The Effects of Language Barriers on the treatment of HIV/AIDS in Namibia

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Abstract
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Background: HIV/AIDS continues to be a devastating disease of great global importance despite the fact that antiretroviral therapy (ART) is a proven effective treatment. In the last decade, there have been massive efforts to improve access to antiretroviral drugs (ARVs) around the world. Beyond the logistics of obtaining access to ART, many personal, social, cultural, and economic factors influence an HIV+ person's ability or willingness to initiate and adhere to ART. This study investigates one such factor, the effects that language barriers between the patient and provider potentially have on the treatment of HIV in Namibia.

Methods: Patients analyzed (n=387) were a subset of a larger (n=590) prospective study at four ART clinics around Namibia. All patients were enrolling in ART for the first time between Jan 2012 and Jan 2013. Background demographic information was collected at enrollment and their consultation with their provider was audio recorded and later coded using Roter interaction analysis system (RIAS) methodology. Language barrier, the exposure of interest, was defined as the patient and provider speaking at least one language in common and was assessed for 387 subjects. Adherence to treatment was measured by timing of attendance to their first follow-up appointment after their initial treatment visit. Low patient positive affect and low provider positive affect were calculated from global affect scores, which are a part of the RIAS coding, and split into binary variables based on expected results. The number of questions asked by the

patient was also calculated from the RIAS data and excluded questions checking patients own understanding or asking for repetition as they are likely caused by language barriers. The outcome measured was the length of the consultation as determined by the length of the audio file. Poisson regression was used to obtain relative risks (RRs) for the binary outcomes and linear regression was used to analyze the continuous outcomes. Multivariable analyses adjusted for clinic, patient gender, age, education, and marital status and included robust variance estimates that adjusted for within-provider correlation. A set of secondary analyses on the effects of translators on these same outcomes were also performed.

Results: Language barrier was not significantly associated with adherence (RR 1.05, 95% CI 0.96, 1.15), low provider positive affect RR=1.74 (0.78, 3.89), or low patient positive affect RR= 1.41 (0.96, 2.07). The coefficients relating language barrier to consultation length and number of questions were not meaningful or significant. Amongst those with language barrier, having a translator was associated with an increase in the mean consultation length by 2.65 min (p= 0.047).

Conclusion: We found that patient provider language barriers were not associated with a change in likelihood of patient adherence and were associated with low provider and patient positive affect score though they were not significant at the α=0.05 level. Furthermore, the presence of a translator increases the mean length of consultation but does not affect adherence or positive affect of the provider or patient. This was the first study to look into the effects of language barriers on HIV/AIDS treatment in a developing country, and further research is needed to verify and further explore this relationship.

Introduction:

Though there has been recent progress, HIV/AIDS continues to be a major public health problem around the world with an estimated 34 million people living with HIV, 23 million of whom live in Africa.[1] Current efforts to decrease the burden of HIV/AIDS globally are massive in scale and utilize countless strategies.

There is research regarding the impact of patient-provider language barriers on various aspects of health and healthcare. While none of the previous research surrounding language barriers and health has focused on HIV/AIDS, patient-provider language barriers were found to have a negative impact across many different areas of health. Outcomes researched in which language barriers have been shown to be detrimental to health include: adherence to cardiovascular disease medications[2], health care comprehension[3], health services utilization[4], understanding hospital discharge instruction[5], medication use[6], quality of care[4], and price.[7] Thus it is worthwhile to consider the possibility that patient-provider language barriers could hinder HIV/AIDS treatment.

The early 2000s saw the international recognition of HIV/AIDS as a global emergency. In 2003, the USA committed to investing $15 billion over the next 5 years to fight HIV/AIDS in the President's Emergency Plan for AIDS Relief (PEPFAR). Due to such efforts from the US and many other countries, anti-retroviral therapy (ART) became available to much larger populations than previously. To implement these new HIV/AIDS programs and increase HIV/AIDS treatment, many sub-Saharan African countries relied heavily on foreign clinicians as they responded to this emergency. These foreign doctors often did not speak local languages and conducted consultations in more common "international" languages such as English. Even today, a decade after PEPFAR started, many countries rely heavily on foreign doctors to provide HIV services.[8–10] This creates provider-patient language barriers.

