



## Measure Information

This document contains the information submitted by measure developers/stewards, but is organized according to NQF's measure evaluation criteria and process. The item numbers refer to those in the submission form but may be in a slightly different order here. In general, the item numbers also reference the related criteria (e.g., item 1b.1 relates to sub criterion 1b).

### Brief Measure Information

**NQF #:** 2456

**Corresponding Measures:**

**De.2. Measure Title:** Medication Reconciliation: Number of Unintentional Medication Discrepancies per Medication Per Patient

**Co.1.1. Measure Steward:** Brigham and Women's Hospital

**De.3. Brief Description of Measure:** This measure assesses the actual quality of the medication reconciliation process by identifying errors in admission and discharge medication orders due to problems with the medication reconciliation process. The target population is any hospitalized adult patient. The time frame is the hospitalization period.

At the time of admission, the admission orders are compared to the preadmission medication list (PAML) compiled by trained pharmacist (i.e., the gold standard) to look for discrepancies and identify which discrepancies were unintentional using brief medical record review. This process is repeated at the time of discharge where the discharge medication list is compared to the PAML and medications ordered during the hospitalization.

**1b.1. Developer Rationale:** This measure will drive hospitals to implement interventions to truly improve their medication reconciliation processes. To date, Joint Commission requirements for medication reconciliation have led mostly to pro forma compliance, for example, checking a box saying that medication reconciliation has been performed, without knowing whether clinical care has been affected. By directly measuring error rates in medication orders, this new measure will enable hospitals to better understand where their errors are occurring and the types of errors that exist. This will enable them to implement targeted interventions that actually reduce error rates. The result will be true improvements in medication safety during transitions in care. The rate of unintentional discrepancies per patient is unacceptably high in this country, and there is variation by site. In the six sites studied using the proposed methodology, the range was 2.78 to 4.57 discrepancies per patient (average of 3.44 per patient), thus making medication reconciliation errors the single biggest source of medication errors in the hospital (i.e., as opposed to errors in prescribing, transcribing, or administration).

Studies of medication reconciliation interventions demonstrate that improvements in important outcomes are indeed possible. In a recent systematic review conducted by our group (2), we identified 26 studies. Studies consistently demonstrated a reduction in medication discrepancies (17/17 studies), potential adverse drug events (5/6), and adverse drug events (2/2), and 2/8 studies showed a reduction in health care utilization. In the first Multi-center Medication Reconciliation Quality Improvement Study, involving 1648 patients across 5 hospitals, evidence-based interventions to improve medication reconciliation resulted in a reduction in medication discrepancies by 8% per month over baseline temporal trends (adjusted incident rate ratio 0.92, 95% CI 0.87-0.97,  $p=0.002$ ), using the NQF proposed metric and methodology (technically, the measure was discrepancies per patient, using the number of medications as a model offset in the Poisson regression, which essentially is the same as discrepancies per medication per patient). In the recently completed MARQUIS2 study, involving 4947 patients across 17 hospitals, results were similar but even more robust (adjusted IRR 0.95 per month, 95% CI 0.93-0.97,  $p<0.0001$ ).

**Citations for 1b.1:**

1. Salanitro AH, Kripalani S, Resnic J, et al. Rationale and design of the Multicenter Medication Reconciliation Quality Improvement Study (MARQUIS). BMC health services research. 2013;13:230.
2. Mueller SK, Sponsler KC, Kripalani S, Schnipper JL. Hospital-Based Medication Reconciliation Practices: A Systematic Review. Hospital-Based Medication Reconciliation Practices. Arch Intern Med. Jun 25 2012;1-13.
3. Schnipper JL, Mixon AS, Stein J, Wetterneck TB, Kaboli P, Mueller S, Labonville S, Minahan JA, Burdick E, Orav EJ, Goldstein J, Nolido NV, Kripalani S. The effects of a multi-faceted medication reconciliation quality improvement intervention on patient

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safety: final results of the MARQUIS study. BMJ Qual Saf 2018; 27(12):954-964.

4. Schnipper JL, Reyes Nieva H, Mallouk M, et al. Effects of a refined evidence-based toolkit on medication reconciliation quality and safety at multiple hospitals: results of the MARQUIS2 study. Plenary, Society of Hospital Medicine Annual Meeting, National Harbor, MD.

**S.4. Numerator Statement:** For each sampled inpatient in the denominator, the total number of unintentional medication discrepancies in admission orders plus the total number of unintentional medication discrepancies in discharge orders.

**S.6. Denominator Statement:** The patient denominator is the sum of the number of medications in the gold standard medication lists plus the number of unintentionally ordered additional medications in a random sample of all adults admitted to the hospital. Our recommendation is that 25 patients are sampled per month, or approximately 1 patient per weekday.

So, for example, if among those 25 patients, there are 110 gold standard medications and 40 unintentionally ordered additional medications, and 75 unintentional discrepancies are identified, the measure outcome would be  $75/150 = 0.5$  discrepancies per medication per patient for that hospital for that month.

**S.8. Denominator Exclusions:** Patients that are discharged or expire before a gold standard medication list can be obtained.

