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**Comorbidity and Quality of Life of HIV-Positive Adults Living in Supportive Housing**

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in partial fulfillment of the requirements for the degree  
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## Abstract

*Problem:* Life expectancy for people living with HIV significantly increased with widespread use of antiretroviral therapy, resulting in population increases in comorbidity prevalence. The increased burden of living with both HIV and comorbidities lowers health-related quality of life (HRQoL).

*Methods:* Using a descriptive, correlational, cross-sectional design, a convenience sample of HIV-positive adults was selected from seven supportive housing communities.

Comorbidities were assessed using a modified Self-Administered Comorbidity Questionnaire, and HRQoL using the Patient-Reported Outcome Measurement Information System Scale v1.2 – Global Health.

*Results:* A sample of 17 ( $N = 17$ ) adults reported a mean of 4.2 ( $SD = 2.8$ ) comorbidities. Mean scores for global physical health (GPH) and global mental health (GMH) were 40.8 ( $SD = 9.5$ ) and 45.8 ( $SD = 10.4$ ), respectively. Significant inverse correlations for number of comorbidities ( $r_p = -.77, p < .001$ ) and health survey scores ( $r_p = -.80, p < .001$ ) were observed with GPH scores. Additional significant inverse correlations for number of comorbidities ( $r_p = -.49, p = .047$ ) and health survey scores ( $r_p = -.56, p = .031$ ) were observed with GMH scores.

*Implications for Practice:* A high comorbidity prevalence accompanied by reports of functional limitation and association of decreased HRQoL with increasing number and severity of comorbidity guide targeted intervention development, and support the use of programs such as chronic disease self-management education and support to improve HRQoL in this population of adults living with HIV in supportive housing.

### Comorbidity and Quality of Life of HIV-Positive Adults Living in Supportive Housing

Due to widespread use of combination antiretroviral therapy (ART) in the treatment of HIV, life expectancy for adults diagnosed with HIV has significantly increased (Marcus et al., 2016), and these individuals no longer face the threat of a fatal illness. Instead, the challenge is meeting the demands of living with a chronic disease. Despite improved management, HIV incidence and prevalence in the United States indicates a significant issue remains. In 2018, new diagnoses contributed 37,428 cases to the number of people over the age of 13 years living with a known diagnosis of HIV, bringing the total over one million people (Centers for Disease Control and Prevention, 2020). However, the problem lies not only in the incidence and prevalence, but also in the unintended consequences of treatment advancements, and the effects of said consequences; namely, the increasing prevalence of comorbid health conditions (Cole, Galárraga, Rahman, & Wilson, 2019) and the impact of comorbidity on health-related quality of life (HRQoL).

Given the higher high level of care and complex treatment regimens required to manage both HIV and chronic comorbid conditions, health outcome evaluation must span beyond clinical outcomes to include HRQoL. This patient-reported measure allows the patient to create his/her own definition of health, and is widely used in outcome evaluation of chronic conditions. HIV-status, alone and with the addition of comorbidities, has been associated with low physical and mental HRQoL (Langebeek et al., 2017). Thus, examination of the relationship between comorbidity and HRQoL may help address disparities observed between HIV-positive and HIV-negative populations.

The purpose of this quality improvement (QI) initiative was to identify areas for HRQoL improvement of adults living with HIV in supportive housing. Data for demographics, comorbidities, and HRQoL were collected and analyzed to identify significant relationships. The primary outcome, HRQoL, was assessed as calculated composite scores for global physical health (GPH) and global mental health (GMH). Secondary outcome measures, number and severity of comorbidities, were assessed through patient report of diagnosis, treatment, and limitations related to comorbid conditions. The questions for study were, In adults 18 years of age and older, who are living with HIV in supportive housing in an urban Midwest community

1. What is the comorbidity prevalence and which conditions are most prevalent?
2. How do sociodemographic factors relate to comorbidity and HRQoL scores?
3. What relationship exists between participants' comorbidity and HRQoL scores?

