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Influence of COVID-19 on HIV/AIDS Retention for People living with HIV

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Abstract

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Background:
In the time of Covid-19, various strategies are initiated by the Ministry of Health to ensure that accessibility to health care services remains within reach and undisturbed. The developed strategies include: issues of retention implemented through ensuring that stable client receive multi month dispensation, fast track service, and optimize appointment system. Despite the implementation of these strategies tailored to the improvement of patient retention, many patients at Kanyama level one hospital miss clinical appointments with late timings of drug pick-up. The factors behind late drug pick-up in the presence of COVID-19 were not clearly documented. We therefore set out to investigate the influence of COVID-19 on the timing of drug pick-up among HIV/AIDS patients at Kanyama level one hospital in Zambia.

Methods and Materials:
We carried out a Cross-sectional study at Kanyama level one hospital in Zambia using electronic records of 300 HIV patients were are on ART. Circular systematic sampling was used to select respondents from the list after an initial consented chat. Binary logistic regression was fitted on the data to determine the influence of COVID-19 and its interactions with background factors on late drug pick-up.

Results:
The presence of COVID-19 reduces the chances of picking-up the drugs latte. The interaction of the presence of COVID-19 and aging, (married or being single), having tertiary education and being female increases the chances of picking up the drugs late.

Conclusion: If the complete viral suppression program goals are to be achieved, programs for the improving retention among HIV patients on ART should incorporate more sensitizations and encouragements to the affected subgroups and invest more in the community adherence group, and faith base community initiative (FBI) to maximize on community drug distribution as effective mode of DSD in the presence of COVID-19.

Keywords: *Retention, Timing of Drug Pick-up, Late Drug Pick-up*

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INTRODUCTION

of 45,171 incidence cases and by May 16 the cases had increased to 4,640,339 with 1,766,955 recovered cases and 308,829 mortality cases. As of 14th of March, 2020 world total confirmed cases globally was 142, 539 which doubled in 27 days [2].

COVID-19 has continued to ravage the world dominating in mortality in Europe and the United States as well as other countries in South America and Asia. Predictions by experts reviewed that Africa was going to register millions of COVID-19 deaths, however more than 4 months after the first case was detected in China; mortality was still the lowest compared to anywhere else in the world [3]. The African continent recorded their first case on 14th of February 2020 in Egypt and in SSA, the first case was recorded in Nigeria on the 27th of February, 2020 which was an imported case from Italy. The low rates of COVID-19 recorded in Africa could be attributed to the demographic structures of its population. Mainly Africa is a young population and the disease is more prominent in the elderly and those with underlying medical condition. Thus, it could explain the high numbers recorded in Europe and America compared to Africa [1].

HIV/AIDS remains a major public health problem across all continents, causing the death of millions of adults in their prime, disrupting, and impoverishing families and turning millions of children into orphans [4]. Globally the incidence of HIV has been on the rise, however in regions of Latin America the prevalence of the general population has been at 1% and reported high in major urban areas younger than 25 years. Paraguay recorded an incidence of 13%, 12% in Mexico and 10.5% in Peru [5], The global incidence was estimated to be 36.9 million people living with HIV by the end of 2014. In 2014 alone approximately 2 million where newly infected with HIV [6]. Studies have shown that the global incidence of HIV prevalence for older patients has more than doubled since 1995 in almost all age groups [7].

It is indicated that the pandemic affects the most productive segments of the populations. The Sab Saharan African (SSA) region remains most affected, with 25.8 million people living with HIV and accounting for almost 70% of the global total of new HIV infections [7]. The new number of HIV infections in the overall population in SSA declined by 46% between the period 2000 and 2015, and the decline was reported at 37% in the young people. Regardless of the magnitude of the declines they have been too slow to alter the vulnerability of adolescent girls and young women HIV prevalence from the Zambia data sources indicates a rapid rise from the early 1980 and became steady during the early 1990s [5].