**De.1. Measure Type:** Outcome

**S.17. Data Source:** Electronic Health Data, Electronic Health Records, Instrument-Based Data, Other, Paper Medical Records

**S.20. Level of Analysis:** Facility

**IF Endorsement Maintenance – Original Endorsement Date:** Sep 09, 2014 **Most Recent Endorsement Date:** Jul 31, 2020

**IF this measure is included in a composite, NQF Composite#/title:**

**IF this measure is paired/grouped, NQF#/title:**

**De.4. IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results?** N/A

## 1. Evidence, Performance Gap, Priority – Importance to Measure and Report

Extent to which the specific measure focus is evidence-based, important to making significant gains in healthcare quality, and improving health outcomes for a specific high-priority (high-impact) aspect of healthcare where there is variation in or overall less-than-optimal performance. **Measures must be judged to meet all sub criteria to pass this criterion and be evaluated against the remaining criteria.**

### 1a. Evidence to Support the Measure Focus – See attached Evidence Submission Form

[NQF\\_Evidence\\_Form\\_Attachment\\_092017\\_Updated\\_and\\_Submitted\\_SHM.docx](#)

#### 1a.1 For Maintenance of Endorsement: Is there new evidence about the measure since the last update/submission?

Do not remove any existing information. If there have been any changes to evidence, the Committee will consider the new evidence. Please use the most current version of the evidence attachment (v7.1). Please use red font to indicate updated evidence.

Yes

### 1b. Performance Gap

Demonstration of quality problems and opportunity for improvement, i.e., data demonstrating:

- considerable variation, or overall less-than-optimal performance, in the quality of care across providers; and/or
- Disparities in care across population groups.

**1b.1. Briefly explain the rationale for this measure (e.g., how the measure will improve the quality of care, the benefits or improvements in quality envisioned by use of this measure)**

*If a COMPOSITE (e.g., combination of component measure scores, all-or-none, any-or-none), SKIP this question and answer the composite questions.*

This measure will drive hospitals to implement interventions to truly improve their medication reconciliation processes. To date, Joint Commission requirements for medication reconciliation have led mostly to pro forma compliance, for example, checking a box saying that medication reconciliation has been performed, without knowing whether clinical care has been affected. By directly measuring error rates in medication orders, this new measure will enable hospitals to better understand where their errors are

occurring and the types of errors that exist. This will enable them to implement targeted interventions that actually reduce error rates. The result will be true improvements in medication safety during transitions in care.

The rate of unintentional discrepancies per patient is unacceptably high in this country, and there is variation by site. In the six sites studied using the proposed methodology, the range was 2.78 to 4.57 discrepancies per patient (average of 3.44 per patient), thus making medication reconciliation errors the single biggest source of medication errors in the hospital (i.e., as opposed to errors in prescribing, transcribing, or administration).

Studies of medication reconciliation interventions demonstrate that improvements in important outcomes are indeed possible. In a recent systematic review conducted by our group (2), we identified 26 studies. Studies consistently demonstrated a reduction in medication discrepancies (17/17 studies), potential adverse drug events (5/6), and adverse drug events (2/2), and 2/8 studies showed a reduction in health care utilization. In the first Multi-center Medication Reconciliation Quality Improvement Study, involving 1648 patients across 5 hospitals, evidence-based interventions to improve medication reconciliation resulted in a reduction in medication discrepancies by 8% per month over baseline temporal trends (adjusted incident rate ratio 0.92, 95% CI 0.87-0.97,  $p=0.002$ ), using the NQF proposed metric and methodology (technically, the measure was discrepancies per patient, using the number of medications as a model offset in the Poisson regression, which essentially is the same as discrepancies per medication per patient). In the recently completed MARQUIS2 study, involving 4947 patients across 17 hospitals, results were similar but even more robust (adjusted IRR 0.95 per month, 95% CI 0.93-0.97,  $p<0.0001$ ).

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2. Mueller SK, Sponsler KC, Kripalani S, Schnipper JL. Hospital-Based Medication Reconciliation Practices: A Systematic Review. Hospital-Based Medication Reconciliation Practices. Arch Intern Med. Jun 25 2012;172(12):1-13.
3. Schnipper JL, Mixon AS, Stein J, Wetterneck TB, Kaboli P, Mueller S, Labonville S, Minahan JA, Burdick E, Orav EJ, Goldstein J, Nolido NV, Kripalani S. The effects of a multi-faceted medication reconciliation quality improvement intervention on patient safety: final results of the MARQUIS study. BMJ Qual Saf 2018; 27(12):954-964.
4. Schnipper JL, Reyes Nieva H, Mallouk M, et al. Effects of a refined evidence-based toolkit on medication reconciliation quality and safety at multiple hospitals: results of the MARQUIS2 study. Plenary, Society of Hospital Medicine Annual Meeting, National Harbor, MD.

**1b.2. Provide performance scores on the measure as specified (current and over time) at the specified level of analysis.** *(This is required for maintenance of endorsement. Include mean, std dev, min, max, interquartile range, scores by decile. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities include.) This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*

The Leapfrog group has the largest database on the performance of our measure, using it at hundreds of sites. Here are the results from the 1427 sites that chose to report data this past year:

Mean (SD): 0.18 (0.17)

Median (IQR): 0.14 (0.06, 0.25)

Mix-Max: 0-1.24

Deciles: 0.02, 0.05, 0.07, 0.10, 0.14, 0.18, 0.22, 0.28, 0.38, 1.24

**1b.3. If no or limited performance data on the measure as specified is reported in 1b2, then provide a summary of data from the literature that indicates opportunity for improvement or overall less than optimal performance on the specific focus of measurement.**

In MARQUIS2, involving 17 sites, the number of discrepancies per medication per patient ranged from 0.04 to 0.36. To put this into perspective, the maximum number of discrepancies per medication per patient is 2 (an error on admission and an error on discharge for each medication). A discrepancy rate of 0.36 therefore correlates with an 18% error rate (almost one fifth of all the errors that could be made due to the medication reconciliation process were made). Another way to state this is that if the average patient is on 10 medications (which is typical in these studies), there would be 3-4 errors in medication errors per patient. Previous studies, which were smaller, provide consistent results. Moreover, studies of interventions show improvements in discrepancy rates with medication reconciliation interventions, generally in the 42-59% range. These data clearly demonstrate opportunity for improvement in this measure.

