the 85 discordant cases, 18 had claims with ICD-9 diagnosis codes that should reasonably be attributed to the index hospitalization episode but were excluded based on the current MVC algorithm. The algorithm was adjusted to include these codes.

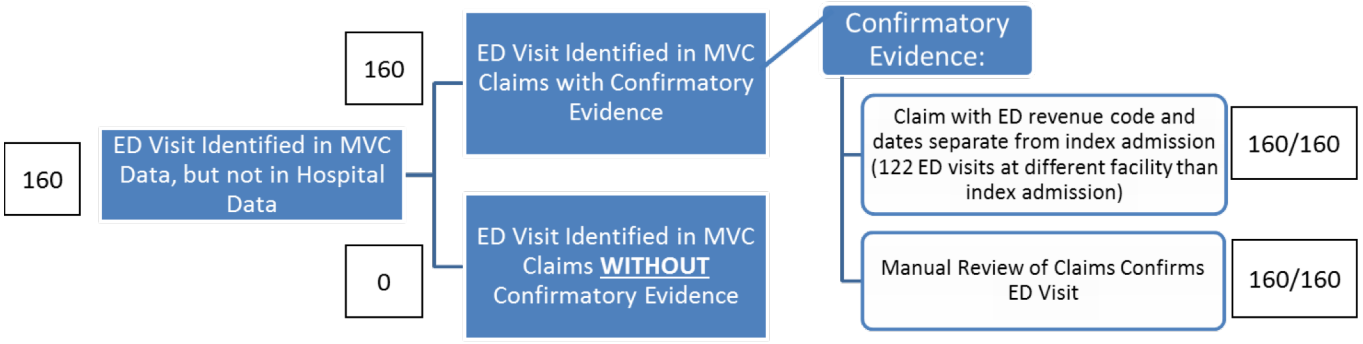
Box 2: In 53 of the episodes with discordant data, the ED visit was identified in MVC, but was either classified elsewhere in the reports or was appropriately excluded.

Of the 46 ED visits that were classified elsewhere, 38 preceded an index admission or a readmission and the ED services are grouped with this hospitalization in the MVC episode. The remaining 8 discordant cases had claims for outpatient operating room services, but no ED visit claims.

There were 7 cases in which an ED visit was evident, but was being appropriately excluded from the episode based on the ICD-9 diagnosis codes present on the claims.

Box 3: There were 14 cases in which we found no evidence of an ED visit in the MVC claims data.

Cell C: There were 160 cases where MVC observed an ED visit that was not evident in the hospital clinical data.



Of the 160 discordant cases, each had confirmatory evidence in the MVC claims of a valid ED visit. These cases had claims with ED revenue codes with dates separate from the index admission. In addition, 122 of these ED visits occurred at a different facility than the index admission, making hospital identification of these visits difficult (and highlighting the value of MVC data for identifying care delivered after an episode of hospitalization).

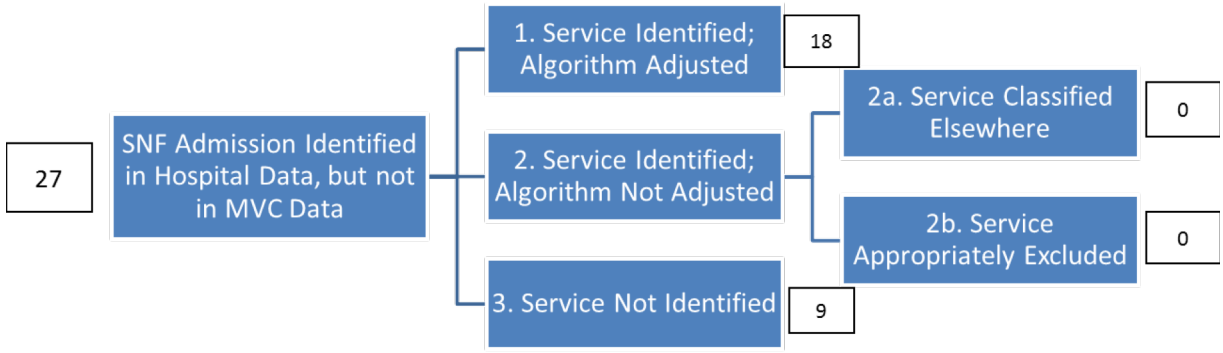
After accounting for these findings and making appropriate adjustments, the Kappa Statistic for ED visits would increase from 0.62 to 0.98.

