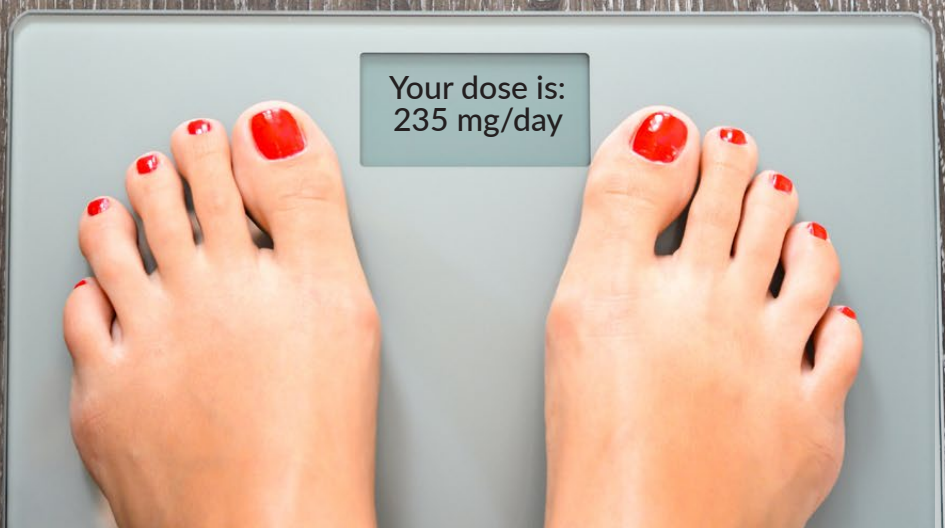
ACCURATE WEIGHT DOCUMENTATION: HOW TO ADHERE TO BEST PRACTICES

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Abstract

Background: The Institute for Safe Medication Practices (ISMP) has recommended that health systems implement preventive measures to decrease weight-based dosing errors.

Problem: Despite a process improvement project that was implemented to meet ISMP's goals, weight documentation discrepancies continue to occur.

Methods: The weight documentation process was reviewed and safety gaps were identified. Pharmacists were notified when patients had greater than 15% weight documentation discrepancy. Notifications were tracked before, during, and after process improvements within the electronic health record (EHR).

Interventions: Streamlining of weight documentation fields within nursing assessments, locking of bed scales, setting an expiration date for the weight documentation field, including a minimum and maximum on height and weight fields, real-time alert for nursing staff upon documentation, and staff education were part of the process improvement plan.

Results: Average monthly weight documentation errors decreased from 115 to 60 per month over the process improvement period.

Conclusion: Human factor errors can result in weight documentation discrepancies despite implementing ISMP's targeted safety goals around weight documentation. A real-time pharmacy notification of weight documentation discrepancies should be required for hospital pharmacists to prevent weight-based dosing errors.

A patient arrived for his dipyridamole stress test in the outpatient stress lab. He was relatively healthy but had recently experienced some chest pain. His last admission to the hospital was approximately five years before when he had pneumonia. The nurse entered a dipyridamole stress test order per medical staff–approved protocol in the electronic health record (EHR). The dipyridamole dose was entered as 0.57mg/kg IVPB x 1. The pharmacist verified the order with a calculated final dose of 32.5mg (0.57mg/kg x 57kg). The dipyridamole was infused without error; however, it was later realized that there was a dosing error. During disposal of the completed medication, the nurse noticed that the IV label listed the patient's weight as 57kg, which was less then what the nurse believed the patient weighed. Upon investigation, it was discovered that the patient's actual weight was 75kg. The weight of 57kg, which was documented in the EHR, was from the previous admission five years ago. This lack of an updated weight resulted in a suboptimal dose of dipyridamole, thus requiring the patient to schedule another dipyridamole stress test. This case example highlights the numerous system failures related to weight-based errors that are common to any healthcare organization. Weight documentation errors can result in medication errors. Health systems should be aware of current processes and have preventive measures in place.

From December 2008 to November 2015, the Patient Safety Authority (PSA) received 1,291 reports related to patient weight. Of these errors, almost 75% reached the patient.[1] An inaccurate weight in the EHR is a patient safety issue because of its effect on ensuring accurate medication dosing.

