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Abstract

Problem. Providing housing to otherwise homeless individuals who are HIV/AIDS-positive has been demonstrated to improve control of the disease. This was a healthcare quality initiative to review the viral load and Cluster of Differentiation Protein Four positive (CD4+) counts over time of residents in an urban housing facility for HIV/AIDS-positive individuals. Also, a nurse-run clinic was introduced for residents, especially those with comorbidities such as hypertension and diabetes.

Methods. A repeated measures design was utilized. Viral loads and CD4+ counts were retrospectively reviewed from facility records at entrance into and five-years later at the facility. Additionally, measurements of blood pressure, blood glucose, and glycosylated hemoglobin (HgbA1C) were obtained from visits to the facility's nurse-run clinic over nine-weeks.

Results. Twenty-nine residents and their families resided in the housing unit (N=29). There was no statistically significant association between housing and improved viral loads (t (2) = -.321, p = .779) and CD4+ counts (t (1) = -2.538, p = .239). Further, nurse clinic usage was low (n=6) and did not provide adequate data for analysis of blood pressure, blood glucose, and HgbA1C monitoring.

Implications for Practice. There were limitations in services provided in the nurse-run clinic which may have contributed to its low utilization by the residents. Providing an advanced practice registered nurse (APRN) may increase services offered and improve clinic utilization. Missed appointments, unrecorded measurements, and improperly recorded lab values contributed to missing data which may have affected data analysis. A more standardized process for record keeping might improve health maintenance.

Permanent Housing and On-Site Nursing Care: Effects on Homeless Individuals with HIV and Other Comorbidities

Homeless individuals have increased risks that may impede their activities of daily living (ADL), including food insecurity, exposure to violence, lack of sanitation facilities, decreased access to transportation and education, mental illness, and exposure to drug abuse and addiction on a daily basis. They are also more susceptible to physical illness, including HIV infection (Milloy, Marshall, Montaner, & Wood, 2012). Lack of access to adequate health care further complicates their risk. Stable housing may minimize some risks. In fact, housing assistance has improved health care and HIV-related outcomes for formerly homeless, HIV-positive individuals (Aidala et al., 2016). Similarly, outcomes for these patients have been enhanced with the addition of on-site nursing support or triage in HIV housing complexes (Dobbins et al., 2016).

HIV infection in the homeless population is a significant problem with an estimated seropositive rate of 10 – 20 % (Milloy, Marshall, Montaner, & Wood, 2012). Not only is there a higher rate of infection in this group, but also increased rates of acute and chronic comorbid illnesses (Dobbins et al., 2016). Also, reduced access to health care leads to a higher level of morbidity and poorer health outcomes (Aidala et al., 2016). The sequel is a higher mortality rate for homeless HIV individuals. Further, a homeless person with HIV is 10 times more likely to die than an HIV patient in stable housing [Adjusted Odds Ratio (AOR) = 9.98, p-value < 0.01] (Milloy et al., 2012).

A primary consideration for this healthcare quality initiative was stable housing being vital for managing personal health care. The purpose of this project was to evaluate

the effect of stable housing in the treatment and control of HIV infection in an urban housing complex for otherwise homeless people living with HIV. Also, the objective was to make additional nursing support available to the residents. The establishment of a nurse-run clinic provided monitoring and support for residents with comorbid conditions such as hypertension and diabetes. Through the effort of providing residential housing and nursing oversight, the overall goal was to determine the impact of clinic usage on indicators including blood pressure, blood glucose, and HgbA1C. The following PICOT questions were asked: How does the provision of stable housing in a residential community for otherwise homeless individuals diagnosed with HIV/AIDS:

1. impact the Cluster of Differentiation Protein Four positive (CD4+) and viral load count from when they entered housing over a five year period of time?
2. influence conditions such as hypertension (blood pressure) or diabetes (blood glucose and HgbA1C) over a nine-week period of time?

Review of the Literature

A search was performed using the MEDLINE (via PubMed), Cochrane Library and Google Scholar databases between the years of 2007 to 2017. Keywords were: HIV/AIDS, housing, nurse-led clinic, nurse triage, and homelessness. The literature search yielded over 90,000 articles with 12 ultimately chosen for this quality initiative. The inclusion criteria were based on age, health, and socioeconomic standing of the participants, with the focus on HIV-positive adults in marginal housing. Studies with self-reported measures or no disruption of housing status were excluded.

