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Health disparities and the digital divide: The relationship between communication inequalities and quality of life among women in a nationwide prospective cohort study in the United States

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Abstract

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COMPETING INTERESTS

The authors have no competing interests to report.

Background—Communication inequalities can affect health-seeking behaviors yet the relationship between Internet use and overall health is inconclusive. Communication-related inequalities vary by race/ethnicity and SES but existing research primarily includes middle-class Whites. We therefore examined the relationship between communication-related inequalities—measured by daily Internet use—and health-related quality of life (QOL) using a nationwide prospective cohort study in the United States that consists of primarily low income, minority women.

Methods—We examined Internet use and QOL among participants in the Women's Interagency HIV Study. Data collection occurred from October 2014-September 2015 in Chicago, New York, Washington DC, San Francisco, Atlanta, Chapel Hill, Birmingham/Jackson and Miami. We used multi-variable analyses to examine the relationship between daily Internet use and QOL.

Results—The sample of 1,915 women was 73% African American and 15% Hispanic; 53% reported an annual income of ≤$12,000. Women with daily Internet use reported a higher QOL at six months, as did women with at least a high school diploma, income >$12,000, and non-White race; older women and those with reported drug use, depressive symptoms and loneliness had lower QOL.

Conclusions—Overcoming communication inequalities may be one pathway through which to improve overall QOL and address public health priorities. Reducing communication-related inequalities—e.g, by providing reliable Internet access—and thus improving access to health promoting information, may lead to improved health outcomes.

Keywords

Quality of life; HIV/AIDS; inequalities; health inequalities

INTRODUCTION

Research demonstrates the need to examine how communication inequalities—in this instance Internet use—may affect health-related outcomes (E. Kontos, Bennett, & Viswanath, 2007). Communication inequalities refer to class and racial differences in the generation, use, manipulation, and distribution of information (Viswanath et al., 2006). In parallel, health disparities in individual- and population-level health could be understood by examining how social determinants such as race, ethnicity, and class are related to how people access, seek, process, and use health-related information (Jung, Ramanadhan, & Viswanath, 2013). Communication influences all aspects of health including prevention, diagnosis, treatment, survivorship, and end-of life care. While technological developments bestow significant advantages to patients, these advantages are primarily realized by those with greater resources. This unequal distribution of access to communication-related technologies may therefore deepen disparities in health status between population subgroups (Viswanath & Kreuter, 2007). For example, recent trends to increase patient access to medical records (e.g., through patient portals or apps) (Arya et al., 2014) as a means to improve patient empowerment may produce 'intervention induced inequalities,' making this topic even more relevant.

While studies demonstrate that Internet use can facilitate healthcare seeking behaviors, data on the relationship between Internet use and overall health-related outcomes are less conclusive (Drainoni et al., 2004; Leung & Lee, 2005). The majority of research indicates potential benefits related to overall health and social mobility (e.g., applying for jobs online) (Leung & Lee, 2005), though some data suggest that Internet use may increase social isolation and loneliness (Kraut et al., 1998; Nie & Erbring, 2000), limit time spent with friends and family members (Shaw & Gant, 2002), and is related to lower quality of life (Leung & Lee, 2005). However, researchers have disputed the directionality of these negative findings and suggest instead that individuals who are lonely or isolated are more likely to use the Internet (Engelberg & Sjöberg, 2004; Wästlund, Norlander, & Archer, 2001).

The likely benefits of Internet use are distributed by race, ethnicity, and social class (Viswanath & Ackerson, 2011; Viswanath et al., 2006). Although Internet access in the United States increased from 40% in 2000 to 87% in 2015 (Anderson & Perrin, 2015), the digital divide remains. While 87% of adults use the Internet, only 59% of individuals over 65 do, compared to 99% of those 18–29 (Anderson & Perrin, 2015). Socio-demographic disparities also exist: only 66% of individuals without a high school education use the Internet compared to 97% of college educated individuals; 97% of individuals with annual incomes of $75,000 use the Internet compared to 77% of those with incomes of $30,000/year (Anderson & Perrin, 2015). Hispanics and Blacks have half the odds of using the Internet compared to Whites (E. Z. Kontos, Emmons, Puleo, & Viswanath, 2010). Groups with limited Internet access are largely identical to those underserved by the healthcare system and who face the greatest health disparities (Viswanath & Kreuter, 2007). Moreover, limited computer literacy skills may interact with limited health literacy among low-SES and minority groups to both inhibit the initiation of Internet-based health information seeking and facilitate the procurement of misinformation because of improper web searching (E. Z. Kontos, Emmons, Puleo, & Viswanath, 2012). Lastly, research on Internet use and health has been conducted almost exclusively among White, middle class people; individuals of lower SES and of color, who bear the greatest burden of health inequities, have seldom been included.

