RESEARCH PAPER

The effect of a modified alarm medicine box in HIV patients undergoing antiretroviral therapy

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Abstract

Introduction: Increased human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) cases in Indonesia create a new social problem, which must be followed up immediately. In this study, we created a modified alarm medicine box that can help HIV patients undergoing antiretroviral therapy (ART). We hope this tool will assist HIV patients in remembering to take their antiretroviral drugs. Aim of the study was to know the effect of a modified alarm medicine box, as a tool to assist HIV patients undergoing ART.

Material and methods: The study employed a quasi-experimental. We used a one-group, pre-test/post-test design to determine the effect of the independent and dependent variables. In this study, we created a tool that can help HIV patients undergoing ART. We distributed the tool to 20 HIV patients at the Yayasan Lentera Pelangi Jakarta foundation. The purpose of this tool is to reduce the risk of delay of ART in HIV patients. We recorded the time difference between before and after the usage of this tool, which was employed for seven days. In addition, we also provided a time report to be completed by the participants as they used the tool.

Results: The delivered range of mean values of the results obtained on the test before using the modified alarm medicine box was 20.76, while after using the tool it was 2.81. From the results of the data analysis obtained by calculating the difference in means (17.94 M_D), and a standard deviation of difference (16.06 SD_D), the standard error average difference was 3.68 (SE_{MD}). In the next calculation, the t-count value was 4.875, and the t-table value (with degrees of freedom (n – 1) and the error rate was $\alpha = 0.05$) was 2.09. The means t-count = 4.875 was larger than the t-table 2.09. This shows that the null hypothesis (H_0) could be rejected and the alternative hypothesis (H_1) could be accepted. Therefore, the calculation results showed that the use of a modified alarm medicine box helped the patients undergoing ARV therapy to take their medicine on time.

Conclusions: The modified alarm medicine box helped the HIV patients in ART. Moreover, it was found that there was a decrease in the amount of delays in taking the drugs after using this tool.

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Introduction

The numbers of people with human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) have been increasing in recent decades. In addition, there are still more people who have contracted HIV or AIDS, but are not yet aware of illness. Of course, this lack of awareness increases the quantity of HIV sufferers every year. Furthermore, the age range of HIV sufferers has expanded from adults between 26-35 years to adolescents as young as 12-years-old.

Various efforts have been made by the government and community volunteers to reduce the scope and impact of the virus. One of the government's roles is to subcontract medicines for those already infected with HIV or AIDS. Because of this program, some positive effects have occurred for people with HIV, such as being able to enjoy their lives again, even though they must consume drugs on a daily basis. These drugs are expected to slow down or prevent HIV virus to transform into AIDS [1].

Although the government treatment program for patients with HIV and AIDS is a step in the right direction, the struggle to liberate Indonesia from the HIV virus does not stop there. In fact, there are still many problems with the program, such as inability or consistency of many patients to take their medicine on time. Moreover, many patients still lead an unhealthy lifestyle that may contribute to worsening their overall health condition. The very rapid process of the development of the virus in human body and its spread to other people in Indonesia, has become a significant challenge in the country.

Based on data released in a Ministry of Health report "The Situation of HIV-AIDS Problem 1987-September 2014", during this period, HIV/AIDS has spread to 381 (76%) of the 498 districts of Indonesia. The province of Bali was the first in Indonesia to discover the presence of HIV/AIDS, while the last province to report its presence was West Sulawesi in 2011.

Until 2000, the number of reported HIV cases was 859. In 2006, the number of newly reported HIV cases rose to 7,195 and in 2014, it reached the amount of 22,869 cases.

The cumulative number of HIV infections in Indonesia was reported up to September 2014 as 150,296 cases. Areas with the highest numbers of reported HIV infections in 2014 were Jakarta (32,782), followed by East Java (19,249), Papua (16,051), West Java (13,507), and Bali (9.637) [2].