Mueller SK, Sponsler KC, Kripalani S, Schnipper JL. Hospital-Based Medication Reconciliation Practices: A Systematic Review. Arch Intern Med. Jun 25 2012;172:1-13.

**1b.4. Provide disparities data from the measure as specified (current and over time) by population group, e.g., by race/ethnicity, gender, age, insurance status, socioeconomic status, and/or disability.** *(This is required for maintenance of endorsement. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included.) For measures that show high levels of performance, i.e., “topped out”, disparities data may demonstrate an opportunity for improvement/gap in care for certain sub-populations. This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*

Perhaps paradoxically, patients over age 85 have fewer medication discrepancies, perhaps because providers are more careful with polypharmacy in these patients and pay more attention to their medication regimens. Not surprisingly, low health literacy in general, low educational attainment, and specifically poor patient understanding of their medications (dose, frequency, indication) is a major risk factor for discrepancies. Health literacy tracks with socioeconomic status. Medicaid insurance is a known risk factor for post-discharge medication non-adherence but is not as established risk factor for inpatient medication discrepancies. There is no known correlation with patient sex or race/ethnicity. The biggest risk factors have more to do with system factors and the complexity of the medication regimen rather than patient demographics.

See attached article for details:

Pippins JR, Gandhi TK, Hamann C, Ndumele CD, Labonville SA, Diedrichsen EK, Carty MG, Karson AS, Bhan I, Coley CM, Liang CL, Turchin A, McCarthy PC, Schnipper JL. Classifying and predicting errors of inpatient medication reconciliation. J Gen Intern Med. 2008;23(9):1414-1422. PMID: 18563493.

**1b.5. If no or limited data on disparities from the measure as specified is reported in 1b.4, then provide a summary of data from the literature that addresses disparities in care on the specific focus of measurement. Include citations. Not necessary if performance data provided in 1b.4**

There are no known disparities by race, ethnicity or gender that have been reported in the literature in relation to medication reconciliation. Several studies have shown that the main predictors of discrepancies are older age and number of medications.(1-5) However, at least some evidence suggests that the very old (over 85) may actually have a lower risk of potentially harmful medication discrepancies.(2) Other risk factors for discrepancies may include low patient understanding of their medications, while having a recent medication list in the electronic medication record has been shown to be protective.(4)

Citations for 1b.5.

1. Climente-Marti M, Garcia-Manon ER, Artero-Mora A, Jimenez-Torres NV. Potential risk of medication discrepancies and reconciliation errors at admission and discharge from an inpatient medical service. Ann Pharmacother. 2010;44(11):1747-1754.
2. Pippins JR, Gandhi TK, Hamann C, et al. Classifying and predicting errors of inpatient medication reconciliation. J Gen Intern Med. 2008;23(9):1414-1422.
3. Gleason KM, McDaniel MR, Feinglass J, et al. Results of the Medications At Transitions and Clinical Handoffs (MATCH) Study: An Analysis of Medication Reconciliation Errors and Risk Factors at Hospital Admission. J Gen Intern Med. 2010.
4. Salanitro AH, Osborn CY, Schnipper JL, et al. Effect of patient- and medication-related factors on inpatient medication reconciliation errors. J Gen Intern Med. 2012; 27(8):924-932.
5. Unroe KT, Pfeifferberger T, Riegelhaupt S, Jastrzembski J, Lohnygina Y, Colon-Emeric C. Inpatient medication reconciliation at admission and discharge: A retrospective cohort study of age and other risk factors for medication discrepancies. Am J Geriatr Pharmacother. 2010;8(2):115-126.

## 2. Reliability and Validity—Scientific Acceptability of Measure Properties

Extent to which the measure, as specified, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. **Measures must be judged to meet the sub criteria for both reliability and validity to pass this criterion and be evaluated against the remaining criteria.**

**2a.1. Specifications** The measure is well defined and precisely specified so it can be implemented consistently within and across organizations and allows for comparability. eMeasures should be specified in the Health Quality Measures Format (HQMF) and the