HIV retention has been one of the important issues in addressing the HIV pandemic especially in the developing world. Following HIV diagnosis, timely linkage and subsequent retention in care is quite important to ensure excellent antiretroviral therapy (ART) [4]. Retention in HIV care is defined as continuous engagement from diagnosis in a package of prevention, treatment, support, and care services; it is as well engaging regularly the patient in care in order to achieve a specific health outcome. Several studies suggests that of the newly diagnosed individuals 59% are returned in care. Clearly poor retention are barriers to fully realizing the individual and public health benefits of Viral Load (VL) suppression afforded by ART [4]. One observed serious problem with retention is late drug-pick. The timing of drug pick is key to the achievement of complete viral load suppression. However, even when all efforts are tailored to the improvement of patient retention, many individuals' miss clinical appointments [5]. As Zambia is badly hit by the out-break of COVID-19, the Ministry of Health has initiated various strategies to ensure that accessibility to health care services remained within reach and undisturbed [8]. Despite the implementation of these strategies tailored to the improvement of patient retention, many patients at Kanyama level one hospital in Zambia miss clinical appointments with late timings of drug pick-up and have subsequent high viral loads. The key factors behind late drug pick-up in the presence of COVID-19 were not clearly documented. Premised on this, we set out to investigate the influence of COVID-19 on late drug pick-up among HIV patients at Kanyama level one hospital in Zambia.

METHODS AND MATERIALS

Study Design and Setting

We employed a cross-sectional study and used a retrospective audit of hospital records. We intended to provide snapshot of information as regards to late drug pic-up among the HIV patients who attend ART at Kanyama level one Hospital in Zambia. The population under study constituted all patients' records diagnosed with HIV from March to October 2020 at Kanyama Level One Hospital in Lusaka Zambia. We collected data on 300 records in order to detect an effect with a power of 80%. We used all patients' records diagnosed with HIV who met the

inclusion and exclusion criteria.

To select participants from the hospital records, circular systematic sampling procedure was used. In this case it is assumed that patients are listed in a circular manner, which allows selections from overlapping intervals. With this sampling procedure, it was possible to continue selecting respondents with replacement in events that respondents originally selected had incomplete cases.

At the time of drug pick up, patients were asked how the COVID-19 situation impacted on their treatment. Using patient ID, the researcher and his team identified individuals in the data base and made a collection list of 889 as the sampling frame. A data puller was designed to record the information for every participant; background characteristics.

Data Analysis

The T-test was used to compare means of the viral load of the patients for; gender (between males and females), late booking (between on time and late drug pick up), and dichotomised distance (between the distance of less than 5km and that of more than 5km). To affirm the prediction of the multivariate (logistic) final model. The analysis of variance was used to compare means of the viral loads of the patients for; age group, marital status, education Level. To affirm the prediction of the multivariate (logistic) final model.

Chi-square test was used to produce cross tabulations as well as the statistic values (x2) for categorical, nominal, or ordinal scaled predictor variables to determine the significance of the relationships between all the categorical predictor variables and the outcome variable using two-way contingency tables. This was used for its appropriateness in comparative analysis between the dependent and each of the predictor variables [9]. All the associations in cross tabulations were determined at $P< 0.05$ at 95% level of confidence.

We used a Pearson correlation to check for redundance among independent variables. This was checked with the correlation coefficient of >= 0.8. One of any two independent variables which were correlated at >= 0.8 were dropped. This process was done to avoid redundancy among independent variables in the multivariate analysis.

To determine the influence COVID-19 on the outcome variable (late drug pick-up), multivariate analysis was done using binary logistic regression analysis. COVID-19 was interacted with other predictor variables to determine the influence of the interactions on late drug pick up. The resulting effects of the predictor variables on the dependent variable were explained by their one-unit increase or status in terms of (Log Odds). Log odds of the outcome variable were modelled as a linear combination of the independent variables. Binary Logistic Regression was chosen in this study because the outcome variable is binary and this study intended only to investigate the general influence of COVID-19 and its interactions with other selected explanatory variables on late drug pick up [10].

Binary Logistic Regression Model

Binary logistic regression was fitted to estimate the (Log Odds) of a patient picking the drugs late. The binary logistic regression equation was estimated as bellow:

Logit (P) = b0+ b1 X1 + b2 X2+ b3 X3 +.... +bp Xp+ E

P: - denotes the probability of the risk of late drug pick up.

