Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____   _____

Runa Hatti Gokhale   Date

Depression Prevalence, Treatment Status, and Association with HIV Viral Suppression among Adults Living With HIV in Care in the United States, 2009-2014

By

Runa Hatti Gokhale, MD

Candidate for MPH

Department of Epidemiology

_____

Patrick Sullivan, DVM, PhD

Committee Chair

_____

Heather Bradley, PhD

Committee Member

Depression Prevalence, Treatment Status, and Association with HIV Viral Suppression among Adults
Living With HIV in Care in the United States, 2009-2014

By

Runa Hatti Gokhale

M.D., Thomas Jefferson University, 2007

A.B., Brown University, 2002

Thesis Committee Chair: Patrick S. Sullivan, DVM, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2018

Abstract

Depression Prevalence, Treatment Status, and Association with HIV Viral Suppression among Adults Living With HIV in Care in the United States, 2009-2014

By Runa Hatti Gokhale

Background: Previous research indicates a high burden of depression among adults living with HIV and an association between depression and poor HIV outcomes. National estimates of diagnosed depression, depression treatment status, and association with HIV clinical outcomes are lacking.

Methods: We used 2009–2014 data from the Medical Monitoring Project to estimate diagnosed depression, antidepressant treatment status, and associations with sustained viral suppression (all viral loads in past year <200 copies/mL). Data were obtained through interview and medical record abstraction and were weighted to account for unequal selection probabilities and non-response.

Results: Of adults receiving HIV medical care in the U.S. and prescribed ART, 25% (95% Confidence Interval [CI]: 23–28) had diagnosed depression during the surveillance period; most (65%) were prescribed antidepressants. The percentage with sustained viral suppression was highest among those without depression (72%, CI: 71%–73%) and lowest among those with untreated depression (66%, CI: 64%–69%). Compared to those without depression, those with a depression diagnosis were slightly less likely to achieve sustained viral suppression (aPR 0.95, CI: 0.93–0.97); this association held regardless of treatment status (aPRs 0.96 [0.94–0.99]; 0.92 [0.89–0.96], persons with treated and untreated depression compared to no depression, respectively).

Conclusion: The burden of depression among HIV-infected adults in care is high. While depression is statistically associated with a lower prevalence of viral suppression, this difference is not clinically meaningful. Diagnosing and treating depression in persons living with HIV remains crucial, however, to improve mental health and avoid other poor health outcomes.

Depression Prevalence, Treatment Status, and Association with HIV Viral Suppression among Adults Living With HIV in Care in the United States, 2009-2014

By

Runa Hatti Gokhale

M.D., Thomas Jefferson University, 2007

A.B., Brown University, 2002

Thesis Committee Chair: Patrick S. Sullivan, DVM, PhD

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2018

Introduction

One in four persons living with HIV has symptoms of depression [1]. Depression significantly affects

health and wellbeing. Productive life-years lost from depression are greater than from diabetes,

cardiovascular disease, and cancer [2]. Depression is associated with an increased risk of suicide [3] and

diabetes [4], and has been linked to higher incidence of poor outcomes in persons with cardiovascular

disease [5-7].

Previous studies have suggested that persons dually diagnosed with HIV and depression are less

likely to adhere to ART regimens and more likely to have detectable HIV viral loads than those without

depression [8, 9], however most of these studies were conducted more than ten years ago with

relatively small sample sizes. Depression treatment has been shown to increase the probability of HIV

viral suppression [10] and ART adherence [11]; however there are no national estimates on the

association of depression treatment with HIV clinical outcomes. We used medical record data to

determine the prevalence of depression diagnoses and accompanying treatment status in individuals in

HIV clinical care in the United States who were prescribed ART to assess whether treated and untreated

depression are differently associated with HIV viral suppression.