Aside from a few notable exceptions (e.g., with hemodialysis (Afsar, 2013), spinal cord injury (Drainoni et al., 2004), and frailty (Kojima, Iliffe, Jivraj, & Walters, 2016)) communication inequalities—specifically access to the Internet—research has not extended beyond health-seeking behaviors to examine its relationship to biomedical outcomes or the more holistic quality of life (QOL). QOL measures are used to assess an individual's overall health status as opposed to a disease-specific outcome, and is increasingly used to assess chronic disease treatment outcomes and all-cause mortality (Netuveli, Pikhart, Bobak, & Blane, 2012). Measures of QOL help public health practitioners understand injury- and disease-related morbidity and are also used to guide intervention development (Shockey, Zack, & Sussel, 2017). QOL has also been shown to have a prognostic value among cancer, heart surgery, and dialysis patients (Fayers & Machin, 2013; Knudsen, Eidemak, & Molsted, 2016). Research suggests that disparities in QOL are driven by gender, race, and class: reduced QOL scores are found among females, racial-minority individuals, those with less

education, un/under-employment, and of older age (Miners et al., 2014; Shockey et al., 2017).

Social determinants of health shape access to and use of information channels, the ability to process health information, comprehension of health information, and the capacity to act upon that knowledge. This Structural Influence Model outlines the association between social determinants, communication and health outcomes. This model proposes that social determinants act through characteristics such as age, gender, and race to influence the way individuals access health information (Galarce et al., 2011). Based on this model, and the dearth of existing research, the goals of this study were to: 1) examine the relationship between frequency of Internet use at baseline with QOL six months later among HIV-infected and at-risk women in a nationwide cohort that primarily consists of low income, minority individuals, and 2) explore characteristics of women who report daily Internet use.

METHODS

Study Population

Participants were recruited from the Women's Interagency HIV Study (WIHS), an ongoing prospective cohort study of HIV in the US (Chicago, Bronx, Brooklyn, Washington DC, San Francisco, Atlanta, Chapel Hill, Birmingham/Jackson and Miami). Every six months, participants complete a comprehensive physical examination and complete an interviewer-administered questionnaire which collects data on demographics, medical history and QOL. QOL data are collected only at even-numbered visits in WIHS; for this analysis we used QOL data collected at Visit 42. The present analysis also incorporated a one-time questionnaire focused on communication inequalities and Internet use that was administered at all study sites at WIHS Visit 41 (October 1, 2014 to March 31, 2015). All participants provided written informed consent, and the study received approval from Institutional Review Boards at each site and from the WIHS Executive Committee.

Primary Outcome Variables

To assess communication-related inequalities, we asked participants: "On average, how often do you use the Internet or go online?" This included, but was not limited to, social media, email, browsing and general communication. Response options were: "I have never used the Internet," "Less than once a month," "At least once a month, but less than once a week," "Once a week," "3 – 4 times a week," "Once a day," or "More than once a day." Internet use was then dichotomized to 'at least once a day' versus 'less than once a day'. This approach has been used in other studies (Drainoni et al., 2004; Kalichman et al., 2005; Kalichman, Weinhardt, et al., 2002).

QOL data were collected using a shortened version of Bozzette et al. (1995) medical outcome study (MOS-HIV) instrument which includes six domains: physical functioning, role functioning, energy/fatigue, social functioning, and emotional wellbeing (Bozzette, Hays, Berry, Kanouse, & Wu, 1995). The reliability and validity of this measure have been well established and is consistently used to measure the relationship between quality of life and health outcomes specific to HIV populations, including its longitudinal administration

within the WIHS cohort (Aden, Nosyk, Wittenberg, & Schackman, 2014; Duong, Torre, Springer, Cox, & Plankey, 2016; Haley, Haardorfer, et al., 2017; Haley, Kramer, et al., 2017; Hanna et al., 2014; Rogers et al., 2018). This measure's internally consistency and ability to discriminate between distinct groups and predict future health outcomes is also well established (Carretero, Burgess, Soler, Soler, & Catalán, 1996). This study analyzed a summary score calculated using the scores from the six domains based on established algorithms (Liu et al., 2006). Each domain's score is calculated by averaging the raw scores for each corresponding item based on a 0–100 scale, with higher scores representing higher functioning. Conversion to this 100-point scale allows for comparisons between this cohort and previous studies. For example, a "relatively well" adult outpatient had a mean score of 82.7, individuals classified as chronically ill scored 77.3 (McHorney, Ware Jr, Rogers, Raczek, & Lu, 1992), and White, male HIV-positive patients averaged 63.4 (Tsevat et al., 1996).

