Enhancement of the Intravenous Cannulation Catheter Process

(Technical Paper)

The Intersection of the Health Gap and Language Barrier in the United States Health Care System and Its Impact on Afro-Latinas

(STS Paper)

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On my honor as a University Student, I have neither given nor received
unauthorized aid on this assignment as defined by the Honor Guidelines
for Thesis-Related Assignments

Introduction

The United States (U.S.) health care system is one of the most expensive in the world, but is ranked as the worst among countries with similar gross domestic products (GDPs) ("New 11-Country Study," n.d.). One failure in the U.S. health care system is the administration of intravenous (IV) lines or cannulation, a technique in which a cannula, a thin tube, is placed inside a vein to provide venous access (Lund et al., 2012). This procedure is one that can be a painful experience for many patients. Some patients with healthy veins that "roll," a description some medical professionals use for a vein that does not easily yield to a needle-stick, or are difficult to envision are labelled as "tough sticks" (Lund et al., 2012). Tough sticks create a necessity for the improvement of IV cannulation for the comfort of the patient and ease of the medical practitioner.

In addition to the issue of IV insertions, the disparities in the health care certain groups of people receive compared to others is also an issue that has plagued the United States' health care system for centuries. For people of color, specifically Black woman, there has been a continued struggle to receive proper maternal health care ("Maternal Health in the United States," 2015). Furthermore, the barrier that Black women face in order to receive adequate medical care is only intensified when they do not speak the same language as their physician (Partida, 2007). An examination of what factors contribute to the racial disparity and language barrier in maternal health care in the United States and the methodology of IV insertions is important to the improvement of patient care and treatment.

Technical Topic

Over 200 million Americans undergo the placement of IV lines. Common procedures such as catheter insertion, drug delivery, and blood drawing all depend on IV lines. IV

cannulation is generally performed by nursing staff, phlebotomists, and medical doctors. The first successful attempt in most patients is over 70%. However, for the remaining 30%, who are regarded as "tough sticks", the use of ultrasound technology is utilized to find a vein, but this may still not be successful. The ineffectiveness of ultrasound technology means many patients are stuck with a needle for IV cannulation more than once, which causes discomfort, and even a lack of trust for the medical practitioner (Cooke et al., 2018). Moreover, a successful first attempt at placing an IV line in the patient, also known as a first pass, is an important part of a patients' effective treatment. Therefore, this technical project aims to study how to improve first pass rates of intravenous cannulation.

In addition to ultrasounds, near infrared (NIR) and transillumination technologies are used to find a vein in patients that are considered "tough sticks." These technologies are normally used as a last resort when a vein has not been found ("NIR vs. Ultrasound vs. Transillumination for Vein Access," n.d.). While these technologies are useful, they are time consuming, expensive, and logistically difficult to perform, requiring additional trained teams of medical practitioners. In addition, locating a vein is not always the issue in the case of a 'tough stick.' Many other reasons for 'tough sticks' exist, including 'rolling veins,' movement of the patient, patient phobias, dehydrated patients and varying skin thickness. Simpler methods such as tourniquets, warm compresses, elevation, and relaxation can help a medical practitioner perform this procedure, though these methods are less effective than the previously mentioned visualization techniques and also do not necessarily address the wide range of difficulties associated with IV cannulation.

A survey of medical practitioners that perform these intravenous procedures will be performed in order to gauge the major issues and areas in need of improvement for the needle.

Physical modifications to guide even the most inexperienced medical professionals through the insertion, such as a mechanism to guide the needle or a simpler method for visualization of the veins will follow, based on the major issues medical professionals find with current methods determined by the survey. Testing on IV practice arms will then be used to determine whether or not the modifications improve first pass rates among both experienced and inexperienced medical professionals.

STS Topic

In recent years, a discussion on the disparities that exist within the U.S. healthcare system has become part of popular discourse. The discussion around Black healthcare, specifically Black maternal health, have become topics of recent debates. Celebrities, like Beyoncé Knowles-Carter and Serena Williams, have shared their hardships with receiving adequate medical care during the process of giving birth to their children (Chiu, 2018). These stories highlight the fact that economic status and education level do not make a substantial difference in preventing negative healthcare outcomes for Black women. This racial disparity in maternal health care in the U.S. is known as the health gap. Likewise, the language barrier that exists within the U.S. healthcare system leads to negative healthcare outcomes for people who either do not speak English or for whom English is their second language (Partida, 2007). The intersection of these issues leaves one group of people in the cross-hairs, Afro-Latinas. These topics have been researched extensively separately but, the intersection of them has not. Thus, this research paper will aim to specifically focus on Latinas who are racialized as Black in the U.S.

This topic is critically important for a plethora of reasons. First, the U.S. fares worse in preventing pregnancy-related deaths than most countries with similar GDPs ("New 11-Country Study," n.d.). The most notable disparity in mortality rates in the U.S. is defined by race: Black

women die at a rate that ranges from three to four times the rate of their white counterparts, this difference in risk has remained unchanged for the past six decades ("Maternal Health in the United States," 2015). Women of color tend to have poorer access to high quality reproductive health information and services, are discriminated against in the healthcare system and experience higher rates of disrespect and abuse from the medical community. Additionally, there is evidence suggesting that the stress associated with daily experiences of racial discrimination can increase the risk of negative perinatal outcomes including preterm birth and delivery of a low birth weight infant for women of color ("Maternal Health in the United States," 2015).

