THE USE OF COMMUNITY HEALTH WORKERS IN INCREASING

ANTIRETROVIRAL ADHERENCE IN THE DEVELOPING WORLD:

SYSTEMATIC REVIEW

by

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INTRODUCTION

With HIV/AIDS on the forefront of the global health arena and grassroots movements for health empowerment growing as a trend in the modern world, the question must be asked: "What is the effect of community health workers on antiretroviral treatment adherence in people in the developing world who are on antiretroviral medication for HIV/AIDS?" This systematic review is intended to postulate a clear and resounding answer to this question by examining the available evidence and presenting a conclusion based on the synthesis of published research. This paper also includes a reflective component in first person regarding the development of the thesis and growth of the researcher as a scholar.

BACKGROUND

Thirty long years have passed since the discovery of the small RNA virus that would change the world, taking its drastic toll not just on over thirty million lives today but also health systems around the globe. Over the three decades that researchers and public health workers have toiled to minimize the devastation left in the wake of HIV, strategies have shifted and evolved with the changing times and emerging research. As policymakers have fought stigma, funding issues, and high-risk behavior in order to prevent new infection and promote health, the most important milestone has been the introduction of and evolution of antiretroviral treatment (ART), through which HIVinfection/AIDS (HIV/AIDS) has been transformed from a death sentence to a chronic illness (Palmisano & Vella, 2011).

However, the mere existence of antiretroviral medication does nothing to curb the deadly virus. Only 54% of those in need of antiretroviral treatment in low- and middle-

income countries (LMICs) are currently covered by ART. This challenge of access is precipitated and exacerbated by increased demand for ART, increased survival rates of people living with HIV/AIDS (PLWHA), lack of human resources for health, and poor national health systems that turn to inappropriate, top-down solutions (World Health Organization [WHO], UNAIDS, & UNICEF, 2012). In his 2008 article, Van Damme postulated that if the current doctor-intensive health systems remain in place and unchanged, ART coverage would stall at 10-20% of the 3 by 5 target (3 million provided with ART), and the goal of universal access by 2015 will remain an unattainable dream (Van Damme, Kober, & Kegels, 2008).

Even if coverage is increased, the health of people living with HIV/AIDS can only be achieved when adherence to antiretroviral treatment is strictly maintained (Machtinger & Bangsberg, 2005). Adherence to antiretroviral treatment reduces mortality in HIV-positive people through viral load suppression; conversely, nonadherence is highly correlated with risk of progression to AIDS, demonstrating that adequate adherence is vital to promoting positive treatment outcomes (Bangsberg et al., 2001; Gifford et al., 2000). Research purports that those who are 80% adherent to antiretroviral treatment have nearly doubled viral reduction compared to individuals with less than 80% adherence rates (Steele & Grauer, 2003). Studies indicate that adherence to antiretroviral treatment averages 70%. Some antiretroviral medications, however, require >95% adherence to have their full intended and sustained effect (Machtinger & Bangsberg, 2005).

While it may seem that treatment adherence is solely a secondary prevention strategy, high adherence to antiretroviral treatment is not only beneficial to the HIV-

positive person, but also to the uninfected person (Hayes, Sabapathy, & Fidler, 2011). The Centers for Disease Control and Prevention (CDC) states that early treatment of those with HIV/AIDS can reduce transmission by 96% (CDC, 2011), and the National HIV/AIDS Strategy for the United States cites HIV treatment as a primary intervention to reduce new infections (The White House Office of National AIDS Policy, 2010). It follows, therefore, that strategies to increase adherence to antiretroviral treatment among people living with HIV/AIDS will also serve as primary prevention methods for those uninfected.

It is obvious that structural change is necessary to protect the lives of the 34 million people currently living with HIV/AIDS not only for their benefit, but also for the benefit of those who are uninfected. Restructuring is necessary not only to move toward universal access, but also to promote more effective treatment strategies for optimal outcomes. HIV/AIDS has widely affected those in LMICs, which bear 90% of the global HIV burden; in addition, prevention, education, and treatment efforts are fraught with infrastructure and access related barriers (WHO, UNAIDS, & UNICEF, 2011). A problem particularly evident in LMICs is the health worker crisis.