Methods

Medical Monitoring Project design and data collection

The Medical Monitoring Project (MMP) is an HIV surveillance system designed to produce nationally

representative estimates of behavioral and clinical characteristics of adults living with HIV in the United

States. MMP is a complex-sample, annual cross-sectional survey. For the 2009–2014 data collection

cycles, MMP described adults receiving HIV clinical care. US states and territories were sampled first,

followed by facilities providing HIV care within sampled jurisdictions, and then by HIV-infected adults

(persons aged 18 years and older) who had at least one medical care visit during January – April of each

cycle at participating facilities. Data were collected through face-to-face or telephone interviews and medical record abstractions for the one year preceding interview date for the 2009–2012 cycles and for the two years preceding interview date for the 2013 and 2014 cycles (hereafter referred to as the "surveillance period"). All sampled states and territories participated in MMP: California (including the separately funded jurisdictions of Los Angeles County and San Francisco), Delaware, Florida, Georgia, Illinois (including Chicago), Indiana, Michigan, Mississippi, New Jersey, New York (including New York City), North Carolina, Oregon, Pennsylvania (including Philadelphia), Puerto Rico, Texas (including Houston), Virginia, and Washington. During the six MMP cycles included in analyses, the eligibility-adjusted facility response rate ranged from 76–86% and eligibility-adjusted individual patient response rate ranged from 49–56% [12-16]. Data were weighted on the basis of known probabilities of selection at state or territory, facility, and patient levels. In addition, data were weighted to adjust for nonresponse by using predictors of patient-level response, including facility size, race/ethnicity, time since HIV diagnosis, and age group.

Ethics statement

MMP, as a public health surveillance activity, was determined to be non-research in accordance with the federal human subjects protection regulations at 45 Code of Federal Regulations 46.101c and 46.102d and CDC's Guidelines for Defining Public Health Research and Public Health Non-Research [17]. Participating states or territories and facilities obtained local Institutional Review Board (IRB) approval to conduct MMP, if required locally.

Variables used in the analysis

 "Any depression" was defined as documentation of depression on either outpatient or inpatient medical record abstraction from the patient's main source of outpatient HIV clinical care. Those diagnosed with depression were further categorized as having either "treated depression" or "untreated depression" based on the presence or absence of a prescription for an antidepressant in outpatient or

inpatient medical records. Viral suppression was defined as all HIV RNA levels undetectable or less than 200 copies per milliliter during the 12 months preceding interview date.

Analytic methods

We estimated weighted percentages and associated 95% confidence intervals (CI) for having any depression, treated depression and untreated depression. We then restricted our study population to those prescribed ART and used Rao-Scott chi-square tests to test associations of behavioral and clinical characteristics with any depression and untreated depression. We estimated weighted percentages for viral suppression stratified by depression status and used multivariate logistic regression and adjusted marginal predictions to estimate adjusted prevalence ratios (aPR) of HIV viral suppression conditional on depression status. We constructed two models, one that estimated the prevalence ratio of viral suppression for those with any depression versus no depression, and another that estimated the prevalence ratio of viral suppression for those with untreated depression or treated depression separately versus those with no depression. Each model was adjusted for potentially confounding variables. In all multivariate analyses we included variables as potential confounders that were significantly associated with any depression and viral suppression ($P \leq 0.05$), as well as those important for face validity. To assess potential bias introduced by the change in the surveillance period (12 versus 24-months) between the 2012 and 2013 MMP cycles, we performed a sensitivity analysis. Specifically, we separately estimated the prevalence of depression and its association with viral suppression using 2009 – 2012 data and 2013 – 2014 data. All analyses were performed using procedures for survey data analysis in SAS/STAT 9.3 (SAS Institute, Cary, NC) and SUDAAN 11 (RTI International, Research Triangle Park, NC).

