



Reminder Systems for Improving Adherence among HIV-infected Adolescents Attending a Tertiary Facility in Abuja

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Authors' contributions

This work was carried out in collaboration between both authors. Author EEE designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author AAO managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Adherence to antiretroviral therapy is a key factor in the successful treatment of people living with HIV infection. Use of reminder system has been shown to improve adherence to antiretroviral therapy. This study was conducted to identify the reminder systems used by the HIV-infected adolescents in our health facility and determine the relationships with adherence using self-report and pill count.

Study Design: This was a cross sectional study.

Place and Duration of Study: The study was done at Paediatric Special Treatment Clinic of the University of Abuja Teaching Hospital, Nigeria. The data collection was over a six month period, September 2015 to February, 2016.

Methodology: This was a face-to-face interviewer administered pretested questionnaire-based study. Adherence was measured using three-day recall self report and pill count, with convenience sampling method employed.

Results: One-hundred and forty-five adolescents aged 10 years to 19 years participated in the

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study, 80(55.2%) were males, 78(53.8%) were between the ages of 10-13 years, 111(76.6%) were Christians, 91(62.7%) had secondary level of education, and 61(42.1%) were from the middle socio-economic class. The most common reminder systems used were the alarm devices 43(29.7%), timers 34(23.4%) and parents 39(26.9%). Twenty-two (15.2%) participants did not use any form of reminders for their self-care. Use of reminder systems had a statistically significant relationship with gender ($P = .031$), social class ($P = .003$) and self-report ($P = <0.001$).

Conclusion: The alarm system was mostly used by adolescents for their medication adherence and was associated with gender, social class and self-reporting. It is hoped that interventional studies will be carried out on the use of types of electronic reminder devices to ARV medications with the aim of its integration into the routine care of HIV-infected adolescents in Nigeria.

Keywords: Reminder systems; HIV infected; adherence; adolescents; alarms.

1. INTRODUCTION

Adherence to antiretroviral therapy is an important factor in the success to the treatment of HIV-infected people. Non-adherence is associated with an increased number of patient hospitalisation [1], poorer health outcomes and low quality of life [2,3]. An adherence level of 95% or more is accepted as the required level to prevent resistance and to achieve an undetectable viral load [4]. Such a high level is required because of the rapid replication and mutation rate of HIV [5].

Intervention strategies used to support adherence include directly administered antiretroviral drugs [6,7], financial incentives, [8] counselling, education and social support [1]; electronic reminders, computer software, internet and mobile appliances [9,10] and pill boxes [11]. Pill boxes have been reported to be efficacious in improving adherence in resource-limited settings where practical and cost-effective methods are required due to poor access to medication, inadequate staff, stigma, a high cost of treatment and unstable basic resources which lead to barriers in adherence to ARV drugs [11]. However, pill boxes are not commonly used in Nigeria.

Forgetting to take ARV drugs is the most common reported reason for non-adherence in many studies [12-14], therefore the use of reminder systems are important in improving adherence. Considering the stigma attached to HIV, a good reminder system should maintain confidentiality and not attract too much attention from others.

Several reminder systems have been employed to improve adherence such as the use of electronic reminders like pagers and alarms; and mobile phone reminders like short messages

systems, automated voice reminders and pictorial messages; and personal digital assistants [10,15,16,17]. Some studies have reported improvement in adherence while others report no statistically significant difference.

The use of mobile phones has been shown to improve chronic disease management in developed countries and have been proposed as a potential strategy in supporting ARV therapy adherence in developing countries [18-20]. There are a growing number of people who own cell phones all over the world including resource limited settings and so this method may be an important tool in achieving adherence in such areas [21].