In the 2006 WHO Report, *Working Together for Health*, the World Health Organization's Director-General Dr. Lee Jong-wook diagnosed the health worker crisis:

There is a chronic shortage of well-trained health workers. The shortage

is global, but most acutely felt in the countries that need them most. For

a variety of reasons, such as the migration, illness or death of health

workers, countries are unable to educate and sustain the health

workforce that could improve people's chances of survival and their

well-being (Jong-wook, 2006, p. 1).

With many of the least developed countries also having the highest disease burden, it is

no wonder that access to health care in the global arena is inequitable (WHO, 2004).

The health worker crisis present throughout the globe is exacerbated for those

working with HIV/AIDS. The Joint Learning Initiative pinpoints the triple-threat on

healthcare workers for HIV/AIDS as (a) the increased workload and specialty of care

because of the HIV/AIDS pandemic, (b) the dwindling population of health workers

themselves affected by illness and death related to HIV and AIDS and at high risk for

transmission, and (c) the stressors of caring for HIV/AIDS patients, which lead to high

burnout rates and fatigue (Joint Learning Initiative, 2005).

Because of the excessive deterioration of the HIV/AIDS healthcare workforce and

the inability of doctors and nurses to fill the gap due to a lack of time, resources, and

education, community health workers are a particularly appealing solution and are

increasingly common in communities ravaged by HIV/AIDS (Joint Learning Initiative,

2005; Babu & Eisenberg, 2010). Community health workers (CHWs) have the potential

to address the paucity of well-trained health workers that is so glaringly evident in

LMICs.

Community health workers emerged as a necessary means of survival in

impoverished and marginalized communities reeling from the effects of a limited number

of trained health professionals (Lehman & Sanders, 2007; Bureau of Health Professions,

2007). Although the concept has existed and been implemented for generations as a

designated and distinct role, CHWs began to appear in research literature in the 1960s,

particularly barefoot doctors in China (Bureau of Health Professions, 2007; Standing & Chowdhury, 2008). Following the Alma Ata Declaration in 1978, a surge of CHW programs arose in response to the call to promote health for all (Christopher, Le May, Lewin & Ross, 2011). The explosion of CHWs was intended to meet a dual need: lower-cost alternatives to centralized health care systems and additional manpower in the scarcity of health care professionals. However, because of the lack of support and sustainable strategies, many CHW programs failed and the concept's popularity declined (Van Ginneken, Lewis, & Berridge, 2010). However, as HIV/AIDS grew to become the most devastating disease the world has ever seen, CHWs were once again called upon to assist with the demanding and complex needs that emerged (U.S. Department of State, 2001). As the public health community embraced the idea, research and funding jumped to new levels, ushering in governmental support through grants in the 1990s. In the current era, CHWs are becoming a recognized and integral part of the effort to reduce health disparities and improve health equity, policymakers worldwide are pushing CHW legislation, and methodology is becoming more uniform with guidelines and frameworks (Kenya, Chida, Symes, & Shor-Posner, 2011).

Varying widely in characteristic and role, CHWs in general are trained lay-people who work to improve their communities' health in culturally appropriate ways that increase acceptance and a sense of ownership by local community members, promoting community-driven transformative work (Lehman & Sanders, 2007). Community health workers have been used in a variety of foci to increase communities' access and linkage to care and treatment; however, this systematic review focused specifically on community health workers who are providing antiretroviral treatment-related

interventions in their communities (Witmer, Seifer, Finocchio, Leslie, & O'Neil, 1995). This review will define CHWs as laypersons, compensated or volunteer, trained in a treatment-related task with the purpose of improving the health outcomes of HIV/AIDS people on antiretroviral treatment. Professional health practitioners will not be considered community health workers.

