Hospital-Acquired Anemia and Clinical Laboratory Test Utilization Practices

Michelle Brown, MS, MLS(ASCP)^{CM}SBB^{CM}

Assistant Professor

Clinical and Diagnostic Sciences

UAB THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Knowledge that will change your world

After this discussion you will be able to

1. Describe the various causes of hospital-acquired anemia.

2. Describe interventions the have been used to decrease hospital anemia due to diagnostic blood loss.

3. Apply health behavior theory to the evaluation of clinical laboratory test utilization by healthcare providers.

What is hospital-acquired anemia (HAA)?

- Anemia that develops after a patient has been admitted to the hospital.

- Chronic anemia <u>vs</u> HAA

  - Chronic anemia is more often due to nutritional deficiencies, chronic inflammation, renal and bone marrow disorders.

  - HAA is more likely from in-hospital treatments and processes of care

Hospital-acquired anemia by the numbers

- Large study at the Cleveland Clinic (Koch, 2013)

  - Better understand HAA

  - Examine whether HAA is associated with increased mortality, LOS, and total hospital charges

- Looked at 188,447 adult hospitalizations

  - The prevalence of HAA was 74%

  - HAA was associated with increased mortality which increased with degree of HAA

  - LOS increased with degree of HAA

  - Total hospital charges 1.8 fold increase with HAA (eg $30,000 w/o HAA, $54,000 with HAA)

Hospital-acquired anemia by the numbers

- Within 48 hours of admission to the ICU, 70% of patients have a hemoglobin <12 g/dl

- By day 3, 95% of patient in the ICU have a hemoglobin below normal (Corwin, 2004)

- Eyster et al – nosocomial anemia due to "blood letting" for diagnostic studies in the 1970s

- This problem continues in the 21st century

Causes of hospital-acquired anemia

- HAA is multifaceted and may result from:

    - Procedural blood loss – surgery (McEnvoy, 2013)

    - Hemodilution – IV Fluid and acute normovolemic hemodilution (Parasa, 2016)

    - Diagnostic blood loss – phlebotomy (Corwin, 2004)

Diagnostic blood loss

- Laboratory diagnostics are essential for diagnosis, treatment, and monitoring of patients.

- Average daily blood loss due to phlebotomy is 17.3-70 ml/day (Corwin et al, 1995; Woodhouse et al, 2001; Polhill et al, 2016)

  - Average daily blood loss in ICU is 3x that of the ward

  - On average 285 mL/week/patient

- Consider rejected specimens

- Consider waste for CVC draws

  - Non-coagulation specimens – 2x dead space

  - For coagulation testing – 6x dead space (5mL) should be drawn

Efforts to decrease diagnostic blood loss

- Small volume tubes (Dolman et al, 2015)

  - Statistically significant decrease in the amount of blood drawn

  - Few transfusions of these patients

- Blood conservation device (Mukhopadhyay et al, 2011)

  - Diverts blood that would normally be discarded and returns it after blood draw

  - Mixed data – some studies show benefits, some do not

- Analysis of test utilization (Zhi et al, 2013)

Test ordering practices

- Since 1970, progressed from 50 available tests to more than 3,500. (Hickner, 2014)

- Wide variation in usage of diagnostic tests between providers, specific institutions, and regions (Busby et al, 2013)

- Survey of internal medicine and family medicine physicians (Hickner et al, 2014)

    - 14.7% were uncertain about test ordering

    - 8.3% were uncertain about the interpretation of the results

Choosing Wisely

- American Board of Internal Medicine along with over 70 medical society partners

- Goals

  - Decrease wasteful testing and procedures

  - Promote evidence-based decision-making

An initiative of the ABIM Foundation

Decrease unnecessary testing

- Some tests are outdated

  - ie Bleeding time

- Some should no longer be run for a particular reason

  - ie ESR to assess inflammation

- Frequency should be considered

  - ie Chemistry profile no more frequently than every 12 hours

  - ie CBC w/diff should only be performed every 36 hours

Test ordering practices

- 15-year systematic review determined there is a 20.6% overutilization rate. (Zhi et al, 2013)

- Interventions:

  - Education – no documented sustainable success, however, ongoing investigation (Polhill et al, 2016)