A randomised controlled trial in Kenya applied the use of mobile phone technologies by sending daily or weekly text messages reminding participants to take their ARV drugs and measured their adherence using Medication Event Monitoring System (MEMS). The study was for 48 weeks, during which 53% of the intervention group achieved at least 90% adherence, while 40% of the control group achieved at least 90% adherence [21]. The authors, however, raised the issue of confidentiality, since several people may share a single cell phone [21]. This is similar to concerns raised by participants in another intervention study using automated interactive voice response and pictorial messages sent via mobile phones. Here, the Participants perceived a risk of unintentional disclosure of their HIV status and the resulting stigma using this reminder systems [10].

A cohort study carried out among 150 adults in India, reported an increase in adherence from 85% to 91% in patients using mobile phone adherence reminders. This increase was maintained for six months after the conclusion of

the study. When combined with counselling, mobile phone reminders via SMS and telephone calls improved adherence as well as treatment outcome in a single-blind, parallel group randomised controlled trial [10].

Conversely, Shet et al. [17] in a multicentre randomised controlled trial did not find any statistically significant effect on the use of mobile phone intervention to improve adherence among HIV-infected adults. However, there is a need to note that text messages in resource limited setting are not necessarily cheap like in developed countries where they may even come free with the service. Also, mobile network services can be quite unreliable in many rural areas which can impair the delivery of these text messages. The use of this technology does not also take into consideration the literacy level of the patient and the ability of accessing text messages on the mobile phones by all individuals. Lastly, there is the challenge of sustainability outside research purposes.

A systematic review study reported no significant evidence for the use of electronic reminders for improving adherence to antiretroviral medications among HIV-infected adults [22], while another study, a meta analysis of randomised controlled trials reported that electronic reminders were a simple and effective method to improve adherence to medications for chronic disease [15].

Adolescents are the only age group with deaths from HIV not declining [23]. Twenty-nine adolescents are infected with HIV every hour and in the year 2015, 1.8million adolescents were living with HIV. Adolescents are currently a target population for intervention by world health agencies [23] to reduce the spread, morbidity and mortality from HIV.

Very few studies have been carried out on the use of reminder systems as a strategy to improve adherence to ARVs using only an adolescent populace [24]. In a systematic review using 52 peer-reviewed journals, only two of these studies used only adolescents; and counselling was the intervention method used to assess improvement in adherence. The authors also noted the dearth of data in respect to intervention studies from a strict adolescent populace but reported that task shifting, community-based adherence support, mHealth platforms, and group adherence counselling were strategies used in adult populations that showed good potential for adaptation and testing among adolescents [24].

It is important to know what self-care reminder systems adolescents are currently employing to improve their ARV medication adherence so that intervention strategies can be planned and strengthened around these reminder systems and subsequently integrated into the health system.

Therefore, this study aims to identify the reminder systems used by the HIV-infected adolescents attending UATH and determine the relationship between the reminder systems and adherence using self-report and pill count.

2. MATERIALS AND METHODS

The University of Abuja Teaching Hospital (UATH) is a 350 bedded tertiary health care centre located in Gwagwalada Area Council in Abuja, the Federal Capital Territory of Nigeria (FCT). The hospital serves its host community, Gwagalada, the other parts of FCT, and the surrounding states which include Nasarawa, Kogi, Kaduna and Niger.

HIV-infected adolescents and children access care mainly at the Paediatric Special Treatment Clinic (PSTC) in the teaching hospital which is open on Mondays through Fridays between the hours of 8 am and 4 pm. Patient care is mainly provided by a Paediatric Consultant, medical officers, resident doctors undergoing training in Paediatrics, nurses, pharmacists, adherence counsellors, home – based care staff, records clerks, nutrition officers, and other support staff. Adolescents between the ages of 10 and 19 years are seen in the adolescent clinic of the unit. Adherence counselling is a component of the care received by all adolescents attending the clinic and this is performed mainly by the trained clinic consellers.

This was a descriptive, cross-sectional, hospital - based study carried out at the PSTC of UATH, Gwagwalada, Abuja, FCT. The data collection was over a period of six months, September 2015 to February, 2016.