Where P is a dichotomous dependent variable with values 0 (picking on time)

or 1 (picking late).

b0: denotes the intercept (often labeled as the constant), it shows the expected mean value of P when all X = 0.

b1... bp: - denotes the coefficients of the independent variables.

X1...Xp: - denotes the independent variables. All dichotomous variables were converted into dummies before they could be entered in the model. The model was built using the Enter Method.

Model Goodness-of-Fit

Cox & Snell RSquare, -2log likelihood and Hosmer–Lemeshow goodness-of-fit tests were used to determine the goodness-of-fit of the model. The Hosmer–Lemeshow goodness-of-fit test is based on the observed against expected number of responses and according to [11] the larger the P-value ($P >0.05$) the better fit of the model on the data.

RESULTS

The age of respondents was significantly associated with the timing of drug pick up [Chi square value = 129.561; P= .000]. It is indicated that within gender, relatively, majority of the respondents (41.1%) who booked late were females. Marital status of respondents was significantly associated with the timing of drug pick up [Chi square value =170.855; P= 000]. It is indicated that within marital status, relatively,

majority of the respondents (67.9%) who booked late were singles. Household income level of respondents was significantly associated with the timing of drug pick up [Chi square value 8.246; P= 041].

We use a logistic regression analysis and did fit three models using the ENTER method to determine the effect of COVID-19 on late drug pick-up and its interaction with the selected explanatory variables on the timing of drug pick-up. In the first model all the predictor variables were entered to determine their single general effect on the timing of drug pick-up. In the second model, COVID-19 effect on drug pick-up as single variable and its interactions with other predictor variables were entered in the model to determine their general interaction effect on the timing of drug pick up. In the third-final model, COVID-19 effect on drug pick-up as a single variable and the interactions which were associated with the timing of drug pick-up, were entered. The goodness-of-fit of the final model was done for prediction accuracy by -2 log likelihood, Cox & Snell R squared and Hosemer and Lemesho tests.

Modelling

Model One

The first model was fitted on single variables to determine their influence on late drug pick up. The method used in building this is model is the ENTER method. Therefore, all the variables under study were included in the analysis whether they were significant at bivariate level of analysis or not. This process formed the basis for building the final model to determine the influence of COVID-19 with its interactions on late drug pick-up.

In Table 1; the intercepts indicates that when all-other predictor variables are held constant, the chances of picking up drugs late reduces by 1.39 log odds, [(P < 0.05): CL: 95%].

Overall, age group, marital status, income level, education level and body mass index contributed significantly to the model. Being in age group (25-29) years, the chances of picking-up the drugs late increases by .013 log odds, [(P < 0.05): CL: 95%]. Being married and being single increase the chances of picking up the drugs late by 3.65 and 2.95 log odds, [(P < 0.05): CL: 95%] respectively. Furthermore, being in the income band (K1001-K2000), increased the chances of picking-up the drugs late by 6.40 logs odd, [(P < 0.05): CL: 95%]. Having tertiary education increases the chances of picking-up the drugs late by 1.43 log odds, [(P < 0.05): CL: 95%], while having Primary education reduces the chances of picking up the drugs late by 1.77 log odds, [(P < 0.05): CL: 95%]. Being obese increases the chances of picking-up the drugs late by 0.81 log odds, [(P < 0.05): CL: 95%], while having a viral load of 1000+ copies and living at 5+km from the hospital, reduces the chances of picking up the drugs late by .12 and 3.41 log odds, [(P < 0.05): CL: 95%] respectively. Being Female increases the chances of picking-up the drugs late by 3.93 log odds, [(P < 0.05): CL: 95%]. The presence of COVID-19 reduces the chances of picking-up the drugs late by 0.258 log odds, [(P < 0.05): CL: 95%].