Several units of measure include weight as a basis for dosing medications, such as mg/kg, mcg/kg/min, mg/m^2, etc. An Institute for Safe Medication Practices (ISMP) best practice recommends that providers order medications in weight-based units and pharmacists review the weight-based units prior to dispensing for pediatrics, excepting topical agents.[2] High-alert medications, such as some forms of chemotherapy, are based on body surface area, which is calculated according to a patient's weight. The wrong weight can place the patient at a higher risk of side effects or poor outcomes due to an ineffective dose. Some cardiac medications are titrated to response and can be dosed based on the patient's weight (mcg/kg/min). The wrong weight can delay a patient's response or overshoot the target goal. Anticoagulants like heparin have a narrow therapeutic window to be effective. Heparin can be titrated by units/kg/hour until the activated partial thromboplastin time (aPTT) has reached the target range. If the target goal is exceeded for too long, this can place the patient at a higher risk of bleeding. When patients have declining or improving renal function, some medications need to be adjusted for this change. The Cockcroft-Gault equation is used to estimate a patient's creatinine clearance, which correlates to a patient's renal function. An accurate weight is needed for this calculation. Dosing adjustment errors can compound the differences in dosage.

In addition to prescribing errors, administration errors with the wrong weight can occur. When nurses are administering continuous weight-based IV drips, they enter the patient's weight into the IV pump, which controls the rate of infusion. If the nurse changes the weight in the infusion pump, there is a risk that the infusion rate will change, which can increase the risk of an adverse outcome. If patients are at goal and there is a signifi-

cant weight change, the IV drip rate needs to be back-calculated so the infusion rate stays the same but the units/kg/hour or mcg/kg/hour are dose-adjusted to the new corrected weight.

The PSA has identified multiple causes for weight documentation errors. Documenting a patient's weight in imperial units (pounds) can lead to dosing errors because weight-based medications use the metric system. This can occur if a patient verbally tells the provider their weight in pounds and the conversion is not calculated, or if the patient is weighed on a scale that displays pounds. Estimating a patient's weight due to lack of a scale or the patient being seriously ill is another source of error. An estimated weight can be significantly different from the patient's actual weight. This scenario can occur most often in the emergency department or critical care unit. Transposing numbers when documenting weight in the EHR may also lead to significant dosing errors.[1]

ISMP has listed weight documentation as a Targeted Best Medication Safety Practice for the past six years. They recommend that providers weigh patients during every encounter and avoid the use of a "patient's stated weight." They also discourage using a weight from a previous visit, since this could significantly differ from the patient's current weight. Some bed scales can display values in both pounds and kilograms (one after the other), which can be misread as the wrong value. ISMP recommends a hospitalwide assessment with each hospital's engineering department to determine whether scales can be locked in kilograms. The EHR, infusion pumps, and preprinted order forms should all use metric units for ordering, dispensing, and charting.[3] **Table 1** summarizes ISMP's recommendations for reducing weight documentation errors. Even though ISMP established weight documentation as a best practice goal in December 2013, hospitals still had low adoption rates of documenting weights in metric units (47% fully compliant) and weighing a patient with each admission (44% fully compliant) as of July 2017.[4]

At our institution, pharmacists provide daily assessments of anticoagulants and antibiotics. As unexpected labs resulted, they noticed an increase in weight documentation discrepancies. Due to these discrepancies, an internal department alert system for our pharmacists was created so they could be aware of weight documentation differences during order verification. The pharmacist received a notification if there was a weight discrepancy greater than 15% among any of the weight documentation fields. At the time, there was no literature supporting a specific weight documentation discrepancy that would require a pharmacist's intervention; thus, 15% was our starting point, and adjustment would be considered if we noticed any trends. This notification would enable the pharmacist to adopt a proactive approach to correcting any medication dosing errors. When a weight documentation discrepancy notification fired, the pharmacist would clarify the weight with the nurse, review the patient's medication list, calculate the patient's creatinine clearance for renally adjusted medications, and update the medication orders accordingly. Due to the large volume of notifications that were triggered for the pharmacists to evaluate and the amount of time to address these tasks, this issue was escalated to our medication safety team. In 2013, the pharmacists were evaluating over 100 weight documentation discrepancies per month, as illustrated in **Figure 1**.

