

COMMUNITY SERVICE ARTICLE

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# Maintenance and Counseling of the ECG Machine at the Puskesmas Deket Lamongan in an Effort to Maintain Continuity of Services for the Community

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**ABSTRACT** Some of the problems faced by partners include the EKG machine in the public health center (Puskesmas) at the Puskesmas Deket, Lamongan, which has a fairly high workload on daily use, considering that the population in the working area of the Deket Health Center is 44,193 people, so maintenance is mandatory to be carried out regularly to maintain sustainability. the function of the tool on the other side of the Deket, Lamongan health center there are no special personnel or technicians who carry out routine and periodic maintenance of the ECG machine. Therefore, community service activities in the form of counseling and assistance for health workers at the Deket Health Center, Lamongan are important so that they can carry out ECG machine maintenance activities independently. Furthermore, for the last 5 years or so, health workers at the Deket Health Center, Lamongan have received less training or workshops related to the maintenance of the ECG machine. As a completion step, it is necessary to carry out implementation steps through methods, namely communicating with the head of the Deket Health Center, Lamongan Regency to prepare for the right day and target participants to receive ECG maintenance counseling activities at partners, provide counseling for health workers or the person in charge ECG so the next step is to carry out maintenance activities together. With the method we propose, partners can learn together in implementing the SOPs that have been delivered during the counseling. Furthermore, lecturers and students regularly provide assistance for partners in carrying out maintenance activities for 7 months so that partners are expected to carry out maintenance activities independently. The results obtained after carrying out community service activities are ECG machine operators can use the machine well. Several problems related to the irregular display of the ECG recording can be resolved properly, after replacing the ECG electrode cable section. Maintenance of electromedical equipment, especially ECG is important to be done regularly so that the ECG machine can be operated at any time.

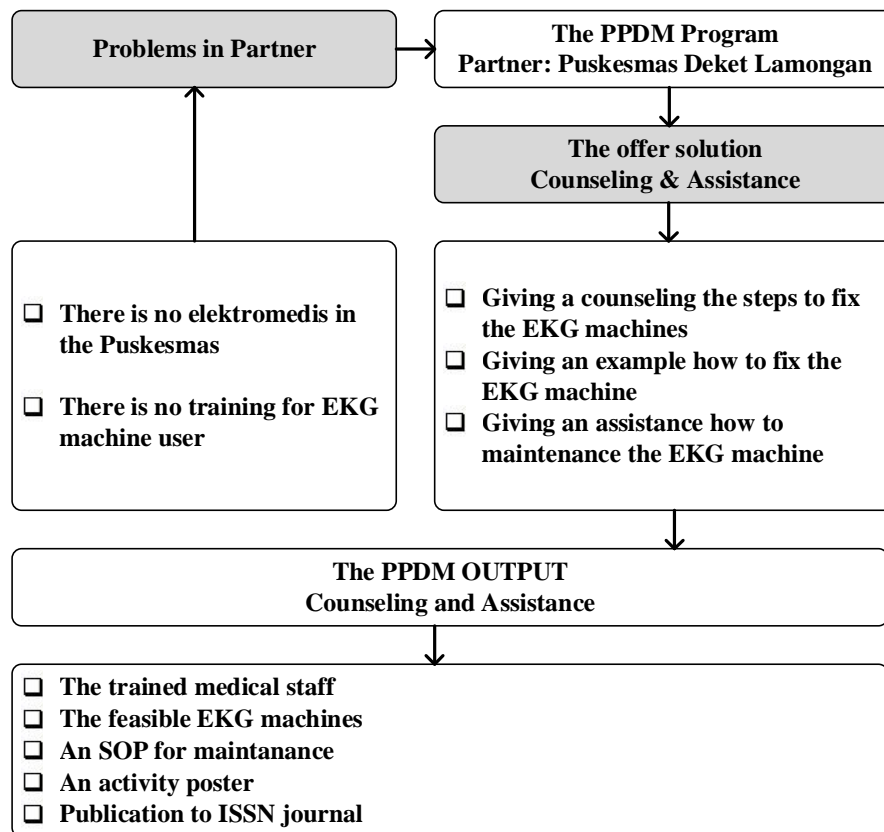
**INDEX TERMS** EKG, community services, maintenance, training.

## I. INTRODUCTION

Health Development is the flagship program among 45 important programs that must be carried out throughout the country related to sectoral and regional development, where the health program is ranked 12th [1]. Therefore, cooperation from all parties is highly expected to succeed in health

development in Indonesia in general and in Lamongan Regency in particular.