Table 1 Single Predictor Effects (influence) on Late Drug Pick-up

Variable Name	Coefficient	Sig.
Intercept	-1.39*	**.000**
Age Group		**.025**
40+	1.23	.065
35-39	.981	.123
30-34	2.05	.987
25-29	.013*	.042
Marital Status		**.000**
Single (3)	2.95*	.000
Separated (2)	1.63	.070
Married (1)	3.65*	.000
Household Income Level		**.000**
3000+(3)	7.48	.100
20001-3000 (2)	1.143	.174
1001-2000 (1)	6.40*	.000
Education Level		**.010**
Tertiary (3)	1.43*	.041
Secondary (2)	1.40	.025
Primary (1)	-1.77*	.042
Body Mass Index		**.003**
Obese (3)	.81*	.001
Over-Weight (2)	-.08	.735
Normal Weight (1)	.12	.434
100+ Copies Viral Load (1)	-.12*	.009
5KM+ (1)	-3.41*	.000
Being Female (1)	3.93*	.000
COVID-19 (1)	-.258	.003

[(-ve effect (influence) indicates reduction chances of late pick-up) (+ve effect (influence) indicates the increase in chances of late pick-up)]

Model Two

The second model was fitted on the effect of COVID-19 as a single variable and its interactions with other predictors to determine their influence on late drug pick up. ENTER method was still employed in fitting the model. Therefore, all the variable under study were included in the analysis. This process formed the second level of analysis for building the final model to determine the influence of COVID-19 with its interactions on late drug pick-up. The interactions which significantly influenced late drug pick-up were advanced into the final third model to finally determine the predictor interactions on late drug pick-up.

In the interactional model; model two, the intercept indicates that when all-other predictor variables are held constant, the chances of picking up drugs late reduces by 2.09 log odds, [(P < 0.05): CL: 95%]. Compared to the first model results, this shows a higher negative autonomous influence on late drug pick-up.

Overall, interaction with age group, marital status, education level, and income level contributed significantly to the model. Singularly, the presence of COVID-19 reduces the chances of picking-up the drugs late by 2.21 log odds, [(P < 0.05): CL: 95%]. The interaction of the presence of COVID-19 with being in age group (25-29) years increased the chances of picking-up the drugs late increases by .035 log odds, [(P < 0.05): CL: 95%]. Interacting the presence of COVID-19 and being married and being single increase the chances of picking up the drugs late by 8.55 and 9.46 log odds, [(P < 0.05): CL: 95%] respectively. Furthermore, interacting the presence of COVID-19 and being in the income band (level) (1001-2000), increased the chances of picking-up the drugs late by 8.65 log odds, [(P < 0.05): CL: 95%], while the interaction between the presence of COVID-19 and being in the band (level) (3000+) reduced the chances of picking-up the drugs late by 8.141 log odds. Interacting the presence of COVID-19 and having tertiary education increases the chances of picking-up the drugs late by 1.206 log odds, [(P < 0.05): CL: 95%], while interacting the presence of COVID-19 and having primary education reduces the chances of picking up the drugs late by 4.331 log odds, [(P < 0.05): CL: 95%]. Interacting the presence of COVID-19 and living at 5km+ from the hospital, reduces the chances of picking up the drugs late by 1.76 log odds, [(P < 0.05): CL: 95%]. Interacting the presence of COVID-19 and being male increases the chances of picking up the drugs late by 1.06 log odds, [(P < 0.05): CL: 95%]. See Table 2.

Table 2 Interactional Predictor Effects on late Drug Pick-up

Interactional Terms	Coefficient	Sig.
Intercept	-2.09*	.000
COVID-19 (1) HC	-2.21*	.000
COVID-19 by Age-group		.032
COVID-191* 40+	.085	.036
COVID-19 1*35-39	.236	
COVID-19 1*30-34	1.46	
COVID-19 1*25-29	.035*	
COVID-19 by Marital Status		000
COVID-19 1 * Single (3)	9.462*	.001
COVID-19 1 * Separated (2)	3.545	.061
COVID-19 1 * Married (1)	8.545*	.000
COVID-19 by Household Income Level		007
COVID-19 1 * 3000+ (3)	-8.141	.400
COVID-19 1 * 2001 - 3000 (2)	-1.451	.260
COVID-19 1 * 1001 -2000 (1)	8.650	.760
COVID-19 by Education Level		004
COVID-19 1* Tertiary (3)	1.206*	.000
COVID-19 1* Secondary (2)	3.414	.200
COVID-19 1* Primary (1)	-4.331	.600
COVID-19 by Body Mass Index		.204
COVID-19 1* Obese (4)	.433	.407
COVID-19 1* Over weight (3)	.222	.695
COVID-19 1* Normal Weight (2)	-.826	.059
COVID-19 1* 200+ Viral Load (1) HC	-.244	.430
COVID-19 1* More_Than_5KM (1) HC	-1.76*	.000
COVID-19 1* Being Male (1) HC	1.06*	.000