Namibia is one such country where there is currently a significant discrepancy between the languages that the patients and providers speak. There is a single medical school in the country, which has been in operation for just three years and has yet to graduate a cohort of its own doctors. Hence, the country's reliance on foreign doctors continues to be an ongoing challenge. As a result, many of the physicians providing anti-retroviral therapy to the Namibian population are not fluent or even conversant in the local languages. These HIV doctors, most of who come from neighboring African countries, rely on English during their clinical consultations. Even though it is the official language, it is estimated that only 7% of Namibians speak English.[11] The majority of people speak one of over 20 indigenous languages, Afrikaans, or German as their primary language.[11,12]

An estimated 13.4% of the adults aged 15 to 49 have HIV/AIDS in Namibia, almost 20 times the estimated prevalence in the United States of America.[1] In 2010, HIV/AIDS caused a combined 241,000 years of life lost (YLL), and was the single highest cause of premature

mortality in Namibia.[13] In this setting, where HIV/AIDS is such a pressing issue and so many different languages are spoken, it is important to understand what effect patient-provider language differences have on HIV/AIDS treatment. The results of this study could help inform future strategies in effective HIV/AIDS treatment in Namibia and around the world.

Methods:

-Study Design

To investigate the association between patient-provider language barriers and HIV care and treatment, we analyzed baseline patient-provider characteristics and assessed HIV treatment adherence in a cohort of HIV-infected individuals. Both linear regression and Poisson regression analysis were used to quantify the relationships between the language barriers and multiple HIV outcome variables in crude and adjusted models.

-Study Setting

This research utilized data collected as part of a larger quasi-experimental study carried out by the International Training and Education Center for Health (I-TECH) and the Namibian Ministry of Health evaluating the effects of patient empowerment training on patient-provider interactions and clinical outcomes at ART clinics. This study enrolled 590 patients between January 2012 and January 2013 from four clinics located in different regions of Namibia: Katutura Health Center, Windhoek; Onandjokwe Lutheran Hospital, Onandjokwe; Rundu State Hospital, Rundu; and Katima Mulilo Regional Hospital, Katima.

-Study Subjects:

To be eligible, the subject had to be 18 years or older, HIV+, newly initiating ART at the time of enrolment, healthy enough to come to the clinic for appointments, a resident of the region in which the clinic is located, and willing and able to give informed consent to participate in the study. Subjects without data on which provider they met with on their first visit were excluded from our smaller study as this information was used to determine if there was a language barrier.

-Data Collection:

Background and demographic information was collected at the time of enrollment for each patient by the study site coordinator when the patient was enrolled into the study. The study site coordinator also collected the provider background and demographic information before patient enrollment started. Trained coders at each site listened to audio recordings of each visit and coded the types of utterances made by the providers and patients using the Roter Interaction Analysis System (RIAS).[14] After coding each conversation, the coders rated the provider and patient on different global affect measures in accordance with their RIAS protocol.

-Measures:

The primary explanatory variable for this analysis was patient-provider language barrier, defined as the provider and the patient not speaking any language in common. As they were enrolled into the study each patient was asked to self-report all languages that they "can speak and understand." Providers were asked to list all languages "you speak fluently" during their baseline survey.

Our HIV/AIDS care and treatment outcomes included adherence to treatment, length of consultation, the number of questions asked by the patient, and patient and provider positive affect scores. Adherence to ART has been proven to be an important HIV treatment measure predicting HIV/AIDS related outcomes including loss of weight, viral load, CD4 counts, AIDS related fatality, and the emergence of drug resistance.[15–17] Though influenced by numerous factors, it has been found that adherence failures are more likely to occur early in the course of treatment.[18–20] There are no perfect methods to measure adherence, especially in low resource settings where data quality and availability could be low.[17,21] Our study uses the attendance of first clinic follow up appointment as a method to measure adherence to treatment. Measuring attendance is a commonly used and well validated way to measure adherence.[17,18,22,23] The clinics' medical and pharmacy records were used to obtain the dates of all patient follow up visits. At their first consultation and enrollment into the study, each patient was only given enough medication to make it to their first follow up appointment 14 or 17 days later. Thus, if they did not come back within 17 days of their enrollment visit, they missed their treatment or were getting their medication elsewhere. The availability of ART medication from other sources is limited but cannot be ruled out completely. However, every patient was given explicit instructions to return to the same clinic for their follow up visit and to get their medications. Even though attendance is not a perfect measure of medication adherence, it is a measure of adherence to the provider's instructions and the overall treatment plan that includes medication.

Each enrollment visit with the providers was audio recorded and coded using RIAS methods by trained coders. The positive affect scores measure the emotional tone of the patients and providers during a consultation.[14,24] These measures were developed as part of the RIAS methodology and are the sum of the individual global affect ratings measuring engagement, interest, friendliness, responsiveness, and hurryness.[14,24,25] The positive outcome scores were split into binary outcomes based on the lowest expected score as defined by the coding protocol.