Methods

A medication safety team mapped weight documentation workflows and completed a proactive safety assessment using ISMP's

Table 1: Summary of ISMP's Recommendations to Decrease Weight Documentation Errors[3] by Hazard



Scales

If scales can measure in both pounds and kilograms/grams, modify the scale to lock out the ability to weigh in pounds.

If purchasing or replacing scales, buy new scales that measure in, or can be locked to measure in, metric units only.



Unit Conversion

Have conversion charts that convert from kilograms (or grams for pediatrics) to pounds available near all scales, so that patients/guardians can be told the weight in pounds, if requested.

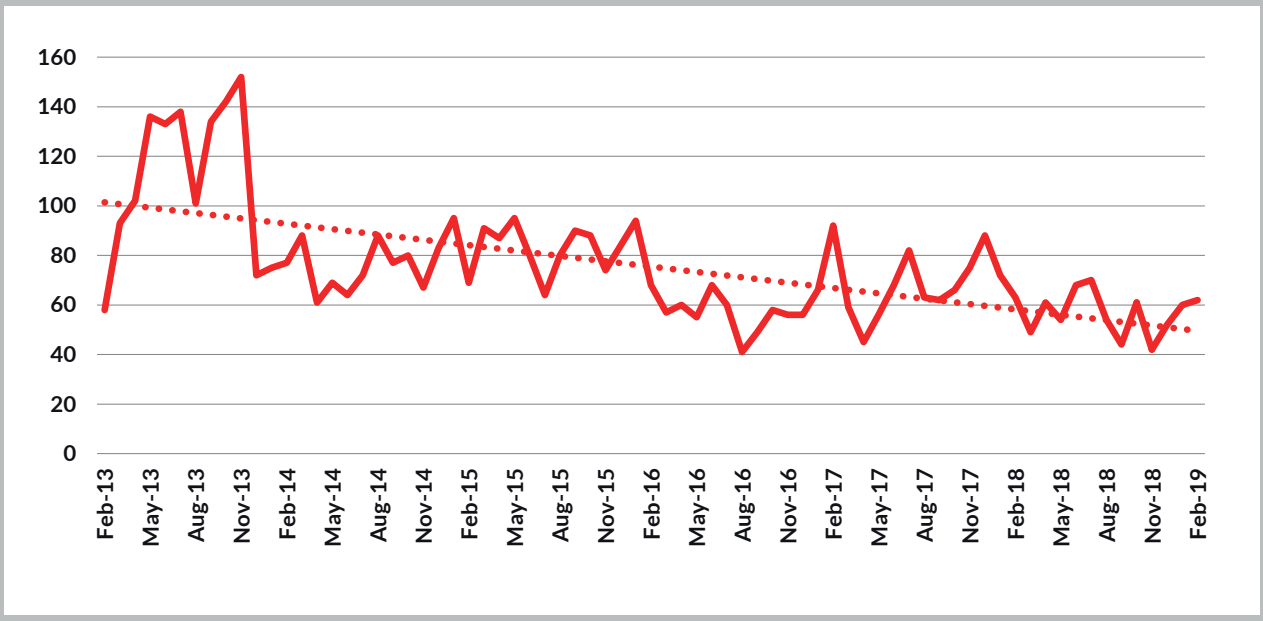


Documentation

Ensure that computer information system screens, medication device screens (e.g., infusion pumps), printouts, and preprinted order forms list or prompt for the patient's weight in metric units only.

In all electronic and written formats, document the patient's weight in metric units only.

Figure 1: Pharmacy Weight Discrepancy Notifications



recommendations. Several documentation forms with multiple weight fields were a source of confusion for both nurses and certified nursing assistants (CNAs), who sometimes felt unsure about which weight field to document. There were also multiple orders for weight documentation within our nursing admission order set.