In general, a normal CD4+ count is considered to be 500 -1,500 cells/mm^3 (U. S. Department of Veterans Affairs, VA, 2016). When the CD4+ count drops below 200

cells/mm^3 because of an infection, AIDs is diagnosed. For those who are HIV-positive, control of the disease is better when the CD4+ count increases, and the viral load decreases. The goal for health maintenance is to reach an undetectable viral load, thereby halting or slowing HIV progression.

There is an association between HIV infection and homelessness. Aidala et al. (2016) stressed individuals who were HIV-positive were at increased risk of becoming homeless. Factors contributing to homelessness included the inability to work because of (frequent) illness, housing assistance restrictions due to drug use or incarceration, poor socioeconomic status, and stigma (Aidala et al., 2016). In contrast, individuals who are homeless have an increased risk of becoming HIV-positive. Logan et al. (2013) found homeless youths were more likely to participate in high-risk behaviors such as illicit drug use, alcohol abuse, and unprotected sex. The National Coalition for the Homeless (2007) reported that 50% of individuals with HIV/AIDS felt they were in jeopardy of losing their housing and 44% expressed concern over finances as the reason. In a systematic review, Beijer, Wolf, and Fazel (2012) noted the prevalence of HIV infection in the homeless population ranged from 0.3% to 21.1%. Furthermore, the HIV rate was five to 10 times higher among the homeless population when compared to those with stable housing (Milloy, Marshall, Montaner, & Wood, 2012). The authors found homelessness was the strongest independent factor for the lack of medical care [AOR = 2.3, 95% confidence interval (CI) = 1.1- 6.1] (Milloy, Marshall, Montaner, & Wood, 2012).

Aidala et al. (2016) found access to permanent housing provided individuals with HIV an improved level of health. The systematic review revealed housing status to be a major predictor of viral load suppression (AOR = 0.69; 95% CI = 0.48 - 0.99) (Aidala et

al., 2016). Additionally, 15 of 17 cohort or cross-sectional studies concluded homelessness was related to lower CD4+ counts and higher viral loads. Further, stable housing was an essential factor in improved access to care, retention in care, medication adherence, and reduced risk of HIV transmission (Aidala et al., 2016). In fact, unstable housing was one of the most critical factors in inadequate medication adherence despite any insurance coverage (Aidala et al., 2016).

Milloy et al. (2012) explored the relationship between medication adherence and housing. They found a correlation between inadequate housing and a reduction in quality HIV medical care (Milloy et al., 2012). Individuals receiving housing assistance had higher odds of entering into routine medical care, better odds of appropriate HIV treatment, and improved medication adherence and therapeutic outcomes (Milloy et al., 2012). Those who were homeless had lower rates of viral load suppression after starting medication [adjusted hazard ratio (AHR) = 0.60, *p*-value = 0.003) (Milloy et al., 2012). Dobbins et al. (2016) found stable housing improved medication adherence, thereby increasing life expectancy and improving quality of life. In a cross-sectional analysis of 260 women living with HIV, Webel et al. (2013) concluded stable housing increased social support for HIV self-management behaviors and was an essential factor for improved outcomes.

While stable housing may offer residents a level of support with access to a social worker, most do not provide additional nursing support. Dobbins et al. (2016) analyzed the incorporation of nursing care into permanent housing and the effects on HIV biomarkers. The CD4+ count and viral load are considered HIV biomarkers and monitored every three months for HIV infected individuals. These markers measure the

level of immune suppression (CD4+ count), susceptibility to superimposed infection (viral load), and both may predict the potential for mortality. Dobbins et al. (2016) found the addition of on-site nursing care in permanent housing facilities stabilized CD4+ and viral load counts. While there are several studies to support housing in maintaining health, there is a gap in the literature when analyzing nurse-led efforts to supplement treatment of the homeless HIV patient placed in residential housing.

Diabetes and hypertension are common HIV comorbidities (Okeke, Thibaut, Eron, & Napravnik, 2016; Roerink, Meijering, Bosch, de Galan, & van Crevel, 2015). From 1996 to 2013 the incidence of hypertension in HIV infected individuals has increased (Okeke et al., 2016). The incidence of hypertension in the HIV population was 1.68 per 100 person-years (PY) and rose to 5.35 per 100 PY in 2013. Theoretically, immunosuppression from HIV influences the higher risk of hypertension in this population (Okeke et al., 2016). Cardiovascular disease is a leading cause of death for patients with HIV, and early diagnosis and effective management for both HIV and hypertension are important for improved outcomes. Patients with a CD4+ cell count above 500 cells/mm^3 were at much lower risk of developing hypertension. The association between developing hypertension and treatment with antiretroviral medications remains unclear; however, the link between increased risk of diabetes and taking HIV medications is well established (Roerink et al., 2015). The prevalence of diabetes in HIV infected individuals is three to 14% with most being diagnosed after HIV diagnosis and the beginning of medication. The timely treatment of HIV and its comorbidities is considered the hallmark of reducing mortality and maintaining health (Aidala et al., 2016).