### **Review of the Literature**

A comprehensive search of the literature, limited to full-text, English language, peer-reviewed articles published from 2012 to 2019, was conducted via Academic Search Complete, CINAHL, MEDLINE, PsycINFO via EBSCOhost, and PubMed. Searches using the key terms, “HIV,” “HIV-positive,” “HIV infection,” “HIV comorbid\*,” “comorbid\*,” “multimorbidity,” “multiple comorbid\*,” “health-related quality of life,” and “quality of life,” yielded 5,070 titles. Abstracts of 82 articles were reviewed, and 35 did not meet preliminary criteria: (a) sample includes people living with HIV, (b) examines comorbidity, or (c) use of HRQoL. The full text of the remaining 47 articles were reviewed with the criteria: (a) adult subjects, (b) multigender samples, (c) quantitative design, and (d) high-income country setting. Following elimination of 35

articles for qualitative study design, single-gender samples, and low-income country setting, 12 articles remained.

Multiple disparities experienced by people living with HIV, including life expectancy, comorbidity, and HRQoL, were identified. For instance, comparative analysis of life expectancy in large prospective cohort of HIV-positive and HIV-negative adults concluded, while consistent access to care and use of ART in HIV-positive adults created sharp increases in life expectancy, these factors did not equalize life expectancy between the two populations (Marcus et al., 2016). In the years 2008 to 2011, Marcus et al. (2016), found a 13-year gap in life expectancy existed between HIV-positive and HIV-negative adults. Influences such as early ART initiation (with CD4 count  $\geq 500$ ) and absence of risk factors (e.g., smoking, substance use, and hepatitis B or hepatitis C coinfection) did not eliminate the gap, but reduced it to 5.7 years (Marcus et al., 2016). While all life expectancy disparities are not accounted for, these findings highlight the importance of access to care, use of ART, and risk reduction in creating positive health outcomes for people living with HIV.

With the incline in life expectancy also came increasing comorbidity prevalence. In a retrospective analysis of Medicaid claims of HIV-positive beneficiaries from 2003 to 2012, Cole et al. (2019) identified significant increases in comorbidity measures, including an increase in the average number of comorbidities from 2.62 to 3.31, and the percent of beneficiaries with five or more comorbidities from 21.1% to 27.4%. Similarly, a prospective cohort study conducted by Wong et al. (2018) identified significant increases in comorbidity; however, lower percentages were identified at baseline and conclusion of the study. The number diagnosed with two or more comorbidities started at

8.4% in 2000 and increased to 22.4% in 2009 (Wong et al., 2018). Variations in the number of conditions evaluated for may contribute to these inconsistencies.

The most prevalent conditions identified by Cole et al. (2019) were HTN, mental illness, pulmonary disorders, liver disease, and cardiovascular disease, and the greatest increases were observed in hyperlipidemia, CKD, HTN, and DM (Cole et al., 2019). Correspondingly, comparative analysis of HIV-positive and HIV-negative adults identified HTN, hyperlipidemia, DM, and CKD as most prevalent, each having significantly higher rates in HIV-positive adults. It is important to note, Mayer et al. (2018) assessed for ten conditions, heavily focused on malignancies, and did not include mental illness, pulmonary disorders, or liver disease. In contrast, Cole et al. (2019) assessed for 27 conditions, providing a much more detailed picture of comorbidity, and a possible explanation for the variations of the most prevalent conditions.

In addition to disparities in comorbidity, two cross-sectional studies observed disparities in HRQoL of adults living with HIV (Engelhard et al., 2018; Langebeek et al., 2017). Chiefly, Langebeek et al. (2017) identified an independent association between HIV diagnosis and low physical and mental HRQoL using multivariate linear regression. Accordingly, small yet significant disparities in physical and mental HRQoL were observed compared to HIV-negative adults (Langebeek et al., 2017). The authors hypothesized HRQoL differences would intensify with increasing age and number of comorbidities. While these hypotheses were rejected, an independent association was found between increasing number of comorbidities and low HRQoL in HIV-positive adults (Langebeek et al., 2017).

Similarly, comparison of a prospective cohort study of adults with DM type 1 and randomized control trials (RCTs) of adults with rheumatoid arthritis and DM type 2, Engelhard et al. (2018) found significant differences in HRQoL of adults living with HIV compared to adults living with other chronic conditions. Specifically, lower mental HRQoL was found in adults living with HIV compared to those with the three other conditions (Engelhard et al., 2018). In contrast, physical HRQoL of adults living with HIV was comparable to those with DM type 1 and DM type 2, and significantly higher than those with rheumatoid arthritis. Additional evidence of the association between comorbidity and HRQoL was demonstrated by significantly greater odds of low physical HRQoL scores with severe comorbidity (i.e., past cardiovascular event, non-AIDS-related cancer, end-stage kidney disease, and insulin therapy in DM) compared to having no comorbidities (Engelhard et al., 2018).