While the prevalence of CHW programs is evident and studies have indicated improved outcomes with community health worker-implemented interventions, no systematic review has yet compiled the data relevant to the effectiveness of CHWs on antiretroviral treatment adherence in LMICs, according to preliminary database searches. An existing systematic review indicates positive effects of CHW programs on HIV/AIDS patient outcomes in the United States, but the vast cultural and contextual differences surrounding the use of CHWs in the developing world necessitates a systematic review focused on that region's use of CHW programs, comparing their effectiveness to the standard of care for people living with HIV/AIDS on antiretroviral treatment (Kenya et al., 2011). This proposed systematic review will contribute to the understanding of the effect of CHW programs on antiretroviral treatment adherence for HIV-positive people in the developing world and will investigate the most effective strategies and frameworks for CHW-mediated interventions among this population.

<div align="center">METHODOLOGY</div>

Thesis and Scholarly Development

I first became aware of the importance of antiretroviral adherence in Haiti and Uganda, where I dealt with marginalized people living with HIV/AIDS and limited access to care and little to no community support. I was struck by the fact that the

inability of the orphans and widows with whom I was working to continue consistently on treatment was perhaps even more dangerous than not starting treatment initially due to their potential for treatment failure and resistance. I became more invested in the issues of adherence and strategies during my time as an intern at the World Health Organization in the Department of HIV/AIDS as a member of the treatment and care task force, where I assisted in guideline development for pediatric antiretroviral treatment. With a disparity between evidence-based practice and end user preference and feasibility, we were faced with a choice that made it necessary to consider community structures and empowerment strategies as the final authority in our guideline decision. As I performed supportive research, it became obvious that people on antiretroviral treatment need the most effective possible interventions to ensure progress and success in the battle against HIV/AIDS. To this aim, I began work on a systematic review of the literature regarding empowering, community-based strategies that have the potential to influence adherence to antiretroviral treatment.

With the intent of providing quantitative support for participative medicine, I attempted to formulate a question that would capture the importance of empowerment to treatment adherence. From general patient- and family- involvement strategies to motivational interviewing, preliminary searches displayed either a paucity of research that made performing a systematic review unnecessary, or existing systematic reviews that precluded the need for a further review. After developing several drafts and modifying factors based on background research, I constructed the final PICO research question, characterized by definition of the population, intervention, comparison, and outcome criteria.

PICO Question

In order to gain insight into a specific people group, each selected study's population was identified as HIV-positive people of any age living in the developing world. Participants had acquired HIV through any mode of transmission. Subjects were required to be on conventional antiretroviral treatment, regardless of the specific medication, regimen, or form. The developing world was defined as low- and middle-income countries, as classified by the World Bank as those countries with a gross national income per capita equal to or below $12,615 (current USD) (The World Bank, 2012).

The review included studies that evaluated the direct contact of community health workers who implemented a variety of antiretroviral treatment-related interventions, regardless of their frequency or duration, on antiretroviral treatment outcomes. In order to have an explicit outcome, community health workers were specifically identified as laypeople from communities within which they work, without extensive professional health training, who perform tasks to promote health within their communities whether or not they are compensated. Professional health practitioners were not considered community health workers. In addition, CHW use as a component of a multimodal intervention, as opposed to the main intervention, was excluded from this review.

Considered studies were those that included the following outcome measures that are empirically measurable, standardized criteria indicative of antiretroviral adherence: viral load, as measured in copies/mL, or CD4 count, reported in cells/mm3 (Ferguson et al., 2005). As recommended by the 2013 *Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: Recommendations for a*

public health approach from the World Health Organization, virologic data will be supplemented by additional information (such as pill counts, self-report, pharmacy refill records) to ensure that no confounding factors are responsible for virologic changes (WHO, 2013). These markers should be measured and used consistently throughout the studies in order to demonstrate a trend. Studies with lack of uniformity in these measurement techniques will be excluded.

This review targeted the highest quality of evidence, randomized control trials (RCTs), but also considered other experimental study designs including non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies for inclusion.