Results

Depression prevalence

Overall, an estimated 27% (95% Confidence Interval [CI]: 25%–29%) of US persons receiving care for HIV infection during 2009 to 2014 had diagnosed depression during the surveillance period; 10% (CI: 9%–10%) had depression and were not prescribed antidepressants and 17% (CI: 16%–19%) had depression and were prescribed antidepressants (Table 1). Among 28,279 MMP participants, 26,150 (92% of weighted sample) were prescribed ART and comprised our analytic sample for the remainder of analyses. Depression diagnosis was associated with sex (females 30% vs. males 26%; $p < 0.01$), sexual orientation, and race/ethnicity (Table 2). Respondents whose household incomes were at or below the federal poverty level had a higher prevalence of depression compared with those living above the poverty level (29% vs. 26%; $p < 0.01$), as did those who were homeless in the past 12 months compared with those who were not. Higher prevalence of depression was observed among those with health insurance coverage compared with those who were uninsured or covered through Ryan White HIV/AIDS Program assistance only, as well as among those whose HIV infection was diagnosed at least 10 years ago compared with those who were diagnosed with HIV fewer than 10 years ago (29% vs. 24%; $p < 0.01$). Similarly, higher prevalence of untreated vs. no depression was observed among females, those who identified their sexual orientation as bisexual or other, were living at or below the poverty level, were recently homeless, had insurance coverage, and had a longer duration since HIV diagnosis.

Depression and HIV viral suppression

The percentage of persons with sustained viral suppression was highest among those without depression (72%, CI: 71%–73%) and lowest among those with untreated depression (66%, CI: 64%–69%) (Table 3). When comparing those with a depression diagnosis to those without, after controlling for gender, race, homelessness, health insurance status, drug use, and time since HIV diagnosis, those with a diagnosis of depression were less likely to achieve viral suppression (aPR 0.95, CI: 0.93–0.96). When comparing those with either treated or untreated depression to those without depression, after adjusting for the same characteristics, those with treated and untreated depression were less likely to

achieve HIV viral suppression (aPRs 0.96 [0.94–0.99]; 0.92 [0.89–0.96], respectively). Sensitivity analyses

demonstrated no significant impact of the change in surveillance period on the observed associations.

Discussion

Our study estimates that one-quarter of HIV-infected adults in care had diagnosed depression

during the one or two years prior to interview and that most were prescribed antidepressants. While

depression was previously linked to poorer HIV clinical outcomes including ART adherence and viral

suppression, here depression was associated with only a modest decrease in viral suppression

regardless of treatment status. This finding is encouraging with regards to HIV clinical outcomes and

suggests depression may not be a significant barrier to ART adherence. However, depression is

associated with many poor mental and physical health outcomes regardless of HIV status; providers

should continue to diligently screen and treat depression in their patients living with HIV infection.

These are the first nationally representative estimates of diagnosed depression among HIV-

infected adults in care in the U.S. Previous national estimates have relied upon self-reported symptoms

of depression and indicate a depression prevalence similar to the 25% in this population [1]. The burden

of depression among adults living with HIV infection is significantly higher than in the general

population; Do and colleagues found a prevalence of current depression that was 3 times as high among

adults in HIV care as within the general population of U.S. adults [1]. In addition, our study indicates that

65% of persons dually diagnosed with HIV and depression are prescribed antidepressants. Similar

estimates in the literature are scarce, however a study of antidepressant treatment status among the

general population of U.S. adults screening positively for depression estimate a treatment percentage of

30%; depression prevalence among this population was 8.4% [18].

Neither depression nor depression treatment status were associated with clinically meaningful

differences in sustained viral suppression. Among people living with HIV, depression has been associated

with lower rates of ART prescription, poorer ART adherence, lower CD4 counts, higher viral loads, and higher incidence of comorbid illness [8, 9, 19-22]. The 2014 Recommendations for HIV Prevention with Adults and Adolescents Living with HIV discuss depression as a factor that could decrease ART adherence [23]. Our study finding that, regardless of depression treatment status, individuals dually diagnosed with HIV and depression and treated with ART are only minimally less likely to achieve viral suppression contradicts previously published reports. This finding may reflect change over time in HIV pharmacotherapy, including development of single-tablet ART regimens, decreased pill burden, and increased tolerability [24-26]. Simpler ART regimens may improve ART adherence in persons dually diagnosed with HIV and depression.