Quality Data Model (QDM).
<p><b>De.5. Subject/Topic Area</b> (check all the areas that apply):</p> <p><b>De.6. Non-Condition Specific</b>(check all the areas that apply):  <a href="#">Care Coordination, Person-and Family-Centered Care, Safety : Medication</a></p> <p><b>De.7. Target Population Category</b> (Check all the populations for which the measure is specified and tested if any):  <a href="#">Elderly</a></p>
<p><b>S.1. Measure-specific Web Page</b> (Provide a URL link to a web page specific for this measure that contains current detailed specifications including code lists, risk model details, and supplemental materials. Do not enter a URL linking to a home page or to general information.)  <a href="#">We are in the process of developing a webpage.</a></p> <p><b>S.2a. If this is an eMeasure</b>, HQMF specifications must be attached. Attach the zipped output from the eMeasure authoring tool (MAT) - if the MAT was not used, contact staff. (Use the specification fields in this online form for the plain-language description of the specifications)  <a href="#">This is not an eMeasure Attachment:</a></p> <p><b>S.2b. Data Dictionary, Code Table, or Value Sets</b> (and risk model codes and coefficients when applicable) must be attached. (Excel or csv file in the suggested format preferred - if not, contact staff)  <a href="#">Attachment Attachment: MedRec_Workbook_Leapfrog_2017_Final_NQF.xlsx</a></p> <p><b>S.2c.</b> Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.  <b>Attachment:</b></p> <p><b>S.2d.</b> Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.</p> <p><b>S.3.1. For maintenance of endorsement:</b> Are there changes to the specifications since the last updates/submission. If yes, update the specifications for S1-2 and S4-22 and explain reasons for the changes in S3.2.  <a href="#">Yes</a></p> <p><b>S.3.2. For maintenance of endorsement</b>, please briefly describe any important changes to the measure specifications since last measure update and explain the reasons.  <a href="#">The number of discrepancies is now divided by the number of medications to more accurately account for the fact that discrepancies (errors) are dependent on the number of opportunities for error. For each gold standard medication or unintentionally ordered additional medication, it can be ordered incorrectly ordered at admission, at discharge, both, or neither. Therefore, the number of discrepancies per medication per patient can range from zero to two. This more fairly judges hospitals because patient populations may vary with respect to the complexity of their medication regimens. We attempted to address concerns regarding how to reconcile the measure for patients with numerous medications versus patients with a lower number of medications in part by modifying the metric so that it is now discrepancies per medication per patient.</a></p> <p><b>S.4. Numerator Statement</b> (Brief, narrative description of the measure focus or what is being measured about the target population, i.e., cases from the target population with the target process, condition, event, or outcome) DO NOT include the rationale for the measure.  <a href="#">IF an OUTCOME MEASURE, state the outcome being measured. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).</a>  <a href="#">For each sampled inpatient in the denominator, the total number of unintentional medication discrepancies in admission orders plus the total number of unintentional medication discrepancies in discharge orders.</a></p>

**S.5. Numerator Details** (All information required to identify and calculate the cases from the target population with the target process, condition, event, or outcome such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)

IF an OUTCOME MEASURE, describe how the observed outcome is identified/counted. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).

First, a “gold-standard” preadmission medication history is taken by one or more trained pharmacists at each site. Every site can have a trained pharmacist. We have stopped calling them study pharmacists, just trained pharmacists. Pharmacist training materials have been developed to support pharmacists (please see training materials in attachment), which specifically reviews how to take a gold standard medication history, including compliance with a best practices checklist (see attached materials). The pharmacist utilizes all available sources of information to take the medication history, including subject and family/caregiver interviews, prescription pill bottles, outpatient electronic medical records, community pharmacy data, and prescription fill information (see Appendix A for complete protocol). The gold-standard medication history is taken within 24 hours of admission but after the medication history has been taken as part of usual care.

The resulting preadmission medication list is then compared with the medical team’s documented preadmission medication list and with all admission and discharge medication orders. Any discrepancies between the gold-standard history and medication orders are identified and reasons for these changes sought from the medical record. Pharmacists may also need to communicate directly with the medical team to clarify reasons for discrepancies, as needed. Medication discrepancies that are not clearly intentional are then recorded, along with the reason for the discrepancy:

1. History discrepancies: the order is incorrect because the medical team’s preadmission medication list is incorrect (e.g., the team did not know the patient was taking aspirin prior to admission, does not record it in the preadmission medication list, and therefore does not order it at admission)
2. Reconciliation discrepancies: the medical team’s preadmission medication list is correct, but there is still an error in the orders. For example, the team knew the patient was taking aspirin prior to admission and documents it in the preadmission medication list. The team decides to hold the aspirin on admission for a clinical reason such as bleeding, but the team forgets to restart the aspirin at discharge. The admission discrepancy would be considered intentional (no error, not counted in the numerator), but the discharge discrepancy would be counted as a reconciliation error.

The type of error should also be recorded: omission, discrepancy in dose, route, frequency, or formulation, or an additional medication. Lastly, the time of the error should be recorded: admission vs. discharge.

See attached materials for a flow diagram explaining how history discrepancies, reconciliation discrepancies (PowerPoint slides), intentional and unintentional discrepancies are defined and operationalized.

**S.6. Denominator Statement** (Brief, narrative description of the target population being measured)

The patient denominator is the sum of the number of medications in the gold standard medication lists plus the number of unintentionally ordered additional medications in a random sample of all adults admitted to the hospital. Our recommendation is that 25 patients are sampled per month, or approximately 1 patient per weekday.

So, for example, if among those 25 patients, there are 110 gold standard medications and 40 unintentionally ordered additional medications, and 75 unintentional discrepancies are identified, the measure outcome would be  $75/150 = 0.5$  discrepancies per medication per patient for that hospital for that month.

**S.7. Denominator Details** (All information required to identify and calculate the target population/denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)

IF an OUTCOME MEASURE, describe how the target population is identified. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).

Patients are randomly selected each day from a list of admitted patients the day before. A target number of patients are selected (e.g. one patient per weekday) and these patients are interviewed by the pharmacist.

**S.8. Denominator Exclusions** (Brief narrative description of exclusions from the target population)



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Patients that are discharged or expire before a gold standard medication list can be obtained.

**S.9. Denominator Exclusion Details** (All information required to identify and calculate exclusions from the denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)

Please see exclusion listed above.

**S.10. Stratification Information** (Provide all information required to stratify the measure results, if necessary, including the stratification variables, definitions, specific data collection items/responses, code/value sets, and the risk-model covariates and coefficients for the clinically-adjusted version of the measure when appropriate – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format with at S.2b.)

Stratification could be done by service if desired by NQF, for example: non-ICU medicine, non-ICU surgery, ICU, and other.