Search Strategy

The search strategy aimed to find published studies of high quality that answer the posed question. A two-step search strategy was utilized in this review. An initial limited search of MEDLINE and CINAHL was undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe article. A second search using all identified keywords and index terms was then undertaken across all included databases. Studies published in English were considered for inclusion in this review. Studies published since 1987, when the FDA approved the first antiretroviral medication, were considered for inclusion in this review.[1]

The databases searched were CINAHL, PubMed/MEDLINE, EMBASE, and Global Health. Initial keywords used were *Community Health Worker* (*CHWs*), *Community Health Aides*, *Health Auxiliary*, *Lay Health Workers* (*LHWs*), *Voluntary*

Health Worker, *Village Health Workers*, *Barefoot Doctors*, *Promotores*, *Peer Counseling*, *Peer Assistance Program*, *Community Health Services*, *Human Immunodeficiency Virus* (*HIV*), *Acquired Immunodeficiency Syndrome* (*AIDS*), *Antiretroviral Agents*, *Antiretroviral Treatment*, *HIV Infections Drug Therapy*, *Highly Active Antiretroviral Treatment* (*HAART*), *Anti-HIV Agents*, *Anti-AIDS Drugs*, *Acquired Immunodeficiency Syndrome Therapy*, *Medication Adherence*, *Medication Persistence*, *Medication Compliance*, and/or *Patient Adherence*. Terms were divided into 24 different searches to identify which search terms were collecting the most unique data.

All studies identified during the database search were assessed for relevance to the review based on the information provided in the title, abstract, and descriptor/MeSH terms. Full text was retrieved for all studies that met the inclusion criteria (Appendix).

Figure 1: Study Inclusion and Exclusion Flow Diagram
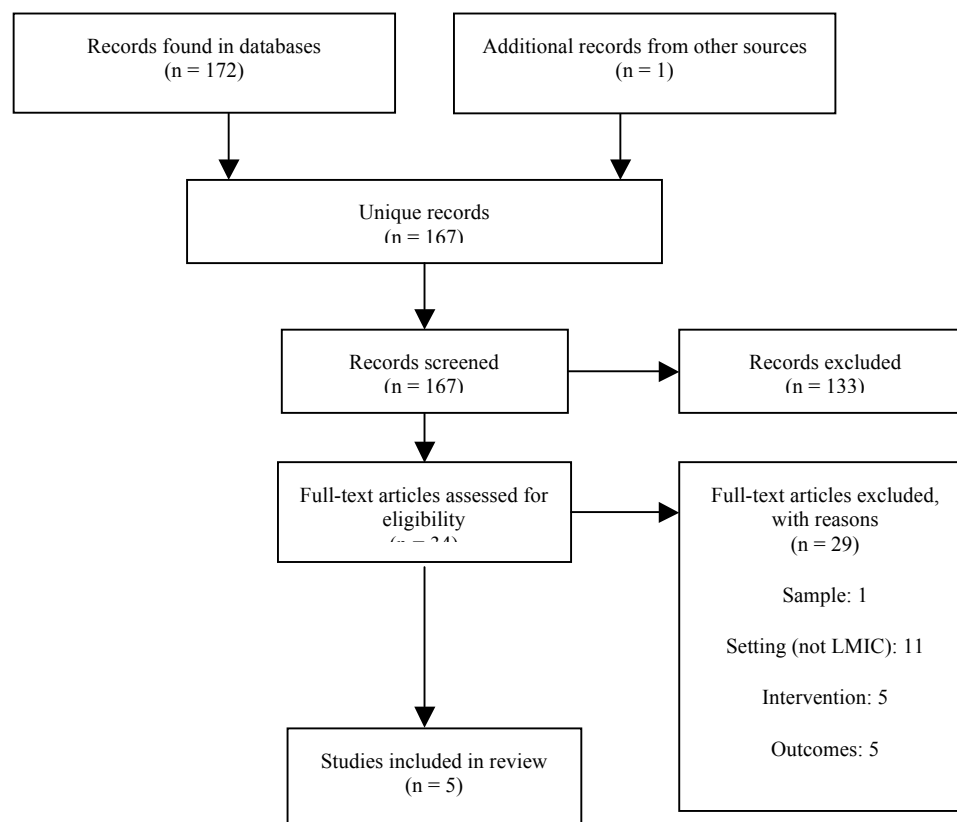
<u>RESULTS</u>

A total of 167 unique articles was acquired through the search of MEDLINE, Embase, CINAHL, and Global Health databases. After using the methodology outlined to include and exclude studies, five studies remained.