Until 2005, the number of reported AIDS cases was 5,184. In 2006, the number of AIDS cases rose to 3,665. By 2011, this number reached 7,312 cases, finally falling to 1,876 cases in 2014. The cumulative number of AIDS cases from 1987 to September 2014 was 55,799, with the highest number of cases of HIV and AIDS occurring in Jakarta. This rise is connected to changing lifestyles in Jakarta, including an increase in homosexual activity and its associated risks for the spread of HIV and AIDS between sexual partners. However, those at risk for HIV and AIDS transmission in Indonesia also include heterosexuals, recipients of blood transfusions, babies through perinatal transmission, injection drug users, etc. However, the situation in Indonesia still requires further investigation and analysis [3].

HIV/AIDS

Many people are still not aware of the difference between HIV and AIDS, with many believing that the two are the same. HIV is a virus that attacks the body's immune system, causing the body to become weak as it fights off infection [4]. As a result of the body's weakened immune system, other viruses or so-called opportunistic diseases can attack the body [5].

Without a treatment, a person with HIV can survive for 9 to 11 years after acquiring the infection. In other words, the presence of this virus in the body will cause immune system deficiency. Transmission of the HIV virus can occur through the exchange of bodily fluids such as semen, blood, vaginal fluid, and breast milk. Furthermore, HIV weakens the body by killing important cells, such as helper T cells, macrophage, and dendritic cells [6].

ARV therapy

ARV drugs are taken to slow dawn the progression of the HIV virus in the body. ARV drugs must be taken by HIV patients on a daily basis for their entire lives [7]. Termination of drugs in the treatment process poses a new problem for HIV sufferers. Unfortunately, the side effects of the ARV drugs can discourage patients from taking their medicines [8]. Because of unpleasant side effects caused by the ARV drugs, HIV patients can become reluctant to take the medications regularly [9]. Many patients also stop taking their ARV drugs, when their health condition improves. However, irregularity in taking antiretroviral drugs or their complete rejection can cause patients' health to deteriorate. Once the virus becomes immune to first-line ARV, a drug resistance can occur, which requires the patient to take second-line ARV drugs that are more expensive [10].

Accuracy of antiretroviral therapy

ARV therapy or antiretroviral drugs are anti-HIV drugs that can suppress the development of HIV in the body. Some commonly used ARVs in Indonesia include durival and neviral. All patients diagnosed with HIV need to begin ARV therapy immediately [11]. Moreover, the use of ARV drugs should be directed by a physician. ARV therapy serves to suppress the proliferation of HIV rather than curing the infection. Therefore, ARV therapy should be continued daily for the entire life. If ARV therapy is stopped, HIV will spread and increase in the blood. Furthermore, cessation of antiretroviral drug consumption in HIV patients puts them at the risk of viral resistance to ARV drugs [12].

The essence of the modified alarm medicine box

This study examined the use of a modified medicine box to remind HIV sufferers to take their ARV drugs during antiretroviral therapy in a proper manner. There are two important functions of this device:

- a reminder alarm that sounds every 12 hours,
- a storage compartment for ARV pills.

The concept of the modified alarm medicine box to improve the accuracy of ARV therapy for HIV and AIDS sufferers is actually very simple. As a reminder for people with HIV to take medication every 12 hours, this tool assists HIV patients in remembering to take their antiretroviral drugs. Because the alarm box has been modified to contain a small box of ARV drugs, not only can it provide a place to store ARV drugs, but also it can be taken with patients anywhere.

The modified alarm box will thus hopefully assist HIV patients in remembering to take their ARV drugs every 12 hours, which in turn will prevent the development of viral resistance to ARV drugs. The modified alarm box displayed in Figure 1.

Material and methods

The research method used in the present study was a quasi-experimental, one-group pre-test/post-test design to investigate the effect of the independent and dependent variables. The independent variable was the patients' timeliness in taking the ARV therapy drugs, while the dependent variable was the modified alarm box [13].

Each participant's medical history and records were examined prior participating in the study. The research design can be illustrated in Figure 2.

In the present study, the entire population was the subject of the study, including children and adults (both male and female) with HIV and AIDS receiving treatment at the Yayasan Lentera Pelangi Jakarta Foundation. A total of 20 out of 40 patients from the foundation participated in this study [14].

The study sample was a partial or representative sample of the population under study. The results of sample research should be generalizable to the target population [15], as applying the research conclusions to the entire population [16]. The present study used a purposive sampling technique, based on the following patient characteristics:

- confirmed HIV/AIDS positive status,
- aged between 15-30 years,
- under antiretroviral therapy (ARV),
- willing to participate in the study for seven days and fill out the time report.