SKILLED NURSING FACILITY ADMISSIONS

Level of Agreement for SNF Admissions (Kappa Statistic=0.63)			
Service identified in MVC claims data	*Service identified in Hospital clinical data*		**Total**
	No (0)	Yes (1)	
No (0)	1,721	27	1,748
Yes (1)	21	43	64
Total	1,742	70	1,812

Investigation of Discordance

Cell B: There were 27 cases in which a hospital observed a SNF admission that was not evident in the MVC data.



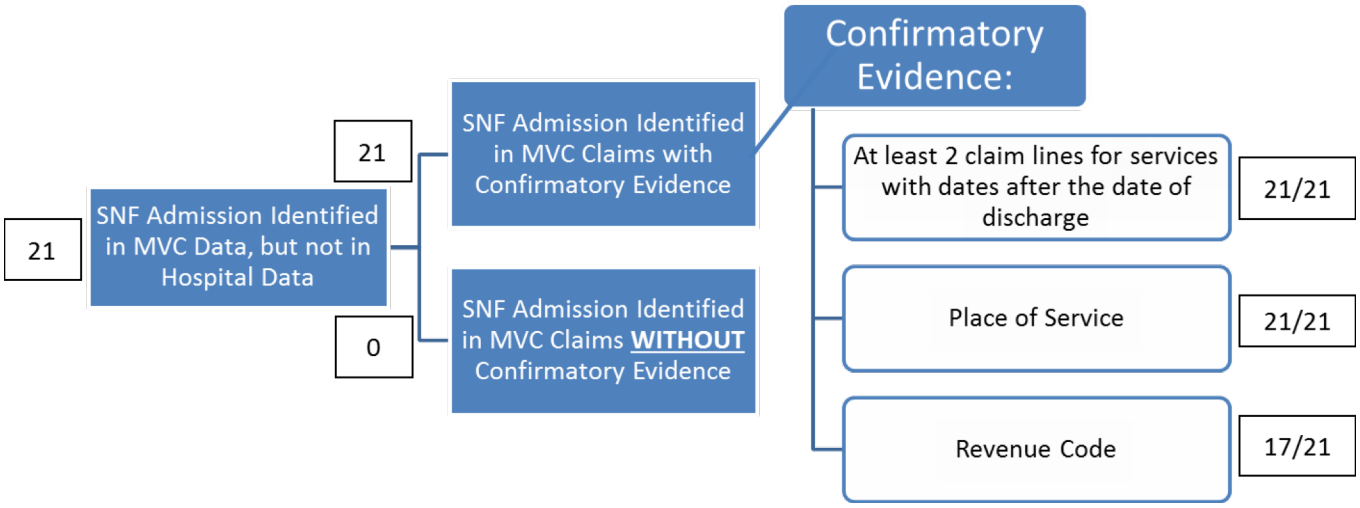
Box 1: Of the 27 discordant cases, 18 had a SNF admission identified in the MVC claims and investigation of these episodes yielded improvements in the MVC algorithms. First, the V5789 ICD-9 diagnosis code was being incorrectly excluded based on the current algorithm. Each of the

excluded claims with this diagnosis code had valid SNF revenue codes and a SNF place of service designation. Second, some of these 18 cases had SNF valid claims that were currently unpriced due to the lack of a corresponding code in the Medicare data (the source of payment data for the MVC algorithms). Our methods will be adjusted to accurately price these claims.

Box 2: There were 0 cases in which the service was identified, but was classified elsewhere or appropriately excluded.

Box 3: There were 9 cases where hospitals reported care in a SNF and we found no evidence of a SNF admission in the MVC claims data despite an exhaustive search of all available claims.