  - Computer entry – hard stop decreased duplicate orders, push back from medical staff (Procop et al, 2014; Pageler, 2013)

  - No one has examined the health behavior of clinicians related to HAA and DBL

Health behavior theory

- Transtheoretical Model

- Health Belief Model

- Social Cognitive Theory

- Theory of planned Behavior

- Many others

- Partnering theory and practice can help us better understand people's choice

Theory of Planned Behavior

- Theory of Planned Behavior
  - Attitude toward behavior (A)
  - Subjective norm (SN)
  - Perceived behavioral control (BC)

Intention → Behavior
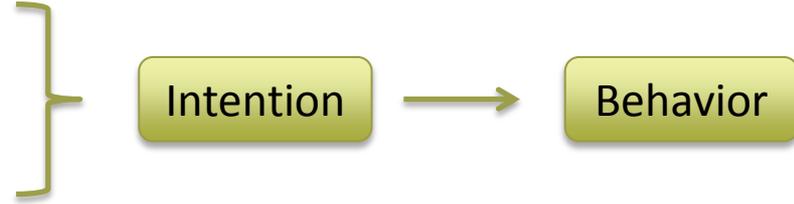
Theory and healthcare professional's behavior

- Support for TPB in healthcare behaviors:

  - Predicting safety behaviors of nurses (Javadi et al, 2013)

    - Quantitative study of 124 nurses, concluded that normative beliefs had the greatest influence

  - Incorporating research evidence into clinical decision-making by nurses (Cote et al, 2011)

    - Quantitative study of 336 nurses, concluded that normative beliefs and behavioral control had the greatest influence

  - Healthcare professionals intention to use clinical guidelines (Kortteiso et al, 2010)

    - Quantitative study, many professions, in 26 organizations

      - Physicians – behavioral control had the greatest influence

      - Other healthcare professions – normative beliefs had the greatest influence

Theory and healthcare professional's behavior

- Systematic review of health behavior theories used to assess healthcare professionals behaviors and intentions. (Godin et al, 2008)

  - 1966-2007

  - TPB was the most widely used theory for assessing behaviors and intentions

  - TPB explained the most variance in behaviors by healthcare professionals

  - Categories: clinical practice, compliance with guidelines, documentation, counseling

  - Key element: TPB is the "most relevant theory" for studying behaviors of healthcare professionals

Theory and test utilization

- Theory of planned behavior: the constructs of attitudes toward a behavior, subjective norm, and perceived control, shape an individual's intention (Ajzen, 1985)

- No theory-based interventions have been used to assess or improve laboratory test ordering practices.

Statement of the Problem

- Anemia is associated with poor quality of life, and increased morbidity and mortality. (Lucca et al, 2008; Koch et al, 2013)

- Anemia can be acquired in the hospital.

- Diagnostic blood loss contributes to hospital-acquired anemia (HAA). (Corwin et al, 2004)

- National effort to decrease unnecessary testing. (Mordon et al, 2014)

- There are no studies which have sought to understand behaviors of providers associated with laboratory ordering practices.

Purpose of the Study

The purpose of this mixed methods study is to determine the behavioral factors which influence test ordering by healthcare providers on the medical intensive care unit (MICU) and to examine the feasibility of implementing techniques to decrease unnecessary test ordering by these providers on the MICU.

Aims of the Study

1. Determine the behavioral factors which influence test ordering by healthcare providers on the MICU.

2. Examine the feasibility of implementing techniques to decrease unnecessary test ordering by healthcare providers on the MICU.

Theoretical Framework

- Strive to better understand provider's medical decision to order diagnostic tests

- Behavior = test ordering

- Theory of Planned Behavior

  - Attitude toward behavior (A)

  - Subjective norm (SN)

  - Perceived behavioral control (BC)

Intention → Behavior
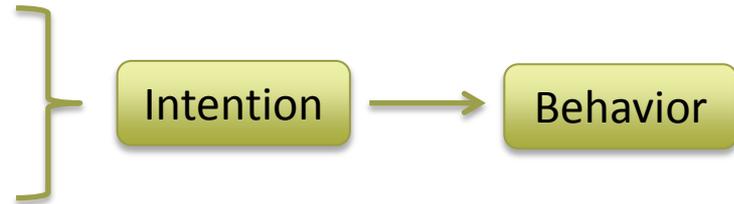
Study Design

- Explanatory Sequential Mixed Methods

- Quantitative:

  - Administer the instrument to attending physicians, fellows, residents, and nurse practitioners on the medical intensive care unit (MICU) at UAB

  - Determine barriers and enabling factors

- Qualitative:

  - Interview providers to gain a deeper comprehension of test ordering and other factors contributing to hospital acquired anemia due to diagnostic blood loss

Quantitative Research Questions

1. For healthcare providers in the MICU, what is the knowledge, attitudes, subjective norm, and perceived control of HAA due to diagnostic blood loss?

2. What barriers exist that prevent healthcare providers from decreasing test orders on the MICU?

3. What techniques would enable healthcare providers to decrease test ordering on the MICU?

Qualitative Research Questions

1. What common themes about test ordering and HAA due to diagnostic blood loss are revealed during interviews with healthcare workers in the MICU?

2. What common themes about barriers associated with test ordering and HAA due to diagnostic blood loss are revealed during interviews with healthcare workers in the MICU?

3. What common themes about enabling factors associated with test ordering and HAA due to diagnostic blood loss are revealed during interviews with healthcare workers in the MICU?

Mixed Methods Research Question

What do the qualitative and quantitative data together reveal about test ordering practices and the perceptions of HAA due to diagnostic blood loss of healthcare providers in the MICU?

Participants and Setting

- Literature clearly delineates that patients in the ICU have more blood drawn than patients on the general ward. (Smoller, 1986)

- The MICU was selected as the site from which to draw participants since it is an ICU that has been identified as having a large number laboratory tests ordered per patient. (Polhill, 2016)

- The patients are likely more stable than in other ICUs such as the trauma and burn and the surgical ICUs.

- Multiple levels of providers will be invited to participate: attending physicians, fellows, residents, and nurse practitioners.

Instrument Design

- Survey items will address knowledge, attitude, subjective norm, and perceived control

- Ajzen's *Constructing a Theory of Planned Behavior Questionnaire* will guide the item design

- 3-5 items will be used to address each construct

- 7 point bipolar scales will be used for each item

- Demographic information will be collected

- Providers will be asked if they are willing to be contacted for a follow up interview.

Sample Construct-Based Questions

- Attitude

  - Decreasing the amount of blood drawn from my patients in the MICU would be

    Good for my patients:__1__:__2__:__3__:__4__:__5__:__6__:__7__:Bad for my patients

- Subjective norm

  - Most of the providers on MICU only order lab tests when indicated

    Definitely true:__1__:__2__:__3__:__4__:__5__:__6__:__7__:Definitely false

- Perceived control

  - Whether or not I order lab tests is completely up to me

    Strongly Disagree:__1__:__2__:__3__:__4__:__5__:__6__:__7__:Strongly Agree

Interviews

- Interview questions will be determined based on results of the survey.

- Through the interviews, researchers will seek a deeper understanding of the behavioral factors associated with the decision to order laboratory tests.

- Grounded theory will be used to better understand the behaviors of the healthcare providers.

- Through qualitative analysis, data will progress through the processes of description, conceptual ordering, and theorizing to develop a theory "grounded" in the interview data (Corbin, 2014).

Data Analysis

- Descriptive statistics will be compared and contrasted through reflection of the constructs of TPB through the survey.

- Interviews will be recorded, transcribed, and coded for themes and sub-themes.

To be continued...

No, really…

- Final product
  - Better understanding of the behaviors of clinicians associated with test ordering practices
  - A survey instrument that others can use in their ICUs to identify opportunities to decrease HAA due to DBL

References

- Busby, J., Schroeder, K., Woltersdorf, W., Sterne, J. A., Ben-Shlomo, Y., Hay, A., & Hollingworth, W. (2013). Temporal growth and geographic variation in the use of laboratory tests by NHS general practices: using routine data to identify research priorities. *Br J Gen Pract*, *63*(609), e256-e266.