The informatics team tackled the large task of streamlining our nursing admission assessment forms (**Figure 2**), which included three weight documentation fields: measured weight, clinical weight, and estimated weight. The measured weight field was used when the patient was physically weighed. Upon admission, this value was copied over to the clinical weight field, which was used by default in the dosing calculator when a weight-based drug was ordered; this field was also used to calculate weight-based continuous IV infusions. The clinical weight and measured weight fields should be the same value in most patients. The estimated weight field was designated for use by the emergency department when staff were unable to physically weigh the patient. The emergency department nursing staff member would then copy this value into the clinical weight field when a weight-based drug was ordered. These three fields were displayed on various documentation forms throughout the EHR. The clinical weight field was available on over 27 different inpatient assessment forms. If a provider ordered a daily weight for a congestive heart failure patient whose weight can fluctuate due to fluid gain or loss, these three fields displayed for the nurse and CNA. This allowed for the clinical weight field to be easily changed and subsequently affect medication dosing. The goals of this modification were to display the clinical weight field on the patient admission forms and estimated weight field for the emergency department.

During a patient's admission process, a nursing admission order set was ordered, which included three orders for weights, each linked to three different forms—resulting in nine weight documentation fields. Every weight order that fired an increased the chance for documentation errors. This created unnecessary work for the nurse and CNA. Removing the two additional weight orders streamlined documentation.

Upon reviewing ISMP's recommendations, the medication safety team identified that the bed scales needed to be locked and contacted our engineering department. Engineering had to develop their own process to track and lock the bed scales and implement a check to lock new bed scales. Since this took time and resources to implement this fix, locking of the bed scales was included in their maintenance schedule of the beds.

An EHR risk point was identified where the clinical weight field was crossing encounters. We resolved this issue by setting the clinical weight field to expire after 28 days. This would decrease the risk of an old weight being used for a new weight-based order.

Additional ways to decrease weight documentation errors have been

identified at pediatric hospitals, including developing custom decision support for weight documentation so that the EHR alerts the provider if the documentation is greater than 10% of the normal range based on the patient's age.[5] At our institution, we do not have a pediatric ward, but the informatics team implemented a minimum and maximum for height and weight fields on our documentation forms along with a real-time alert if the patient's new documented weight changed by 10%. Our nurses and CNAs document most of the patients' weights, so they would be alerted at the time of documentation if there was a typographical error.

During a medication safety discussion, a process gap was identified regarding who would zero out the bed scales prior to a new admission or patient transfer. The bed scale should be tared before a patient is weighed and no equipment should be on the bed when weighing a patient. Education was provided to the nurses and CNAs on the correct process to ensure beds are tared prior to admissions.

The process of streamlining the documentation forms, locking bed scales, adding safety alerts, and educating staff on weight documentation was an almost two-year project. Other disciplines, including dietary and ambulatory services, were involved because they also had weight fields embedded within their documentation forms. As such, changes to these fields would have affected their workflow. Weight field changes would also impact other fields such as body mass index, Cockcroft-Gault creatinine clearance, and body surface area. It took significant time to discuss workflows with these different key stakeholders, secure approval to change the forms, and test workflow once the changes were introduced.