Individuals with depression are more likely to develop cardiovascular disease and more likely to develop diabetes, and to attempt suicide, and they have higher all-cause mortality than individuals without depression [7, 27-30]. Among those living with HIV, studies evaluating the associations between depression and non-HIV related clinical outcomes are limited. However, we know the burden of many non-HIV related clinical outcomes to be high in this population [31-33]. Productive years lost due to disability from depression are 3 times greater than from diabetes, 8 times greater than from cardiovascular disease, and 40 times greater than from cancer [34]. A 2016 WHO study found that scaling up depression and anxiety treatment led to a gain of 43 million extra years of healthy life over a 15-year period equaling $310 billion [35]. It is crucial that providers remain diligent in diagnosing and treating depression among their patients living with HIV.

Guidelines addressing depression treatment for persons living with HIV exist, but could benefit from updates to reflect advances in HIV pharmacotherapy. The American Psychiatric Association Practice Guideline for the Treatment of Persons with HIV/AIDS were published in 2000, and while the organization has since published a Guideline Watch [36], the Guideline itself has not been reviewed or updated since its initial publication [37]. The Guideline suggests that individuals living with HIV infection

should be treated for depression per standard depression treatment recommendations. Specific guidance is given for the assessment and monitoring of potential drug-drug interactions, but given the shifting landscape in HIV pharmacotherapy, updated guidelines may assist providers in selecting appropriate antidepressant regimens that will not disrupt HIV treatment plans.

Limitations

This study has limitations. We relied on provider diagnosis of depression to assess depression status; patients with depression not diagnosed by their provider would not have been categorized as depressed; other analyses have examined self-reported depression symptoms [1]. Moreover, we abstracted medical records only from individuals' primary HIV provider; records held at other locations were not included in analysis. It is possible that depression diagnoses were missed in this way. We were not able to assess the prevalence of psychotherapy treatment. It is possible that some of the 35% of individuals not prescribed pharmacotherapy in our study were receiving psychotherapy alone.

Conclusion

In conclusion, while one quarter of HIV-positive adults in care in the United States have diagnosed depression, depression is not associated with a clinically significant lower prevalence of sustained viral suppression regardless of depression treatment status. However, it is important to note that depression, when undiagnosed and untreated, can result in poor mental and physical health outcomes regardless of HIV status. Given the high prevalence of depression among persons living with HIV, it is crucial that HIV clinical providers remain vigilant in diagnosing and treating depression in their patients.

Funding

Acknowledgements

Table 1. Prevalence of depression among HIV-infected adults in care in the United States: Medical Monitoring Project, 2009-2014 (n=28,279)

	Weighted % (95% CI)
No Depression	73 (71 - 75)
Any Depression	27 (25 - 29)
Untreated Depression	10 (9 - 10)
Treated Depression	17 (16 - 19)

Table 2. Characteristics of HIV-infected adults in care diagnosed with depression in the United States: Medical Monitoring Project, 2009-2014 (n=26,150)[a]

Characteristic	Any Depression (n=26,150) Weighted % (95% CI)	P value	Untreated Depression (n= 26,150) Weighted % (95% CI)	P value
Total	27 (25–29)		9 (9–10)	
Age in years		0.0629		0.3903
18-29	24 (22–27)		10 (8–12)	
30-39	26 (24–28)		10 (9–11)	
40-49	28 (25–28)		9 (8–10)	
≥50	27 (26–29)		9 (8–10)	
Gender		<.0001		0.0059
Male	26 (24–28)		9 (8–10)	
Female	30 (28–33)		11 (9–12)	
Transgender[b]	27 (22–33)		10 (7–13)	
Sexual Orientation		0.0012		0.0074
Homosexual	28 (26–30)		9 (8–10)	
Heterosexual	25 (23–27)		10 (9–11)	
Bisexual	28 (25–31)		11 (9–12)	
Other	28 (20–36)		11 (7–16)	
Race		<.0001		0.6783
White, non-Hispanic	33 (30–36)		10 (9–11)	
Black, non-Hispanic	23 (21–24)		9 (8–10)	
Hispanic[c]	25 (22–28)		9 (8–10)	
Other	32 (29–35)		10 (8–12)	
Highest level of education		0.8172		0.0475
<High school	27 (25–30)		10 (9–11)	
High school diploma or equivalent	27 (25–29)		10 (9–11)	

