INTRODUCTION

With advances in information technology analytics applications, society stands to benefit greatly from health care innovation. The ability to link physicians, hospitals, pharmacies, clinics, and patients to health information networks and clinical and financial data management and analyses can prove to be invaluable in the diagnosis and treatment of chronic episodes of illnesses such as AIDS/HIV.

This access to data is a necessity in order for hospitals and physicians to provide the highest level of safety and quality of care. Providing the correct diagnosis and procedures is critical for the patient’s utmost care. With the high costs associated with AIDS/HIV procedures, medications, and physician consultants, the integration of IT can offset these costs and improve the efficiency of the organizations. Factors such as cost of care and length of stay continue to drive health service delivery, resource availability, and quality of care.

Business analytics (BA), often termed business intelligence (BI), applications can carefully provide insight into the (in)significance of these factors in health care systems’ abilities to treat AIDS/HIV in general. In particular, demographic variables that relate to cultural, socioeconomic status and community dimensions of those most impacted (namely, Black Americans in the United States, which is the focus of this writing) by the AIDS/HIV epidemic are often disregarded. For the broader community, the questions to address are diverse. What can business analytics inform us about Black Americans infected by AIDS/HIV? What are the broader cultural issues that often are not modeled by analytical tools? How do these findings stand to impact public policy and how the health care community can better assist those living with the disease? In this chapter, I take on these questions by first reviewing major issues and trends in AIDS/HIV and IT literatures by focusing on health disparities in one historically underserved group; namely, Black Americans. Next, I present public health conceptual framework that augments this discourse by depicting those factors uncovered in traditional information technology/systems works. This chapter concludes with recommendations for future research opportunities for examining AIDS/HIV public policy issues.

BACKGROUND

According to Data Bulletin (2003), between 1991 and 2003, per capita spending on health care in the United States rose almost 95%, with little improvement in national health metrics. Among policymakers, well-regarded media outlets, and others (Kovak, 2005), there is widespread disagreement about a final solution to the problem of rising health care costs. Moreover, there is equally widespread agreement that one element must be a large-scale, systemic change in the uses of information technology for health care management and delivery.

Comprehensive IT systems have improved efficiency and productivity in virtually every major industry, with the conspicuous exception of health care, based on recent RAND reports (Fonkych & Taylor, 2005). Used primarily for administrative tasks such as billing and scheduling, IT offers great promise for use in Electronic Medical Record Systems (EMR-S) or as a clinical diagnostic aid.

The AIDS/HIV epidemic continues to have a riveting impact on the United States. In order to slow the epidemic, analytics enables the field to improve upon its understanding of the dynamics behind the disease. There are an estimated 800,000 to 900,000 people currently living with AIDS/HIV in the United States, with approximately 40,000 new AIDS/HIV infections occurring in the United States every year. More recently, gender has become a significant factor to pay attention to when identifying new cases each year. For several years, men dominated the estimates of new infections; women, in general, are now also significantly affected, and Black women, in particular. Adopted from the
Centers for Disease Control and Prevention (CDC), Figure 1 shows that 70% of new HIV infections each year occur among men, although women are also significantly affected and hold the other 30%.

With regard to race, more than half of newly affected AIDS/HIV cases occur among Black Americans, although this subpopulation only represents 13% of the total population of the United States. Hispanics, who make up about 12% of the United States population, are also disproportionately affected. Figure 2 shows the estimates of annual new infections according to race. Blacks lead with more than 50%, while White and Hispanics trail behind with significantly lower percentages.

An even more astounding statistic shows that Black women accounted for 72% of all new diagnosed AIDS/HIV cases in the United States. The AIDS diagnosis rate for Black men was nearly 11 times greater than their white male peers, and this rate is 23 times greater for Black women in comparison to white women (CDC, 2005; LaVeist, 2005).

Business analytics (BA) focuses on effective use of these data and information to drive positive business actions such as those already noted. The body of knowledge for this area includes both business and technical topics, including concepts of performance management; definition and delivery of business metrics; data visualization; and deployment and use of technology solutions such as OLAP, dashboards, scorecards, analytic applications, and data mining (http://www.tdwi.org). Analytics technologies reduce uncertainty, predict with precision, and optimize performance, and can be inclusive of forecasting, text and data mining, and statistical methods, just to name a few. These technologies can enable health care organizations to effectively use:

- **Electronic medical records (EMR).** Stores all patient information in a centralized location and allows physicians, nurses, patients, and other clinical staff to access clinical and financial data spontaneously.

*Figure 1. Estimate of annual new infections by gender (N = 40,000)*

![MEN 70% WOMEN 30%](image)

*Figure 2. Estimate of annual new infections by race*

![BLACK 54% WHITE 26% HISPANIC 19% OTHER 1%](image)
Analytics

- **Computerized physician order entry systems (CPOE).** Manages order and fulfillment of medical actions, including prescriptions, lab orders, discharges, transfers, and referrals.

- **Clinical decision support systems (CDSS).** With the increased use of evidence-based medicine and the need for currency among clinical professionals, innovative knowledge can impact patient outcomes. These systems provide information on diagnosis, treatments, and recommendations given the situation.