**S.11. Risk Adjustment Type** (Select type. Provide specifications for risk stratification in measure testing attachment)

No risk adjustment or risk stratification

If other:

**S.12. Type of score:**

Continuous variable, e.g. average

If other:

**S.13. Interpretation of Score** (Classifies interpretation of score according to whether better quality is associated with a higher score, a lower score, a score falling within a defined interval, or a passing score)

Better quality = Lower score

**S.14. Calculation Algorithm/Measure Logic** (Diagram or describe the calculation of the measure score as an ordered sequence of steps including identifying the target population; exclusions; cases meeting the target process, condition, event, or outcome; time period for data, aggregating data; risk adjustment; etc.)

See Appendix Attached (2019 Leapfrog Hospital Town Hall Call-Medication Discrepancies for NQF-Final (PowerPoint Presentation))

**S.15. Sampling** (If measure is based on a sample, provide instructions for obtaining the sample and guidance on minimum sample size.)

IF an instrument-based performance measure (e.g., PRO-PM), identify whether (and how) proxy responses are allowed.

For statistical process control charts, the recommended minimal sample size is 20 data points per time period (in this case, 20 patients per month). Beyond that, depending on several factors, additional data does not have a large impact on the SPC limits.

<https://www.spcforexcel.com/knowledge/control-chart-basics/how-much-data-do-i-need-calculate-control-limits>

IF an instrument-based performance measure (e.g., PRO-PM), identify whether (and how) proxy responses are allowed.

To minimize sampling bias, we used a method whereby the list of admitted patients from the day prior are randomized in the order in which they are approached (see attached workbook, tabs for Instructions and Sampling). Once approached, the goal is for the pharmacist to take a gold-standard medication history before the patient is discharged from the hospital unless the patient declines. This may require multiple attempts (e.g., because the patient is off the floor at a procedure or test or wants the pharmacist to return at another time). By approaching patients on the first full day after admission, this method also minimizes bias by length of stay. As noted above (2b2.2.), patients who were measured were generally older, with longer lengths of stay, and on more medications, but these differences would likely be less in a non-research setting. We know of no better way to minimize selection bias for this metric.

Once selected for measurement, there should be no missing data, as all data collection is inherent to the process of taking a gold-standard medication history and comparing it to medication orders, which should always be accessible, and reviewing the medical record to determine whether discrepancies were unintentional, which should also always be available.

While the proportion of patients excluded from the measure might vary by site (e.g., due to differences in length of stay or intensity of procedures), the populations of those included in each site should be more comparable to each other. In addition, for this measure, the more important factor is the stability of a patient population within a site over time (See notes above about tracking

improvements over time, S.11).

**S.16. Survey/Patient-reported data** (If measure is based on a survey or instrument, provide instructions for data collection and guidance on minimum response rate.)

Specify calculation of response rates to be reported with performance measure results.

N/A

**S.17. Data Source** (Check ONLY the sources for which the measure is SPECIFIED AND TESTED).

If other, please describe in S.18.

Electronic Health Data, Electronic Health Records, Instrument-Based Data, Other, Paper Medical Records

**S.18. Data Source or Collection Instrument** (Identify the specific data source/data collection instrument (e.g. name of database, clinical registry, collection instrument, etc., and describe how data are collected.)

IF instrument-based, identify the specific instrument(s) and standard methods, modes, and languages of administration.

Please see Med Rec Leapfrog Workbook Excel Attachment.

**S.19. Data Source or Collection Instrument** (available at measure-specific Web page URL identified in S.1 OR in attached appendix at A.1)

Available in attached appendix at A.1

**S.20. Level of Analysis** (Check ONLY the levels of analysis for which the measure is SPECIFIED AND TESTED)

Facility

**S.21. Care Setting** (Check ONLY the settings for which the measure is SPECIFIED AND TESTED)

Inpatient/Hospital

If other:

**S.22. COMPOSITE Performance Measure** - Additional Specifications (Use this section as needed for aggregation and weighting rules, or calculation of individual performance measures if not individually endorsed.)

## 2. Validity – See attached Measure Testing Submission Form

nqf\_testing\_attachment\_7\_27\_2018\_Final\_Submitted\_revised\_08012019\_Final\_Resubmitted\_112019.docx

### 2.1 For maintenance of endorsement

Reliability testing: If testing of reliability of the measure score was not presented in prior submission(s), has reliability testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.

Yes

### 2.2 For maintenance of endorsement

Has additional empirical validity testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.

No

### 2.3 For maintenance of endorsement

Risk adjustment: For outcome, resource use, cost, and some process measures, risk-adjustment that includes social risk factors is not prohibited at present. Please update sections 1.8, 2a2, 2b1,2b4.3 and 2b5 in the Testing attachment and S.140 and S.11 in the online submission form. NOTE: These sections must be updated even if social risk factors are not included in the risk-adjustment strategy. You MUST use the most current version of the Testing Attachment (v7.1) -- older versions of the form will not have all required questions.

Yes - Updated information is included



### 3. Feasibility

Extent to which the specifications including measure logic, require data that are readily available or could be captured without undue burden and can be implemented for performance measurement.

#### 3a. Byproduct of Care Processes

For clinical measures, the required data elements are routinely generated and used during care delivery (e.g., blood pressure, lab test, diagnosis, medication order).

##### 3a.1. Data Elements Generated as Byproduct of Care Processes.

Generated or collected by and used by healthcare personnel during the provision of care (e.g., blood pressure, lab value, diagnosis, depression score)

If other:

#### 3b. Electronic Sources

The required data elements are available in electronic health records or other electronic sources. If the required data are not in electronic health records or existing electronic sources, a credible, near-term path to electronic collection is specified.

**3b.1. To what extent are the specified data elements available electronically in defined fields (i.e., data elements that are needed to compute the performance measure score are in defined, computer-readable fields)** Update this field for **maintenance of endorsement**.