The language barrier poses significant challenges to providing effective and high-quality healthcare. Research tells the general population that communication failures between patients and their caregivers contribute to adverse events and medical errors (Partida, 2007). Linguistic diversity within the United States today is far greater than Europe. Moreover, rapid growth of the population with limited English proficiency (LEP) is emerging as a new risk that few doctors are prepared to handle (Partida, 2007).

The creation of the two systems of inequality has also influenced, and been perpetuated, by the medical technology that has been created and used in the U.S. health care system. The methodologies used to treat Black Latinas was created solely for treating white patients (Bulatao, Anderson, & National Research Council (US) Panel on Race, 2004). The technologies used to treat Black Latinas was created for white cis-gendered men (Bulatao et al., 2004). These two notions are the connection between the social elements and technical elements that will be the center of analysis of this project.

The STS theory that will be used to frame this analysis is co-production. Co-production is the simultaneous process through which modern societies form their epistemic and normative understandings of the world ("Sheila Jasanoff," n.d.). This framework is best laid out in Sheila Jasanoff's *States of Knowledge* in which she demonstrates how scientific ideas and beliefs, and (often) associated technological artifacts, evolve together with the representations, identities, discourses, and institutions that give practical effect and meaning to ideas and objects ("Sheila Jasanoff," n.d.). Co-production will be the theory used in this study because the issue of disparities in health care is one that spans multiple centuries. Throughout the history of these disparities, society and technology have influenced one another in favor of those in power. However, if used too broadly or uncritically, co-production risks noetic flatness, which is when technology and society co-produce each other equally and the justification for maintaining the boundary between them dissolves and actor-network theory may be used (Tembo, Morrow, Worswick, & Lennard, 2019). Additionally, unless overlapping sets of boundary-work are used, co-production may also fail to account for power differentials within each variable, in this case, within technology and society (Tembo et al., 2019). Therefore, in this research paper co-production will be applied specifically to the health gap and language barrier in order to avoid noetic flatness and provide an overlap in the boundaries for this research.

Research Question and Methods

The question that will be the focus of this research is: What are the barriers that inhibit Afro-Latinas from receiving adequate medical care? This topic will be analyzed using historical case studies, wicked problem framing, and discourse analysis. A historical case study is an approach that will support answering questions about the stereotypes and implicit biases that led to the formation of the health gap and language barrier. This method will support new ways of

interpreting current systems of power and deeper understanding of the how the past is currently affecting health care. The source that will be used in this section of analysis is a Vice article about the circumstance surrounding Erica Garner's death (Douglas, 2018). More historical case studies will be gathered that center around the language barrier and how education level does or does not impact the health gap.

Wicked problem framing is a framework that was inspired by Rittel and Weber's work on how planning efforts fail, it has become a way of understanding complex and dynamic problems. The sources that will be used in this section will be the evidence that will lay the foundation for the reader to understand the health gap and language barrier as separate issues. This section will take place before the final piece of analysis that brings these two issues together for examination. The sources that will be used in this section include a study by Alio et. al about how the environment can impact maternal health care (Alio et al., 2010). Studies by Harvard Public Health Magazine, Knight et al., Maternal Health Task Force, Pallotto et al. about the overall issue of black maternal health care in the U.S. (Boston & Ma, 2018; Knight, Kurinczuk, Spark, & Brocklehurst, 2009; "Maternal Health in the United States," 2015; Pallotto, Collins, & David, 2000). The effects of implicit bias and the language barrier on health care providers and the quality of care they provide will be studied (FitzGerald & Hurst, 2017; Gerrish, Chau, Sobowale, & Birks, 2004). Finally, the importance of translators in healthcare in order to eliminate the language barrier and the overall issue of the language barrier will be evaluated (Ku & Flores, 2005; Partida, 2007).

Discourse analysis will be used to as a means to interpret data gathered through literature reviews, interviews, and other events that generated dialogue. The sources that will be used in this section include a study about the multifaceted approach needed to address Black maternal

health ("Black Women's Maternal Health," n.d.). Additionally, a component of the analysis will be devoted to an examination of what is being done globally to combat these issues. Therefore, a study about how the language barrier affects health care providers in South Africa will be examined (Hussey, 2012). Further research about the work being done globally surrounding these issues will be completed for this project.

Conclusion

Intravenous cannulation is an important aspect of many areas of public health, and is one that can be improved. The mitigation of 'tough sticks' and improvement of first pass rates will decrease the time and energy required for IV insertion. The intersection of the health gap and language barrier present in the U.S. health care system is stopping Afro-Latinas from receiving adequate medical care. A solution to this issue will allow for a more equitable health care system to be created in the U.S. Furthermore, it would allow for a solution for these issues as separate entities to be created which would allow more people of color to receive better medical care. Finally, a solution to this issue would help to expose and break down systems of power that have plagued this country for centuries. The expected results of this project are that there will be a correlation between the histories of the health gap and language barrier that will be uncovered. This will allow for an examination and discovery of what is causing negative outcomes in health care for Afro-Latinas.