Another part of the RIAS coding was a count of different types of questions asked by the patients. By adding up all the number of questions asked by each patient in their enrollment consultation, we calculated the continuous outcome measure. Requests for repetition and questions asking about the patient's understanding were excluded from this measure due to the likelihood that this type of question would be a direct result of language barriers rather than an indicator for patient engagement. The number of questions patients ask is a rough measure of patient engagement[26] which has been proven to have beneficial effects on patient satisfaction[27],

perceived health[27,28], and adherence.[27,28] However, this outcome is limited because language barriers could influence the number of questions asked in either direction as there are logical reasons why language barriers could cause fewer or more questions to be asked.

The quality of the data was monitored throughout the data collection period and measures for inter-coder agreement for the RIAS and global affect scores was calculated at 81.4% and 80.3% respectively.

The final outcome measure was the length of the initial consultation as measured in minutes. Consultation length has been shown to effect the information obtained by the provider[29], the care and medication a provider prescribes[30], and patient satisfaction.[31] In low resource settings with few providers per capita the amount of time spend with each patient is often limited and the effects of language on consultation length could have meaningful implications.

Translators are commonly used as a method of overcoming language barriers in various settings including clinics and hospitals. Research out of the United States has found that trained medical interpreters are effective at increasing patient understanding.[32] However, no research has focused on the effects of having non-trained medical interpreters in developing countries. Our secondary analysis looked at the effect of having a translator present at the initial consultation of these outcome measures.

Based on research and theory we selected socio-demographic covariates to add to our models to further explore our research questions and try to limit bias. These variables include: patient age (18-24, 25-34, 25-44, 45-54, 55+), patient gender (male/female), years of education (0, 1-4, 5-7, 8-12, 13+), the clinic they visited, and their marital status (single, married/cohabitating, separated/widowed).

-Data Analysis

Data were analyzed using STATA statistical software package version 12.0 (Stata Corporation LP, College Station, Texas, USA. Descriptive statistics including means, frequencies, and proportions were used to examine the distribution of patient characteristics and the outcomes. The crude and adjusted relative risks and 95% confidence intervals were calculated using Poisson regression with a log link for the binary outcomes, and linear regression was used to analyze the continuous outcomes. Both the Poisson and linear regressions included robust variance estimates that were adjusted for within provider correlation.[33] Covariates included in the adjusted models were determined *a priori*.

Results:

In total, 590 patients were enrolled into the patient empowerment training study. Data regarding patient and provider language concordance was available for 387 people who had either RIAS (n=342) and/or Global Affect data (n=330; appendix A). The 203 people missing language barrier data differed significantly from the 387 individuals in our study population in their distribution across clinics and education, with KAT missing the most despite having the fewest patients, and the missing group being more educated (appendix B). The groups did not differ significantly in gender, age, or marital status. Further analysis found that the outcomes of low patient and provider positive affect, consultation length, and number of questions all varied significantly by clinic but not by education and neither were significantly associated with adherence (appendix C).

Within our sample population of 387 participants, the number of patients, the number of providers, and the demographic characteristics varied by clinic (Table 1), and there was <1% missing data for all the demographic variables collected. Katima Mulilo Regional Hospital (KAT) was the smallest clinic with only 27 participants in the final sample, Onandjokwe Lutheran Hospital (ONA) had 44, Rundu State Hospital had 148 and Katutura Health Center (KHC) had 168. The number of different providers at the clinics seeing multiple patients at their enrollment visits also ranged widely; all but a single patients at ONA were seen by 1 provider, RUN had 2 providers, KHC had 4 providers, and KAT had 5 providers that saw more than one patient. Of these 12 providers, 33% were women and none of them were from Namibia. In addition, a total of 5 providers saw one patient. The small number of providers at each clinic prompted the use of adjustments to the analyses to account for clustering by provider. Adherence rates did not differ significantly amongst providers but the other outcomes did (appendix C).

The primary exposure of interest, language barrier, varied widely by clinic. At KAT, 85% of patients saw a provider for their enrollment visit with whom they did not share a common language, in ONA 75%, in RUN 49% and in KHC 45%. Further analysis showed that of the 184 participants with no language barrier, 156 shared the language of English, 16 shared Oshiwambo, and 12 shared both English and Oshiwambo with their providers. The secondary analysis exposure variable of having a translator present also varied by clinic. Amongst patients-provider visits with language barriers, KHC only had translators present at 15% of the enrollment visits where there was a language barrier, KAT had translators at 22%, RUN at 43%, and ONA at 58%. However, overall 17% of participants with language barriers were missing data regarding presence of a translator and the rates of missing data varied by clinic.