Figure 2: Nursing Adult Admission Orders and Forms

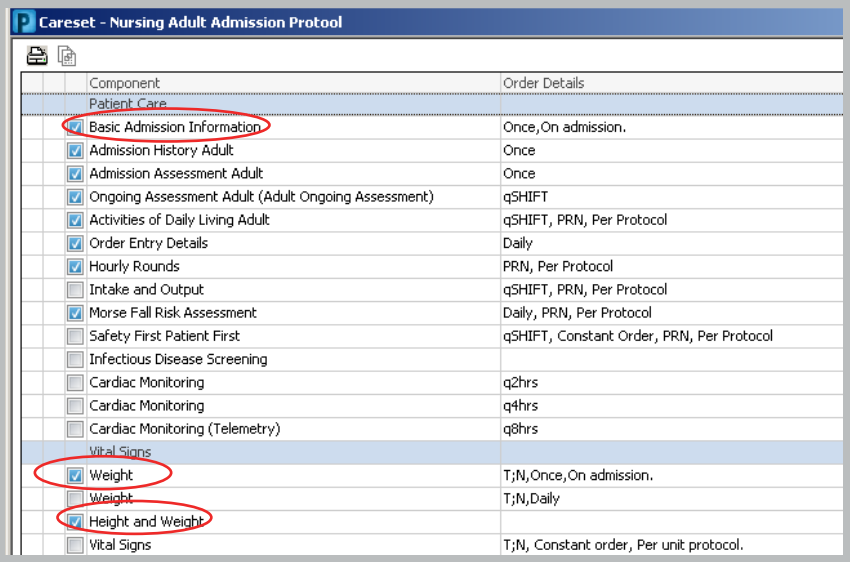


Figure 2a: Form for Basic Admission Information Order

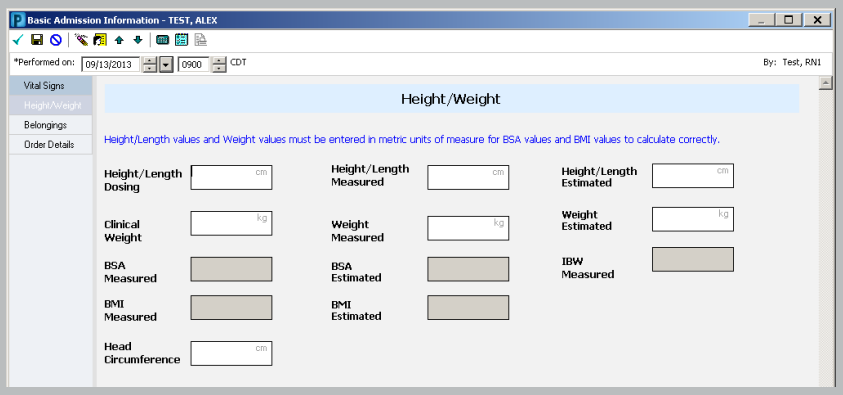


Figure 2b: Form for Weight Order

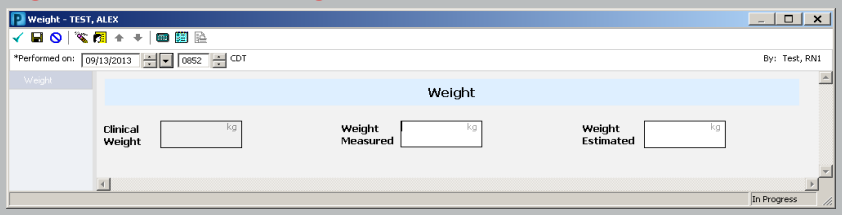


Figure 2c: Form for Height and Weight Order

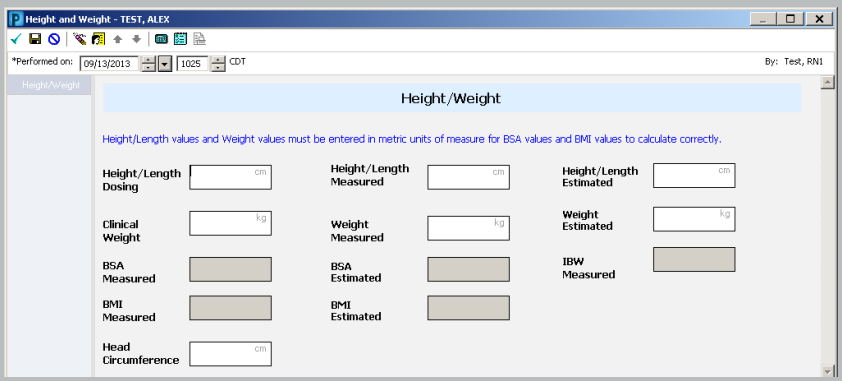


Figure 3: Nursing Weight Order/Admission 2013–2014



Results

Implementation of our interventions with the documentation process and safety enhancements to our EHR decreased the number of weight documentation errors, as seen in **Figure 1**. Data collection took place before and after our process improvement period. During this time, the pharmacists were notified to evaluate patients with a weight documentation discrepancy greater than 15%. A report was generated for the pharmacist weight notification from our electronic health record. Prior to any safety enhancements and documentation cleanup, the pharmacy had received its peak weight discrepancy notification of almost 150 notifications, with an average of 115 notifications per month in 2013. In 2014, we started to work on improving our documentation process. In 2015 and 2016, we implemented safety enhancements in our EHR as mentioned above. Weight discrepancy notifications trended down and by 2018 were averaging 60 notifications per month. Streamlining the number of weight orders within the nursing admission order set reduced the number of weight orders per admission from 3.77 in February 2013 to 1 in December 2014, as seen in **Figure 3**.

