



Utilizing Biostatistical Analysis of Case Management Data to Enhance Future Outcomes of the Youth and AIDS Projects

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ABSTRACT

- It is hypothesized that retrospective data can be used to understand the effect of case management on viral load and CD4 count over time as well as the associations between client characteristics and the Youth and AIDS projects' (YAP) effectiveness in linking youth to adequate health care.
- In the United States, there is a great disparity between the percentages of HIV-infected youth linked to medical care (25%), the percentage of HIV-infected youth retained in care (11%) and finally those achieving viral suppression (6%). In contrast, successful case management can be associated with a higher retention rate in care and better outcomes for HIV+ clients.
- The purpose of this research is to provide analytical data, that when acted upon, will improve the effectiveness of the Youth and AIDS projects' (YAP) case managers in linking and retaining HIV-infected youth to adequate health care needed to achieve positive viral suppressive outcomes.
- By conducting a statistical analysis using linear mixed and logistic regression models on all YAP case management clients (80) from 2014 -2017, we will determine individual client characteristics (age, sex, demographic background, mental illness, substance abuse ...) that are associated with YAP's effectiveness in linking HIV-infected youth to health care. Our first and second analysis measured success as having a viral load less than 200 and having a CD4 count greater than 200 for a minimum of 12 months respectively.

BACKGROUND

- Case management, defined as a "subset of care coordination models", is the bridge between HIV-infected persons and health care or other social services resources¹.
- One study² linking the effect of case managers on unmet needs of HIV-Infected persons³ was able to generalize the association between case management and better client outcomes by constructing a national probability sample and doing a statistical analysis on data pertaining to the needs of these clients and their utilization of medical care and medications. The analysis shows that having sustained contact with case managers leads to a lower number of unmet needs (emotional counseling, income assistance, housing ...) and an increased utilization of antiretroviral therapy².
- Although these studies show a positive relationship between case management and improving client outcomes, the cascade of care indicates a failure to achieve a significant percentage of youth being retained in care. Also, these studies have focused on a comprehensive population model including both youth and adults. However, my research will focus on youth that are exposed to predisposing factors such as age, sex, ethnicity, housing, substance abuse, mental illnesses and adherence to HIV medication. When it comes to youth (ages 13-29), individuals are more vulnerable given that they are infected at an early age. Obstacles such as depression could interfere with the quality of case management. Therefore, the studies cited do not discuss the specific characteristics of clients over an extended period.

METHODS

In order to better assess the role of case management and its effectiveness on client outcomes at the Youth & AIDS projects (YAP), data on its clients needed to be collected and analyzed:

- YAP currently stores client data, such as viral load and CD4 count, on Microsoft Excel spreadsheets in Box, a cloud content management and file sharing service approved by the University of Minnesota's Institutional Review Board.
- Once these sources had been located, the first step was to identify all clients actively seeking case management (N = 80) in YAP as of 2017 and who had been enrolled in YAP for at least a year between 2014 and 2017. This was done using a report run on CAREWare which lists the status of all clients who were involved in YAP between the years 2014 and 2017.
- Given inconsistencies in the way the retrospective data was managed across these years, a Master Excel spreadsheet was compiled to table the following data found in YAP's "Status Sheets" for each year between 2014 and 2017: **Date of Enrollment, Clinic, Most Recent Viral Load and CD4 count (self-reported by client), Number of Doctor Visits, and Date of Acuity Assessment.** Billed units of case management per year were only found for the years 2016 and 2017 and were used to measure **Case Management Time per year.**
- After defining the outcome studied, it is necessary to collect data for our independent variables in addition to age, sex, and ethnic background. Acuity Assessments are used by case managers to determine whether a client is experiencing one of the prioritized barriers requiring immediate attention. The following indicators were converted to a dichotomous (Y/N) variable as follows: **Homelessness** (Score 4 = Y), **New Diagnosis** (Score 4 = Y), **Untreated Mental Illness** (Score 4 = Y), **New to Anti-retroviral Therapy** (Score 4 = Y), **Engaging in medical care** (2 Doctor Visits = Y), **Non-adherence to HIV medication** (Score greater than 2 = Y), **Substance Abuse** (Score greater than 2 = Y), **Unstable Income** (Score greater than 2 = Y).
- 2017 Cross Sectional Association between demographics, Acuity indicators, and the outcome of achieving viral suppression (viral load < 200) and the outcome of having a high CD4 count (>200)** were examined using two-sample t test or Fisher's exact test, depending on the nature of the variable. Multivariate analyses were conducted using logistic regression models.
- Change in continuous viral load and CD4 count over time was evaluated using linear mixed models. Change in dichotomous viral load and CD4 count over time was evaluated using generalized linear mixed models.** Models included a fixed effect of year and a random intercept to account for correlations among repeated measures within subject. Analyses were done for 2 year interval, 3 year interval, and 4 year interval separately.
- Analyses were performed using SAS 9.3 (SAS Institute, Cary NC). P-values less than 0.05 were considered statistically significant, and those less than 0.1 were considered marginally significant.