Study Characteristics

As shown in Table 1, three of the studies were experimental (Chang et al., 2010; Munoz et al., 2011; Peltzer et al., 2012) and two were retrospective observational studies (Igumbor, Scheepers, Ebrahim, Jason, Grimwood, 2011; Luque-Fernandez et al., 2013). The majority of the studies (4) took place in sub-Saharan Africa, which is representative of the prevalence of HIV/AIDS, with three of them located in South Africa. All but one of the studies used the clinic setting as the recruiting center and intervention base. Three of the studies monitored patients for over 2 years, providing long-term interventions, while the other two followed patients for 3 and 6 months.

Two studies had a sample size over 1000 (Chang et al., 2010; Luque-Fernandez et al., 2013), but all had sample sizes over 100. Igumbor et al. (2011) and Chang et al. (2010) reported over 60% female samples in their studies, while the other studies maintained a relatively equal gender split. Three studies focused on special populations: Peltzer et al. (2012) on nonadherent patients, and Igumbor et al. (2011) and Munoz et al. (2011) on new ART patients. All studies dealt with adults who were HIV-positive and qualified for ART.

Interventions varied, but the two most prevalent uses of community health workers were education, counseling, and medication provision, including directly

observed therapy. CHWs were also involved in reminding, supporting, accompanying, and referring patients.

Peltzer et al. (2012) involved more than one type of community health worker, lay health workers and adherence counselors, in the intervention. Measured outcomes had great heterogeneity, but the most prevalent outcomes were viral load (including indicators of failure, suppression, and rebound) and reported adherence.

Effects

Table 1 shows that three out of five studies reported that CHW interventions significantly improved adherence and its associated outcomes (Igumbor et al., 2011; Munoz et al., 2011; Luque-Fernandez et al., 2013). The other two studies reported conditional or trending improvement in outcomes for patients in CHW intervention groups (Chang et al., 2010; Peltzer et al., 2012). All studies showed a beneficial difference in adherence for patients who were part of community health worker implemented intervention, but the results were not always statistically significant. No studies favored the control (no use of community health workers).

Recommendations

All authors concluded that, with appropriate planning and proper infrastructure, community health worker interventions were a positive method of increasing outcomes for individuals on ART. Models designed with adequate support, local integration, thorough training, and self-selection were most effective.

TABLE 1: Study Summaries and Results					
Study	**Methods**	**Participants**	**Interventions**	**Outcomes**	**Notes/Limitations**
Chang, L.W., Kagaayi, J., Nakigozi, G., Sempija, V., Packer, A.H., Serwadda, D., … & Reynolds, S.J. (2010)	Randomized cluster trial, unblinded	Sample size: 15 clinics, 1336 patients Group 1: 10 clinics / 970 patients Group 2: 5 clinics / 366 patients Demographic data: Adults, Female 66.2%, Male 33.8%, 33% already on ART at start of study Inclusion criteria: CD4 count <250 or WHO stage IV illness (ART initiation criteria) Location: Rakai District, Uganda Site: mobile clinics	Group 1: In addition to usual care, patients received symptom and adherence monitoring, counseling, education and referral by nominated, approved, and trained Peer Health Workers [PHWs], (people with HIV, good adherence to ART for 6 months, literate). Group 2: usual standard of care.	Group 1: Percent with virologic failure – 24 wks 9.7, 48 wks 9.2, 72 wks 5.5, 96 wks 6.5, 120 wks 6.6, 144 wks 5.7, 268 wks 4.6, 192 wks 1.2. <95% adherence 1.4%, <100% adherence 25.5%, Lost to follow up 2.2% Group 2: Percent with virologic failure – 24 wks 10.4, 48 wks 11.0, 72 wks 6.5, 96 wks 12.7, 120 wks 11.5, 144 wks 14.7, 268 wks 15.4, 192 wks 18.5. <95% adherence 2.4%, <100% adherence 23.3%, Lost to follow up 4.1% Conclusions: Intervention had no significant effect for patients who initiated ART during the trial (<120 weeks of ART), but did show trend toward improved overall outcomes for those who started ART prior to the trial. Virologic failures were significantly ($p=0.005$) lower in the intervention compared to the control arm at most testing intervals ≥96 weeks and trended significantly ($p=0.016$) downward over time compared to control group. PHW arm showed significantly decreased lost to follow-up rates (p-0.01), but had no effect on overall VF, short-term virologic outcomes, or adherence.	PHWs may help with treatment fatigue Usual care additions over study period: a peer educator program to promote use of preventive care services, use of viral load results to guide care, more focused ART-related health messaging, enhanced adherence counseling, chart stickers for patients with virologic failure, and second-line ART provider talks.