Hypertension and diabetes are also considerations for the general population. According to the Centers for Disease Control and Prevention (CDC, 2017), 29% of adults have hypertension. Additionally, only 54% of those diagnosed with hypertension are controlled. Hypertension is a contributing factor in almost one out of every 1,000 deaths per year. In contrast, diabetes affects 9.4% of the population with 90% to 95% having type II (CDC, 2016). A larger percentage is suspected to have undiagnosed diabetes (23.8%), and 33.9% have prediabetes (CDC, 2016). The CDC (2016) cited diabetes as the seventh leading cause of death in the United States accounting for 24.7 per 1,000,000 deaths a year. Hypertension and diabetes are not only a health care factor for those with HIV but also for people without an HIV diagnosis.

Self-monitoring of blood pressure and blood glucose has been shown as effective means for controlling hypertension and diabetes, respectively (Jo et al., 2017; Tanenbaum, Leventhal, Breland, Yu, Walker, & Gonzalez, 2015). In an observational study of self-blood pressure monitoring, Jo et al. (2017) found blood pressure decreased from 142/88 to 129/80mmHg in 3 months. Tanenbaum et al. (2015) did a qualitative interview study of adults with non-insulin dependent Type II diabetes and determined subjects who used self-monitoring of blood glucose improved their control. The participant's mean HgbA1C was 43 mmol/mol (6.1%). (Tanenbaum et al., 2015).

The framework for many healthcare quality initiatives is the Donabedian model. The model focus is on structure, process and outcomes. Include just a bit about the Donabedian model in this paragraph and provide a reference. The Plan-Do-Study-Act (PDSA) method is also based on the Donabedian model. You may want to briefly

explain this and provide a reference since you are performing the first cycle of the PDSA method.

Method

Design

This healthcare quality initiative was based on the Donabedian model. Structure was established by performing a retrospective analysis of case records using a repeated measures design for HIV-positive residents living in a residential facility within the last five years. Then, an observational, descriptive design was used to obtain information about, individuals with the comorbidities of hypertension and diabetes who visited a new nurse-run clinic located within a community room in the residential housing complex. The process of the newly implemented nurse-run clinic was evaluated using the Plan-Do-Study-Act (PDSA) method.

Setting

Otherwise homeless individuals with an HIV/AIDS diagnosis are accepted into the small residential facility. The residential facility is located in a large Midwestern, urban, inner city area and is situated in an area considered to have one of the highest rates of health issues (City of St. Louis Department of Health, 2016b). The population within the facility's zip code was 11,736 in 2013 but is one of the least populated zip codes in the city. The predominant race is African-American (96.4%) with Caucasians accounting for 1.4% and other races attributing to 2.2% of the population. The median household income in 2013 was the lowest in the city at $15,126 with 52.5% of households below the poverty level. The region had a high incidence of HIV infection but a mid- to low-incidence of AIDS. Mortality due to heart disease and stroke were comparatively mid- to

low- at 202.3 per 100,000 residents and 41.0 per 100,000 respectively (City of St. Louis Department of Health, 2016b). Deaths due to diabetes had mid- to high-incidence at 55.7 per 100,000. There were four community health centers within the zip code (City of St. Louis Department of Health, 2016a). The National Provider Identifier Database (n.d.) identified one of the health centers as a Federally Qualified Health Center (FQHC).

Sample

A convenience sample of HIV-positive individuals and their families who were otherwise homeless but living in a residential housing facility for individuals with HIV/AIDS were selected. The inclusion criteria were individuals or their family members diagnosed with HIV/AIDS living at the housing complex and aged 18-70 years. Adult residents who visited the nurse-run clinic and found to have hypertension or diabetes were monitored for blood pressure, blood glucose, and/or HgbA1C. Exclusion criteria included individuals living at the complex who were under the age of 18-years and those who did not have HIV/AIDS.

Approval Processes

Approval from the University of Missouri-Saint Louis Institutional Review Board (UMSL IRB) was acquired. The project was also reviewed and approved by the Chief Program Officer and a member of the Board of Directors of the residential facility.