On the other hand, participants were excluded from the research based on the following criteria:

- no compliance with the exercise guidelines or using the modified alarm box at the specified times,
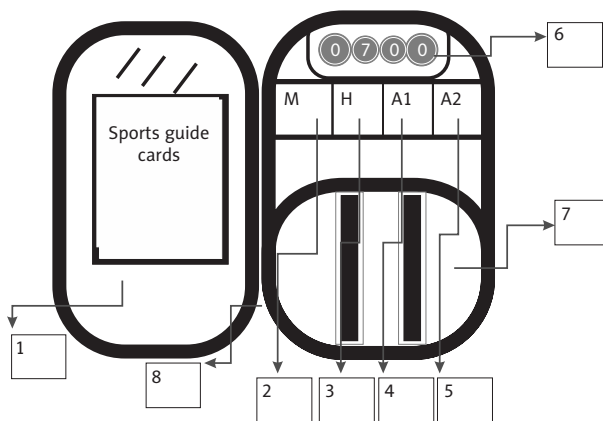
Explanation Figure:
1. Sports guide cards, as a supporting feature of this tool.
2. Memo button, the button is one device part of the four devices to set the alarm box.
3. Hour button, the button is the device key to set the time, especially in adjusting the clock.
4. Alarm 1 button, the button is the device key to set the time, especially in set minutes.
5. Alarm 2 button, the button is the device key to set the dead or live alarm rings.
6. Digital numbers to see the time or hours.
7. Box baffle device, which is useful for storing PIL ARV safely and efficiently.
8. Box cover device or a box cover cover, which is useful for keeping the PIL ARV safe in the box.

Figure 1. The modified alarm box
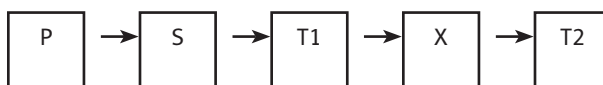
Explanation:
P: Population
S: Sample
T1: Pre-test before study with modified alarm box (medical record)
X: Study with modified alarm box
T2: Post-test after study with modified alarm box

Figure 2. The research design

- lack of usage of the modified alarm box due to malfunctioning of the alarm box itself.

In accordance with the research hypothesis and data analysis techniques used, the statistical hypothesis illustrates as follows:

- H0: $\beta y1 \leq 0$,
- H1: $\beta y1 > 0$.

Results

The present study is based on the timeliness of HIV patients taking ARV therapy drugs (X) using a modified alarm box (Y).

Data

The data described below are intended to provide an overview of the analyses, which includes the lowest values, highest values, means, standard deviations, standard errors, frequency distributions, and histograms of each variable.

Table 1. Frequency distribution before using modified alarm box

No.	Interval class	Midpoint	Frequency	Percentage (%)
1	0-12.15	6.075	6	30
2	12.16-24.31	18.235	9	45
3	24.32-36.47	30.395	2	10
4	36.48-48.63	42.555	1	5
5	48.64-60.79	54.715	1	5
6	60.80-72.95	66.875	1	5
Total			20	100

Table 2. Frequency distribution after using modified alarm box

No.	Interval class	Midpoint	Frequency	Percentage (%)
1	0-1.67	0.835	7	35
2	1.68-3.35	2.515	6	30
3	3.36-5.03	4.195	5	25
4	5.04-6.71	5.875	1	5