>High school	27 (25–29)	9 (8–10)	
Level of poverty[d]		0.0008	0.0002
Above poverty level	26 (24–28)	9 (8–9)	
At or below poverty level	29 (27–31)	11 (10–12)	
Homelessness		<.0001	0.0001
No, not homeless	26 (25–28)	9 (9–10)	
Yes, was homeless[e]	36 (33–39)	12 (11–14)	
Health insurance coverage during the last 12 months		<.0001	0.0117
Uninsured	22 (20–23)	8 (7–9)	
Yes	28 (26–30)	10 (9–10)	
Uninsured (Ryan White only)	23 (21–26)	8 (6–9)	
Any drug use in the previous 12 months		<.0001	<.0001
No	25 (23–27)	9 (8–10)	
Yes	33 (30–35)	11 (10–12)	
Duration of HIV		<.0001	0.0394
<10 years	24 (23–26)	9 (8–10)	
≥10 years	29 (27–31)	10 (9–11)	
ART adherence (100% dose adherence in the previous 3 days)		<.0001	0.0008
No	32 (29–35)	11 (10–13)	
Yes	26 (25–28)	9 (8–10)	

[a]Analyses limited to those who received an ART prescription

[b]Patients were classified as transgender if sex at birth and gender reported by the patient were different, or if the patient chose transgender in response to the question about self-identified gender.

[c]Hispanics or Latinos might be of any race. Patients are classified in only 1 race/ethnicity category.

[d]Poverty guidelines as defined by the Department of Health and Human Services (HHS); the 2013 guidelines were used for patientsinterviewed in 2014 and the 2014 guidelines were used for patients interviewed in 2015. More information regarding the HHS poverty guidelines can be found at http://aspe.hhs.gov/frequently-asked-questions-related-poverty-guidelines-and-poverty.

[e]Living on the street, in a shelter, in a single-room–occupancy hotel, or in a car.

Table 3. Prevalence of HIV viral suppression and unadjusted and adjusted associations between a diagnosis of depression and viral suppression among HIV-infected adults in care in the United States: Medical Monitoring Project, 2009-2014 (n = 26,150)[a]

| | Weighted Prevalence of Viral Suppression | Virally Suppressed | | | |
| | | PR (95% CI) | | | |
	% (95% CI)	Unadjusted	P value	Adjusted[b]	P value
Model 1					
No depression	72 (71 - 73)	1.00		1.00	
Any depression	69 (67 - 70)	0.96 (0.93 - 0.98)	**< 0.0001**	0.95 (0.93 - 0.97)	**< 0.0001**
Model 2					
No Depression	72 (71 - 73)	1.00		1.00	
Treated Depression	70 (68 -72)	0.97 (0.95 - 1.00)	**0.0228**	0.96 (0.94 - 0.99)	**0.0018**
Untreated Depression	66 (64 - 69)	0.92 (0.89 - 0.96)	**< 0.0001**	0.92 (0.89 - 0.96)	**< 0.0001**

[a]Analyses limited to those who received an ART prescription

[b]Adjusted for potential confounders (gender, race, homelessness, health insurance status, drug use, time since HIV diagnosis)

References

1. Do AN, Rosenberg ES, Sullivan PS, et al. Excess burden of depression among HIV-infected persons receiving medical care in the united states: data from the medical monitoring project and the behavioral risk factor surveillance system. PloS one **2014**; 9(3): e92842.

2. GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet **2016**; 388(10053): 1545-602.

3. Bozorgmehr A, Alizadeh F, Ofogh SN, et al. What do the genetic association data say about the high risk of suicide in people with depression? A novel network-based approach to find common molecular basis for depression and suicidal behavior and related therapeutic targets. Journal of affective disorders **2018**; 229: 463-8.

4. Hunter JC, DeVellis BM, Jordan JM, et al. The association of depression and diabetes across methods, measures, and study contexts. Clinical diabetes and endocrinology **2018**; 4: 1.

5. Lichtman JH, Froelicher ES, Blumenthal JA, et al. Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: systematic review and recommendations: a scientific statement from the American Heart Association. Circulation **2014**; 129(12): 1350-69.

6. Thombs BD, de Jonge P, Coyne JC, et al. Depression screening and patient outcomes in cardiovascular care: a systematic review. Jama **2008**; 300(18): 2161-71.

7. Drudi LM, Ades M, Turkdogan S, et al. Association of depression with mortality in older adults undergoing transcatheter or surgical aortic valve replacement. JAMA cardiology **2018**.

8. Carrico AW, Bangsberg DR, Weiser SD, Chartier M, Dilworth SE, Riley ED. Psychiatric correlates of HAART utilization and viral load among HIV-positive impoverished persons. AIDS (London, England) **2011**; 25(8): 1113-8.

9.   Springer SA, Dushaj A, Azar MM. The impact of DSM-IV mental disorders on adherence to combination antiretroviral therapy among adult persons living with HIV/AIDS: a systematic review. AIDS and behavior **2012**; 16(8): 2119-43.

10.   Mills JC, Harman JS, Cook RL, et al. Comparative effectiveness of dual vs. single-action antidepressants on HIV clinical outcomes in HIV-infected people with depression. AIDS (London, England) **2017**; 31(18): 2515-24.

11.   Horberg MA, Silverberg MJ, Hurley LB, et al. Effects of depression and selective serotonin reuptake inhibitor use on adherence to highly active antiretroviral therapy and on clinical outcomes in HIV-infected patients. Journal of acquired immune deficiency syndromes (1999) **2008**; 47(3): 384-90.

12.   Centers for Disease Control and Prevention. Behavioral and clinical characteristics of persons receiving medical care for HIV infection—Medical Monitoring Project, United States, 2012. Available at: http://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-HSSR_MMP_2012.pdf. Accessed March 8.

13.   Centers for Disease Control and Prevention. Behavioral and clinical characteristics of persons receiving medical care for HIV infection—Medical Monitoring Project, United States, 2014 Cycle (June 2014–May 2015), **2016**.

14.   Centers for Disease Control and Prevention. Behavioral and clinical characteristics of persons receiving medical care for HIV infection—Medical Monitoring Project, United States, 2013 Cycle (June 2013–May 2014), **2016**.

15.   Centers for Disease Control and Prevention. Behavioral and clinical characteristics of persons receiving medical care for HIV infection—Medical Monitoring Project, United States, 2011 **2015**.

16.   Centers for Disease Control and Prevention. Behavioral and clinical characteristics of persons receiving medical care for HIV infection—Medical Monitoring Project, United States, 2010, **2014**.

17. Centers for Disease Control and Prevention. Distinguishing public health research and public health nonresearch. Available at: http://www.cdc.gov/od/science/integrity/docs/cdc-policy-distinguishing-public-health-research-nonresearch.pdf Accessed June 22.

18. Olfson M, Blanco C, Marcus SC. Treatment of adult depression in the United States. JAMA internal medicine **2016**; 176(10): 1482-91.

19. Nanni MG, Caruso R, Mitchell AJ, Meggiolaro E, Grassi L. Depression in HIV infected patients: a review. Current psychiatry reports **2015**; 17(1): 530.