Overall, 90% of patients returned for their follow up appointment within 17 days of enrollment, though this number varied by site from 85% at KAT to 95% at ONA (Table 2). The mean consultation length was 6.1 min, and the mean number of questions was 0.83. Overall, 46% of patient initial visits had low patient positive affect scores and 15% had low provider

positive affect scores as calculated from the global affect data. However, all these outcomes varied by clinic.

The crude analysis showed that a patient-provider language barrier was not significantly associated with any of the outcomes of interest (Table 3). To obtain more accurate estimates, we controlled for the potential confounders of clinic, gender, age, education, and marital status and corrected the variance to adjust for provider clustering effects. These adjusted models increased the risk estimates for patient and provider low positive affect however none of the associations reached significance. A patient who did not speak a common language as their provider was 1.05 (95% CI 0.96, 1.15) times as likely to show up for their follow up appointment as someone who spoke a common language with their provider. We found a weak positive association between language barriers and both low patient and provider positive affect, a decrease in consultation length by approximately 30 seconds, and a small decreased mean number of questions asked by the patient; however, none of the results reached statistical significance.

The secondary analyses looked into the effects of having a translator on the outcomes of interest. Patients with language barriers who had translators had consultations that were a mean of 2.65 (95% CI: 0.04 , 5.26) min longer than those who did not have translators at their consultations (appendix D). No other findings comparing these two groups to each other or to those without language barriers had any significant findings.

Discussion

To our knowledge, this study is the first to look at the effects of patient-provider language barriers on HIV treatment in a developing country. Interestingly, we found that the patients who did not speak a common language with their provider were as likely to come back for their follow up visit as patients who spoke a common language with their provider. We also found that language barriers were associated with a higher likelihood of low provider and patient positive affect though these associations did not achieve statistical significance. Our secondary analysis found that the presence of a translator did not change or modify the effects of language barriers on the outcomes measured, except that it increased the average consultation length by two and a half minutes.

The main strength of this study is that it was able to utilize data collected for a different purpose to analyze an important question regarding HIV/AIDS treatment in developing countries. The demographic data collected was thorough and complete which allowed us to correct for multiple possible confounders. The main outcome of adherence is widely accepted as an important measure in the field of HIV/AIDS treatment. The outcome measures of patient and provider low positive affect and number of questions asked by the patient were determined from the RIAS and global affect scores, which were coded by individual coders at each clinic. An effort was made to insure that all coders coded similarly, and measures of consistency were

above 80%. Any remaining systematic discrepancy between sites would have been adjusted out by controlling for clinic.

The data also has limitations. We did not have exposure data or outcome data for 203 patients, 34% of the original study population. These patients with missing data differed significantly from the sample of 387 patients by which clinics they attended. Inasmuch as the outcomes differ between clinics, having a sample in which the clinic distribution is not representative of the whole study population could bias our results. Even though the association between clinic and the outcome variables were not all significant, it could have biased the risk estimates towards the null. The low number of providers could also present bias because provider is significantly associated with all the outcomes except adherence and could be directly related to their ability to speak a language in common with their patient. Taking clustering by provider into account during the analyses helps account for expected within provider correlation with the outcomes.

The measures used also present some limitations to the analyses. A more strict measure of language barrier, such as provider and patient do not share the same primary language, may have produced more exaggerated outcomes. However, we did not have any patients and providers who shared primary languages so this would not have been a useful or realistic measure in this study population, and it would not have taken into account truly multi-lingual patients. Our measure for language barrier was ultimately a measure of whether the patient spoke English or not. In the patient-English was the language shared in 92% of consults with no language barrier. Though we controlled for education and region, other factors such as measures of socio-economic status could play a role in one's ability to speak English. Other unmeasured variables such as family size[34] , food insecurity[35,36], and perceived stigma and discrimination[37] all effect adherence to HIV treatment and possible other outcomes as well. A larger sample size of patients and providers would have helped diversify the languages shared between patients and providers and provide a sample size large enough to control for more variables without losing power. The measurement for adherence is also relatively short (first return visit), as HIV/AIDS requires lifelong adherence and we are only measuring if they come back for their first follow up visit. There are many factors including