TABLE 1: Study Summaries and Results

Study	Methods	Participants	Interventions	Outcomes	Notes/Limitations
Igumbor, J. O., Scheepers, E., Ebrahim, R., Jason, A., Grimwood, A. (2011)	Retrospective observational study	Pt level analysis: 540 Group 1: 56% Group 2: 125 – 25% had no patient advocate (PA) support or clinic-based counselor Demographics: Female – 64%, Male – 36%, Age range 0-50+ Inclusion criteria: starting ART Location: S. Africa Site: 12 clinics with patient advocate (PA) services, 14 without PA services, 3 provinces, unspecified whether urban or rural	Group1: patients had services of PAs, also known as adherence supporters through community-based adherence support programs. PAs serve as the link between clinical services and the community and provide psychosocial assessment, pre-initiation assessment, and individualized adherence support services according to patient needs (includes home visits and follow-ups) Group 2: No PA support (not specified in article)	Group 1: 6 months – 24% unsuppressed VL, 89% treatment pickup rate >95%, median time of suppressed VL – 235 days, median retention in care time – 561 days Group 2: 6 months - 42% unsuppressed VL, 67% treatment pickup rate >95%, median time of suppressed VL – 199 days, median retention in care time - 455 days Conclusion: For patients with patient advocates, 42.9% fewer participants had unsuppressed viral load, 32.8% more participants had pickup rates over 95%. Group 1 participants' median time of suppressed viral load was 36 days longer and median time of retention in care was 106 days longer than their Group 2 counterparts. A significantly (p=0.021) higher percentage of group 1 had >95% treatment pickup rates. Group 1 had significantly (p=0.001) more pts with VLs <400 copies/mL.	Limitations: Some patients without PAs still received intervention from clinic-based adherence counselor

TABLE 1: Study Summaries and Results					
Study	**Methods**	**Participants**	**Interventions**	**Outcomes**	**Notes/Limitations**
Luque-Fernandez, M.A., Van Cutsem, G., Goemaere, E., Hilderbrand, K., Schomaker, M., Mantangana, N., ... & Boulle, A. (2013)	Retrospective observational evaluation	Sample size: 2829 patients Group 1: 502 Group 2: 2327 Demographic data: median age 33, 71% female, 29% male Inclusion criteria: clinically stable, ≥ 18 years old, been on same ART regimen for 18 mo., most recent, CD4>200, two consecutive suppressed viral loads Location: Khayelitsha, Capetown, S. Africa Site: Community health centers/clinics	Group 1: ART Adherence club – group facilitated by lay club facilitator, meets for less than an hour every 2 months for clinical assessment, ART dispensing, and referral if necessary. Peer support, facility nurse support, and annual blood tests. Group 2: patients qualified for clubs but continued to be managed outside of the club model in "Mainstream care." (undefined)	Group 1: 29.8 deaths or losses to follow-up per 1000 person-years, 40-month clinic retention 97%. Virologic rebound 31.8 per 1000 person years Group 2: 116.9 deaths or losses to follow-up per 1000 person-years, 40 month clinic retention 85%, Virologic rebound 90.4 per 1000 person-years Conclusion: Intervention reduced deaths or losses to follow-up by 57% (HR=0.43) and virologic rebound by 67% (HR=0.33). Patients in the club were 14.1% more likely to be retained in care than those not in groups.	Less virologic rebound indicates better adherence