Discussion

Despite implementing the above fixes, weight documentation errors can occur due to human factors. For example, a staff member might document a patient's weight on the wrong patient's chart due to a lack of bedside computers or portable scanning devices. A user could also weigh the patient in the room, proceed into the hallway where a computer is available, and document the patient's weight on the wrong chart. Other human factor errors include transposing numbers incorrectly during electronic documentation (e.g., typing 57 kg instead of 75 kg), documenting a patient's weight based on the patient's word (e.g., stated weight) and not physically weighing the patient, and typing the patient's height in the weight field (and vice versa).[6] Because documentation remains susceptible to human error, implementing a redundancy such as the pharmacist notification can be an effective strategy.

Human factor errors such as transcribing errors, having the incorrect chart open in the EHR, and not zeroing out the bed scale are potential causes of weight documentation discrepancies. The weight documentation discrepancies did trend down after our improvements, but they were not eliminated.

Despite efforts to implement these best practices, hospitals continue to struggle with weight documentation errors due to human factors. There are three categories of human errors: knowledge-based, rule-based, and skill-based. Knowledge-based errors occur when a person does not have enough experience or knowledge to handle a task.[7] An error can occur when they try to "guess" what the answer would be based on their current knowledge

base. Rule-based errors occur when rules are misapplied or not followed.[7] One example seen was weighing a patient one after another and writing their results on a piece of paper which was then later entered into the computer. This would be considered using a shortcut to perform a task rather than following the standard process. Skill-based errors are errors that occur when a routine task is performed without much thought.[7] An example of this would be not taring the bed or weighing the patient with equipment.

Poor design of systems, equipment, and tools can contribute to human factor errors. At our institution, an enhancement to our EHR could have contributed to a skill-based error. When a medication is ordered with a weight-based dose (e.g., 10mg/kg), a dosing calculator window displays for the provider where they can view the weight-based dose, patient's weight, and final dose in the calculation and then click the mouse to close the screen. The enhancement to the EHR performs the calculation in the background without another window opening for the provider. This saves the provider an extra mouse click and screen in the process of placing an order; however, the provider does not see the weight that is pulled into the calculation window (10mg/kg x 75kg = 750mg). This removes a potential source for an intervention in cases where there is an erroneous weight.

Whenever possible, human factors engineering should be incorporated into the EHR documentation workflow. This discipline reviews employees' work environments and the available technology. The goal is to improve performance and decrease hazards. When a system has elements that increase the likelihood of error or injury, this is considered a hazard.[8] The design of the weight documentation field was a human factors risk point for our EHR because, as stated above, staff may experience confusion about the correct place to document weight when multiple weight fields were available on a nursing assessment form. If hospitals do not have access to a human factors engineer, a human factors assessment should be performed to proactively identify high risk points. ISMP has listed some hazards and performance measures that should be included in the weight documentation process (**see Table 1**).

Conclusion

In conclusion, health systems should have processes in place to decrease weight documentation errors. During this process improvement, it was key to educate multiple disciplines on the repercussions of incorrect weight documentation. It is important to put sustainable processes in place, rather than just applying a temporary fix to this issue. Despite the implementation of recommended practices, however, human factors errors can still occur. As new employees are hired, new beds are purchased for the hospital, or new electronic forms are built, it is important to have a process in place to prevent operational errors from occurring (e.g., orientation, training, and locking of new beds) and system design checks in place to prevent the use of unnecessary data entries in the EHR. The goal is to minimize human factors errors even though they are sometimes unavoidable. A process should be implemented to provide pharmacists with real-time weight documentation discrepancies in order to correct any current medication dosing errors and prevent future errors as a safety check.

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