These results are an interesting first look into the effects of language barriers on HIV/AIDS treatment in Namibia. The higher likelihood of having low patient and provider positive affect scores if there is a language barrier, while not significant in this study, would make logical sense. The patient and provider positive affect scores are measures of general emotional tone of the patient and provider and are a culmination of interest/attentiveness, friendliness/warmth, responsiveness/ engagement, and sympathy/empathy, any of which could be affected by language barriers. A qualitative study similarly found that language barriers in a South African hospital negatively influenced patient and provider attitudes.[38] Furthermore, other studies have linked language barriers to poor patient satisfactions.[39,40]

Our findings suggest that a patient provider language barrier is not associated with adherence. Language barriers have been found to be associated with poorer understanding of appointment type and medications OR 0.63 (95% CI 0.42 – 0.95).[3] Other research found weak associations between poor communication measures and adherence to cardiometabolic medication, RRs 1.07-1.16, $p<0.05$.[41] While these studies measured communication barriers and adherence differently than our study, the low risk estimates associated with adherence suggest that our null results not be too far off. Risk estimates associating language barriers and follow-up of incomplete mammogram results were shown to vary substantially between clinics, RRs 1.1 (95% CI 0.09 – 1.3) to 2.3 (1.4 – 3.9).[42] We did not test for effect modification by clinic as this study did so it is possible that our results would change if we looked at the clinics individually. Further analysis and better powered studies should be used to investigate the relationship between adherence to HIV treatment and language barriers in finer detail.

One hypothetical explanation for the lack of association between language barriers and the reported HIV/AIDS treatment outcomes is that Namibians are used to communicating with people who speak a different language than they do. It is logical that in areas, like Namibia, where many different languages are commonly spoken, people are better at non-verbal communication and achieving understanding in languages they do not speak. While not tested directly, this theory is supported by one study's findings that international physicians working in the U.S. use strategies like repetition and non-verbal communication to overcome communication and cultural barriers.[43] Further research is needed to test this theory more directly in Namibia and other communities around the world where multiple languages are commonly spoken.

Another explanation could be that patients are getting the information and support to return for their follow visits from sources outside the clinic. With high HIV/AIDs rates, it is likely that patients know others with living with HIV/AIDS rates who could inform them on the importance of returning for their follow up visits. Many clinics even set up group counseling sessions to help inform the patients about HIV/AIDS and its treatment. While these possible external information sources were not measured in this study, they would be important for future research to try to compensate for.

Possible explanations aside, this lack of association between adherence and language barriers could be seen as a positive finding for countries like Namibia with few or no domestically trained clinicians and for international aid relief organizations, both of which rely heavily on providers working with patients who quite often speak different languages to provide treatment for HIV/AIDS. It could also be positive news for places like Namibia where many different languages are spoken, because even if the provider was Namibian, they may not speak the language of all the people they need to treat for HIV/AIDS. Furthermore, it suggests that extensive training in local languages may not be the best use of resources to increase adherence to HIV/AIDS treatment.

The fact that translators did not affect any of the outcomes except consultation length could be attributed to the fact that only a small sample size had information on translators and because the translators were typically not trained as such. Using a non-trained medical interpreter, such as an accompanying child, can have a detrimental effect on health outcomes.[4] Past research shows that having a trained translator increases patient satisfaction and understanding.[4] This would suggest a possible increase in patient and provider positive affect, however no such increase was observed. Mixing the effects of untrained and trained medical translators would likely bias our results towards the null. A larger study with more complete information on the types of translators, this potential bias could be controlled for.

The generalizability of our results to other countries and settings in which patients and providers do not speak the same language is unknown. Unique aspects of Namibian culture that were not measured in this study could be a factor in our results. Similar studies in other countries should be undertaken to test the generalizability of these results. Further research is also needed to verify these results and look at the effects of language barriers on other HIV/AIDS outcomes including CD4 counts, viral loads, long-term adherence, and mortality.

Conclusion:

In summary, we found that patient-provider language barriers were not associated with a change in likelihood of patient adherence and were associated with low provider and patient positive affect score though not significant at the $\alpha=0.05$ level. Furthermore, a translator present increased the mean length of consultation but did not affect scores the adherence or positive affect of the provider or patient. This was the first study to look into the effects of language barriers on HIV/AIDS treatment in a developing country, and further research is needed to verify and further explore this relationship.

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Table 1: Baseline Characteristics of HIV+ Individuals Initiating ARV at Clinics in Namibia, 2012-2013.