[(-ve effect (influence) indicates reduction chances of late pick-up) (+ve effect (influence) indicates the increase in chances of late pick-up)]. HC- higher category

Model Three

The third model was fitted on the effect of COVID-19 as a single variable and its interactions with other predictors to determine predictor interactions of late drug pick up. ENTER method was still employed in fitting the model. Therefore, all the variable under study were included in the analysis. This process formed the final level of analysis to determine the influence of COVID-19 with its interactions on late drug pick-up. The interactions which were significant in the second model were advance to the third model. To refine the interactions, marital status categories married and single were collapsed to form one category which was then taken as the higher category in the final analysis. Education level was also made a dummy to single out the effect of tertiary education.

In the final model, the intercept indicates that when all-other predictor variables are held constant, the chances of picking up drugs late reduces by 1.09 log odds, [(P < 0.05): CL: 95%]. Compared to the first and second model results, this shows a lower negative autonomous influence on late drug pick-up.

Singularly, the presence of COVID-19 reduces the chances of picking-up the drugs late by 3.16 log odds, [(P < 0.05): CL: 95%]. The interaction of the presence of COVID-19 and age increase the chances of picking-up the drugs late by .04 log odds, [(P < 0.05): CL: 95%]. Interacting the presence of COVID-19 and being married and being single increase the chances of picking up the drugs late by 5.16 log odds, [(P < 0.05): CL: 95%] respectively. Interacting the presence of COVID-19 and having tertiary education increases the chances of picking-up the drugs late by 1.21 log odds, [(P < 0.05): CL: 95%]. Interacting the presence of COVID-19 and being male increases the chances of picking up the drugs late by 4.03 log odds, [(P < 0.05): CL: 95%].

Model Goodness of Fit

Model 3 illustrated 96.5% accuracy of data prediction. The model indicated that variations of 9.6% (Cox & Snell R^2: 0.096) in late drug pick-up was explained by the model. The -2 Log Likelihood value of 1912.26, with the Hosmer and Lemeshow test value of [.068], indicated that the model estimates were acceptable and gave indication of a good model fit.

Table 3 Final model interactional effect on late drug pick-up

Interactional Terms	Coefficient	Sig.
Intercept	-1.090*	.000
COVID-19 (1) HC	-3.16*	.000
COVID-19 1 * 25-29 Age Group HC	.04*	.036
COVID-19 1 * Married and Singe [Marital Status (1) HC]	5.16*	.000
COVID-19 1 * Tertiary Education Level [Education Level (1) HC]	1.21*	.000
COVID-19 1 * Being Male (1) HC	4.03*	.000

[(-ve effect (influence) indicates reduction chances of late pick-up) (+ve effect (influence) indicates the increase in chances of late pick-up)]

DISCUSSION

Singularly, the presence of COVID-19 reduces the chances of picking-up the drugs late. The possible explanation to this scenario could be convinced with literature which shows that people living with HIV and on effective antiretroviral treatment (ART) do not appear to be at greater risk of getting and subsequently dying of COVID-19. Therefore, despite the presence of COVID-19, some patients were still able to collect required ART drugs. Researchers' understanding is that the risk of developing severe COVID-19 symptoms in people living with HIV is evolving [16–18].