Works Cited

Alio, A. P., Richman, A. R., Clayton, H. B., Jeffers, D. F., Wathington, D. J., & Salihu, H. M.

(2010). An Ecological Approach to Understanding Black–White Disparities in Perinatal

Mortality. *Maternal and Child Health Journal*, *14*(4), 557–566.

https://doi.org/10.1007/s10995-009-0495-9

Black Women's Maternal Health: (n.d.). Retrieved October 4, 2019, from

http://www.nationalpartnership.org/our-work/health/reports/black-womens-maternal-

health.html

Boston, 677 Huntington Avenue, & Ma 02115 +1495-1000. (2018, December 18). America is

Failing its Black Mothers. Retrieved October 4, 2019, from Harvard Public Health

Magazine website: https://www.hsph.harvard.edu/magazine/magazine_article/america-is-

failing-its-black-mothers/

Bulatao, R. A., Anderson, N. B., & National Research Council (US) Panel on Race, E. (2004).

Health Care. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK24693/

Chiu, A. (2018, August 7). Beyoncé, Serena Williams open up about potentially fatal childbirths,

a problem especially for black mothers. Retrieved October 31, 2019, from Washington

Post website: https://www.washingtonpost.com/news/morning-

mix/wp/2018/08/07/beyonce-serena-williams-open-up-about-potentially-fatal-childbirths-

a-problem-especially-for-black-mothers/

Cooke, M., Ullman, A. J., Ray-Barruel, G., Wallis, M., Corley, A., & Rickard, C. M. (2018). Not

"just" an intravenous line: Consumer perspectives on peripheral intravenous cannulation

(PIVC). An international cross-sectional survey of 25 countries. *PLOS ONE*, *13*(2),

e0193436. https://doi.org/10.1371/journal.pone.0193436

Douglas, D. (2018, January 2). Did Racism Kill Erica Garner? Retrieved October 4, 2019, from

        Vice website: https://www.vice.com/en_us/article/vby7qy/did-racism-kill-erica-garner

FitzGerald, C., & Hurst, S. (2017). Implicit bias in healthcare professionals: A systematic

        review. *BMC Medical Ethics*, *18*. https://doi.org/10.1186/s12910-017-0179-8

Hussey, N. (2012). The language barrier: The overlooked challenge to equitable health care.

        South African Health Review, *2012/2013*(1), 189–195.

Knight, M., Kurinczuk, J. J., Spark, P., & Brocklehurst, P. (2009). Inequalities in maternal

        health: National cohort study of ethnic variation in severe maternal morbidities. *BMJ*,

        338, b542. https://doi.org/10.1136/bmj.b542

Ku, L., & Flores, G. (2005). Pay Now Or Pay Later: Providing Interpreter Services In Health

        Care. *Health Affairs*, *24*(2), 435–444. https://doi.org/10.1377/hlthaff.24.2.435

Lund, F., Schultz, J.-H., Maatouk, I., Krautter, M., Möltner, A., Werner, A., … Nikendei, C.

        (2012). Effectiveness of IV Cannulation Skills Laboratory Training and Its Transfer into

        Clinical Practice: A Randomized, Controlled Trial. *PLOS ONE*, *7*(3), e32831.

        https://doi.org/10.1371/journal.pone.0032831

Maternal Health in the United States. (2015, August 14). Retrieved September 27, 2019, from

        Maternal Health Task Force website: https://www.mhtf.org/topics/maternal-health-in-the-

        united-states/

New 11-Country Study: U.S. Health Care System Has Widest Gap Between People With Higher

        and Lower Incomes | Commonwealth Fund. (n.d.). Retrieved October 30, 2019, from

        https://www.commonwealthfund.org/press-release/2017/new-11-country-study-us-health-

        care-system-has-widest-gap-between-people-higher

NIR vs. Ultrasound vs. Transillumination for Vein Access. (n.d.). Retrieved October 3, 2019, from https://www.veinlite.com/blog/post/nir-ultrasound-transillumination-vein-access/

Pallotto, E. K., Collins, J. W., & David, R. J. (2000). Enigma of Maternal Race and Infant Birth Welght: A Population-based Study of US-born Black and Caribbean-born Black Women. *American Journal of Epidemiology*, *151*(11), 1080–1085. https://doi.org/10.1093/oxfordjournals.aje.a010151

Partida, Y. (2007). Language Barriers and the Patient Encounter. *AMA Journal of Ethics*, *9*(8), 566–571. https://doi.org/10.1001/virtualmentor.2007.9.8.msoc1-0708.

Sheila Jasanoff: Co-production. (n.d.). Retrieved October 23, 2019, from https://sheilajasanoff.org/research/co-production/

Tembo, D., Morrow, E., Worswick, L., & Lennard, D. (2019). Is Co-production Just a Pipe Dream for Applied Health Research Commissioning? An Exploratory Literature Review. *Frontiers in Sociology*, *4*. https://doi.org/10.3389/fsoc.2019.00050