- Corwin, H. L., Gettinger, A., Pearl, R. G., Fink, M. P., Levy, M. M., Abraham, E., ... & Shapiro, M. J. (2004). The CRIT Study: anemia and blood transfusion in the critically ill-current clinical practice in the United States.*Critical care medicine*, *32*(1), 39-52

- Corwin, H. L., Parsonnet, K. C., & Gettinger, A. (1995). RBC transfusion in the ICU: is there a reason?. *CHEST Journal*, *108*(3), 767-771.

- Coˆté, F., Gagnon, J., Houme, P. K., Abdeljelil, A. B., & Gagnon, M. P. (2012). Using the Theory of Planned Behaviour to predict nurses' intention to integrate research evidence into clinical decision-making. *Journal of advanced nursing*, *68*(10), 2289-2298.

- Dolman, H. S., Evans, K., Zimmerman, L. H., Lavery, T., Baylor, A. E., Wilson, R. F., & Tyburski, J. G. (2015). Impact of minimizing diagnostic blood loss in the critically ill. *Surgery*, *158*(4), 1083-1088.

THE UNIVERSITY OF
ALABAMA AT BIRMINGHAM
Knowledge that will change your world

References

- Hickner, J., Thompson, P. J., Wilkinson, T., Epner, P., Shaheen, M., Pollock, A. M., ... & Taylor, J. R. (2014). Primary care physicians' challenges in ordering clinical laboratory tests and interpreting results. *The Journal of the American Board of Family Medicine*, *27*(2), 268-274.

- Javadi, M., Kadkhodaee, M., Yaghoubi, M., Maroufi, M., & Shams, A. (2013). Applying theory of planned behavior in predicting of patient safety behaviors of nurses. *Materia socio-medica*, *25*(1), 52.

- Kortteisto, T., Kaila, M., Komulainen, J., Mäntyranta, T., & Rissanen, P. (2010). Healthcare professionals' intentions to use clinical guidelines: a survey using the theory of planned behaviour. *Implementation Science*, *5*(1), 1.

- Koch, C. G., Li, L., Sun, Z., Hixson, E. D., Tang, A., Phillips, S. C., ... & Henderson, J. M. (2013). Hospital-acquired anemia: Prevalence, outcomes, and healthcare implications. *Journal of hospital medicine*, *8*(9), 506-512.

References

- Lyon, A. W., Chin, A. C., Slotsve, G. A., & Lyon, M. E. (2013). Simulation of repetitive diagnostic blood loss and onset of iatrogenic anemia in critical care patients with a mathematical model. *Computers in biology and medicine*, *43*(2), 84-90.

- McEvoy, M. T., & Shander, A. (2013). Anemia, bleeding, and blood transfusion in the intensive care unit: causes, risks, costs, and new strategies. *American Journal of Critical Care*, *22*(6), eS1-eS13.

- Mukhopadhyay, A., See, K. C., Chan, Y. H., Yip, H. S., & Phua, J. (2011). Effect of a blood conservation device in patients with preserved admission haemoglobin in the intensive care unit. *Anaesthesia and intensive care*, *39*(3), 426.

- Pageler, N. M., Franzon, D., Longhurst, C. A., Wood, M., Shin, A. Y., Adams, E. S., ... & Cornfield, D. N. (2013). Embedding time-limited laboratory orders within computerized provider order entry reduces laboratory utilization. *Pediatric Critical Care Medicine*, *14*(4), 413-419.

THE UNIVERSITY OF
ALABAMA AT BIRMINGHAM
Knowledge that will change your world

References

- Parasa, S. K., Bidkar, P. U., & Parida, S. (2016). Acute normovolemic hemodilution to avoid blood transfusion during intracranial aneurysm surgery in a patient with atypical antibodies. *Anesthesia, essays and researches*,*10*(1), 136.

- Procop, G. W., Yerian, L. M., Wyllie, R., Harrison, A. M., & Kottke-Marchant, K. (2014). Duplicate laboratory test reduction using a clinical decision support tool. *American journal of clinical pathology*, *141*(5), 718-723.

- Woodhouse, S. (2001). Complications of critical care: lab testing and iatrogenic anemia. *MLO: medical laboratory observer*, *33*(10), 28-31.

- Zhi, M., Ding, E. L., Theisen-Toupal, J., Whelan, J., & Arnaout, R. (2013). The landscape of inappropriate laboratory testing: a 15-year meta-analysis. *PLoS One*, *8*(11), e78962.