Behavioral and social modifiable factors have also been found to impact quality-of-life domains (Langebeek et al., 2017; Webel, Sattar, Schreiner, & Phillips, 2016). Langebeek et al. (2017) found significantly greater prevalence of tobacco use in HIV-positive adults, and identified substance use, including excessive alcohol intake and tobacco use, to negatively impact mental HRQoL. Furthermore, a cross-sectional study conducted by Webel et al. (2016) demonstrated moderate, but significant relationships between social resource variables and quality of life domains; life satisfaction quality of life increased with increasing social belonging and social capital, and overall functioning quality of life increased with increasing social belonging.

Reliable and valid instruments are required to assess comorbidity and HRQoL, and allow for sample and population comparisons. The Self-Administered Comorbidity

Questionnaire (SCQ; Sangha, Stucki, Liang, Fossel, and Katz, 2003) is a patient self-report tool used to assess comorbidity by determining the presence, treatment, and functional limitation caused by common comorbid conditions. Cross-sectional comparison of the SCQ to the Charlson Comorbidity Index, a widely used comorbidity assessment using medical record review, support the tool's validity and reliability. The overall agreeability between the items of each tool was 90%, and test-retest reliability statistics were significant ( $r = .94$ ; Sangha et al., 2003).

To assess effects of non-HIV-related comorbidities in adults living with HIV, a disease-generic instrument such as the Patient-Reported Outcome Measurement Information System (PROMIS) Scale v1.2 – Global Health is best suited. A cross-sectional comparative study conducted by Hays, Bjorner, Revicki, Spritzer, and Cella (2009) demonstrated good internal consistency reliability for GPH and GMH,  $\alpha = .81$  and  $\alpha = .86$ , respectively. Comparison of results of the PROMIS Scale v1.2 – Global Health with results of the EuroQol- 5 Dimension, a widely used tool to assess generic HRQoL, demonstrated high intercorrelation ( $r = .63$ ) and shared variance ( $R^2 = 0.60$ ; Hays et al., 2009), and support the tool's validity and reliability.

Social and behavioral interventions have shown success in improvement of HRQoL. A systematic review and meta-analysis conducted by Bhatta, Liabsuetrakul, and McNeil (2017) examined 28 RCTs, in which 21 found improvement in quality-of-life domains through social and behavioral interventions. The authors reported, exercise programs achieved improvement in a significant number of quality-of-life domains, most notably general health, mental health, environment, and physical function domains. Although the evidence could not strongly support social and behavioral interventions in

HRQoL improvement (Bhatta et al., 2017), social and behavioral interventions designed to prevent and manage comorbidities and improve social resources may be useful.

Physical and mental HRQoL of people living with HIV is impacted by many factors spanning across sociodemographic characteristics, clinical health, and social wellbeing. Although generalizability was limited by settings in private (Marcus et al., 2016) and universal health care systems (Engelhard et al., 2018; Langebeek et al., 2017), the quantity of evidence suggests modifiable factors are essential in HRQoL outcomes. Recent quantitative research suggests interventions targeted at improved comorbidity management and prevention (Engelhard et al., 2018; Langebeek et al., 2017), modifiable behavior factors (Langebeek et al., 2017), and increasing social resources (Webel et al., 2016) may be useful in improving HRQoL.

The Iowa Model of Evidence-Based Practice-Revised provided the theoretical framework for this QI initiative. This model is an algorithm-based, systematic approach to evidence-based practice and focuses on the appraisal and synthesis of literature to inform the development of pilot programs (Buckwalter et al., 2017). Using this model, stakeholder meetings and review of the literature guided development of a plan to assess comorbidity prevalence and HRQoL in HIV-positive adults living in supportive housing.

## **Methods**

### **Design**

The design for this initiative was descriptive, correlational, and cross-sectional. Data were collected via self-administered questionnaires assessing participants' comorbidities and HRQoL.

**Setting**

This initiative took place in seven supportive housing communities for otherwise homeless HIV-positive adults and their dependents located in an urban Midwest community. These communities, operated by a non-profit organization serving its mission to improve the health and well-being of individuals impacted by HIV, contain 103 apartments, providing long-term stable housing for 186 adults and children.