Data Collection and Analysis

The data were collected via a retrospective resident record review. Demographic data including age, gender, race, and payor status was recorded. Also, CD4+ and viral load counts from initial acceptance into the residential housing and every six months for the first five-years of residence (if applicable) were obtained. For those with diabetes

and/or hypertension, blood pressure, blood glucose, HgbA1C, and attendance at the clinic was also recorded from March 1 through April 30, 2018, when the nurse-run clinic was implemented.

The data collected utilized a repeated measures design; therefore, to assess the effect of housing over time, a paired *t* test was used. All the statistical tests were performed at .05 level of significance. Data analysis was performed using IBM SPSS version 20 software and Excel 2010.

Procedures

Since this was a quality improvement initiative, a team of key stakeholders was formed, including facility staff, management, Board of Directors, and the University of Missouri-Saint Louis (UMSL). There were several meetings conducted to establish a purpose, goal, and plan for the execution of the initiative. This included the analysis of housing as a means of healthcare by providing a stable environment to improve access to health care and better control of chronic conditions, and to provide support for residents with less than optimum results to achieve improved health management. The O'Grady Student Doctoral Fellowship Award provided funding for the project.

Results

Age of participants ranged between 23- to 57-years with a mean *m*= 37.772 years (*sd* = 9.227). Approximately three-fourths of the respondents were males (*n*= 21, 72.4%) while the remaining were females (*n*=8, 27.6%). Except for one participant (*n*=1, 3.4%) who was Caucasian, all other respondents (*n*=28, 96.6%) were African Americans. Very few participants (*n*=2, 6.9%) reported not having medical insurance (Appendix A).

For viral load count, a paired *t* test for measurement at entry and about five years was performed. During entry period of housing, the mean viral load was *m* = 10,785.22 (*sd* = 20,261.831). After 5 years of housing, the viral load was *m* = 24,133.00 (*sd* = 37,417.403). Results of Shaprio-Wilks's test indicated that the distribution of viral load at both time periods does not deviate significantly from normal distribution (SW statistic = .770, *df* =17, *p* =.05 for viral load at entry of housing and SW statistic = .985, *df* =5, *p* = .766 for viral load after 5 years of housing). Results of Shapiro-Wilks' test confirms normality of the distribution of viral load at the two periods. Results of the paired *t* test indicated the null hypothesis was of no significant difference in mean viral load between the two time periods and cannot be rejected at the .05 level of significance (*t* (2) = -.321, *p* = .779). Therefore, there is no significant difference in mean viral load at entry period and after 5 years of housing. The period of housing did not significantly affect viral load. A run chart demonstrated the average viral load to be poorly controlled with values well above the target of 0 IU/mL; however, improvement was evident (Appendix B).

For the CD4+ count the paired *t* test for measurement at entry and about five years was performed. At entry of housing, the mean CD4+ was *m* = 292.50 (*sd* = 263.751). After nearly five years of housing, the mean CD4+ was *m* = 490.50 (*sd* = 374.059). Shapiro– Wilks' test was used to test normality of the distribution of CD4+ at each time period. Results of Shaprio-Wilks's test indicated the distribution of CD4+ at both time periods did not deviate significantly from normal distribution (SW statistic = .972, *df* = 18, *p* =.063) for CD4+ count at entry of housing and (SW statistic = .912, *df* = 6, *p* = .453) for CD4+ at five years of housing. Results of Shapiro-Wilks' test confirmed normality of the distribution of CD4+ at the two periods. Results of the paired *t* test

indicated that the null hypothesis was of no significant difference in mean CD4+ between the two time periods and cannot be rejected at .05 level of significance (t (1) = -2.538, p = .239). Therefore, there was no significant difference in mean CD4+ at entry to housing period and about five years of housing. The period of housing did not significantly affect the CD4+ count. A run chart demonstrated the CD4+ counts improved and remained within the normal limits of 500-1,500 cells/mm^3 and above the value of 200 cells/mm^3 at which a diagnosis of AIDS is usually made. (Appendix C).

For the comparison of BP and HgbA1C level measurements, the n=6. Due to the low n, there were no valid data points; therefore, no descriptive or inferential statistical methods could be applied.

Discussion

This quality improvement initiative evaluated viral load and CD4+ counts for individuals diagnosed with HIV/AIDS who were formerly homeless but were given an opportunity to live in a residential community. A paired t test determined there was no statistically significant difference between viral load and CD4+ counts upon entry into housing and up to five years in residential housing. However, because this was a healthcare quality initiative, run charts demonstrated improvement for both despite statistical insignificance.