- **Wireless networks and remote care.** This technology allows valuable information and observation beyond a hospital bed.

- **Aggregate database on treatment outcomes.** Placing data in databases allows faster assessments and analysis of the data. The data can be quickly filtered to show procedures, treatments, medications, and costs. Valuable information can be pulled much more quickly from electronic sources than hard copies.

**BUSINESS ANALYTICS: HOW IT (UN)INFORMS US**

Business analytics (BA) can better inform hospitals, insurers, and providers of two critical factors in the wake of managed care and capitation: cost of care (COC) and length of stay (LOS) for HIV/AIDS cases. Factors such as a patient’s age, race, gender, and high-risk behaviors are significantly influential in determining COC and LOS. Moreover, geographic location has emerged as a critical factor in the equation. Recent reports by Newsweek (2006), UNAIDS (2004), and the Centers for Disease Control and Prevention (2005) confirm the notion that HIV/AIDS cases have spiked disproportionately in rural United States (particularly the South) and sub-Saharan African countries (particularly Kenya, Tanzania, and South Africa) where people of color comprise significant proportions of the total population.

Using stepwise regression models, SAS Enterprise Guide software (see www.sas.com) and a patient de-identifiable dataset of nearly 90,000 hospital encounters, the author sought to determine how many African American persons had HIV/AIDS. Table 1 shows that roughly 75% of the cases in the dataset represented Blacks, while 23% were whites. Figure 3 plots these figures along the normal curve to illustrate the vast differences in the number of cases between the two groups.

Within the framework of business analytics, these findings, along with other relevant statistics, can be used to inform performance management applications. Within a health care domain, these applications can measure, monitor, and evaluate performance relative to physician, nursing, and other clinical staff retention, internal operations, and clinical care; process performance is relative to disease intervention and diagnostic related groups (DRGs) and productivity enhancement. Hence, these data enable health care organizations to fuse typically disparate clinical and financial data and result in evidence-based medicine/practice.

Balanced scorecards can be generated with these objectives: decrease cost of care, decrease length of stay, and reduced averages by 10% among HIV/AIDS cases in general and Black Americans in particular. Figure 4 shows a snapshot from the SAS Strategic Performance Management (SPM) application to help health care providers meet these objectives. SPM offers graphical representations with diagrams, color-coding, and key

<table>
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<th>Percentage</th>
<th>Cumulative Frequency</th>
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Table 1. Frequency of HIV/AIDS cases found in medical dataset
Analytics

performance indicators (KPIs) functionality to aid in and enhance decision-making.

While BA applications and methods inform of valued statistics in the plight against AIDS/HIV, the numbers do not tell the full story. This is particularly the case in the Black community. In its May 2006 article, “Does Class Trump Race? DiversityInc suggested that to understand health outcomes and disparities, one must not ignore socioeconomic status (SES). This translated into those who have the highest propensity to be uninsured or underinsured; namely, Blacks, Latinos, and those living in impoverished rural areas. Hence, according to Isaacs’ article in the New England Journal of Medicine (2004), many of those living in lower SESs are Black or other ethnic minorities.

Further, much of the health care system is based largely on one’s educational training and the ability to navigate treatment, service delivery, and a host of payer guidelines and policies, all of which warrant some degree of adequate financial and educational resources. Oftentimes, this is not the case of underrepresented groups who are infected and affected by AIDS/HIV in the Black community. Health care policy experts (LaVeist, 2005; Shi & Stevens, 2005) liken these outcomes to race/ethnicity disparities where “adequate measures, such as cultural factors and measures of discrimination have not been developed or implemented, so we are left with race/ethnicity measures serving as relatively inaccurate proxies” (p 35).

Much of the demographics captured in the 90,000 records dataset extends beyond the scorecard in Figure 4 and includes ICD-9 codes, total hospital charges incurred by the patient, diagnoses (as many as 16 per record), medical record numbers, and attending physician codes. While BA applications can stimulate increased comprehension of the correlations among these variables to improve process improvement, forecasting, causal modeling, and resource utilization, just to name a few, clinical and financial systems often do not capture community determinants of vulnerability among chronic disease episodes as classified by Aday (1994). These vulnerable diseases or health conditions link to both the community and individual levels of resources. The community resources encompass cohesiveness among people and neighborhood characteristics (e.g., presence/absence of violence, unemployment rates, access to physical recreation) while the individual level encompasses social and human capital, social status, and health needs. Aday (1994) suggests that there are nine subpopulations that comprise vulnerability. Persons living with AIDS/HIV fall into one of these vulnerable subgroups.