TABLE 1: Study Summaries and Results					
Study	Methods	Participants	Interventions	Outcomes	Notes/Limitations
Munoz, M., Bayona, J., Sanchez, E., Arevalo, J., Sebastian, J., Arteaga, F., …& Shin, S. (2011)	Controlled trial	Sample size: 120 Group 1: 60 Group 2: 60 Demographic data: 46.7% male, 53.3% female, age range not specified Inclusion criteria Adults, about to start or recently started ART Location: Lima Este region, Peru Site: Tertiary public hospital	Group 1: A community-based team including lay health workers provided directly observed treatment (DOT), monitored side effects and threats to adherence, supported patients and families, coordinated appointments, and relayed information to medical team for 12 months. Group 2: Control not described	Group 1: 66.7% achieved virologic suppression, 86.7% on HAART after 2 years, reported adherence 79.3%, mean CD4 count 114.8 Group 2: 46.7% achieved virologic suppression, 51.7% likely to be on HAART after 2 years, reported adherence 44.1%, Mean CD4 count 109.7 Conclusion: Group 1 had significantly higher rates of virologic suppression (p=0.03), significantly greater likelihood of being on HAART after 2 years (p<0.01), and significantly greater reported adherence (p<0.01). CD4 counts showed no statistically significant difference.	Limitation: Control group intervention not described
Peltzer, K., Ramlagan, S., Jones, D., Weiss, S. M., Fomundam, H., Chanetsa, L., (2012)	Non-blind randomized control trial	Sample size: 152 Group 1: 76 Group 2: 76 Demographics: Female – 59%, Male - 53%, age range not reported Inclusion criteria: HIV+, adult over 18 years old, new ART (6-24 mo. of use, previous prescription), adherence problem Location: KwaZulu Natal, S. Africa	Group 1: lay health worker and adherence counselor provided three monthly 1 hour sessions of medication information and with problem-solving skills through group interaction and experience Group 2: (standard of care) medical practitioner has one 20 minute, monthly visit with individuals to review health status.	Group 1: ART adherence – baseline 38 subjects, post-intervention 66, three month follow-up 71 CD4 count – baseline 308, post-intervention 317, three month follow-up 384 Group 2: ART adherence – baseline 36 subjects, post-intervention 63, three month follow-up 65 CD4 count –baseline 264, post-intervention 308, three month follow-up 368 Conclusion: Results not statistically significant, though group 1 had higher adherence rates and CD4 counts at all	

| | | Site: Government accredited ART clinic, urban | | points. | |

<u>DISCUSSION</u>

The studies included in this review indicate that a higher level of treatment adherence may be possible when communities are active partners in intervention. Community health worker interventions engage and transform at a community level because of their use of local laypeople as representatives of the community and facilitators of community transformation (Bureau of Health Professions, 2007).

Non-experimental data confirm that interventions by peer counselors may facilitate adherence through role modeling, confidence building, stigma-reduction, and visibility in the community (Gusdal et al., 2011). Community health workers do not just increase antiretroviral adherence, but also have been purported to promote a variety of other beneficial outcomes, including greater levels of care engagement, service utilization, and self-efficacy versus those receiving standard treatment (Bogart et al., 2012).

Task shifting to community health workers, a method that is increasingly employed to address the paucity of healthcare workers in the developing world, shows potential to be effective in decreasing viral load of HIV-1 and increasing perceived and reported treatment adherence as seen by the results of this systematic review; however, more primary research will create stronger recommendations.