Adolescents aged 10 years to 19 years, attending the PSTC, who had been on ARV drugs for at least six months, who had signed informed consent if 18 and 19 years or from their caregivers if less than 18 years, and verbal assent if less than 18 years. Those who had temporary appointments or were mentally challenged were excluded from the study. At the time of the study, according to available facility

records there were 159 adolescents attending the PSTC of which 145 met the inclusion criteria. All 145 adolescents were enrolled over six months for the study having given consent and assent.

A face to face, interviewer-administered questionnaire which had been pretested was used and filled by the researcher and research assistant that had been trained previously while conducting the study. The questionnaire assessed socio-demography, ARV medication used, levels of adherence in the 3 days prior to presentation at the clinic using self-report and pill count, and the type of reminder system used by the adolescent.

For confidentiality, no names were written on the questionnaires, only identification numbers are given to each participant. The participant's names and numbers were entered into a register which was only assessed by the researcher. There was no disclosure of HIV status to participants who were not aware of their status unless specifically instructed to by their primary caregivers. Therefore, the word "HIV" was excluded from the consent forms and questionnaires.

Adherence for self-report and pill count was calculated and a level of $\geq 95\%$ was assessed as adherent and less than 95% as non adherent.

Ethical approval from the Health Research and Ethics Committee of UATH was obtained before the commencement of the study. The principles of research ethics were maintained.

Data analysis was done with SPSS version 20. Frequency tables were used to present the socio-demographic distribution while chi square was used to determine the relationship between reminder systems and age, gender, educational level of the adolescent, social class and adherence using self-report and pill count. $P < .05$ was regarded as statistically significant. Analysis of social class was based on the classification by Olusanya et al. [25] [Appendix 1]

3. RESULTS

3.1 Socio-demographic Distribution

Results from the 145 study participants were analysed. The age ranged from 10 years to 19 years with a mean age of 13.26 SD \pm 2.43. There were 80 (55.2%) males and 65 (44.8%) females giving a male to female ratio of 1.2: 1. A quarter of the adolescents were Christians (111; 76.6%), 91 (62.7) were in secondary schools while 61 (42.1%) belonged to the middle social class. The socio-demographic distribution of the subjects is shown in [Table 1].

Table 1. Socio-demographic distribution of the adolescents

Variables	Males n (%)	Females n (%)	Total n (%)
Age (years)			
10-13	40 (27.6)	38 (26.2)	78 (53.8)
14-16	33 (22.8)	22 (15.2)	55 (37.9)
17-19	7 (4.8)	5 (3.5)	12 (8.3)
Total	80 (55.2)	65 (44.8)	145 (100)
Religion			
Christian	64 (44.1)	47(32.4)	111(76.6)
Muslim	16 (11)	18(12.4)	34(23.4)
Total	80 (55.2)	65 (44.8)	145 (100)
Level of education of the adolescents			
Tertiary	1(0.7)	1(0.7)	2(1.4)
Completed secondary	3 (2.1)	2 (1.4)	5 (3.4)
Secondary	46 (31.7)	45 (31)	91 (62.7)
Primary	30 (20.7)	17 (11.7)	47 (32.4)
No formal	0	0	0
Total	80 (55.2)	65 (44.8)	145 (100)
Social Class			
Upper	22 (15.2)	27 (18.6)	49(33.8)
Middle	38 (26.2)	23 (15.9)	61 (42.1)
Lower	20 (13.8)	15 (10.3)	35 (24.1)
Total	80 (55.1)	65 (44.8)	145 (100)

3.2 Reminder Systems Used by the Adolescents

Forty-three (29.7%) of the adolescents used such alarms. Devices with alarms such as mobile phones, wall clocks and wrist watches were the most commonly used reminders for medication adherence. The alarms were set for the time the medication was expected to be taken. Parents and other caregivers (34; 23.4% and 3; 2.1% respectively) were also used as reminders for their wards to take their ARV medications. Twenty-two (15.2%) adolescents did not use any reminder system. The reminder systems used by the adolescents are shown [Table 2].