Moreover, Stevens and Shi (2003) offer a conceptual model linking race and ethnicity with health care experiences. Their model encapsulates family characteristics that denote societal and environmental drivers and health system characteristics capturing health and social policy. While socioeconomic status or income

Figure 3. Normal curve showing Whites (case 1) and Blacks (case 2)
can trump race, as suggested by the Kim (2006) article, other dimensions of discourse cannot be ignored; namely, cultural factors, discrimination, health needs, provider factors, and health system factors. Cultural factors rest largely on family structure norms or beliefs and language that impact care delivery, behaviors, and health decision-making and seeking. Discrimination provides the pathway to link race to (un)intended motives, practices, and care delivery, thereby resulting in negative consequences associated with the medical system in general. Health needs influence services sought and implementation of recommendations by patients. Provider factors examine how patients interact with physicians and vice versa. It has been well documented that “physician perceptions and beliefs about patients are affected by race, ethnicity and socioeconomic status” (Shi & Stevens, 2005, p. 43) and do impact physicians’ delivery of services and treatment plans. Lastly, health system factors examine the availability of health care resources and insurance coverage.

Furthermore, each of these dimensions can be linked to health disparities, particularly among Black Americans living with AIDS/HIV and dwelling in vulnerable scenarios of low social and human capital and high unemployment. Among the most vulnerable are those residing in the rural South (USA) where AIDS/HIV infection rates are increasing at alarming rates while literacy rates are often less than 30% for completing a high school education. These areas are characterized by the presence of high unemployment rates, incarceration among Black men, drug trafficking, and migrant workers.

**FUTURE TRENDS AND CONCLUSION**

Business analytics are applications and methodologies that can augment our understanding of a phenomenon in question. In this case, BA was used to analyze a de-identifiable set related to medical encounters or visits to a teaching hospital. BA offers statistical analyses, forecasting, and scorecards to describe the AIDS/HIV cases discovered in the dataset. However, BA is only as sound as the data provided to its users. Oftentimes, this will require that health care researchers analyze more than one dataset or examine findings from other reference disciplines to enrich their interpretation of results. The goal here is to offer the reader the opportunity to step back and reflect on the discourse at hand and recognize that chronic diseases such as AIDS/HIV in vulnerable populations (e.g., Blacks in rural South or in significantly vulnerable scenarios) are not monolithic. A deeper understanding of broader public health frameworks can shed auxiliary viewpoints on the data, thereby affecting one’s interpretation of the results.

Hence, critical to this dialogue is the awareness of health literacy, cultural competency, and health communications in this domain. While there are numerous Internet resources that cover Black Americans’ health, disparities, and AIDS/HIV, the current system is best exemplified by the absence of adaptive structuration (DeSanctis & Poole, 1994). That is, unintended community structures and human action can and often do emerge under the conditions of advanced technologies’ designs where IT designers and sponsors are not void of predefined notions of structuration. Health care Web
sites can lack the presence of cultural competency and a substantial degree of effectiveness in disseminating AIDS/HIV and other pertinent medical information to the Black community. To this end, Healthy People 2010 (2006) concluded:

*Often people with the greatest health burdens have the least access to information, communication technologies, healthcare, and supporting social services. Even the most carefully designed health communication programs will have limited impact if underserved communities lack access to crucial health professionals, services, and communication channels that are part of a health improvement project.*

Lastly, how AIDS/HIV issues are communicated to targeted groups could augment findings from clinical and financial applications that serve as input into BA applications. Health communication scholars argue that the media do not simply report on health issues, but rather play a major role in setting the agenda of health issues for the general public (Pitts & Jackson, 1993). This school of thought agrees with scholars that have analyzed the influence of the media in setting the public agenda on political issues (McLeod, Kosicki & McLeod, 1994; McCombs, 1994; Walker and Kiwanuka-Tondo, 2003). These areas offer promising research opportunities in the context of AIDS/HIV nationally and globally and can help define public policy discourse.

REFERENCES


**KEY TERMS**

**Business Analytics/Intelligence:** Use of data and information to drive business actions, including concepts of performance management, definition and delivery of business metrics, data visualization by using online analytical processing (OLAP), dashboards, scorecards, analytic applications, and data mining.

**Capitation:** Typically associated with managed care; a fixed payment or reimbursement plan that physicians receive based on care delivery to patients.

**Cultural Competency:** The ability of an organization, group, or individual to work crossculturally in an effort to administer health care services and treatment; this is critical to the patient-physician relationship along with access to appropriate care and quality outcomes.

**Diagnostic Related Groups (DRGs):** A classification of hospital case types into groups expected to have similar hospital resource use. The groupings are based on diagnoses (using ICD), procedures, age, sex, and other attributes.

**Health Disparities:** Differences in the incidence, prevalence, mortality, burden of disease, or other adverse health conditions that exist among specific population groups.

**Healthy People 2010:** Objectives for the United States to achieve specified health care status, based on a 10-year timeframe. These objectives include extensive discussion on vulnerable populations, community groups, providers, and so forth, in an effort to improve overall health.

**ICD-9 Codes:** International Classification of Diseases–9th Division

**Managed Care:** An arrangement of specific health providers that are contracted through a structured plan for managing service delivery and cost of care.

**Socioeconomic Status (SES):** A measure of social and economic position that is a function of occupation, income level, and education.

**Vulnerability:** Propensity of poor health and/or lack of access to health care services.