Using the Theory of Fundamental Causes to Show the Potential Effects of Socioeconomic Status on Surgical Outcomes

Journal of Health Disparities Research and Practice

Volume 9
Issue 2 *Summer*

Article 8

2016

Using the Theory of Fundamental Causes to Show the Potential Effects of Socioeconomic Status on Surgical Outcomes

Mehwish Qasim, A.B.D. , *University of Iowa*, mehwish-qasim@uiowa.edu

Using the Theory of Fundamental Causes to Show the Potential Effects of Socioeconomic Status on Surgical Outcomes

Abstract

Surgical procedures are both costly and common. There are large differences in surgical outcomes both within and between hospitals based on patient characteristics such as measures of income. In both 2000 and 2009, patients residing in low-income communities had worse morbidity and mortality rates, across a wide range of quality indicators. In this review, the author will explicate the Theory of Fundamental Causes as it relates to surgical care, review key empirical findings and address potential limitations of the theory. This review will provide a platform for researchers to discuss current research in surgical disparities using the Theory of Fundamental Causes and help guide an agenda for future research.

Keywords

Socioeconomic Status; Surgery; Health Disparities; Conceptual Model; Review

Journal of Health Disparities Research and Practice
Volume 9, Issue 2, Summer 2016, pp. 143-153

School of Community Health Sciences
University of Nevada, Las Vegas

Using the Theory of Fundamental Causes to Show the Potential Effects of Socioeconomic Status on Surgical Outcomes

Mehwish Qasim, University of Iowa

ABSTRACT
Surgical procedures are both costly and common. There are large differences in surgical outcomes both within and between hospitals based on patient characteristics such as measures of income. In both 2000 and 2009, patients residing in low-income communities had worse morbidity and mortality rates, across a wide range of quality indicators. In this review, the author will explicate the Theory of Fundamental Causes as it relates to surgical care, review key empirical findings and address potential limitations of the theory. This review will provide a platform for researchers to discuss current research in surgical disparities using the Theory of Fundamental Causes and help guide an agenda for future research.

Keywords: Socioeconomic Status; Surgery; Health Disparities; Conceptual Model; Review

INTRODUCTION

Since the two landmark Institute Of Medicine (IOM) reports *To Err is Human* [IOM, 1999] and *Crossing the Quality Chasm* [IOM, 2001], health systems and policymakers have scrutinized the quality of care provided to patients and focused on the minimization of medical errors that lead to adverse patient outcomes. Adverse outcomes following surgery vary widely by procedure, hospital characteristics, surgeon and hospital volume, and patient characteristics such as income.

Patient mortality is a commonly used quality metric that has both face validity and likely "buy-in" from surgeons as a bottom-line measure of surgical practice [Birkmeyer, Dimick, & Birkmeyer, 2004]. Outcomes often vary based on the complexity of the procedure; complex procedures are typically associated with increased risk to the patient. Non-cardiac procedures typically have a baseline mortality rate below 5%: for example, Abdominal Aortic Aneurysm (AAA) Repair has a 2.6% mortality rate whereas Coronary Artery Bypass Graft (a cardiac procedure) has an 8.5% mortality rate [O'Brien et al., 2009]. Even within hospitals, patients that

were operated on by low-volume surgeons have nearly four times the mortality rate of patients that were operated on by high-volume surgeons for one procedure-- pancreatic resection [Birkmeyer et al., 2003]. In both 2000 and 2009, patients residing in low-income communities had higher morbidity and mortality rates across a wide range of quality indicators [Qasim & Andrews, 2013]. The same study found that patients residing in low-income communities had mortality rates that were three-times higher when compared to patients residing in high-income communities for esophageal resection for cancer.

The available literature in the field of health disparities motivates the elimination of disparities as an equity consideration [AHRQ, 2011; AHRQ, 2012; Smedley, Stith, & Nelson, 2003]. However, policymakers, especially now in the era of budget constraints and political battles over controlling spending, are largely concerned with efficiency considerations - improving quality and reducing costs [Cook, Liu, & McGuire, 2012]. A recent study estimated that health disparities cost $1.24 trillion from 2003-2006 in direct medical costs, premature death, and lost productivity adding a strong economic incentive for the study and elimination of health disparities to the fold [LaVeist, Gaskin, & Richard, 2011].