RESULTS

1) A) 2017 Cross Sectional Association with the Outcome of Achieving Viral Suppression (viral load < 200) Using Bivariate Analysis:

	Overall	viral load < 200	viral load >= 200	P value
Ethnic BKGND, N (%)				
Afro-American	42 (66%)	27 (64%)	15 (36%)	0.082
All others	22 (34%)	19 (86%)	3 (14%)	
Homelessness, N (%)				
Y	9 (27%)	3 (33%)	6 (67%)	0.01
N	24 (73%)	20 (83%)	4 (17%)	
Non-adherence to HIV medication				
Y	9 (27%)	2 (22%)	7 (78%)	0.0008
N	24 (73%)	21 (87%)	3 (13%)	
New to Anti-retroviral Therapy				
Y	4 (12%)	1 (25%)	3 (75%)	0.073
N	29 (88%)	22 (76%)	7 (24%)	

Table 1. Association between demographic, Tier 3 indicators & viral suppression

1) B) Full model (N = 33) Using Logistic Regression:

	Odds Ratio	95% CI lower	95% CI upper	P value
Afro-American (Y vs N)	0.078	0.004	1.698	0.105
Homeless (Y vs N)	0.096	0.007	1.321	0.0798
Non-adherence to HIV medication (Y vs N)	0.100	0.011	0.937	0.0438
New to Anti-retroviral Therapy (Y vs N)	0.275	<0.001	227.986	0.71

Table 2. Odds Ratios & CI obtained after adjusting for variable with low P value.

1) C) Final Model (N = 33) Using Logistic Regression:

	Odds Ratio	95% CI lower	95% CI upper	P value
Homeless (Y vs N)	0.151	0.018	1.272	0.082
Non-adherence to HIV medication (Y vs N)	0.054	0.006	0.453	0.0071

Table 3. Odds Ratios & CI obtained after dropping last indicator in Table 4.

2) 2017 Cross Sectional Association with the Outcome of Having a High CD4 Count (CD4 count > 200) Using Bivariate Analysis:

	Overall	CD4 count > 200	CD4 count <= 200	P value
Case Management Time (Hours), N				
Mean (SE)	61	57	4	0.016
Range	226 (21)	232 (22)	136 (24)	
	27 - 963	27 - 963	78 - 192	
Non-adherence to HIV medication				
Y	9 (28%)	6 (67%)	3 (33%)	0.017
N	23 (72%)	23 (100%)	0 (0%)	

Table 4. Association between demographic, Tier 3 indicators & high CD4 count

3) Change in Viral Load Over Time:

Year	Mean	SE	% being <200
1	17825	11845	70
2	4143	1392	77
P value	0.23		0.39

Table 5. Mean viral loads for YAP clients active for 2 consecutive years (N= 56)

4) Change in CD4 Count Over Time:

Year	Mean	SE	% being >200
1	537	41	90
2	586	46	97
3	610	47	94
P value	Overall: 0.058 ; Y1 vs Y3: 0.057		0.56

Table 6. Mean CD4 counts for YAP clients active for 3 consecutive years (N= 31)

SUMMARY OF RESULTS

- The results shown are only the most significant results noted.
- In the 2017 Cross Sectional Association with the outcome of achieving viral suppression, the null hypothesis of independence for homelessness and non-adherence to HIV medication were rejected. The odds of viral load < 200 for those non-adherent to HIV medication is 0.054 times that of those adherent to HIV medication, after adjusting for homeless. Similarly for homelessness, the odds of viral load < 200 for those homeless is 0.151 times that of those not homeless, after adjusting for non-adherence to HIV medication.
- In change of viral load over time, the null hypothesis was failed to be rejected for the analyses done over 2-year, 3-year, and 4-year intervals.
- In the 2017 Cross Sectional Association with the outcome of having a high CD4 count, the null hypothesis of independence for case management time and non-adherence to HIV medication were rejected. However, multivariate analysis (logistic regression) could not be done due to the zero cell count for non-adherence to HIV medication.
- In change of CD4 count over time, the null hypothesis was failed to be rejected for the analyses done over 2-year, 3-year, and 4-year intervals. However, a marginally significant increase in the sample's mean CD4 count over time can be seen between years 1 and 3 for the 3-year interval analysis given that the p-value is still less than 0.1.

CONCLUSIONS

- The hypothesis is validated: Case management has a positive effect on increasing the CD4 count of clients over time based on the marginally significant trend observed in both the cross-sectional and longitudinal results.**
- Although both homelessness and non-adherence to HIV medication are concluded to be negative factors that impede the outcome of being viral suppressed, no conclusions can be made to determine the effect of case management on change in viral load over time.
- Going forward, the outcome of viral suppression should continue to be investigated due to our small sample size and difficulty to access clinical data. Potentially partnering with other youth case management groups across the country to combine more data and changing the type of study from retrospective to prospective could further ensure better data collection and promising results.**

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REFERENCES

1. Brennan-Ing, Mark, Liz Seidel, Leslie Rodgers, Jerome Ernst, Doug Wirth, Daniel Tietz, Antonio Morretti, and Stephen E. Karplak. "The Impact of Comprehensive Case Management on HIV Client Outcomes." (Report). 11.2 (2016): n. pag.
 2. Katz, M.H., W.E. Cunningham, J.A. Fleishman, R.M. Andersen, T. Kellogg, S.A. Bozette, and M.F. Shapiro. "Effect of Case Management on Unmet Needs and Utilization of Medical Care and Medications among HIV-Infected Persons." Annals of Internal Medicine 135:8 (2001): 557-65.