**Sample**

A convenience sample was obtained using the inclusion criteria (a) current HIV-positive community resident, (b) 18 years of age or older, and (d) and consent to participate. Non-residents and individuals under the age of 18 were excluded. To maintain confidentiality of HIV status, all adult residents were welcomed to participate; however, HIV-negative residents were not included in data analysis.

**Approval Process**

Approval was first obtained from the doctoral committee at the University of Missouri-St. Louis (UMSL). A letter approving the QI initiative's planned procedures was then obtained from the collaborating organization. The UMSL Institutional Review Board granted final project approval.

**Procedures**

Initial planning began with problem identification and early initiative formation between the initiative leader, doctoral committee, and staff from the collaborating organization. As an introduction to the community, the initiative leader attended tenant meetings before implementation. Due to the onset of the COVID-19 pandemic, the implementation plan was modified. The plan shifted from group implementation during

chronic disease self-management-focused educational sessions to on-site visits with individual interaction. One week before scheduled visits, the Client Services Coordinator for each community hung flyers in shared areas, and all households received a packet containing a copy of the consent to participate and a detailed initiative brochure with the date and time of the scheduled visit. Accompanied by the Client Services Coordinator, the initiative leader attempted contact at every household. The purpose, requirements, risks, and benefits of involvement were reviewed upon contact, and if the resident agreed to participate, understanding was verified, and informed consent was obtained. In place of the educational sessions, a self-management educational booklet was developed offered to all contacts regardless of participation.

### **Data Collection and Analysis**

Data collection occurred between June 26, 2020, and July 7, 2020. Predictor variables collected were age, gender, race, education level, income, household size, insurance status, tobacco use, and HIV-status. Scores for GPH and GMH, were obtained using the PROMIS Scale v1.2 – Global Health. This scale asks ten questions related to physical and mental health with a five-category response scale, ranging from 1 (*poor*) to 5 (*excellent*). Responses were scores by the HealthMeasures Scoring Service and returned *t* scores for GPH and GMH ( $\mu = 50, \sigma = 10$ ). The health survey, a modified version of the SCQ, assessed number of comorbidities and their severity, or the health survey score (HS score). The HS score was calculated by assigning one point for each ‘yes’ response for diagnosis, treatment, and functional limitation caused by 14 common conditions, with a highest possible score of 42; higher scores indicated greater comorbidity severity.

Data were de-identified, prepared for statistical analysis using Microsoft Excel, and analyzed using Intellectus Statistics software. Descriptive statistics summarized all data and were reported as frequencies for sample demographics (Figure 1) and comorbidity prevalence (see Figure 2) and mean and standard deviation for number of comorbidities, HS score, GPH scores, and GMH scores (see Figure 3). Sample means for GPH and GMH scores were examined using two-tailed, one-pair *t* tests. Statistical differences in number of comorbidities, HS score, GPH scores, and GMH scores between demographic groups were determined using one-way ANOVA. Relationships between comorbidity scores and HRQoL scores were analyzed using Pearson correlation and point-biserial correlation. Significance for all inferential statistics was set at .05.

### Results

From the 186 residents, 17 ( $N = 17$ ) HIV-positive adult residents completed the questionnaires and met inclusion criteria. HS scores for two participants were excluded from analysis due to incomplete data. Participants were ages 35-50 years ( $n = 7, 41.2\%$ ) and 51+ years ( $n = 7, 41.2\%$ ), male ( $n = 10, 58.8\%$ ), and Black ( $n = 16, 94.1\%$ ). See Figure 1 for full demographic profile.

A total of 72 comorbidities were reported by the sample, with the most prevalent conditions being lung disease ( $n = 10, 58.8\%$ ), HTN ( $n = 9, 52.9\%$ ), depression ( $n = 9, 52.9\%$ ), arthritis ( $n = 9, 52.9\%$ ), and back pain ( $n = 9, 52.9\%$ ; see Figure 2). Sample means for number of comorbidities, health survey score, GPH score, and GMH score were 4.2 ( $SD = 2.8$ ), 11.2 ( $SD = 8.1$ ), 40.8 ( $SD = 9.5$ ), and 45.8 ( $SD = 10.4$ ), respectively. The two-tailed, one-sample *t* test found the sample mean GPH score to be significantly different from the reference population ( $p = .001$ ; see Figure 3). Results of the one-way

ANOVA demonstrated significant variance in number of comorbidities and GPH by age group,  $F(2, 14) = 3.80, p = .045, \eta_p^2 = 0.36$  and  $F(2, 14) = 4.85, p = .025, \eta_p^2 = 0.41$ , respectively. Post-hoc analysis showed differences in number of comorbidities and GPH scores between ages 18-34 years and 35-50 years were significant ( $p = .049$  and  $p = .036$ , respectively; see Figure 3).