Surgical procedures are extremely high cost as well as common. Surgical admissions also accounted for nearly 27% of hospital admissions in 2013, second only to medical admissions, 33.9% of admissions in 2013 [HCCI, 2014]. Surgical admission type averaged $34,583 per encounter in 2013. This represents an 8.5% growth from the previous year [HCCI, 2014]. Despite high costs, procedure rates have been increasing in specific sub-populations over recent decades [Partridge, Harari, & Dhesi, 2012; HCCI, 2014], partially due to advances in medical technology, improvement in analgesics and anesthesia and new and emerging drugs, devices, tests and procedures [Bernstein, Hing, Burt, & Hall, 2001].

Conceptual frameworks can direct the collection and analysis of data and organize ideas in research, yet very little has been published that provides systematic guidance specifically for the topic of disparities in surgical care. Only one review has attempted to organize the study of surgical disparities using a conceptual framework [Birkmeyer, Dimick, & Birkmeyer, 2004], highlighting a potential void in the literature that this review addresses. Many models also under-recognize the importance of social factors on surgical outcomes. In this review, the author will explicate the Theory of Fundamental Causes as it relates to surgical care, review key empirical findings and address potential limitations of the theory. This review will provide a platform for researchers to discuss current research in surgical disparities using the Theory of Fundamental Causes and guide an agenda for future research. The benefit of examining the topic of surgical disparities using the Theory of Fundamental Causes is that this theory explicitly recognizes the complex and interrelated factors and relationships that affect surgical outcomes. Further, the Theory of Fundamental Causes explicitly recognizes socioeconomic status as an inherent or "fundamental" cause, a key innovation when compared with other models [Birkmeyer, Dimick, & Birkmeyer, 2004].

RESULTS

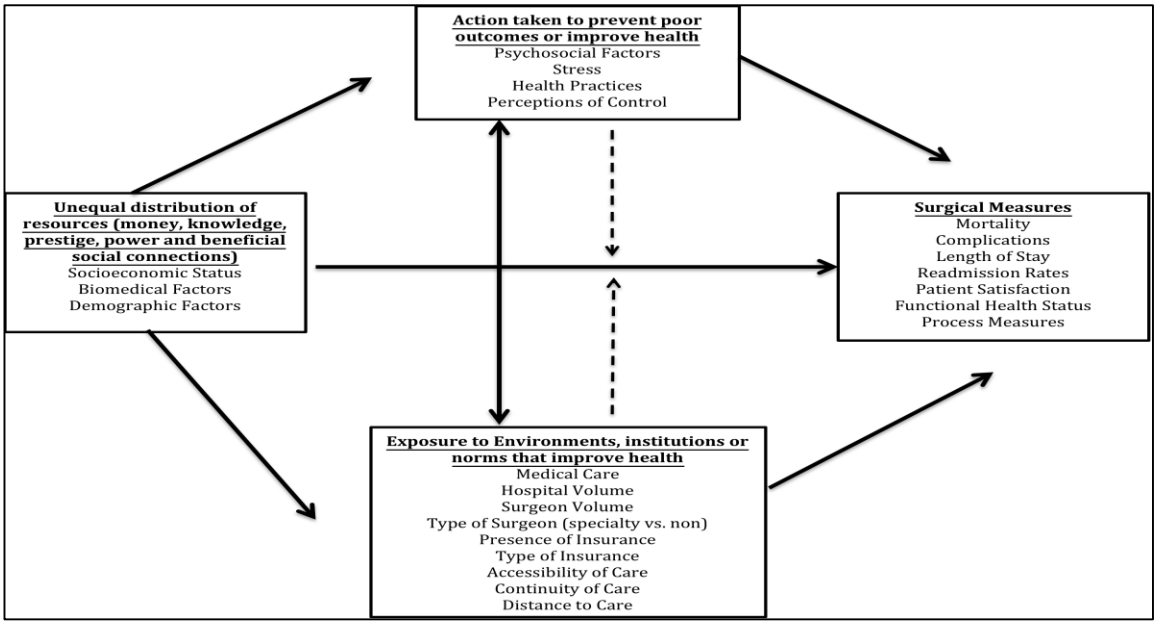

Figure 1: Potential Effects of Socioeconomic Status on Surgical Outcomes using the Theory of Fundamental Causes **+Adapted from [Williams, 1990; Diex Roux, 2012]**