20. Mayston R, Kinyanda E, Chishinga N, Prince M, Patel V. Mental disorder and the outcome of HIV/AIDS in low-income and middle-income countries: a systematic review. AIDS (London, England) **2012**; 26 Suppl 2: S117-35.

21. Mitchell AJ, Lord O, Malone D. Differences in the prescribing of medication for physical disorders in individuals with v. without mental illness: meta-analysis. The British journal of psychiatry : the journal of mental science **2012**; 201(6): 435-43.

22. Gonzalez JS, Batchelder AW, Psaros C, Safren SA. Depression and HIV/AIDS treatment nonadherence: a review and meta-analysis. Journal of acquired immune deficiency syndromes (1999) **2011**; 58(2): 181-7.

23. Centers for Disease Control and Prevention, Health Resources and Services Administration, National Institutes of Health, et al. Recommendations for HIV prevention with adults and adolescents with HIV in the United States. **2014**.

24. Yager J, Faragon J, McGuey L, et al. Relationship between single tablet antiretroviral regimen and adherence to antiretroviral and non-antiretroviral medications among Veterans' Affairs patients with Human Immunodeficiency Virus. AIDS patient care and STDs **2017**; 31(9): 370-6.

25. Truong WR, Schafer JJ, Short WR. Once-daily, single-tablet regimens for the treatment of HIV-1 infection. P & T : a peer-reviewed journal for formulary management **2015**; 40(1): 44-55.

26.   Beer L, Mattson CL, Bradley H, Shouse RL. Trends in ART prescription and viral suppression among HIV-positive young adults in care in the United States, 2009-2013. Journal of acquired immune deficiency syndromes (1999) **2017**; 76(1): e1-e6.

27.   Nicholson A, Kuper H, Hemingway H. Depression as an aetiologic and prognostic factor in coronary heart disease: a meta-analysis of 6362 events among 146 538 participants in 54 observational studies. European heart journal **2006**; 27(23): 2763-74.

28.   Barefoot JC, Helms MJ, Mark DB, et al. Depression and long-term mortality risk in patients with coronary artery disease. The American journal of cardiology **1996**; 78(6): 613-7.

29.   Pan A, Lucas M, Sun Q, et al. Bidirectional association between depression and type 2 diabetes mellitus in women. Archives of internal medicine **2010**; 170(21): 1884-91.

30.   Moise N, Khodneva Y, Jannat-Khah DP, et al. Observational study of the differential impact of time-varying depressive symptoms on all-cause and cause-specific mortality by health status in community-dwelling adults: the REGARDS study. BMJ open **2018**; 8(1): e017385.

31.   Mayer KH, Loo S, Crawford PM, et al. Excess clinical comorbidity among HIV-infected patients accessing primary care in US community health centers. Public health reports (Washington, DC : 1974) **2018**; 133(1): 109-18.

32.   Drozd DR, Kitahata MM, Althoff KN, et al. Increased risk of myocardial infarction in HIV-infected individuals in North America compared with the general population. Journal of acquired immune deficiency syndromes (1999) **2017**; 75(5): 568-76.

33.   Sackoff JE, Hanna DB, Pfeiffer MR, Torian LV. Causes of death among persons with AIDS in the era of highly active antiretroviral therapy: New York City. Annals of internal medicine **2006**; 145(6): 397-406.

34.   Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet **2012**; 380(9859): 2197-223.

35.   Chisholm D, Sweeny K, Sheehan P, et al. Scaling-up treatment of depression and anxiety: a global return on investment analysis. The lancet Psychiatry **2016**; 3(5): 415-24.

36.   American Psychiatric Association. Guideline Watch: Practice guideline for the treatment of patients with HIV/AIDS. Available at: https://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/hivaids-watch.pdf. Accessed March 30.

37.   American Psychiatric Association. Practice guideline for the treatment of patients with HIV/AIDS, **2000**.