There were several limitations in data collection that may have affected the statistical results. One was the small sample size (N=29). Another was the data collection process. Data was incomplete because residents may have missed some of their appointments. In addition, even if the resident was seen by a provider, the visit results may not have been recorded. For the visit to be recorded, the provider's office must have

communicated the values to the case manager at the residential facility. Unfortunately, there were times when the case manager did not record the visit. Last, the caseworkers may have had a different standard for reporting. Visits with normal lab values were sometimes recorded as N/A, missed or as an unrecorded visit. Hence, there may have been normal lab values that were not recorded.

This project also evaluated the implementation of a nurse-run clinic to assist with overall health maintenance, especially for those with the comorbid conditions of hypertension and diabetes. There was a small number of residents who came in for hypertension and diabetes maintenance (n=6). Only one individual was found to have hypertension, and none had diabetes. This individual returned to the clinic for ongoing monitoring of blood pressure. The clinic was limited to the scope of practice for a registered nurse (RN). Perhaps expanding the scope to that of an advanced practice registered nurse (APRN) where medication management and minor procedures would have appealed to the residents and improved utilization of an on-site health clinic.

Implications for practice would be an improved process for reporting of maintenance data such as the CD4+ and viral load counts at the residential community. A recommendation would be all CD4+ and viral load counts be recorded, regardless of their "normal" value. In addition, increasing the capability of the nurse clinic with an advanced practice registered nurse may improve utilization of the clinic if residents know they have a readily available source of health care for adjustment of medications and monitoring of other comorbid conditions.

Recommendations for further study include a larger sample, including measurements from all residential properties owned by the organization. Even with the

current errors in data reporting, a larger sample may offer a more comprehensive insight. Also, one of the offers daily on-site medication distribution. Analyzing similar data from a property controlling daily medication to the properties promoting self-medication would be of interest.

Conclusion

While there was not a statistically significant difference found in viral load and CD4+ counts from entry into housing over a five-year period, there was evidence of improvement. The nurse-run clinic utilization was low and did not provide enough data for analysis for comorbid conditions such as hypertension and diabetes. An on-site health clinic may be better utilized if services offered were expanded to include medication adjustments and monitoring of comorbid health conditions by an APRN. The development of a full-service clinic in caring for the HIV-positive and homeless population may further improve the health and quality of life for these individuals.

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Appendix A

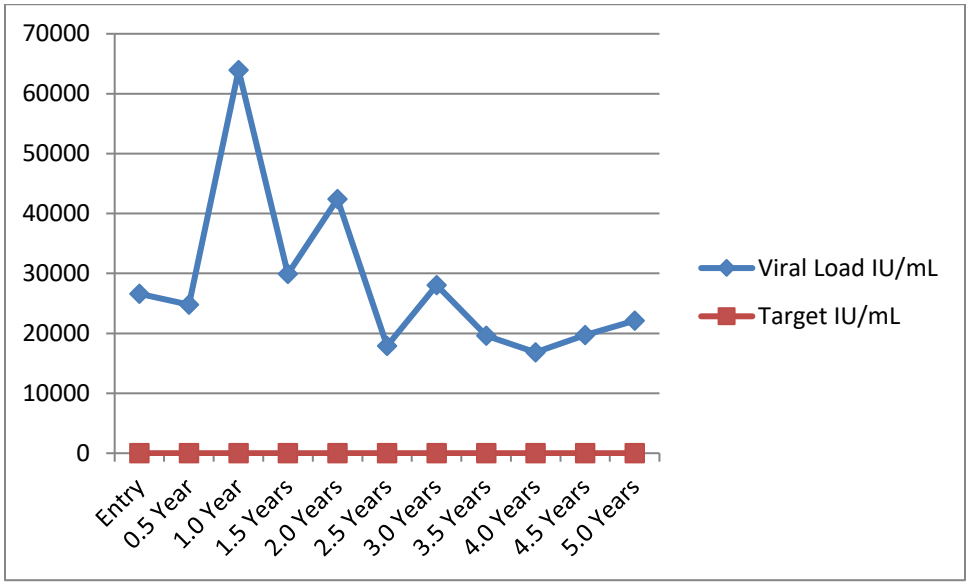
Table 1

Descriptive Statistics of the Demographic Variables of the Respondents in the Sample

Variable		n	%	Mean	SD	min	max
Age		29	100	37.72	9.227	23	57
Gender	Male	21	72.4				
	female	8	27.6				
Race	White	1	3.4				
	African American	28	96.6				
Insurance	Yes	27	93.1				
	No	2	6.9				

Appendix B

Figure 1. Run Chart of Average Viral Load (IU/mL)



Appendix C

Figure 2. Run Chart of Average CD4+ Counts (cells/mm^3)