The Theory of Fundamental Causes

The Theory of Fundamental Causes describes the persistent and direct relationship between socioeconomic status and morbidity and mortality over time, despite improvement in specific diseases and conditions that were believed to cause the morbidity and mortality among individuals of low SES. [Link & Phelan, 1995]. This theory is supported by the work of several authors [Link & Phelan, 1995; Link & Phelan, 1996; Phelan, Link, Diez-Roux, Kawachi, & Levin, 2004; Phelan & Link, 2005; Phelan, Link, & Tehranifar, 2010; Williams, 1990; Williams, 1997] and argues that SES embodies an array of resources, such as money, knowledge, prestige, power and beneficial social connections that protect health no matter what mechanisms are relevant at any given time (see Figure One). Explained another way, societies shape patterns of disease reflecting the distribution of advantage and disadvantage in those societies. The Theory of Fundamental Causes posits that individuals of higher SES have access to information and resources necessary to rely upon this information. At the top of figure one, you can see that this connection to health would manifest itself through prevention of disease or improved prognosis once disease occurs [Link & Phelan, 1995]. As seen at the bottom of figure one, SES may also influence the norms, environments and institutions that affect health. An example of this is the health benefit of living or working in specific neighborhoods [Link & Phelan, 1995].

A fundamental social cause of inequities in surgical outcomes, socioeconomic status in this case, must have four key components according to this theory:

1) Socioeconomic status influences multiple surgical outcomes.
2) Socioeconomic status affects surgical outcomes through multiple risk factors.

3) The association between socioeconomic status and surgical outcomes is reproduced over time via the replacement of intervening mechanisms.
4) Socioeconomic status involves access to resources that can improve prognosis following surgery or prevent surgery.

1) Socioeconomic status influences multiple surgical outcomes.

The link between socioeconomic status and surgical measures (see Figure One) has been well established. A cross-sectional analysis of six common, high-risk procedures found that Medicare patients with lower socioeconomic status have higher rates of operative mortality than patients with higher socioeconomic status across a wide range of surgical procedures [Birkmeyer, Gu, Baser, Morris, & Birkmeyer, 2008]. More recently, a longitudinal study found that in both 2000 and 2009, adult patients from low-income areas had worse mortality and complication rates than those from high-income for 9 of the 12 surgical measures [Qasim & Andrews, 2013]. Surgical length of stay has also been linked to measures of low socioeconomic status: Medicaid patients had the longest length of stay despite controlling for age, gender, income, geographic region, operation, and 30 comorbid conditions in a longitudinal study examining eight major surgical operations. [LaPar et al., 2010].

Readmission rates also vary by patient socioeconomic status. Readmission rates were consistently higher for patients residing in the poorest communities than for patients residing in the wealthiest communities for all 10 surgical procedures examined in a recent cross-sectional analysis [Qasim & Andrews, 2012]. The biggest differences were noted for Cesarean section where the readmission rate was 60 percent higher for patients residing in low-income communities and nearly 30 percent higher readmissions for hip replacement. Another measure, functional recovery following surgery, is relatively understudied. A prospective cohort study of Australian patients' functional recovery following hip and knee replacements found that after adjusting for other covariates, SES was not an independent predictor following large joint arthroplasty [Dowsey, Nikpour, & Choong, 2014]. However, a systematic review examining whether psychosocial factors add additional predictive power beyond controlling for clinical factors, found that psychosocial factors are indeed significant in predicting surgical recovery [Rosenberger, Jokl, & Ickovics, 2006]. A study examining Surgical Care Improvement Project (SCIP) measures, an extensive list of process measures aimed at reducing surgical complications, used Medicare data and found that hospital compliance with SCIP measures is not reliably correlated with risk-adjusted surgical outcomes [Nicholas, Osborne, Birkmeyer, & Dimick, 2010]. A recent longitudinal study examining Total Knee Arthroplasty (TKR) found that patients with reported incomes under $25,000 were less likely to be satisfied with surgical outcomes than patients with higher incomes [Barrack et al., 2014].

2) Socioeconomic status affects surgical outcomes through multiple risk factors.

There are several medical and psychosocial risk factors that affect surgical outcomes. The relationship between socioeconomic status—medical care—surgical outcomes has been extensively studied because this pathway is considered "actionable" and data is more readily available to assess medical factors as compared to factors such as individual health behaviors. It has been firmly established that poorer individuals have impeded access to care, present with advanced disease and receive lower quality care [Williams, 1990]. Socioeconomic status can affect surgical outcomes through medical care factors such as the presence or absence of health care insurance, the lack of a regular source of care, the quality of care received from hospitals

and providers, the surgical volume of a hospital or surgeon, and characteristics of the patient visit such as cultural barriers and physician communication.