3.3 Relationship between Reminder Systems and Variables

Reminder systems were found to have statistically significant relationship with

gender ($X^2 = 12.3$; $P = .03$), social class ($X^2 = 26.803$; $P = .003$) and adherence using self-report ($X^2 = 21.6$; $P = .001$) but not with age ($X^2 = 10.62$; $P = .39$) educational level of the adolescent ($X^2 = 18.905$; $P = 0.53$) and adherence using pill count ($X^2 = 8.17$; $P = 0.15$).

These are depicted in [Tables 3, 4, 5, 6 and 7].

3.4 Adherence Percentages among Adolescents who do Not Use Reminder Systems

Although 22 adolescents did not use any reminder system 20 (13.8%) and 2 (1.38%) had $\geq 95\%$ and $< 95\%$, respectively using self-report while 14 (9.7%) and 8 (5.5%) had $\geq 95\%$ and $< 95\%$, respectively with pill count.

Table 2. Reminder systems used by the adolescents

Reminder system used	No.	Percent (%)
Alarms	43	29.7
Timer	34	23.4
Parents	34	23.4
None	22	15.2
Meal time	9	6.2
Other caregivers	3	2.1
Total	145	100

Table 3. Relationship between reminder system and age

Reminder system	Age range			Total	X^2	P value
	10-13	14-16	17-19			
Alarms	22	17	2	34	10.62	.39
Timer	17	15	4	43		
Parents	21	9	4	34		
None	8	12	2	22		
Meal time	7	2	0	9		
Other caregivers	3	0	0	3		
Total	78	55	12	145		

Table 4. Relationship between reminder system and gender

Reminder system	Male n (%)	Female n (%)	Total n (%)	x^2	P value
Alarms	20 (13.79)	23	43	12.3	.03
Timer	21	13	34		
Parents	22	12	34		
None	15	7	22		
Meal time	2	7	9		
Other caregivers	0	3	3		
Total	80	65	145		

Table 5. Relationship between reminder system and educational level of the adolescents

Reminder system	Primary	JS	SS	Completed secondary	Tertiary	Total	X ²	P value
Timer	11	14	8	0	1	34	18.905	.53
Alarms	12	15	13	2	1	43		
Parents	12	12	9	1	0	34		
Other caregivers	2	1	0	0	0	3		
Meal time	5	2	2	0	0	9		
None	5	3	12	2	0	22		
Total	47	47	44	5	2	145		

Table 6. Relationship between reminder system and social class

Reminder system	Upper n (%)	Middle n (%)	Lower n (%)	Total n (%)	x ²	P value
Alarms	22	13	8	43	26.803	.003
Timer	9	16	9	34		
Parents	5	18	11	34		
None	11	8	3	22		
Meal time	2	6	1	9		
Other caregivers	0	0	3	3		
Total	49	61	35	145		

Table 7. Relationship between reminder system and adherence using self-report and pill count

Reminder system	Self-report		X ²	P value	Pill count		X ²	P value
	≥ 95% n (%)	<95% n (%)			≥ 95% n (%)	<95% n (%)		
Alarms	41	2	21.6	0.001	19	24	8.17	.15
Timer	34	0			18	16		
Parents	30	4			16	18		
None	20	2			14	8		
Meal time	9	0			7	2		
Other caregivers	1	2			0	3		
Total	135	10			74	71		

4. DISCUSSION

Adherence in adolescents has been reported to be suboptimal. Self-care measures adopted by adolescents to improve their adherence should be encouraged. The reminder systems used here by the adolescents were similar to that reported in another study [9] although that study was done among adults [9].

This study found that the most common reminder system used by the adolescents were alarms (electronic reminder devices). This is a good method as alarms may not draw as much attention as picture messages or automated voice recording used with mobile phone reminder systems. Alarms have also been reported to improve adherence in some studies. Tao et al. [15] noted that the use of electronic reminders was a simple and potentially effective method to

apply to adolescents since the study was done among adults.