Results of Pearson correlation demonstrated strong inverse correlations for number of comorbidities ( $r_p = -.77, p < .001$ ) and health survey scores ( $r_p = -.80, p < .001$ ) with GPH scores. As well as, weak to moderate-strength inverse correlations for number of comorbidities ( $r_p = -.49, p = .047$ ) and health survey scores ( $r_p = -.56, p = .031$ ) with GMH scores. Moderate to strong inverse correlations for back pain ( $r_{pb} = -.64, p = .011$ ), lung disease ( $r_{pb} = -.72, p = .002$ ), and GI disorders ( $r_{pb} = -.55, p = .024$ ) with GPH scores were observed. For GMH scores, depression was found to have a strong inverse correlation ( $r_{pb} = -.71, p = .003$ ) and GI disorders a moderate-strength inverse correlation ( $r_{pb} = -.59, p = .024$ ). No additional significant correlations were identified.

### Discussion

The prevalence of comorbidity is high in this sample of HIV-positive adults living in supportive housing. All but one participant reported at least one comorbidity. Surprisingly, more than half of reported conditions (57%,  $n = 41$ ) cause participants to feel functionally limited. More surprisingly, in 89% of cases with functional limitation ( $n = 36$ ), limitation is perceived even in the presence of health care provider management. In light of sustained limitation, future inquiry into the types of limitations experienced and possible explanations for the persistence including treatment regimen understanding, treatment adherence, and barriers to adherence, are recommended. Chronic disease self-

management education and support may be beneficial in addressing sustained limitation, supported by the greater strength of relationships identified between HS scores and scores for GPH and GMH, compared to number of comorbidities.

Compared to the general population, this sample has a significantly lower level of GPH, which is also associated with an increasing number and severity of comorbidities in participants. These findings implicate GPH as an area of concern that warrants intervention and continued surveillance. They also suggest programming focused on prevention and improved management of comorbidity may address the disparity. Additional disparities within the sample for number of comorbidities and GPH scores were identified between age groups, with a significantly higher number of comorbidities and significantly lower GPH scores found in participants age 35-50 years compared to participants ages 18-34 years. Therefore, residents ages 35-50 years may experience the greatest benefit from interventions addressing comorbidity and GPH. Considering the timing of assessment during the global COVID-19 pandemic, reassessment in the post-pandemic period is recommended to identify any impacts reduced access to care and isolation may have on comorbidity and HRQoL.

At the condition-specific level, the moderate to strong inverse relationships between comorbidity factors and HRQoL scores suggests the most significant improvements may be achieved in GPH with lung disease-targeted interventions and GMH with depression-targeted interventions, whereas modest improvements in GPH may be achieved through interventions targeting back pain. Both GPH and GMH scores were correlated with GI disorders; however, the sample's prevalence of GI disorders sample was low ( $n = 3$ , 17.6%) and targeted interventions may not be highly beneficial.

This QI initiative provides the collaborating organization with important baseline data that can facilitate achievement of their mission to improve the health and quality of life of people impacted by HIV, even so, limitations exist. First, the cross-sectional design provides only a snapshot in time and cannot identify data trends and causal relationships. Next, the small and homogenous sample resulted in insufficient sample sizes among variable categories, causing exclusion of multiple sociodemographic variables from statistical analysis. Finally, comorbidity assessment using self-administered questionnaires can potentially result in misreporting of comorbid conditions. To add, consideration of health literacy capabilities of the study population should be made when using self-administered tools.

### **Conclusion**

Multiple areas were identified for HRQoL improvement of adults living with HIV in supportive housing in a Midwest community. This sample demonstrated a high prevalence of comorbidity accompanied by considerable reports of functional limitation related to comorbid diagnoses. Low scores for GPH were reported, with the lowest scores observed in participants ages 35-50 years. Three of the most prevalent conditions, depression, back pain, and lung disease, were also found to have significant relationships with GPH and GMH scores. These findings guide targeted intervention development, and support the use of programs such as chronic disease self-management education and support to improve HRQoL in this population of adults living with HIV in supportive housing.