For example, the relationship between hospital volume and surgical outcomes has been extensively studied in over 125 studies demonstrating that there is a persistent inverse relationship. There is evidence from cross-sectional analyses and retrospective studies to suggest that patients of low socioeconomic status, uninsured patients, minorities and Medicaid patients are less likely to receive care at high-volume hospitals and more likely to receive care at low-volume hospitals despite adjusting for additional patient-level characteristics [Hauch, Al-Qurayshi, Friedlander, & Kandil, 2014; Liu et al., 2006]. High hospital volume for surgery correlates with fewer adverse outcomes [Chowdhury, Dagash, & Pierro, 2007]. Surgical volume has also been examined and exhibits the same inverse relationship; high surgical volume for a surgeon correlates with fewer adverse outcomes [Chowdhury, Dagash, & Pierro, 2007]. In 91 percent of the studies examined in this review, specialist surgeons had significantly better outcomes than general surgeons [Chowdhury, Dagash, & Pierro, 2007]. A new study used fixed-effects regression and found differences in hospital quality explained 35% of the observed disparity in mortality rates following surgery for the Medicare population [Rangrass, Ghaferi, & Dimick, 2014]. This estimate calls into question previous assumptions that understated the importance of medical care to health outcomes (as compared to individual behavioral and lifestyle characteristics). It may also be the case that medical care is more important for surgical outcomes than for measures of general health status, where lifestyle may play a larger part.

There is also a large body of research that supports the relationship between payer status and surgical outcomes using binary logistic regression and hierarchical multiple regression models [Boxer et al., 2002; LaPar et al., 2011; LaPar et al., 2012; Stone et al., 2013]. Insurance status may affect surgical outcomes in a number of ways: 1) restricted access to high-quality care, 2) higher acuity at presentation; and 3) poor preoperative health [Dasenbrock et al., 2012]. Unsurprisingly, uninsured individuals and patients that report Medicaid as their payer have the highest adjusted risks of mortality following surgery [LaPar et al., 2010]. When compared to patients that have private insurance, Medicaid patients have more trouble accessing both primary and surgical care due to lower reimbursement rates, scheduling adequate follow-up care (continuity), and receive lower quality care [O'Shea, 2007]. This study also noted that differences persisted despite accounting for clinical factors, socioeconomic status, and type of care received.

Psychosocial factors also represent important risk factors that influence surgical outcomes. Although recognized as valuable, psychosocial factors in surgical care have been explored in limited contexts. Many researchers note that the link between psychosocial factors, SES and surgical outcomes has not been investigated in a systematic fashion [Williams, 1990]. The literature regarding psychosocial factors and surgery is especially sparse and conflicting [Williams, 1990; Rosenberger, Jokl, & Ickovics, 2006].

It has been said that psychosocial factors are the major mechanism responsible for social-status based variations in health [Williams, 1990]. The term "psychosocial factors" is often used interchangeably with "stress" [von Känel, 2012]. Poorer individuals are likely to have higher levels of stress and may be more vulnerable to stressors than their higher-income counterparts [Williams, 1990]. Stress is associated with high rates of crime, unemployment, divorce, physical hazards such as pollutants and chemicals, discrimination, poverty, and daily hassles and

struggles. According to a review of literature, surgery triggers an internal response which is often termed the "stress response"; a series of hormonal changes in the body [Desborough, 2000]. Stress has a widely accepted and consistently negative relationship with health, progress, outcomes and immune system response [Esch, Stefano, Fricchione, & Benson, 2002].

The specific role of stress to surgical outcomes revolves around the body's physiological responses. "When we're stressed, the immune system's ability to fight off antigens is reduced. That is why we are more susceptible to infections." [McLeod, 2010]. Stress responses increased heart rate and strain on the circulatory system and increased blood pressure [McLeod, 2010]. In addition, corticosteroids, stress hormones, also suppress the effectiveness of the immune system (reducing lymphocytes), which leads to greater susceptibility to infections [McLeod, 2010].