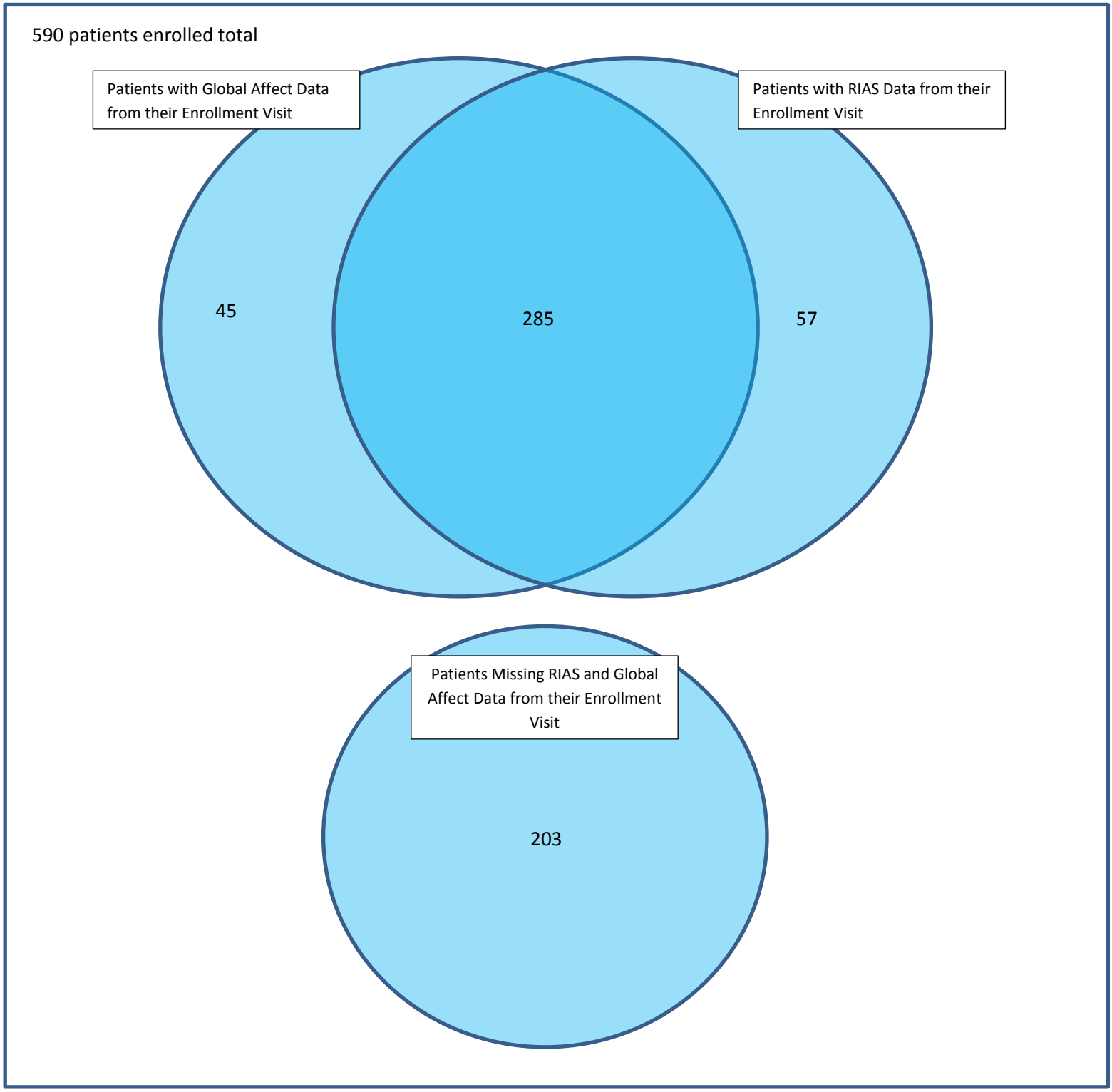
	KHC*	ONA*	RUN*	KAT*	Total
n (patients)	168	44	148	27	387
n (providers)[+]	4	1	2	5	12
Patient Gender: %					
male	46	34	22	22	33
female	54	66	78	78	67
Patient age (yrs) %					
18-24	10	9	14	7	11
25-34	44	34	55	59	48
35-44	35	32	28	26	31
45-54	9	20	3	7	8
55+	3	2	1	0	2
Patient Education (yrs) %					
0	8	7	4	0	6
1-4	13	23	9	7	12
5-7	18	23	18	19	19
8-12	58	48	66	74	61
13+	2	0	2	0	2
Patient Marital Status %					
single	57	50	49	57	51
married/cohabitating	42	34	46	42	43
separated/widowed	2	16	5	1	5
Language Barrier %					
No	55	25	51	15	48
Yes	45	75	49	85	52
Translator Present n**	75	33	72	23	203
% No	79	36	36	48	53
% Yes	15	58	43	22	33
% Missing	6	6	21	30	14