Covariates

Demographic, clinical, and behavioral variables included: HIV status, age, education (less than high school, high school graduate, more than high school), income (>$12,000/year), race/ethnicity (non-Hispanic White, Hispanic, African-American, other), loneliness (Three-Item Loneliness Scale (Hughes, Waite, Hawkley, & Cacioppo, 2004)), past six months drug use (marijuana, crack, cocaine, heroin, illicit methadone, methamphetamines, hallucinogens, or non-prescribed prescription drugs), and depressive symptoms (measured by a score of ≥16 on the Center for Epidemiologic Studies-Depression scale (CESD)).

Statistical Analyses

Inclusion in the analyses depended on whether the woman attended either Visit 41 and/or Visit 42 as well as whether she completed the corresponding questionnaire at each visit. Medians, interquartile ranges, and proportions were derived to summarize study variables. Bivariate analyses of the factors associated with women's daily Internet use used data from Visit 41. Multi-variable analyses (covariates from Visit 42) were conducted to analyze the relationship between daily Internet use at Visit 41 and quality of life at Visit 42. Though this analysis used data from multiple time points, it applied a cross-sectional approach. The QOL measure is censored from above and below. For example, for a woman reporting a score of 100, all that is known is that her true QOL is at least the same as that of another woman reporting 100. A two-limit tobit model, commonly used when you have both ceiling and floor effects (Long, 1997), was used for QOL; We also examined interactions between other covariates and QOL. Stata, version 12.1, was used for statistical analyses.

RESULTS

All women in the WIHS cohort were eligible (N=2,262), of whom 2,114 (93%) provided information on communication inequalities, including Internet use, at Visit 41. A total of 1,915 women were included in the QOL analyses at Visit 42. The mean elapsed time between visits was 5.9 months and there was no association between this elapsed time and QOL. The majority of women (84%) were interviewed within 5–7 months of the previous visit. The average age of the 1,915 women was 48.7 (see Table 1). The majority was African

American (72.9%) and over half (52.5%) had an annual income ≤$12,000; educational attainment was equally distributed across the three categories. Over two-thirds (70.1%) were HIV-infected and one-quarter (25.7%) reported past six-month drug use. One-third (31.6%) reported depressive symptoms, just over half (51.9%) reported feeling lonely "some of the time or often," and the average QOL score was 69.6 (range 0–100). Over half of the women (54.6%) reported daily Internet use.

Quality of Life

To address the first research question, we conducted a multi-variable analysis to examine factors associated with QOL (see Table 2). Women with daily Internet use reported a higher QOL than those without daily use; this effect was stronger for HIV-negative women (b=5.56; 95%CI: 2.65, 8.48) than HIV-positive women (b=2.00; 95% CI: 0.07, 3.94). QOL decreased with age (b=−0.26; 95% CI: −0.35, −0.18). Women with any drug use in the last 6 months (b=−3.61; 95%CI −5.36, −1.86) and those met the CES-D criterion for depressive symptoms (b=−20.33; 95%CI: −22.29, −18.37) reported lower QOL scores compared to those who did not. Women with more frequent loneliness (b=−6.59; 95%CI: −8.11, −5.08) also had lower QOL scores than those with less frequent episodes.

Women who graduated high school reported a higher QOL (b=2.41; 95%CI: 0.54, 4.29) than those who did not; attending college had no effect. Women with an annual income >$12,000 (b=2.37; 95%CI: 0.77–3.97) had higher QOL scores. Compared to non-Hispanic White women, Hispanic women (b=7.21; 95%CI: 3.96–10.46) and African American women (b=5.98; 95%CI: 3.28–8.68) were more likely to report a higher QOL.