Some data elements are in defined fields in electronic sources

**3b.2. If ALL the data elements needed to compute the performance measure score are not from electronic sources, specify a credible, near-term path to electronic capture, OR provide a rationale for using other than electronic sources.** For **maintenance of endorsement**, if this measure is not an eMeasure (eCQM), please describe any efforts to develop an eMeasure (eCQM).

Data elements are in defined fields.

**3b.3. If this is an eMeasure, provide a summary of the feasibility assessment in an attached file or make available at a measure-specific URL. Please also complete and attach the NQF Feasibility Score Card.**

Attachment:

#### 3c. Data Collection Strategy

Demonstration that the data collection strategy (e.g., source, timing, frequency, sampling, patient confidentiality, costs associated with fees/licensing of proprietary measures) can be implemented (e.g., already in operational use, or testing demonstrates that it is ready to put into operational use). For eMeasures, a feasibility assessment addresses the data elements and measure logic and demonstrates the eMeasure can be implemented or feasibility concerns can be adequately addressed.

**3c.1. Required for maintenance of endorsement.** Describe difficulties (as a result of testing and/or operational use of the measure) regarding data collection, availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, time and cost of data collection, other feasibility/implementation issues.

**IF instrument-based**, consider implications for both individuals providing data (patients, service recipients, respondents) and those whose performance is being measured.

1. When some sites started to use "intervention pharmacists" separate from "study pharmacists," sites needed to make sure that the measurement process interfered as little as possible with the intervention (e.g., by approaching patients later, not providing intervention pharmacists with information, etc.)
2. Some sites needed to work on logistics so that under most circumstances, evaluation was done after discharge orders were written but either before or not much after patient discharge. This improved access to discharge orders and the ability to contact providers in case serious errors were identified that needed to be corrected.
3. Sites have found it easier to build this evaluation into the daily work of a pharmacist. That way, if a patient is unavailable, the pharmacist can continue with their other clinical responsibilities.
4. There are efficiencies to having the same pharmacist perform admission and discharge comparisons on the same patient and do them at the same time. However, if preferable logistically, this could be a separate person from the pharmacist who collects the gold standard medication history.
5. This process takes about an hour per patient, but can take more or less depending on the patient.

6. The main barrier to data collection has been the availability of a trained pharmacist at each site. If this measure were to be endorsed by NQF, then this resource would be required for each hospital, and this problem would be solved, much in the same way that all hospitals hire study nurses to collect data for NSQIP. This has already happened at Leapfrog sites.

**3c.2. Describe any fees, licensing, or other requirements to use any aspect of the measure as specified (e.g., value/code set, risk model, programming code, algorithm).**

There are no fees, licensing, or other requirements to use the measure as specified. If sites measure through the Leapfrog group, there are fees associated with being a member site. There are also fees associated with the MARQUIS Collaborative, which is sponsored by the Society of Hospital Medicine. Both of these can facilitate measurement and benchmark results, but neither of them are required to conduct measurement. The SHM MARQUIS web page has all the materials needed for measurement, and they can be downloaded for free.

## 4. Usability and Use

Extent to which potential audiences (e.g., consumers, purchasers, providers, policy makers) are using or could use performance results for both accountability and performance improvement to achieve the goal of high-quality, efficient healthcare for individuals or populations.

### 4a. Accountability and Transparency

Performance results are used in at least one accountability application within three years after initial endorsement and are publicly reported within six years after initial endorsement (or the data on performance results are available). If not in use at the time of initial endorsement, then a credible plan for implementation within the specified timeframes is provided.

#### 4.1. Current and Planned Use

NQF-endorsed measures are expected to be used in at least one accountability application within 3 years and publicly reported within 6 years of initial endorsement in addition to performance improvement.

Specific Plan for Use	Current Use (for current use provide URL)

#### 4a1.1 For each CURRENT use, checked above (update for maintenance of endorsement), provide:

- Name of program and sponsor
- Purpose
- Geographic area and number and percentage of accountable entities and patients included
- Level of measurement and setting

The Leapfrog Group currently measures discrepancy rates (as defined in this application) in 1427 sites. Currently, the scale is only 20 patients per quarter to keep the burden low on entities, but it might be increased in the future. The results are not being publicly reported, but sites are given their own results with comparison to national averages for similar hospital types (e.g., large teaching hospitals). The goal is to drive internal improvement efforts and reductions in discrepancy rates within sites. In the future, accountability might require either a certain degree of improvement in discrepancy rates over time or achievement of a certain absolute level of discrepancies per medication per patient.

**4a1.2. If not currently publicly reported OR used in at least one other accountability application (e.g., payment program, certification, licensing) what are the reasons? (e.g., Do policies or actions of the developer/steward or accountable entities restrict access to performance results or impede implementation?)**

N/A

**4a1.3. If not currently publicly reported OR used in at least one other accountability application, provide a credible plan for implementation within the expected timeframes -- any accountability application within 3 years and publicly reported within 6 years of initial endorsement. (Credible plan includes the specific program, purpose, intended audience, and timeline for implementing the measure within the specified timeframes. A plan for accountability applications addresses mechanisms for data aggregation and reporting.)**

N/A

**4a2.1.1. Describe how performance results, data, and assistance with interpretation have been provided to those being measured or other users during development or implementation.**

**How many and which types of measured entities and/or others were included? If only a sample of measured entities were included, describe the full population and how the sample was selected.**

The Leapfrog Group currently provides guidance for data collection and tracks results for each member site. While sites can be benchmarked against other sites, the main focus of interpretation is to help sites improve their own discrepancy rates over time as they engage in efforts to improve their processes, rather than compare sites against each other. As noted above, currently 1427 sites are included in this measure through Leapfrog.