Figure 3. Chart of frequency distribution before using modified alarm box
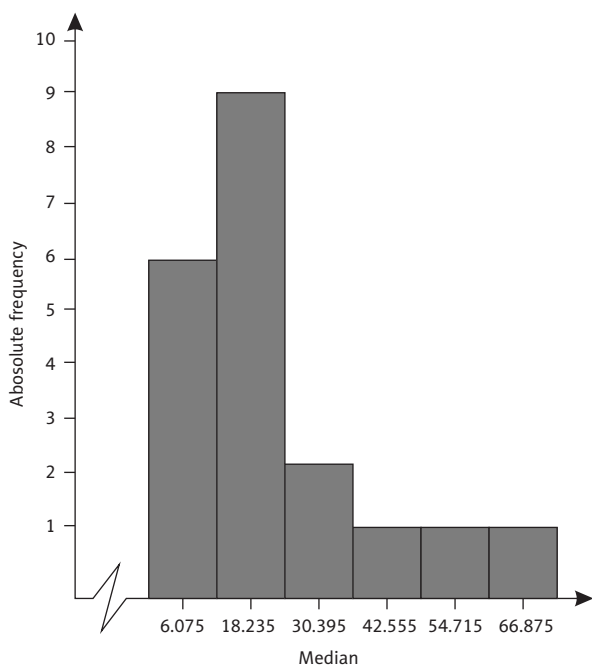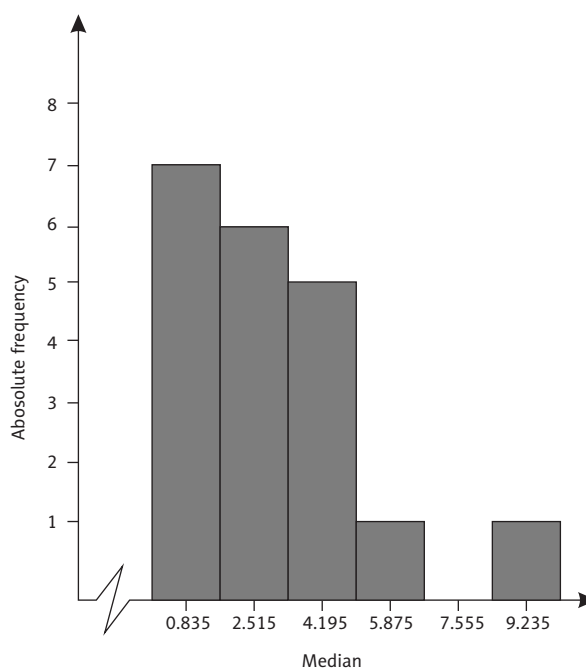

Figure 4. Chart of frequency distribution after using modified alarm box

During this research, the results were differentiated according to two variables: before using the modified alarm box and after using the modified alarm box. The data of before using the modified alarm box had the following values: highest value (64,285 minutes), lowest value (0 minutes), average value (20.76 minutes until a week), standard deviation (16.9), and standard error (3.87). In addition, the data of after using the modified alarm box had the following values: highest value (8,857 minutes), lowest value (0 minutes), average value (2.81 minutes until a week), standard deviation (2.23), and standard error (0.511).

Data of test results before using the modified alarm box

The data obtained from the initial test had a time range of 64,285 to 0, and obtained an average of 20.76 with a standard deviation of 16.9, and standard error of 3.87. This is shown in the frequency distributions displayed in Table 1 and Figure 3.

Data test results after using the modified alarm box

The data obtained from the final test had a time range of 0 to 8,857, obtained an average of 2.81 with a standard deviation of 2.23, and a standard error of 0.511. This is shown in the distributions displayed in Table 2 and Figure 4.

Statistical hypotheses testing

The delivered range of mean values of the results obtained from the test before using the modified alarm box was 20.76, while the range after using the modified alarm box was 2.81. From the results of the data analysis obtained by calculating the difference in means (M_D) 17.94, with a stan-

Table 3. Data from before and after using modified alarm medicine box (average of seven days)

No	Initial name	Sex	Time before using (minutes)	Time after using (minutes)
1	T	Female	22.14	2.14
2	P.S.	Male	30.00	2.00
3	A	Female	15.00	1.28
4	A	Female	23.14	4.28
5	R	Male	12.85	1.42
6	R	Female	64.28	2.14
7	D	Female	50.71	5.00
8	R	Male	0	0
9	N	Female	0	0
10	I	Male	5.00	2.14
11	W	Female	22.85	8.85
12	S	Female	42.85	1.42
13	Y	Female	34.28	2.14
14	H	Male	20.00	3.57
15	F	Male	15.00	6.42
16	I.A.	Male	20.71	5.00
17	G	Male	6.42	2.14
18	S	Male	4.28	1.42
19	A	Male	9.28	0.71
20	B	Male	16.42	4.28