Psychosocial factors include lifestyle characteristics and living conditions such as sedentary behavior, smoking, alcohol use, poor nutrition, substance abuse, perceptions of loss of control, social integration and support. As discussed previously, lower income individuals present with higher levels of stress. Compared to the over 100 studies that looked at hospital volume, 29 studies examined the influence of psychosocial factors on clinical outcomes after surgery. Results indicate that even after accounting for known clinical factors, attitudinal and mood factors were strongly predictive of surgical outcomes whereas personality factors were least predictive [Rosenberger, Jokl, & Ickovics, 2006]. Attitudinal factors in particular demonstrated the strongest association with measures of functional recovery; attitude has an important relationship with performing activities of daily living [Rosenberger, Jokl, & Ickovics, 2006]. A more recent literature review examined the effect of psychological variables on surgical recovery and found that there was significant heterogeneity across the 16 eligible studies. Results seem to suggest that overall, trait and state anxiety, state anger, active coping, subclinical depression, and intramarital hostility appeared to inhibit recovery, whereas dispositional optimism, religiousness, anger control, low pain expectations, and external locus of control seemed to promote recovery [Mavros et al., 2011].

Health practices are also associated with overall health. This relationship extends to surgical outcomes. Chemicals from smoking affect blood pressure and heart rate, depresses antibody production and the function of cells, which controls the body's response to infections. There is an association between smoking and increased rates of infection [Shaw, 2011]. In one prospective study, it was shown that patients who smoked cigarettes regularly before surgery had almost a twofold greater risk of infection than did nonsmokers [Nagachinta, Stephens, Reitz, & Polk, 1987]. Similar inflammatory responses have been found for obesity when compared to other diseases. "Obesity, like other states of malnutrition, is known to impair the immune function, altering leukocyte counts as well as cell-mediated immune responses" [de Heredia, Gómez-Martínez, & Marcos, 2012]. Therefore, obesity would be positively related to adverse surgical outcomes. Alcohol use, both acute and chronic, impairs the immune system. For example, alcohol inhibits the functions of the cells that ingest and destroy invading microorganisms by altering the production of molecules that coordinate the immune response [Szabo, 1997]. Thus, alcohol use is associated with an increased susceptibility to infections, which can lead to adverse postoperative outcomes [Szabo, 1997].

3) The association between socioeconomic status and surgical outcomes is reproduced over time via the replacement of intervening mechanisms.

The works of Link and Phelan have extensively commented on the reemerging link between socioeconomic status and health outcomes. Water sanitation and infectious disease, two important and established links between socioeconomic status and health outcomes prior the 20th century have since been eradicated as major risk factors. Yet, other risk factors have emerged that have taken the place of infectious disease and water sanitation: smoking, exercise, cardiovascular disease to name a few [Link, Phelan, & Tehranifar, 2010]. Williams[1990] describes the well known example of coronary heart disease (CHD): CHD and risk factors for CHD were positively associated with social status in the 1950s. Over time, however, CHD and its risk factors (sedentary lifestyle, blood pressure, smoking) become inversely associated with social status [Williams, 1990]. Link & Phelan attribute this change to the dissemination of knowledge, power and resources that are readily accessible to those of higher socioeconomic status [2010]. Williams [1990] also references AIDS as a more recent case; early cases of AIDS were middle-class white males. Today, however, AIDS is more prevalent in poorer populations and those of minority status [Williams, 1990].

In comparison to the study of health disparities, the study of disparities in surgical outcomes is examined in limited contexts. There remains work to be done investigating the specific mechanisms, which contribute to the persistence of disparities in surgical outcomes over time as reported in recent studies [Qasim & Andrews, 2013]. Studies predict that as new technologies are further developed (genetic testing for example), we will continue to see the reemergence of disparities via new intervening mechanisms due to the primacy of SES as a contributor of disparities [Link & Phelan, 2010].

4) Socioeconomic status involves access to resources that can improve prognosis following surgery or prevent surgery.

Individuals of higher SES have access to the information and resources necessary to act upon this information. This connection to health care would manifest itself through prevention of disease/surgery or improved prognosis once the disease/surgery occurs [Diez Roux, 2012]. SES may also influence the norms, environments and institutions that affect health. For example, the health benefits of living or working in specific neighborhoods may manifest themselves such that there is lower crime, noise, traffic, pollution and violence in neighborhoods of high socioeconomic status. Conversely, living in areas of low socioeconomic status is associated with a decreased availability in healthy foods (food deserts), poorer access to parks, medical facilities, etc.

As stated in the previous section, the dissemination of knowledge and information is ultimately most advantageous for individuals of higher SES. There is substantial work to be done to elucidate and separate the various interactive relationships with socioeconomic status and other variables, as well as to examine the exact resources and mechanisms through which SES affects surgical outcomes.