Much of current evidence proposes that HIV is less of a risk factor for severe COVID-19 than other health conditions (15). However, HIV patients who are not on treatment or virally not suppressed may be at a greater risk of getting COVID-19 [16–18]. Therefore, in trying to feel safer from getting COVID-19 and subsequently dying of it, patients try to make sure that they have the required drugs always and as such they make sure not to miss the drug pick-up times. During this period, the facility introduced the 6MMD campaign which aimed at calling all recipients of care [ROCs] for drug top up so as to provide with them enough stock even if the country was to go into total lockdown. Similarly, a study done in Zambia by Pry et. al., [15] reported that the implementation of COVID-19 mitigation guidance involving task-shifted patient communication and mobilisation alongside 6MMD significantly increased early return to ART clinic, potentially reducing interruptions in HIV care during a global public health emergency. Another consistent result was found in Nigeria by Andrew et. al., [16]. Andrew et. al., [16]'s result indicates that the presence of COVID spiked retention on ART among PLHIV initiating treatment and this indicated that immediate multi-month's dispensation (MMD) in this population may be a sustainable practice. HIV program infrastructure can be leveraged and adapted to respond to the COVID-19 pandemic These strategies seem to have helped many recipients of care to be consistent with pharmacy pick-ups.

When the presence of COVID-19 was interacted with age group [25-29] years, the chances of picking-up the drugs late increased. The possible reason to this could be that, the middle-aged patients, have different priorities and value their lives less as compared to other populations group. This finding is consistent with the results of the study which was done in the republic of Congo by Kamerhe [18] which looked at the differentiated service delivery adaptations during COVID-19 for antiretroviral therapy retention reported that patients aged above 18 years of age were considered among key populations as they required specified services for them to be maintained on care. It is further postulated that, young adults attended fewer pharmacy-only visits compared to other population groups and as a result, their retention to care become highly compromised [12].

The presence of COVID-19 interacted with being married and being single increase the chances of picking drugs late. The two extreme categories produced positive coefficients indicating a hazardous influence on the timing of drug pick-up. These categories increased the chances of late drug pick-up. Married patients could be too busy with so many things to do for their families and as well, taking major precautions on the aspect of contracting COVID-19. Other studies' findings [19,20] indicate that single patients may have little or no encouragement, support, and care as far as the pick of ART drugs is concerned and coupling this with the presence of COVID-19 single patients may completely turn-off themselves on taking control of the hush situations. This study compares with what was found in a study conducted in Canada [14]. However, past studies

do not show much information for an explanation to this finding. Therefore, future research may take it up to try and provide a vivid explanation to this effect.

When the presence of COVID-19 and having tertiary education were interacted, they positively influenced the chances of picking-up the drugs late. While it was expected that this could be scenario with patients in lower education level categories. The possible explanation this result could be that highly educated too much fear for COVID-19 to HIV. Literature shows that most educated people do not fear HIV compared to none or less educated individuals. Therefore, they confine themselves in seclusion to try and avoid COVID-19. Interacting the presence of COVID-19 and being female increased the chances of picking up the drugs late. Other past studies [19–28] shows that females maybe having a bit of challenges in picking up drugs or making up for clinical appointments. This is in line with literature which indicates that many HIV-infected men experience treatment challenges that are different from women and these challenges are often associated with poorer outcomes in terms of retention [13]. Therefore, coupling this with the presence of COVID-19, women could be having so much fear of the pandemic as compared to men. This may be leading them to picking up drugs late or missing normal appointments depending on the situation of the COVID-19 wave [20].

LIMITATIONS

This study employed secondary data; hospital records for patients, data were not collected specifically for this study. Therefore, in order to make the data suit the study modifications were done to the data which may otherwise, to some-lesser extent affect the fitting of the model. This study recruited only the patients from Kanyama level one Hospital, Zambia and therefore, its findings cannot be inferred to other hospitals considering also the fact that hospital managements, workforce and environments differ.

CONCLUSION

While many programs are being implemented in the quest to improve HIV patients' retention on ART, the presence of COVID-19 has really hit hard on them, therefore more initiatives in the programs being implemented should be tailored towards circumventing these bottlenecks to timely ART pick-up if the complete viral suppression program goals are to be achieved. We recommend that the programs for the improving retention among HIV patients on ART should incorporate more sensitizations and encouragements to the young adults (25-29years), the married and the singles and there is need to invest more in the community adherence group, implementation of the faith base community initiative (FBI); maximize on community drug distribution as effective mode of DSD in the presence of COVID-19.

DECLARATION

Competing interests There were no competing interests from all authors in this study.

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