Table 4. Research data influence of modified alarm box, average, standard deviation, standard error, before and after using the alarm box

(x)	(y)	(x − X)	(y − X)	(x − X)²	(y − X)²
22.14	2.14	1.38	−0.67	1.9044	0.4489
30	2	9.24	−0.81	85.3776	0.6561
15	1.28	−5.76	−1.53	33.1776	2.3409
23.14	4.28	2.38	1.47	5.6644	2.1609
12.85	1.42	−7.91	−1.39	62.5681	1.9321
64.28	2.14	43.52	−0.67	1,893.9904	0.4489
50.71	5	29.95	2.19	897.0025	4.7961
0	0	−20.76	−2.81	430.9776	7.8961
0	0	−20.76	−2.81	430.9776	7.8961
5	2.14	−15.76	−0.67	248.3776	0.4489
22.85	8.85	2.09	6.04	4.3681	36.4816
42.85	1.42	22.09	−1.39	487.9681	1.9321
34.28	2.14	13.52	−0.67	182.7904	0.4489
20	3.57	−0.76	0.76	0.5776	0.5776
15	6.42	−5.76	3.61	33.1776	13.0321
20.71	5	−0.05	2.19	0.0025	4.7961
6.42	2.14	−14.34	−0.67	205.6356	0.4489
4.28	1.42	−16.48	−1.39	271.5904	1.9321
9.28	0.71	−11.48	−2.1	131.7904	4.41
16.42	4.28	−4.34	1.47	18.8356	2.1609
Σ	415.21	56.35			
χ	20.76	2.81			
SD	16.9	2.23			
SE_{MD}	3.87	0.511			

dard deviation difference of (SD_D) 16.06, the difference in the standard error average was (SE_{MD}) 3.68. In the next calculation, the t-count value was 4.875, the t-table value with degrees of freedom ($n - 1$), and the error rate of $\alpha = 0.05$ was 2.09. The means the t-count of 4.875 was larger than the t-table value of 2.09. Thus, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted. Therefore, the calculation results show that the use of the modified alarm box positively affected the patients' timeliness of taking the ARV therapy drugs.

Discussion

Based on the data analysis, it was found that the hypotheses could be accepted. This means that using the modified alarm box had a significant effect on the patients who were able to take their ARV drugs on time. The study findings also showed a positive effect on the motivation of HIV patients to live a healthy lifestyle. It was found that by using this tool, a decreased level of delays in taking ARV medication has occurred, as evidenced by the coefficient value after using the modified alarm box at an average value of 2.81. This is considerably lower rate than the value before using the modified alarm box at an average value of 20.76.

Conclusions

After analyzing the data, it can be concluded that the use of the modified alarm box had a direct effect on the timeliness of the patients' consumption of their ARV medication. This means that, if this tool can be developed and distributed to patients, it can reduce or resolve the problem of viral drug resistance.

Practical implications

1. The modified alarm medicine box can serve as a tool to facilitate ARV therapy for HIV patients in a timely manner.
2. The modified alarm medicine box can serve as a tool to prevent viral resistance among HIV patients.

Acknowledgments

Table 5. Before and after tests using modified alarm box for t-test count

No	Before (x)	After (y)	D= (y − x)	D²
1	22.14	2.14	−20	400
2	30	2	−28	784
3	15	1.28	−13.72	188.2384
4	23.14	4.28	−18.86	355.6996
5	12.85	1.42	−11.43	130.6449
6	64.28	2.14	−62.14	3,861.3796
7	50.71	5	−45.71	2,089.4041
8	0	0	0	0
9	0	0	0	0
10	5	2.14	−2.86	8.1796
11	22.85	8.85	−14	196
12	42.85	1.42	−41.43	1,716.4449
13	34.28	2.14	−32.14	1,032.9796
14	20	3.57	−16.43	269.9449
15	15	6.42	−8.58	73.6164
16	20.71	5	−15.71	246.8041
17	6,42	2.14	−4.28	18.3184
18	4.28	1.42	−2.86	8.1796
19	9.28	0.71	−8.57	73.4449
20	16.42	4.28	−12.14	147.3796
Σ	415.21	56.35	−358.86	11,600.6586

Conflict of interest

The author's declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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