Timers were the second most common reminder systems used. Timers are similar to the alarms used as they both tell time, the difference being that these timers do not have alarms that are set at specific times to ring for the purpose of taking ARV medications. This may suggest that alarms would have been used by these adolescents if they were accessible to the adolescents. Saberi and Johnson [9] reported that an adherence-enhancing tool for self-care should be familiar to the user, easy to use and should not attract much attention. Individually-tailored methods should also be customised to the user's needs. This suggests that alarms and timers may be well suited for adolescents to use as a reminder system on a large scale. No adolescent in this study used pagers; this could be because they

are not readily available in Nigeria. A study reported that the size of pagers may be a hindrance to its use [9].

Quite a number of adolescents used their parents or other caregivers as reminders for their medications. This method implies the involvement of caregivers in the administration of ARV medications to the adolescents which is good because adolescents especially the older ones are frequently left to care for themselves as they are often regarded as adults. A drawback with this method is that the caregivers may forget to administer the medications or may be affected by other factors like illness or travelling and so will not be available to remind the adolescent to take his or her medication.

A few adolescents used meal times as a reminder for their medications. This depicts a behavioural tool used to integrate the adolescent's medication time into their daily routine [8]. A good method if meals are served at a regular time daily. Integration of medication time to the daily routine is a good method to improve adherence [8].

Only 22 (15.2%) adolescents did not use a reminder system. This suggests that most adolescents would prefer to use a reminder system.

The relationship between reminder systems and gender was statistically significant similar to a study by Abdulrahman et al. [16] Further research and analysis needs to be done to determine which gender will be the most likely to use a reminder system.

There was also a statistically significant relationship between the use of reminder systems and adherence using self-report similar to another study [16]. Reminder systems as previously reported in other studies can improve adherence.

The adherence percentages using self-report and pill count was high among adolescents who did not use any reminder systems. More studies may need to be conducted to find out what factors may be responsible for this besides the usual adherence counselling received by all adolescents at the clinic.

5. CONCLUSION

Majority of the adolescents used a form of reminder system or another for self-care to

improve adherence. It is hoped that intervention studies will be carried out on the use of electronic reminder devices (preferably alarms) and adherence to ARV medications using a larger adolescent sample size with the aim of integrating this already existing reminder system method to the routine care of HIV-infected adolescents in Nigeria. As recommended by the World Health Organisation, young people living with HIV should be involved in the planning and provision of services to be provided for them [26].

A limitation of this study was that only the available adolescents in the clinic were used. A larger sample size would have been preferred. Also, due to the small size of available adolescents, no random sampling of the study participants was done. Adherence was measured using only self-report and pill counts which some studies have demonstrated to overestimate adherence rates. Antiretroviral drug assays would also have been included as a measure of adherence. This method is not available at the facility where the study was done and is quite expensive.

CONSENT

At the time of the study, according to available facility records, there were 159 adolescents attending the PSTC of which 145 met the inclusion criteria. All 145 adolescents were enrolled over six months for the study having given consent and assent.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX 1

Determination of Social Class Using Olusanya's Classification

This uses father's occupation and mother's educational level.

Father's score (A)

1

2

3

Father's occupation

Professionals, top civil servants, business executives, politicians

Middle-level civil servants, well to do traders, skilled artisans and trained personnel like nurses, technologists, teachers, police officers

Semi-skilled and unskilled personnel - like typists, clerks, technical assistants, tailors, messengers, cleaners, labourers, drivers, masons, subsistence farmers, etc

Mother's score (B)

0

1

2

Mother's educational level

Education up to university level

Secondary or post secondary education but below university level

No formal or only primary education

Social class of subject = A + B

Total score 1 = Social class I

2 = Social class II

3 = Social class III

4 = Social class IV

5 = Social class V

Social class I and II = Upper class

Social class III = Middle classes

Social class IV and V = Lower class

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