**KHC- Katutura Health Center ; ONA- Onandjokwe Lutheran Hospital*
RUN- Rundu State Hospital ; KAT-Katima Mulilo Regional Hospital
+ - 5 providers who gave consultation to just 1 patient were excluded
***in visits where patients and providers did not speak a common language*

Table 2: Selected HIV/AIDS Treatment Outcomes at Clinics in Namibia, 2012-2013.						
		KHC*	ONA*	RUN*	KAT*	Total
Adherence	n	168	44	148	27	387
	% No	10	5	11	15	10
	% Yes	90	95	89	85	90
Low patient positive affect	n	149	40	116	19	326
	% No	36	95	66	37	54
	% Yes	64	5	34	63	46
Low doctor positive affect	n	148	42	116	18	324
	% No	79	100	85	100	85
	% Yes	21	0	15	0	15
Consultation Length	n	152	42	115	20	329
	mean (min.)	5.5	8.3	5.2	11.3	6.1
Questions†	n	127	44	147	24	342
	mean (#)	1.53	0.39	0.36	0.83	0.83
**KHC- Katutura Health Center ; ONA- Onandjokwe Lutheran Hospital* *RUN- Rundu State Hospital ; KAT-Katima Mulilo Regional Hospital* † *- number of questions asked by patient excluding bids for repetition and questions about a their own understanding of something stated*						

Table 3: Risk estimates relating the patient-provider language barrier to HIV treatment outcomes		
Primary Analyses	Crude RR (95% CI)	Adjusted* RR (95% CI)
Adherence to treatment schedule n(387)	1.04 (0.97 , 1.11)	1.05 (0.96 , 1.15)
Low provider positive affect n(324)	1.35 (0.79 , 2.31)	1.74 (0.78 , 3.89)
Low patient positive affect n(326)	1.21 (0.95 , 1.53)	1.41 (0.96 , 2.07)
	Crude Coefficients (95% CI)	Adjusted Coefficients (95% CI)
Consultation length (min) n(329)	0.45 (-0.51 , 1.40)	-0.54 (-1.65 , 0.56)
Number of questions asked by patient n(342)	-0.43 (-0.88 , 0.02)	-0.07 (-0.47 , 0.33)
*adjusted for: clinic, patient gender, patient age, patient education, patient marital status, and provider		

Appendix A: Venn Diagram of Study Population



Appendix B: Comparison of Missing and Non-Missing Baseline Data

Table A1: Comparison of Baseline Characteristics Between the Patients Missing and Non-Missing Exposure Data			
	Not-Missing	Missing	p-value
n	387	203	
Clinic %			
KHC	43.4	15.3	<0.000*
ONA	11.4	30.5	
RUN	38.2	10.3	
KAT	7.0	43.8	
Patient Gender: %			
male	33.3	35.0	0.689*
female	66.7	65.0	
Patient age (yrs) %			
18-24	10.9	13.3	0.679**
25-34	48.1	40.9	
35-44	31.0	36.9	
45-54	8.0	8.4	
55+	1.8	0.5	
missing	0.2	0.0	
Patient Education (yrs) %			
0	5.9	3.4	0.006**
1-4	12.4	9.4	
5-7	18.9	11.8	
8-12	61.2	74.9	
13+	1.6	0.5	
Patient Marital Status %			
single	51.4	54.7	0.442*
married/cohabitating	43.2	47.9	
separated/widowed	5.4	6.9	
missing	0.0	0.5	
Adherence %			
No	10.3	9.4	0.707*
Yes	89.7	90.6	
** Chi-squared test*			
*** non-parametric test for trends*			

Appendix C: Statistical differences in Outcomes by Clinic, Education, and Provider

Table A2: Comparison of Outcomes Across Clinic						
Clinic		Run	KAT	KHC	ONA	P-value
Adherence	% No	11.5	14.8	10.1	4.6	0.494*
n=387	% Yes	88.5	85.2	89.9	95.5	
Low Patient Positive Affect	% No	65.5	36.8	35.6	95.2	<0.000*
n=326	% Yes	34.5	63.2	64.4	4.8	
Low Provider Positive Affect	% No	85.3	100.0	79.1	100	0.002*
n=324	% Yes	14.7	0	20.95	0	
Consultation Length (min)						
n=329	mean	5.2	11.3	5.5	8.3	<0.000**
Questions						
n=342	mean	0.36	0.83	1.53	0.39	<0.000**
* Chi-squared p-values						
** AVOVA p-values						