Cell C: There were 21 cases in which MVC observed a SNF admission that was not evident in the hospital clinical data.



Of the 21 discordant cases, each had confirmatory evidence in the MVC claims of care provided in a skilled nursing facility. Specifically, the available claims for each of the cases met two or more of the following conditions:

21 had at least 2 claim lines for a SNF admission with dates following the index admission

21 had claims with a SNF place of service designation

17 had claims with a common, valid inpatient SNF revenue code

The mean SNF payment for these 21 cases was $2,308.25 and the median payment was $1,531.62.

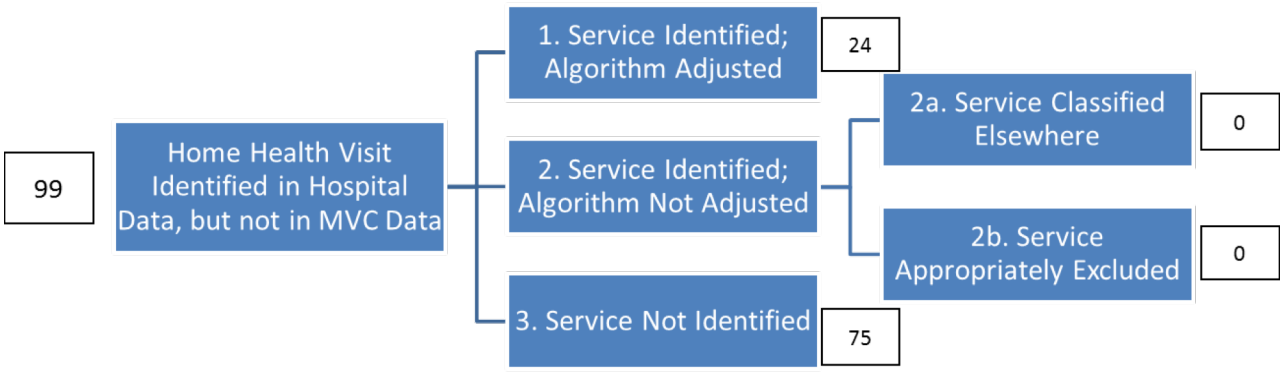
After accounting for these findings and making the appropriate adjustments, the Kappa Statistic for skilled nursing facility services would increase from 0.63 to 0.95.

HOME HEALTH VISITS

Level of Agreement for Home Health Visits (Kappa Statistic=0.71)			
Service identified in MVC claims data	*Service identified in Hospital clinical data*		**Total**
	No (0)	Yes (1)	
No (0)	764	99	863
Yes (1)	168	781	949
Total	932	880	1,812

Investigation of Discordance

Cell B: There were 99 cases in which a hospital observed a home health visit that was not evident in the MVC data.



Box 1: Of the 99 discordant cases, 24 had claims with ICD-9 diagnosis codes that should reasonably be attributed to the index hospitalization episode but were excluded based on the current MVC algorithm. These cases included claims with valid home health revenue codes and a home health place of service designation. These cases had the following ICD-9 diagnosis codes or CPT codes that are now be included in our algorithms:

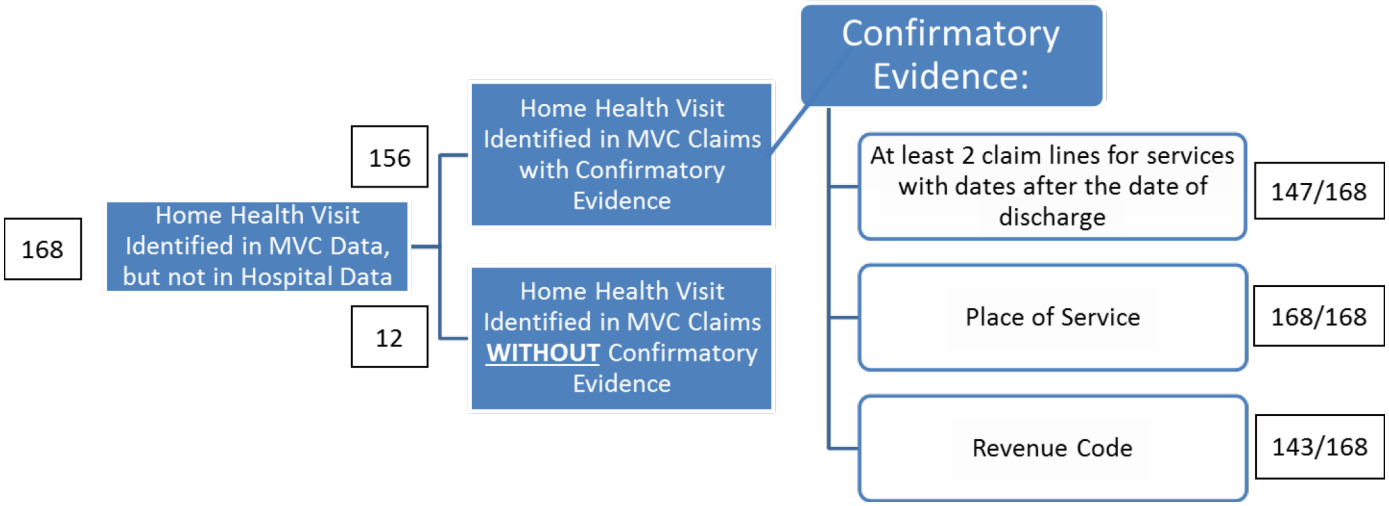
V571: Care involving other physical therapy
V5789: Care involving other specified rehabilitation procedure

G0154: Direct skilled nursing services of a licensed nurse in the home health or hospice setting

Box 2: There were 0 cases in which the service was identified but was classified elsewhere or appropriately excluded.

Box 3: There were 75 cases in which we found no evidence of a home health visit in the MVC claims data despite an exhaustive search of all available claims. Most of these cases had a home health discharge disposition on their index admission claims but no home health claims.

Cell C: There were 168 cases where MVC observed a home health visit that was not evident in the hospital clinical data.



Of the 168 discordant cases, 156 had confirmatory evidence in the MVC claims of provision of home health services. Specifically, the available claims for each of the cases met two or more of the following conditions:

147 had at least 2 claim lines for home health services with dates following the index admission
168 had claims with a home health place of service designation
143 had claims with a common, valid home health revenue code

The mean home health payment for these 168 episodes with discordant data was $916.17 and the median payment was $552.00.

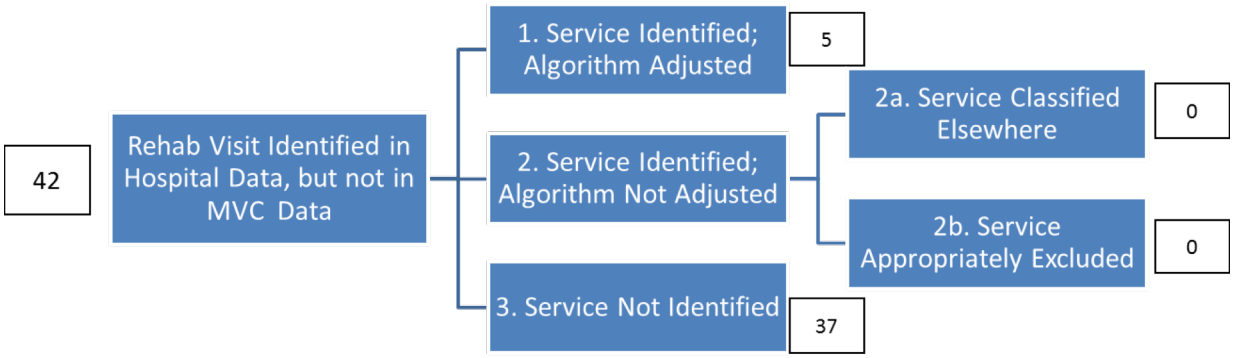
After accounting for these findings and making the appropriate adjustments, the Kappa Statistic for home health services would increase from 0.71 to 0.90.