Factors Associated with Daily Internet Use

After demonstrating that women with daily Internet use reported higher QOL scores, we subsequently examined which types of women use the Internet daily (see Table 3). Only one-third (36.3%) of women 55+ used the Internet daily compared to 77.6% of women aged 25–41 ($p<0.001$); older people were less likely to report using the Internet. Women without a high school education reported less daily Internet use (37.7%) compared to women with some college (73.9%; $p<0.001$); women with an income of ≤$12,000 were less likely to report daily use (39.8%) than women with higher incomes ($p<0.001$). Race/ethnicity was also associated with daily Internet use: about half of African American women (52.9%) and Hispanic women (50.7%) reported daily Internet use compared to 68.6% of non-Hispanic White women ($p<0.001$). Women with depressive symptoms reported less daily Internet use (45.7%) compared to those who did not (58.4%; $p<0.001$). Lastly, women who reported any drug use in the last six months were less likely to report Internet use (47.8%) compared to those without reported drug use (56.8%; $p<0.001$). Recruitment site, HIV status, and loneliness were not related to daily Internet use.

DISCUSSION

This analysis demonstrated an association between communication inequalities at baseline (operationalized as daily Internet use) and health-related QOL six months later among a cohort of HIV-infected and at-risk women. Importantly, even after controlling for socio-

demographics, mental health and substance use, women with daily Internet use had higher health-related QOL scores than women without daily Internet use. The size and representativeness of the WIHS cohort support the generalizability of these findings to women with and at high risk for HIV infection in the U.S., particularly racial/ethnic minority women who have frequently been excluded from QOL-related research. We also identified characteristics of women who are more likely to face communication inequalities: namely, women who were older, ethnic/racial minorities, women with less education, lower incomes, and who reported loneliness, depression, and substance use. These results fill a gap in the literature by exploring the association between communication inequalities (i.e., frequency of Internet use) and QOL as opposed to disease-specific outcomes, which are more commonly evaluated. These results also advance research by incorporating a sample that has been previously excluded, specifically low income, minority women.

Communication Inequalities and QOL

This study supports existing research demonstrating that Internet use is associated with positive health outcomes (Arya et al., 2014; Engelberg & Sjöberg, 2004; Wästlund et al., 2001). The association between daily Internet use and better QOL may be due to a number of factors. Women with more active Internet use may be engaged in social activities in ways that promote their mental health and overall wellbeing. However, the Internet is not just important for social activities; research demonstrates its utility in accessing health-related information (Kalichman, Benotsch, Weinhardt, Austin, & Luke, 2002; Kalichman et al., 2005). Women may also be searching for information that might otherwise affect health, such as healthy recipes or exercises. Increased Internet use also has implications for improving health literacy (Kobayashi, Wardle, & von Wagner, 2014), which research demonstrates is related to higher QOL scores (Kalichman, Benotsch, et al., 2002; Kalichman et al., 2005). For example, Jung et al. (2013) found that the likelihood of belonging to a low self-rated health group was higher among patients who had avoided health information, whose family members had not sought health information, and those who had not attended any college and resided in the lowest household income bracket (Jung et al., 2013).

Research has demonstrated that individuals of lower SES benefit less from receipt of information than their counterparts of higher SES (Kalichman, Benotsch, et al., 2002; Kalichman et al., 2005) – in part because of lower overall literacy and likely also lower *health* literacy. Few health information websites are designed to cater to the needs of those in the lower SES groups who are more likely to have lower literacy skills (E. Kontos et al., 2007). Providing greater access to and enhancing the quality of media, particularly health media, by taking into account factors associated with social determinants may contribute to addressing health disparities (Viswanath & Ackerson, 2011).

Regardless of HIV status, women in the WIHS share similar demographic characteristics. However, there was a notably stronger association between daily Internet use and QOL among HIV-negative women than HIV-infected women. One explanation may be because HIV-infected women are dealing with the stress of a chronic disease, they are less responsive to factors potentially associated with QOL, such as Internet use. It may also be that as a function of regular HIV care they are more linked into social support services and have

access to additional benefits as a result of their HIV status (e.g., housing, case managers, transportation, dental services, etc.), which may cause them to rely less on the Internet.

Who Faces Communication Inequalities?

An estimated 15% of Americans lack Internet access. Individuals who lack Internet access are also those who face health-related disparities due to poverty, those who in racial/ethnic minority groups, and those with lower education levels (Anderson & Perrin, 2015). Similar to other research (Afsar, 2013; Viswanath & Ackerson, 2011), this study found an association between higher education and increased daily Internet use; racial/ethnic minorities were also less likely to report daily Internet use.