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Figure 1. Frequencies and percentages for sample demographics.  $N = 17$ . Due to rounding, totals may not equal 100%. Data labels for race, gender, and income include: ‘other’ race ( $n = 1, 5.9\%$ ), ‘other’ gender ( $n = 1, 5.9\%$ ), and ‘\$12,000-\$30,999’ income ( $n = 1, 5.9\%$ ). \* represents category ‘HS diploma/GED’ category.

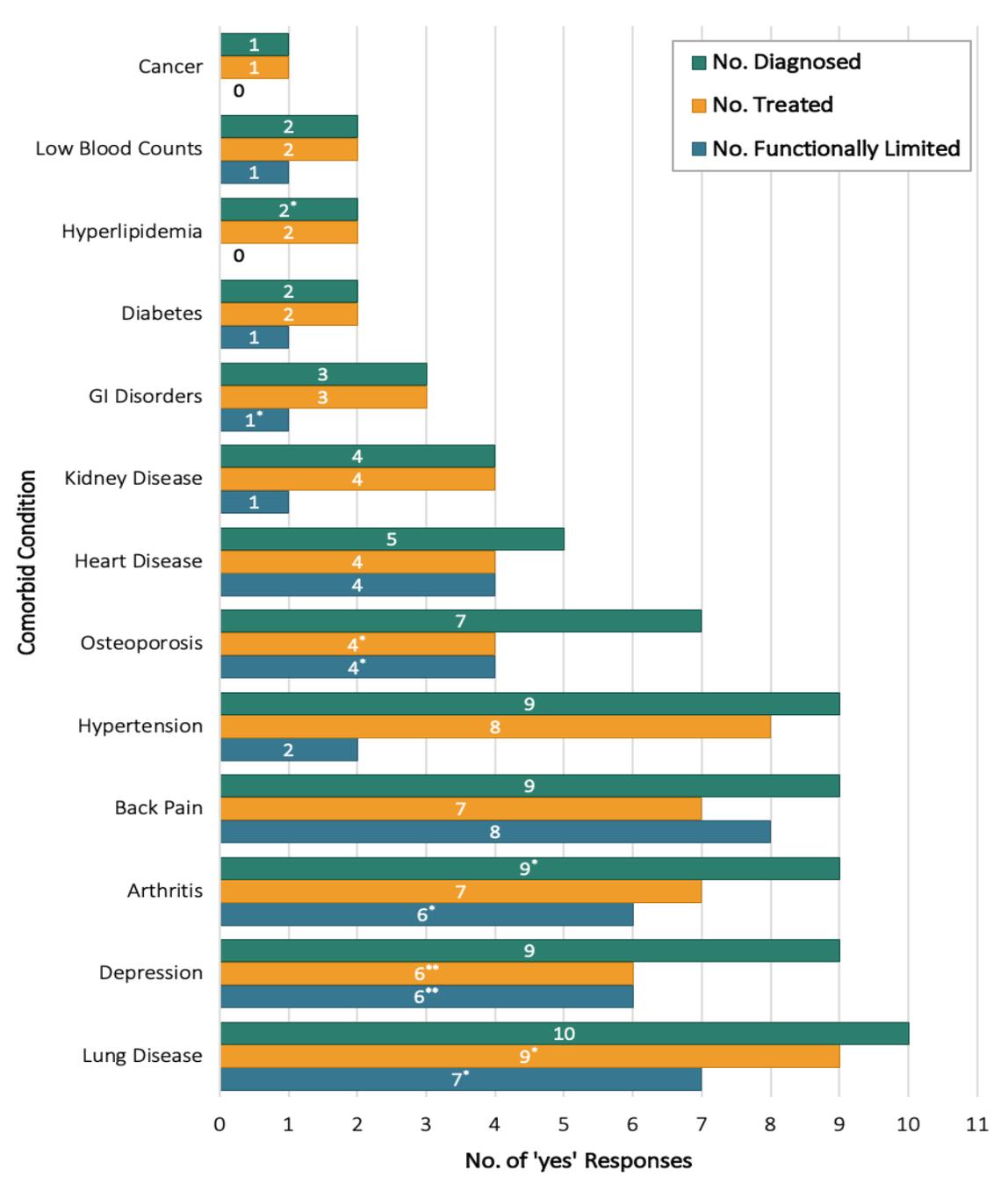


Figure 2. Frequency of diagnosis, treatment, and functional limitation by comorbid condition. *N* = 17. Diagnosis of liver disease was not reported by any participants and was excluded from the figure. \* indicates category was missing one response, and \*\* indicates category was missing two responses.