REHABILITATION VISITS

Level of Agreement for Rehab Visits (Kappa Statistic=0.16)			
Service identified in MVC claims data	*Service identified in Hospital clinical data*		**Total**
	No (0)	Yes (1)	
No (0)	547	42	589
Yes (1)	873	350	1,223
Total	1,420	392	1,812

Investigation of Discordance

Cell B: There were 42 cases where a hospital observed a rehab visit that was not evident in the MVC data.



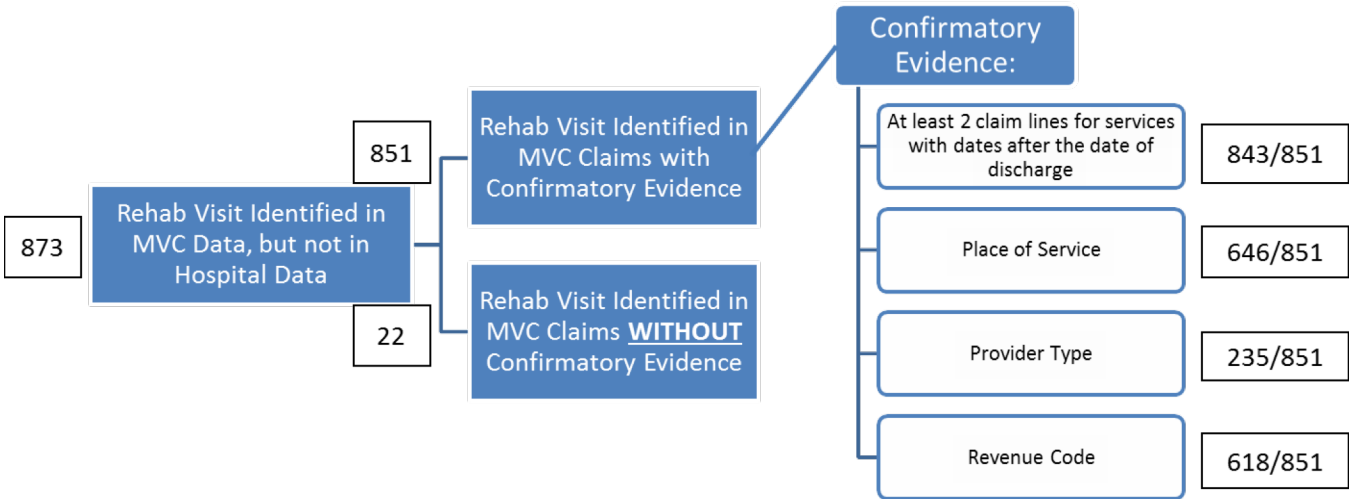
Box 1: Of the 42 discordant cases, 5 had claims with ICD-9 diagnosis codes that should reasonably be attributed to the index hospitalization episode but were excluded based on the current MVC algorithm. Each of these cases had claims with valid rehab revenue codes and rehab place of service designation. These cases had the following ICD-9 diagnosis codes:

V571: Care involving other physical therapy
V5789: Care involving other specified rehabilitation procedure

Box 2: There were 0 cases in which the service was identified, but was classified elsewhere or appropriately excluded.

Box 3: There were 37 cases where hospitals reported rehab services and we found no evidence such services visit in the MVC claims data, despite an exhaustive search of all available claims.

Cell C: There were 873 cases in which MVC observed a rehab visit that was not evident in the hospital clinical data.



Of the 873 discordant cases, 851 had confirmatory evidence in the MVC claims for utilization of rehabilitation services. Specifically, the available claims for each of the cases met two or more of the following conditions:

843 had at least 2 claim lines for a rehab visit with dates following the index admission
646 had claims with a rehab place of service designation
235 had claims with a physical or occupational therapist identified as the type of provider in the professional claims
618 had claims with a common, valid rehab revenue code

The mean rehab payment for these 873 cases was $1,576.13 and the median payment was $998.78.

After accounting for these findings and making the appropriate adjustments, the Kappa Statistic for post-discharge rehabilitation services would increase from 0.16 to 0.93.