Internet use is also important for factors with downstream health effects, such as educational attainment and applying for jobs and social welfare (Viswanath & Kreuter, 2007). Additional work (Kalichman et al., 2003; Kalichman, Benotsch, et al., 2002) also found that a wide range of health-seeking behaviors occurred over the Internet, including searching for disease treatment information, involvement in advocacy, and contacting healthcare providers. Research suggests that public libraries have become one of the few places in which individuals in certain low-income neighborhoods can access the Internet (Horrigan, 2016). Many people in these neighborhoods used the computers to apply for jobs, and reported often having to wait over an hour to use computers; high-school students described having to sit directly outside libraries after hours to use their wireless networks in order to complete their homework (Horrigan, 2016). This demonstrates the importance of providing Internet—and computer—access to people in areas that might not be readily served. This could occur through installing additional computers in libraries and community centers and by providing free wireless Internet in places like parks, buses/subways, or houses of worship.

This analysis is one of the first to explore the association between communication inequalities—operationalized as daily Internet use—and QOL as a whole as opposed to a disease-specific outcome; it also did so among a group of predominantly low income, minority women. The strengths of the WIHS cohort include the use of a comprehensive QOL assessment consistent with well-established criteria and extensive survey, clinical and laboratory assessments. This allows us to explore the relationship between daily Internet use and quality of life, while controlling for a variety of factors. In addition, we measured communication inequalities in multiple ways (frequency of access, type of access, ways the Internet was used) and the resulting relationships between those variables and QOL did not vary from that of daily Internet use; however, we could not control for the percent of time that women spent accessing healthy recipes, for example, compared to celebrity gossip. Lastly, this is a national-level cohort, which allowed us to sample women from across multiple regions of the United States.

This study also had limitations. Our measure of daily Internet use does not address specific content. Though we measured daily Internet use at one-time point, and quality of life at the subsequent visit (six months later), both of these were only measured at one point in time for the purposes of this analysis—because QOL is only measured at even-numbered visits we could not control for it at visit 41 which was when the Internet access questionnaire was

incorporated into the WIHS. It is therefore unknown whether daily Internet use is stable, or whether there is a fluctuation over time. In addition, we lacked measures on whether women lived in rural or urban areas, which may also impact Internet access and use. Also, people who have more innate communication ability may be more likely to have the resources, or have chosen to invest in having access to the Internet. However, the relationship between daily use of the Internet and QOL at six months persisted in the final model while controlling for income and education. Finally, women with higher QOL may be better able to access the Internet, especially those of lower SES who may need to travel to a library or other source to attain access.

Public Health Implications

Previous research as demonstrated how daily Internet use can help lessen communication inequalities which otherwise exacerbate health disparities (Viswanath & Ackerson, 2011; Viswanath & Kreuter, 2007). Our research supports previous work by showing an association between daily Internet access and QOL. Providing more consistent access to Internet use, particularly health-related information—may therefore be one pathway through which to address health outcomes and overall quality of life. Internet use is associated with exposure and access to health promoting information, which may lead to improved health outcomes. The majority of communication inequalities research has focused on health outcomes such as cancer and smoking, whereas our analyses expanded the understanding of communication inequalities in two ways: first, by exploring communication inequalities' relationship to health-related quality of life as a whole and second, by focusing on predominantly low income, minority women, who are more likely to face communication inequalities. Future research could expand this line of inquiry by operationalizing communication inequalities in different ways, and by conducting national-level surveys to assess how individual-, community-, and structural-level factors may impact health-seeking behaviors and health-related outcomes.

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REFERENCES

Aden B, Nosyk B, Wittenberg E, & Schackman BR (2014). Health-Related Quality of Life in HIV-Infected and At-Risk Women: The Impact of Illicit Drug Use and Hepatitis C on a Community Preference Weighted Measure. Med Decis Making, 34(6), 800–808. doi: 10.1177/0272989X13507340 [PubMed: 24106234]

Afsar B (2013). The relation between Internet and social media use and the demographic and clinical parameters, quality of life, depression, cognitive function and sleep quality in hemodialysis patients: social media and hemodialysis. General hospital psychiatry, 35(6), 625–630. [PubMed: 23948575]

Anderson M, & Perrin A (2015). 15% of American's don't use the Internet. Who are they? Retrieved from http://www.pewresearch.org/fact-tank/2015/07/28/15-of-americans-dont-use-the-internet-who-are-they/:

Arya M, Kumar D, Patel S, Street RL Jr, Giordano TP, & Viswanath K (2014). Mitigating HIV health disparities: the promise of mobile health for a patient-initiated solution. American journal of public health, 104(12), 2251–2255. [PubMed: 25322292]

Bozzette SA, Hays RD, Berry SH, Kanouse DE, & Wu AW (1995). Derivation and properties of a brief health status assessment instrument for use in HIV disease. JAIDS Journal of Acquired Immune Deficiency Syndromes, 8(3), 253–265.