CONCLUSION

Previous approaches have not recognized the complex, intertwined and reciprocal relationships that exist between socioeconomic status and surgical outcomes. The Theory of Fundamental Causes would be a more comprehensive and reliable framework than previous conceptualizations of the topic and would be a significant contribution to the study of disparities in surgical care. A review that shows the effects of SES on surgical outcomes by using the

Theory of Fundamental Causes could aid in expanding the scope of study in disparities in surgical care. The Theory of Fundamental Causes also has some limitations. Although health is an important goal, there may be "countervailing mechanisms" (competing interests) that supersede health or work to the detriment of health [Link & Phelan, 2010]. Additionally, for the relationship between socioeconomic status and surgical outcomes to be examined, risk factors and treatments must be known so that resources that embody SES have the ability to impact outcomes. For example, cancers of the pancreas and liver are not amenable to treatment and do not exhibit the same level of disparities as present in cancer of the breast, which is amenable to treatment (and thus knowledge, power, resources impact this outcome) [Link & Phelan, 2010].

Future research should examine the specific mechanisms through which socioeconomic status affects surgical outcomes and the persistence of disparities over time. Although there is a body of research that has investigated the relationship between various medical factors and surgical outcomes, there remains much work to be done on the relationship of psychosocial factors such as stress and surgical outcomes. In addition, future research should focus on teasing apart the various interactive effects and relationships between socioeconomic status and surgical outcomes. As one recent study found, differences in hospital quality explained 35% of the observed disparity in mortality rates post-surgery for the Medicare population [Rangrass, Ghaferi, & Dimick, 2014]. Future efforts should focus on prioritizing the relationships and effect on surgical outcomes by various variables so that appropriate interventions may be developed to improve the quality of care for all populations and reduce disparities for patients from disadvantaged backgrounds. This theory is important for surgical teams to understand that there are many contributors beyond the specific episode of care that will contribute to health care outcomes and the disparity that remains based on patient characteristics. Physicians, hospitals, and surgical teams can benefit from proposed research by taking extra precautions to evaluate patients for risk and implementing programs post-discharge to achieve the best possible outcome for each patient. In addition, Accountable Care Organizations might aid in the reduction of disparities in surgical care through the use of coordinated teams providing patient-centered care in which the providers are at risk for both clinical outcomes and financial outcomes.

REFERENCES

Agency for Healthcare Research and Quality. *National Healthcare Disparities Report, 2011*. AHRQ Publication No. 12-0006. March 2012. Available at www.ahrq.gov/qual/qrdr11.htm. Accessed July 18, 2014.

Agency for Healthcare Research and Quality. *National Healthcare Quality Report, 2010*. Rockville, MD: Agency for Healthcare Research and Quality. AHRQ Publication No. 11-0004-1. Available at: http://www.ahrq.gov/qual/qrdr10.htm. Accessed July 18, 2014.

Alter, D. A., Franklin, B., Ko, D. T., Austin, P. C., Lee, D. S., Oh, P. I., … Tu, J. V. (2013). Socioeconomic Status, Functional Recovery, and Long-Term Mortality among Patients Surviving Acute Myocardial Infarction. *PLoS ONE*, *8*(6), e65130. doi:10.1371/journal.pone.0065130.

Barrack, R.L., Ruh, E.L., Chen, J., Lombardi, A.V. Jr, Berend, K.R., Parvizi, J.,… Nunley RM. (2014). Impact of socioeconomic factors on outcome of total knee arthroplasty. *Clinical Orthopaedics and Related Research*, Jan 472(1), 86-97.

Bernstein, A.B., Hing, E., Burt, C.W., & Hall, M.J. (2001). Trend data on medical encounters: tracking a moving target. *Health Affairs (Millwood),* 20(2), 58-72.

Birkmeyer, J.D., Stukel, T.A., Siewers, A.E., Goodney, P.P., Wennberg, D.E., & Lucas, F.L. (2003). Surgeon volume and operative mortality in the United States. *New England Journal of Medicine*, 349(22), 2117-2127.

Birkmeyer, J.D., Dimick, J.B., & Birkmeyer, N.J. (2004). Measuring the quality of surgical care: structure, process, or outcomes? *Journal of the American College of Surgeons,*198(4), 626-32.

Birkmeyer, N.J., Gu, N., Baser, O., Morris, A.M., & Birkmeyer J.D. (2008). Socioeconomic status and surgical mortality in the elderly. *Medical Care*, 46(9), 893-899.