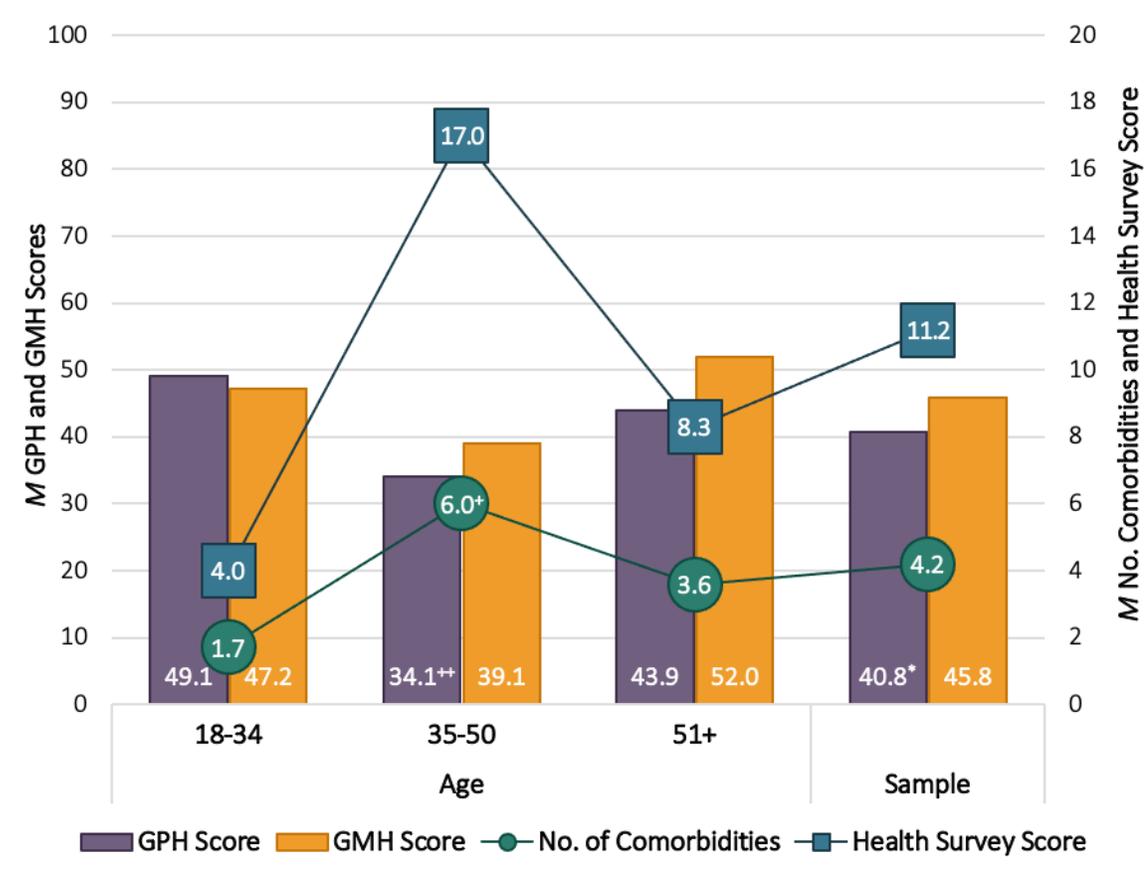


Figure 3. Comparison of means for global physical health (GPH), global mental health (GMH), number of comorbidities, and health survey score stratified by age.  $N = 17$  for GPH, GMH, and number of comorbidities.  $N = 15$  for health survey score.

\* Two-tailed one sample  $t$ -test demonstrated significant difference in sample mean for GPH score compared to reference population ( $p = .001$ ).

+ Number of comorbidities for participants ages 35-50 years were significantly higher than participants ages 18-34 years ( $p = .049$ ).

++ GPH scores for participants ages 35-50 years were significantly lower than participants ages 18-34 years ( $p = .036$ ).