Carretero MD, Burgess AP, Soler P, Soler M, & Catalán J (1996). Reliability and validity of an HIV-specific health-related quality-of-life measure for use with injecting drug users. Aids, 10(14), 1699–1705. [PubMed: 8970691]

Drainoni M-L, Houlihan B, Williams S, Vedrani M, Esch D, Lee-Hood E, & Weiner C (2004). Patterns of Internet use by persons with spinal cord injuries and relationship to health-related quality of life. Archives of physical medicine and rehabilitation, 85(11), 1872–1879. [PubMed: 15520984]

Duong N, Torre P 3rd, Springer G, Cox C, & Plankey MW (2016). Hearing Loss and Quality of Life (QOL) among Human Immunodeficiency Virus (HIV)-Infected and Uninfected Adults. J AIDS Clin Res, 7(12). doi:10.4172/2155-6113.1000645

Engelberg E, & Sjöberg L (2004). Internet use, social skills, and adjustment. Cyberpsychology & behavior, 7(1), 41–47. [PubMed: 15006168]

Fayers PM, & Machin D (2013). Quality of life: the assessment, analysis and interpretation of patient-reported outcomes: John Wiley & Sons.

Galarce EM, Ramanadhan S, Weeks J, Schneider EC, Gray SW, & Viswanath K (2011). Class, race, ethnicity and information needs in post-treatment cancer patients. Patient education and counseling, 85(3), 432–439. [PubMed: 21354761]

Haley DF, Haardorfer R, Kramer MR, Adimora AA, Wingood GM, Goswami ND, . . . Cooper HLF (2017). Associations between neighborhood characteristics and sexual risk behaviors among HIV-infected and HIV-uninfected women in the southern United States. Ann Epidemiol, 27(4), 252–259 e251. doi:10.1016/j.annepidem.2017.03.004 [PubMed: 28476327]

Haley DF, Kramer MR, Adimora AA, Haardorfer R, Wingood GM, Ludema C, . . . Cooper HL (2017). Relationships between neighbourhood characteristics and current STI status among HIV-infected and HIV-uninfected women living in the Southern USA: a cross-sectional multilevel analysis. Sex Transm Infect, 93(8), 583–589. doi:10.1136/sextrans-2016-052889 [PubMed: 28270536]

Hanna DB, Hessol NA, Golub ET, Cocohoba JM, Cohen MH, Levine AM, . . . Kaplan RC (2014). Increase in single-tablet regimen use and associated improvements in adherence-related outcomes in HIV-infected women. J Acquir Immune Defic Syndr, 65(5), 587–596. doi:10.1097/QAI.0000000000000082 [PubMed: 24326606]

Horrigan J (2016). Libraries 2016: Trends in visting public libraries have steadied and many Americans have high expectations for what their local libraries should offer. Retrieved from http://www.pewinternet.org/2016/09/09/2016/Libraries-2016/:

Hughes M, Waite L, Hawkley L, & Cacioppo J (2004). A Short Scale for Measuring Loneliness in Large Surveys Results From Two Population-Based Studies. Res. Aging, 26(6), 655–672. [PubMed: 18504506]

Jung M, Ramanadhan S, & Viswanath K (2013). Effect of information seeking and avoidance behavior on self-rated health status among cancer survivors. Patient education and counseling, 92(1), 100–106. [PubMed: 23523194]

Kalichman SC, Benotsch EG, Weinhardt L, Austin J, Luke W, & Cherry C (2003). Health-related Internet use, coping, social support, and health indicators in people living with HIV/AIDS: Preliminary results from a community survey. Health Psychology, 22(1), 111. [PubMed: 12558209]

Kalichman SC, Benotsch EG, Weinhardt LS, Austin J, & Luke W (2002). Internet use among people living with HIV/AIDS: association of health information, health behaviors, and health status. AIDS Education and Prevention, 14(1), 51–61. [PubMed: 11900110]

Kalichman SC, Cain D, Cherry C, Pope H, Eaton L, & Kalichman MO (2005). Internet use among people living with HIV/AIDS: coping and health-related correlates. AIDS Patient Care & STDs, 19(7), 439–448. [PubMed: 16053401]