Boxer, L.K., Dimick, J.B., Wainess, R.M., Cowan, J.A., Henke, P.K., Stanley, J.C., & Upchurch, G.R. Jr. (2003). Payer status is related to differences in access and outcomes of abdominal aortic aneurysm repair in the United States. *Surgery*, 134(2),142-145.

Chowdhury, M.M., Dagash, H., & Pierro, A. (2007). A systematic review of the impact of volume of surgery and specialization on patient outcome. *British Journal of Surgery,* 94(2),145-61.

Cook, B., Liu,L., & McGuire, T. "The value of reducing racial/ethnic disparities in mental health care". Academy Health Annual Research Meeting [Conference]. Orlando. June 2012.

Dasenbrock, H.H., Wolinsky, J.P., Sciubba, D.M., Witham, T.F., Gokaslan, Z.L., & Bydon, A. (2012). The impact of insurance status on outcomes after surgery for spinal metastases. *Cancer,* 118(19), 4833-4841.

de Heredia, F.P., Gómez-Martínez, S., & Marcos, A. (2012). Obesity, inflammation and the immune system. *Proceedings of the Nutrition Society*, 71(2), 332-338.

Desborough, J.P. (2000). The stress response to trauma and surgery. *British Journal of Anaesthesia,* 85(1), 109-117. Review.

Dowsey, M. M., Nikpour, M., & Choong, P. F. (2014). Outcomes following large joint arthroplasty: does socio-economic status matter? *BMC Musculoskeletal Disorders*, *15*,148.

Diez Roux, A.V. (2012). Conceptual approaches to the study of health disparities. *Annual Review of Public Health*, 33, 41-58.

Esch, T., Stefano, G.B., Fricchione, G.L., & Benson, H. (2002). Stress in cardiovascular diseases. *Medical Science Monitor*, 8(5), RA93-RA101.

Hauch, A., Al-Qurayshi, Z., Friedlander, P., Kandil, E. (2014). Association of socioeconomic status, race, and ethnicity with outcomes of patients undergoing thyroid surgery. *JAMA Otolaryngol Head Neck Surgery,* 140(12), 1173-1183.

Healthcare Care Cost Institute. (2014). 2013 Health Care Cost and Utilization Report, Retrieved from http://www.healthcostinstitute.org/2013-health-care-cost-and-utilization-report.

Institute of Medicine (Ed.). (1999). To err is human: Building a safer health system. Washington, D.C.: *National Academy Press*.

Institute of Medicine. (2001). Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: *National Academy Press*.

LaPar, D.J., Bhamidipati, C.M., Mery, C.M., Stukenborg, G.J., Jones, D.R., Schirmer, B.D., Kron, I.L., & Ailawadi, G. (2010). Primary payer status affects mortality for major surgical operations. *Annals of Surgery*, 252(3), 544-550; discussion 550-551.

Lapar, D.J., Bhamidipati, C.M., Walters, D.M., Stukenborg, G.J., Lau, C.L., Kron, I.L., & Ailawadi, G. (2011). Primary payer status affects outcomes for cardiac valve operations. *Journal of the American College of Surgeons,* 212(5), 759-67.

LaPar, D.J., Stukenborg, G.J., Guyer, R.A., Stone, M.L., Bhamidipati, C.M., Lau, C.L., Kron, I.L., & Ailawadi, G. (2012). Primary payer status is associated with mortality and resource utilization for coronary artery bypass grafting. *Circulation,* 126(11Suppl1), S132-9.

LaVeist, T.A., Gaskin, D., & Richard, P. (2011). Estimating the economic burden of racial health inequalities in the United States. *International Journal of Health Services*, 41(2), 231-8.

Link, B.G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior,* Spec. No. 80–94.

Link, B.G., & Phelan, J.C. (1996). Understanding sociodemographic differences in health—the role of fundamental social causes. *American Journal of Public Health,* 86, 471–473.

Liu J.H., Zingmond, D.S., McGory, M.L., SooHoo, N.F., Ettner, S.L., Brook, R.H., Ko, C.Y. (2006). Disparities in the utilization of high-volume hospitals for complex surgery, *JAMA*, 296(16), 1973-1980.

Mavros, M.N., Athanasiou, S., Gkegkes, I.D., Polyzos, K.A., Peppas, G., Falagas, M.E. (2011). Do psychological variables affect early surgical recovery? *PLoS One*, 6(5):e20306.