MARQUIS2 involved 18 sites. We trained each site on data collection and provided data on this measure every month as part of mentored implementation. The MARQUIS Collaborative is currently enrolling sites.

**4a2.1.2. Describe the process(es) involved, including when/how often results were provided, what data were provided, what educational/explanatory efforts were made, etc.**

Leapfrog provides results quarterly along with an explanatory guide to results.

MARQUIS2 provided results monthly via phone calls with mentors, including discrepancy rates by month and the differences in discrepancy rates between those patients who did and did not receive patient-level interventions. The MARQUIS Collaborative emails results each month and holds monthly virtual "office hours" to help interpret results.

**4a2.2.1. Summarize the feedback on measure performance and implementation from the measured entities and others described in 4d.1.**

**Describe how feedback was obtained.**

Feedback from Leapfrog sites is obtained directly from member sites in 3 ways:

1. Formal 30 day public comment period each November
2. Help desk
3. Key informant interviews

**4a2.2.2. Summarize the feedback obtained from those being measured.**

1. Confusion about the need to have a second medication history taken in order to obtain a gold standard.
2. Questions about the timing of "admission orders" (how long after admission, etc.)
3. Questions about the difference between number of additionally ordered medications and the number of discrepancies (i.e., in orders) due to these medications.
4. Questions about auto-checking in the Leapfrog Worksheet (i.e., what it means when a number turns red, indicating a mistake in the entered data)

**4a2.2.3. Summarize the feedback obtained from other users**

We developed an FAQ document (attached) and created a second webinar to Leapfrog member sites (attached) to help answer these questions. The measure was not changed, only the education about implementing it.

**4a2.3. Describe how the feedback described in 4a2.2.1 has been considered when developing or revising the measure specifications or implementation, including whether the measure was modified and why or why not.**

#### **Improvement**

Progress toward achieving the goal of high-quality, efficient healthcare for individuals or populations is demonstrated. If not in use for performance improvement at the time of initial endorsement, then a credible rationale describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.

**4b1. Refer to data provided in 1b but do not repeat here. Discuss any progress on improvement (trends in performance results, number and percentage of people receiving high-quality healthcare; Geographic area and number and percentage of accountable entities and patients included.)**

**If no improvement was demonstrated, what are the reasons? If not in use for performance improvement at the time of initial endorsement, provide a credible rationale that describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.**

As noted above, improvement has clearly been demonstrated in the MARQUIS1 and MARQUIS2 studies, using monthly feedback of discrepancy rates (and lower discrepancy rates in patients who receive interventions compared to those who don't) to iteratively refine interventions and demonstrate improvement to stakeholders, leading to further spread and sustainability efforts. It is our hope that the involvement of over 1400 sites in Leapfrog's measurement program will similarly drive improvement efforts nationally.

Additionally, through the MARQUIS Collaborative, we plan to work closely with several dozen entities to drive improvement efforts, using discrepancy rates to inform refinements to improvements. This will be less intensive but more scalable than the MARQUIS studies.

#### **4b2. Unintended Consequences**

The benefits of the performance measure in facilitating progress toward achieving high-quality, efficient healthcare for individuals or populations outweigh evidence of unintended negative consequences to individuals or populations (if such evidence exists).

**4b2.1. Please explain any unexpected findings (positive or negative) during implementation of this measure including unintended impacts on patients.**

None

**4b2.2. Please explain any unexpected benefits from implementation of this measure.**

None

### **5. Comparison to Related or Competing Measures**

If a measure meets the above criteria and there are endorsed or new related measures (either the same measure focus or the same target population) or competing measures (both the same measure focus and the same target population), the measures are compared to address harmonization and/or selection of the best measure.

#### **5. Relation to Other NQF-endorsed Measures**

Are there related measures (conceptually, either same measure focus or target population) or competing measures (conceptually both the same measure focus and same target population)? If yes, list the NQF # and title of all related and/or competing measures.

No

**5.1a. List of related or competing measures (selected from NQF-endorsed measures)**

**5.1b. If related or competing measures are not NQF endorsed please indicate measure title and steward.**

#### **5a. Harmonization of Related Measures**

The measure specifications are harmonized with related measures;

**OR**

The differences in specifications are justified

**5a.1. If this measure conceptually addresses EITHER the same measure focus OR the same target population as NQF-endorsed measure(s):**

**Are the measure specifications harmonized to the extent possible?**

No

**5a.2. If the measure specifications are not completely harmonized, identify the differences, rationale, and impact on interpretability and data collection burden.**

The other measures focus on documentation of an action related to medication reconciliation or transmission of medication data

across care transitions. These are fundamentally different than measure 2456, which focuses on the results of these medication reconciliation efforts: having accurate medication orders. The fundamental problem with several of these other measures is that it is easy to “check a box” documenting that a medication reconciliation step has been completed, but it does not mean it has been completed well. In fact, there are times where these documentation efforts can be counter-productive. For example, documenting that a complete medication history has been taken, when in fact it could not be done well, could actually impede transparency among providers and efforts to fix that history the next day. Having said that, there is clearly a role for these types of measures. Further efforts are needed to harmonize these measures with each other to produce a set of complementary measures that together provide a picture of the quality of medication reconciliation. Dr. Schnipper would be happy to be involved in these efforts.

#### 5b. Competing Measures

The measure is superior to competing measures (e.g., is a more valid or efficient way to measure);

OR

Multiple measures are justified.