Kalichman SC, Weinhardt L, Benotsch E, DiFonzo K, Luke W, & Austin J (2002). Internet access and internet use for health information among people living with HIV–AIDS. Patient education and counseling, 46(2), 109–116. [PubMed: 11867240]

Knudsen S. d. P., Eidemak I, & Molsted S (2016). Health related quality of life in 2002 and 2015 in patients undergoing hemodialysis: a single center study. Renal Failure, 38(8), 1234–1239. [PubMed: 27590002]

Kobayashi LC, Wardle J, & von Wagner C (2014). Internet use, social engagement and health literacy decline during ageing in a longitudinal cohort of older English adults. J Epidemiol Community Health, jech-2014–204733.

Kojima G, Iliffe S, Jivraj S, & Walters K (2016). Association between frailty and quality of life among community-dwelling older people: a systematic review and meta-analysis. J Epidemiol Community Health, 70(7), 716–721. [PubMed: 26783304]

Kontos E, Bennett G, & Viswanath K (2007). Barriers and facilitators to home computer and internet use among urban novice computer users of low socioeconomic position. Journal of medical Internet research, 9(4), e31. [PubMed: 17951215]

Kontos EZ, Emmons KM, Puleo E, & Viswanath K (2010). Communication inequalities and public health implications of adult social networking site use in the United States. Journal of Health Communication, 15(sup3), 216–235. [PubMed: 21154095]

Kontos EZ, Emmons KM, Puleo E, & Viswanath K (2012). Contribution of communication inequalities to disparities in human papillomavirus vaccine awareness and knowledge. American journal of public health, 102(10), 1911–1920. [PubMed: 22970692]

Kraut R, Patterson M, Lundmark V, Kiesler S, Mukophadhyay T, & Scherlis W (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? American psychologist, 53(9), 1017. [PubMed: 9841579]

Leung L, & Lee PS (2005). Multiple determinants of life quality: The roles of Internet activities, use of new media, social support, and leisure activities. Telematics and Informatics, 22(3), 161–180.

Liu C, Weber K, Robison E, Hu Z, Jacobson LP, & Gange SJ (2006). Assessing the effect of HAART on change in quality of life among HIV-infected women. AIDS Research and Therapy, 3(1), 1. [PubMed: 16405737]

Long J (1997). Regression Models for Categorical and Limited Dependent Variables. Thousand Oaks, CA: Sage Publications.

McHorney CA, Ware JE Jr, Rogers W, Raczek AE, & Lu JR (1992). The validity and relative precision of MOS short-and long-form health status scales and Dartmouth COOP charts: results from the Medical Outcomes Study. Medical care, MS253–MS265. [PubMed: 1583937]

Miners A, Phillips A, Kreif N, Rodger A, Speakman A, Fisher M, . . . Sherr L (2014). Health-related quality-of-life of people with HIV in the era of combination antiretroviral treatment: a cross-sectional comparison with the general population. The Lancet HIV, 1(1), e32–e40. [PubMed: 26423814]

Netuveli G, Pikhart H, Bobak M, & Blane D (2012). Generic quality of life predicts all-cause mortality in the short term: evidence from British Household Panel Survey. J Epidemiol Community Health, jech-2011–200310.

Nie N, & Erbring L (2000). Internet and Society: A Preliminary Report. Report. Retrieved from http://www.nomads.usp.br/documentos/textos/cultura_digital/tics_arq_urb/internet_society%20report.pdf:

Rogers BG, Lee JS, Bainter SA, Bedoya CA, Pinkston M, & Safren SA (2018). A multilevel examination of sleep, depression, and quality of life in people living with HIV/AIDS. J Health Psychol, 1359105318765632. doi:10.1177/1359105318765632

Shaw LH, & Gant LM (2002). In defense of the Internet: The relationship between Internet communication and depression, loneliness, self-esteem, and perceived social support. Cyberpsychology & behavior, 5(2), 157–171. [PubMed: 12025883]

Shockey T, Zack M, & Sussel A (2017). Health-Related Quality of Life Among US Workers: Variability Across Occupation Groups. American journal of public health, 107(9), 1316–1323. [PubMed: 28640675]

Tsevat J, Solzan JG, Kuntz KM, Ragland J, Currier JS, Sell RL, & Weinstein MC (1996). Health values of patients infected with human immunodeficiency virus: relationship to mental health and physical functioning. Medical care, 34(1), 44–57. [PubMed: 8551811]