McLeod, S. A. (2010). *What is the Stress Response.* Retrieved from www.simplypsychology.org/stress-biology.html

Nagachinta, T., Stephens, M., Reitz, B., Polk, B.F. (1987). Risk factors for surgical-wound infection following cardiac surgery. *Journal of Infectious Diseases,* 156(6):967-73.

Nicholas, L.H., Osborne, N.H., Birkmeyer, J.D., Dimick, J.B. (2010). Hospital process compliance and surgical outcomes in medicare beneficiaries. *Arch Surgery(JAMA Surgery)*, 145(10), 999-1004.

O'Brien, S.M., Clarke, D.R., Jacobs, J.P., Jacobs, M.L., Lacour-Gayet, F.G., Pizarro, C., Welke, K.F., Maruszewski, B., Tobota, Z., Miller, W.J., Hamilton, L., Peterson, E.D., Mavroudis, C., Edwards, F.H. (2009). An empirically based tool for analyzing mortality associated with congenital heart surgery. *The Journal of Thoracic and Cardiovascular Surgery,*138(5),1139-1153.

O'Shea, J.S. More Medicaid Means Less Quality Health Care. *Heritage Foundation*. *Memo #1402*. 2007 Mar:1-4.

Partridge, J.S., Harari, D., & Dhesi, J.K. (2012). Frailty in the older surgical patient: a review. *Age Ageing,* 41(2), 142-147.

Phelan, J.C., & Link, B.G. (2005). Controlling disease and creating disparities: a fundamental cause perspective. *Journals of Gerontology Series B Psychol. Sci. Soc. Sci.* 60(Spec. No. 2), 27–33.

Phelan, J.C., Link, B.G., Diez-Roux, A., Kawachi, I., & Levin, B. (2004). "Fundamental causes" of social inequalities in mortality: a test of the theory. *Journal of Health and Social Behavior,* 45, 265–285.

Phelan, J.C., Link B.G., & Tehranifar, P. (2010). Social conditions as fundamental causes of health inequalities: theory, evidence, and policy implications. *Journal of Health and Social Behavior,* 51(Suppl.):S28–40.

Qasim, M. & Andrews, R.M. (2013). Despite overall improvement in surgical outcomes since 2000, income-related disparities persist. *Health Affairs (Millwood),* 32(10), 1773-1780.

Qasim, M. & Andrews, R.M. *Post-Surgical Readmissions among Patients Living in the Poorest Communities, 2009*. HCUP Statistical Brief #142. September 2012. Agency for Healthcare Research and Quality, Rockville, MD. Available at http://www.hcup-us.ahrq.gov/reports/statbriefs/sb142.pdf.

Rangrass, G., Ghaferi, A.A., & Dimick, J.B. (2014). Explaining Racial Disparities in Outcomes After Cardiac Surgery: The Role of Hospital Quality. *JAMA Surgery,* Jan 8.

Rosenberger P.H., Jokl, P., & Ickovics, J. (2006). Psychosocial factors and surgical outcomes: an evidence-based literature review. *Journal of the American Academy of Orthopaedic Surgeons,* 14(7), 397-405.

Shaw, J. 2011. How Does Cigarette Smoking Affect Your Immune System? Retrieved from http://www.livestrong.com/article/27919-cigarette-smoking-affect-immune-system/#ixzz2PGb3GM5i

Smedley, B.D., Stith, A.Y., & Nelson, A.R., Editors, Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care. 2003. Available from http://www.nap.edu/catalog/12875.html

Stone, M.L., LaPar, D.J., Mulloy, D.P., Rasmussen, S.K., Kane, B.J., McGahren, E.D., & Rodgers, B.M. (2013). Primary payer status is significantly associated with postoperative mortality, morbidity, and hospital resource utilization in pediatric surgical patients within the United States. *Journal of Pediatric Surgery,* 48(1), 81-87.

Szabo, G. (1997). Alcohol's contribution to compromised immunity. *Alcohol Health and Research World,* 21(1):30-41. Review.

von Känel, R. (2012). Psychosocial stress and cardiovascular risk : current opinion. *Swiss Medical Weekly,*142:0.

Williams, D.R. (1990). Socioeconomic Differentials in Health: A review and redirection. *Social Psychology Quarterly,* 53(2): 81-99.

Williams, D.R. (1997). Race and health: basic questions, emerging directions. *Annals of Epidemiology,*7, 322–333.