Table A3: Comparison of Outcomes Across Patient Education Categories							
Years of Education		0	1-4	5-7	8-12	12+	P-value
Adherence	% No	21.7	6.3	9.6	10.1	16.7	0.354
n=387	% Yes	78.3	93.8	90.4	89.9	83.3	
Low Patient Positive Affect	% No	45.5	59.5	49.2	54.5	100.0	0.367
n=326	% Yes	54.6	40.5	50.9	45.5	0.0	
Low Provider Positive Affect	% No	77.27	88.1	79.7	87.4	66.7	0.359
n=324	% Yes	22.7	11.9	20.3	12.6	33.33	
Consultation Length (min)							
n=329	mean	6.67	5.55	6.95	5.93	4.61	0.452**
Questions							
n=342	mean	0.55	0.45	0.46	1.0	2.4	0.091**
* Chi-squared p-values							
** AVOVA p-values							

Table A3: Statistical Differences in Outcomes Across Providers	
Outcome	P-value
Adherence	0.112*
n=387	
Low Patient Positive Affect	<0.000*
n=326	
Low Provider Positive Affect	<0.000*
n=324	
Consultation Length (min)	
n=329	<0.000**
Questions	
n=342	<0.000**
* Chi-squared p-values	
** AVOVA p-values	

Appendix D: Secondary Analysis Results

Table A1: Risk estimates comparing: patients with language berries and no translator present (n=108) to patients with no language barriers (n=123)		
Secondary Analyses	Crude RR (95% CI)	Adjusted* RR (95% CI)
Adherence to treatment schedule	0.94 (0.86 , 1.03)	0.97 (0.88 , 1.07)
Low provider positive affect	0.69 (0.37 , 1.29)	0.65 (0.27 , 1.60)
Low patient positive affect	0.82 (0.63 , 1.05)	0.74 (0.49 , 1.12)
	Crude Coefficients (95% CI)	Adjusted Coefficients (95% CI)
Consultation length (min)	0.25 (-0.57 , 1.07)	0.46 (-1.26 , 2.19)
Number of questions asked by patient	0.17 (-0.51 , 0.86)	-0.18 (-0.95 , 0.58)
*adjusted for: clinic, patient gender, patient age, patient education, patient marital status and variance corrected for clustering by provider		

Table A2: Risk estimates comparing: patients with language and had translator present (n=66) to patients with no language barriers (n=123)		
Secondary Analyses	Crude RR (95% CI)	Adjusted* RR (95% CI)
Adherence to treatment schedule	0.94 (0.84 , 1.04)	0.90 (0.79 , 1.03)
Low provider positive affect	0.88 (0.41 , 1.91)	0.31 (0.14 , 0.68)
Low patient positive affect	1.17 (0.82 , 1.68)	0.67 (0.41 , 1.09)
	Crude Coefficients (95% CI)	Adjusted Coefficients (95% CI)
Consultation length (min)	-2.28 (-4.22 , -0.34)	-0.61 (-2.57 , 1.35)
Number of questions asked by patient	0.80 (0.28 , 1.32)	0.48 (-0.21 , 1.17)
*adjusted for: clinic, patient gender, patient age, patient education, patient marital status and variance corrected for clustering by provider		

Table A3: Risk estimates comparing: patients with language barriers who did not have a translator present (n=108) to those who did have a translator present (n=66)		
Secondary Analyses	Crude RR (95% CI)	Adjusted* RR (95% CI)
Adherence to treatment schedule	1.00 (0.91 , 1.10)	1.02 (0.97 , 1.06)
Low provider positive affect	0.78 (0.38 , 1.63)	1.13 (0.59 , 2.17)
Low patient positive affect	0.70 (0.49 , 0.98)	1.01 (0.79 , 1.29)
	Crude Coefficients (95% CI)	Adjusted Coefficients (95% CI)
Consultation length (min)	2.53 (0.58 , 4.47)	2.65 (0.04 , 5.26)
Number of questions asked by patient	-0.63 (-1.13 , -0.13)	-0.26 (-0.74 , 0.23)
*adjusted for: clinic, patient gender, patient age, patient education, patient marital status and variance corrected for clustering by provider		