Research Recommendations

Because of the paucity of research regarding this topic, there was little homogeneity in regard to specific community health worker interventions and outcome measures, a fact that precluded the possibility of meta-analysis. In addition, study samples tended to be too small to establish statistical significance. Descriptions of the

interventions and control were limited in many cases, and the standard of care for control groups may have varied widely between studies. Because all of the studies occurred in areas with high HIV prevalence, it is difficult to know if subjects were previously or simultaneously involved in other interventions or research initiatives, a fact that may have severely skewed results.

Many of the designs found in the literature could have been applicable to this systematic review if they had evaluated standardized measures as recommended by WHO (2013). Replication of the studies herein with minor modifications, including larger sample size, greater control for outside influences, longer study period, and evaluation of CHW support and design may be the most valuable next step to shed greater light on the effect of CHW interventions on adherence in the developing world. Throughout the article search, repeated reports of qualitative effects of community health worker interventions were found, indicating the need and readiness for a qualitative systematic review to complement the quantitative data herein.

One of the greatest posited benefits of CHW use is sustainability; however, studies regarding the sustainability of community health worker initiatives for antiretroviral treatment are rare. Many studies observe the positive effect of CHWs on the local community, but few do so with empirical data. Because CHWs are commonly employed when resources are limited, a systematic review reporting the economic effects of community health worker interventions would provide valuable information regarding its use in the developing world.

CONCLUSION

This review has compiled the evidence for the effect of community health worker use on antiretroviral adherence in the developing world, highlighting strengths of successful models, and suggestions for improvement from others. While further research with larger sample sizes for statistical significance is necessary, the existing studies indicate that community health worker interventions may be effective in increasing adherence and thereby improving clinical and virologic outcomes in low and middle income countries. These outcomes are only a few of many effects that CHWs can have on communities with high HIV/AIDS prevalence. With the disparity of human resources in low- and middle- income countries, community health workers are a valid and efficient way to improve antiretroviral outcomes and survival for the 95% of people with HIV/AIDS living in the developing world (WHO, 2008).

APPENDIX

Inclusion/Exclusion Table

Study Variable	Inclusion Criteria	Exclusion Criteria
Sample/Population	HIV-positive, >14 years old, acquired through any mode of transmission, current treatment with antiretroviral treatment, regardless of medication, regimen, or form.	Neonates, infants, children only, not on antiretroviral treatment
Setting	The developing world: low- and middle- income countries with gross national income per capita equal to or below $12,615 (current USD)	The developed world, high income countries, the United States
Intervention	Direct contact of community health workers, defined as laypeople from communities within which they work, without extensive professional health training, who perform tasks to promote health within their communities whether or not they are compensated	Treatment solely by professional health practitioners, CHW use as a component of a multimodal intervention
Outcomes	Viral load (copies/mL) or CD4 count (cells/mm3) supplemented by adherence data (pill counts, self-report, pharmacy refill records, etc.) used consistently throughout study	No virologic data or CD4 and/or VL measures alone
Dates	After 1970	Before 1970
Study design	Randomized control trials (RCTs), quasi-experimental, before and after, prospective, retrospective cohort, case control, analytical cross section studies	Expert opinion, clinical practice guideline, systematic review, qualitative study

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ABSTRACT

HIV/AIDS has ravaged the world with its devastating effects, but the advent of antiretroviral treatment has drastically changed the prognosis of the retrovirus. However, adherence to antiretroviral treatment must be maintained with the greatest effort in order to parlay the immense survival benefits of the medication. In low- and middle- income countries, where human resources for health are rapidly being depleted, community health workers (CHWs) have become a popular strategy for increasing the effectiveness of antiretroviral treatment by ensuring optimal adherence. With an approach based on the Joanna Briggs Institute model, this systematic review evaluates published literature from four databases regarding the effect of CHW interventions on antiretroviral adherence outcomes to determine. Of the five studies included in the review, three showed statistically significant improvement of adherence and its related outcomes achieved by the use of community health workers. The other two studies had trends or conditional results that indicated potential efficacy of CHWs to the aforementioned end. While further research is necessary to reach more conclusive and applicable results, CHWs are an appropriate solution to the need for improved antiretroviral adherence.