#### 5b.1. If this measure conceptually addresses both the same measure focus and the same target population as NQF-endorsed measure(s):

Describe why this measure is superior to competing measures (e.g., a more valid or efficient way to measure quality); OR provide a rationale for the additive value of endorsing an additional measure. (Provide analyses when possible.)

N/A

## Appendix

**A.1 Supplemental materials may be provided in an appendix.** All supplemental materials (such as data collection instrument or methodology reports) should be organized in one file with a table of contents or bookmarks. If material pertains to a specific submission form number, that should be indicated. Requested information should be provided in the submission form and required attachments. There is no guarantee that supplemental materials will be reviewed.

**Attachment** **Attachment:** [Measure\\_Maintenance\\_Attachments\\_082019\\_Resubmitted\\_112019.pdf](#)

## Contact Information

**Co.1 Measure Steward (Intellectual Property Owner):** Brigham and Women’s Hospital

**Co.2 Point of Contact:** Jeffrey, Schnipper, [jschnipper@partners.org](mailto:jschnipper@partners.org), 617-732-6201-

**Co.3 Measure Developer if different from Measure Steward:** Veterans Rural Health Resource Center-Central Region, VA Office of Rural Health

**Co.4 Point of Contact:** Peter, Kaboli, [peter.kaboli@va.gov](mailto:peter.kaboli@va.gov), 319-338-0581-7716

## Additional Information

### Ad.1 Workgroup/Expert Panel involved in measure development

**Provide a list of sponsoring organizations and workgroup/panel members’ names and organizations. Describe the members’ role in measure development.**

- Jeffrey L. Schnipper, MD, MPH, FHM, Director of Clinical Research, BWH Hospitalist Service, Associate Physician, Division of General Medicine, Brigham and Women’s Hospital, Associate Professor of Medicine, Harvard Medical School, Boston, MA. MARQUIS Principal Investigator

Primary developer of the measure, used in several studies he has conducted

- Peter Kaboli, MD, FHM, Director, Midwest Rural Health Resource Center, VA Office of Rural Health, Iowa City VA Medical Center, Iowa City, IA. MARQUIS Co-Investigator

Expert on inpatient medication safety and roles of pharmacists. Developer of the measure with Dr. Schnipper

- Stephanie Mueller, MD, General Medicine Fellow, Division of General Medicine, Brigham and Women’s Hospital, Boston, MA. MARQUIS Co-Investigator

Led systematic review of medication reconciliation interventions

- Stephanie Labonville, Pharm D. Pharmacy Services, Brigham and Women’s Hospital, Boston, MA. MARQUIS Study Pharmacist

Has led implementation of measurement protocol and on-site training and evaluation of study pharmacists for MARQUIS and previous studies using this protocol led by Dr. Schnipper.

#2456 Medication Reconciliation: Number of Unintentional Medication Discrepancies per Medication Per Patient, Last  
Updated: Jul 31, 2020

- JoAnne Resnic, MBA, BSN, RN, Former Senior Manager, Center for Hospital Innovation and Improvement, Society of Hospital Medicine, Philadelphia, PA. MARQUIS Project Manager  
Project Manager for initial NQF measure application
- Jenna Goldstein, MA, Directors, Center for Quality Improvement, Society of Hospital Medicine, Philadelphia, PA. MARQUIS Project Manager  
Project Manager for NQF care coordination re-submission
- Peter B. Angood, MD, FRCS(C), FACS, FCCM, Senior Advisor on Patient Safety, National Quality Forum, Washington, DC. MARQUIS Steering Committee Member  
Advisor to MARQUIS, especially regarding measure development

Other Advisors:

- Daniel Coughlin, PharmD, FAACT, DABAT, Vice President, ASHP Research and Education Foundation, Bethesda, MD. MARQUIS Steering Committee Member
- Jeff Greenwald, MD, SFHM, Inpatient Clinician Educator Service, Department of Medicine, Massachusetts General Hospital and Associate Professor of Medicine, Harvard Medical School, Co-Investigator Project RED and Project BOOST, Boston, MA. Chair, MARQUIS Steering Committee
- Sunil Kripalani, MD, MSc, SFHM, Associate Professor, Chief, Section of Hospital Medicine, Associate Director, Effective Health Communication Program, Emphasis Program Area Director, Healthcare and Public Health Research and Management, Vanderbilt University Medical Center, Nashville, TN. MARQUIS Co-Investigator
- Nyryan V. Nolido, MA, Research Project Manager, Brigham and Women's Hospital, Boston, MA. MARQUIS Data Project Manager
- Amanda Salanitro, MD, MPH, Instructor, Geriatric Research, Education and Clinical Center, Tennessee Valley VA Healthcare System and Section of Medicine at Vanderbilt University, Nashville, TN. MARQUIS Co-Investigator
- Mark Williams, MD, FACP, Professor of Medicine & Chief, Division of Hospital Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL. MARQUIS Steering Committee Member

**Measure Developer/Steward Updates and Ongoing Maintenance**

**Ad.2 Year the measure was first released:** 2012

**Ad.3 Month and Year of most recent revision:** 08, 2019

**Ad.4 What is your frequency for review/update of this measure?** The frequency of review is once every one to two years.

**Ad.5 When is the next scheduled review/update for this measure?** 11, 2019

**Ad.6 Copyright statement:**

**Ad.7 Disclaimers:**

**Ad.8 Additional Information/Comments:** Additional References

1. Greenwald JL, Halasyamani L, Greene J, et al. Making inpatient medication reconciliation patient centered, clinically relevant and implementable: a consensus statement on key principles and necessary first steps. J Hosp Med. 2010;5(8):477-485.