Viswanath K, & Ackerson LK (2011). Race, ethnicity, language, social class, and health communication inequalities: a nationally-representative cross-sectional study. PLoS One, 6(1), e14550. [PubMed: 21267450]

Viswanath K, Breen N, Meissner H, Moser RP, Hesse B, Steele WR, & Rakowski W (2006). Cancer knowledge and disparities in the information age. Journal of Health Communication, 11(S1), 1–17. [PubMed: 16641071]

Viswanath K, & Kreuter MW (2007). Health disparities, communication inequalities, and e-health: a commentary. American journal of preventive medicine, 32(5 Suppl), S131. [PubMed: 17466818]

Wästlund E, Norlander T, & Archer T (2001). Internet blues revisited: Replication and extension of an Internet paradox study. Cyberpsychology & behavior, 4(3), 385–391. [PubMed: 11710264]

Table 1:

Characteristics of women recruited from the nine sites at Visit 42 in the WIHS cohort study (October 2014-March 2015)

	Mean	**Std. Dev.**
Quality of life scale (0–100)	69.64	20.60
Age (years)	48.17	9.24
Loneliness Scale (1–3)	1.48	0.59
		Percentage
HIV positive		70.1%
Age (quartiles)		
	25 – 41	24.9%
	>41 – 48	25.1%
	>48 – 54	25.0%
	>54 – 81	25.0%
Educational Level		
	<HS	33.2%
	HS grad	31.3%
	>HS	35.5%
Income>median ($12k)		47.5%
Race/Ethnicity		
	non-Hispanic white	8.7%
	Hispanic	14.8%
	African American	72.9%
	Other	3.6%
Southern site recruitment		33.8%
Any drug use last six months		25.7%
Uses internet daily		54.6%
Loneliness Scale (median split)		
	“hardly ever”	48.2%
	“some of the time or often”	51.9%
Depression (CESD>=16)		31.6%

Table 2:

Multi-variable Model of Quality of Life at Visit 42 on Daily Internet Use* at Visit 41 among 1915 Women

Tobit regression model of Quality of life scale (N = 1915)			
	Coef.	**95% CI**	**p-value**
Age (years)	−0.26	−0.35, −0.18	<0.001
Educational Level			
<HS	ref		
HS grad	2.41	0.54, 4.26	0.01
>HS	−0.32	−2.26, 1.61	0.74
Income>median ($12k)	2.37	0.77, 3.97	0.004
Race/Ethnicity			
non-Hispanic white	ref		
Hispanic	7.21	3.98, 10.46	<0.001
African American	5.98	3.28, 8.68	<0.001
Other	4.38	−0.29, 9.04	0.07
Any drug use last six months	−3.61	−5.36, −1.86	<0.001
Southern site recruitment	2.01	0.33, 3.69	0.02
Uses internet daily			
among HIV− women	5.56	2.65, 8.48	<0.001
among HIV+ women	2.00	0.077, 3.94	0.04
Loneliness Scale (1–3)	−6.59	−8.11, −5.08	<0.001
Depression (CESD>=16)	−20.33	−22.29, −18.37	<0.001

*Other covariates are from Visit 42

Table 3:

Bivariate Analysis of Factors Associated with Daily Internet Use among 1,915 Women at Visit 41 (Oct 2014-March 2015)

		Daily Internet Use		
		%	N	p value
HIV positive				0.167
	No	56.7%	630	
	Yes	53.4%	1,474	
Age				<0.001
	25 – 41	77.6%	526	
	>41 – 48	57.1%	527	
	>48 – 54	46.5%	525	
	>55 – 81	36.3%	526	
Educational Level				<0.001
	<HS	37.7%	701	
	HS grad	50.2%	659	
	>HS	73.9%	742	
Income>median ($12k)				<0.001
	No	39.8%	1,081	
	Yes	71.2%	979	
Race/Ethnicity				<0.001
	non-Hispanic White	68.6%	194	
	Hispanic	50.7%	310	
	African American	52.9%	1,525	
	Other	62.7%	75	
Southern site recruitment				0.81
	No	54.2%	1,397	
	Yes	54.7%	707	
Any drug use last six months				<0.001
	No	56.8%	1,529	
	Yes	47.8%	571	
Loneliness Scale (median split)				0.85
	hardly ever	50.0%	4	
	some of the time or often	54.7%	1,847	
Depression (CESD>=16)				<0.001
	No	58.4%	1,458	
	Yes	45.7%	632	