Partners in this community service program are health workers and technicians at the Deket Health Center, Deket District, Lamongan Regency. Deket sub-district has 44,193 residents, consisting of 22,282 male and 21,191 female



**FIGURE 1.** The results of the repair of the connector on the CardioTouch 3000 ECG machine (a) before and (b) after

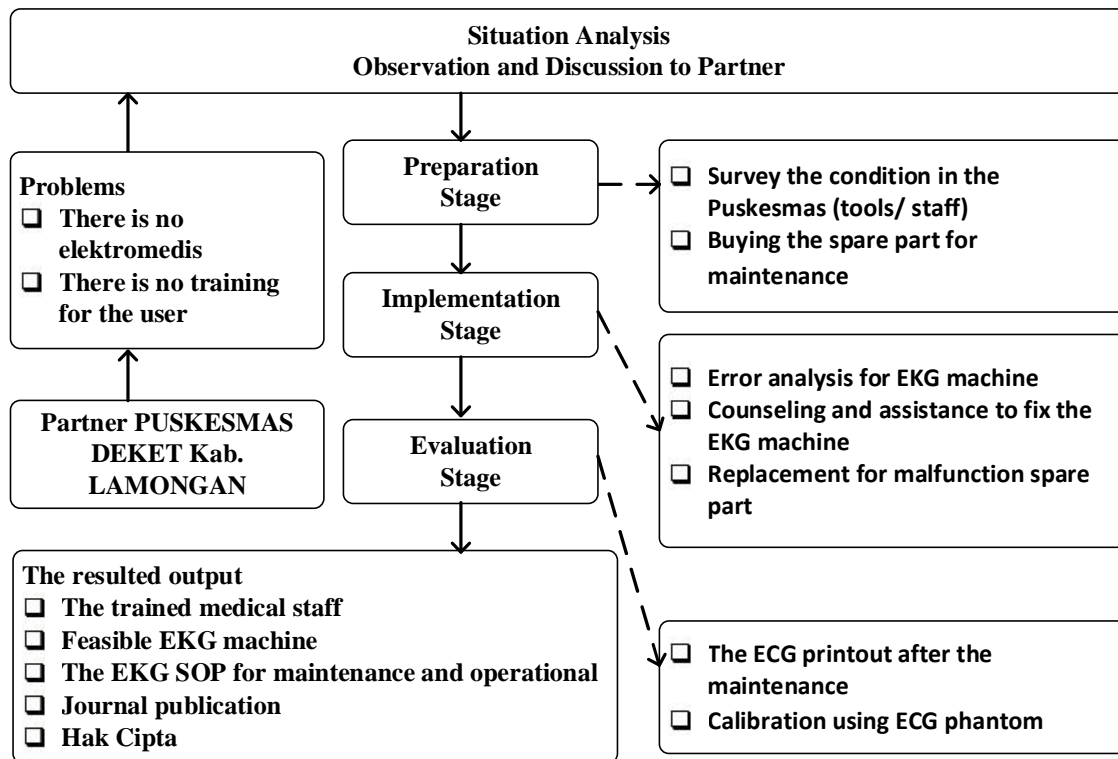
(source: BPS Lamongan Regency). Puskesmas Deket is a 24-hour service center receiving inpatient care. It has 10 polyclinics that operate from 08.00 to 14.00 every day, namely General, Elderly, Family Planning, MCH, Dental, Nutrition, Maternity, Emergency, and Medicine polyclinics. One poly that plays a very important role is the ER (emergency unit) which serves the community in conditions that must be treated immediately. ECG (electro cardiograph) is one of the equipment needed in the emergency room and general poly that is used to diagnose the patient's heart health condition in an emergency or general diagnosis [2][3] [4] [5] [6].

The reality on the ground is that not in all puskesmas in Lamongan Regency there are no electromedical technicians who directly handle maintenance, checking of electromedical devices. If the electromedical device is damaged, it will be left or repaired by a third party with the permission of the local Health Service. An example of a problem that often occurs is the occurrence of noise in the output.

This has inspired the Department of Electrical Engineering, Poltekkes, Ministry of Health, Surabaya to carry out community service at the Deket Health Center, Lamongan Regency. The form of activity is in the form of counseling and assistance in repairing electro cardiography (ECG) machines at the Puskesmas deket Lamongan in an effort to maintain service continuity [6] [2].

One of the efforts to solve the problems mentioned above is to carry out counseling and assistance in repairing medical devices to its users including nurses, midwives and other users of non-medical personnel, so as to increase the knowledge of officers or users which will ultimately have an impact on increasing the productivity of officers or users and improvement of quality and service in health centers [7] [8] (FIGURE 1).

In community service activities carried out by the Department of Electrical Engineering, Poltekkes, Ministry of Health, Surabaya, the focus is on the Electro Cardiography (ECG) equipment used at the Deket Lamongan Health Center. ECG equipment must be ensured that the equipment is in a usable condition, for this reason it is necessary to carry out maintenance and repair activities for damaged equipment. Furthermore, the problem with partners is the absence of electromedical personnel at the Puskesmas. This result is in accordance with the health worker law no. 36 of 2014 that health workers authorized to handle medical devices including Electro Cardiography (ECG) are electromedical personnel. However, because the power of electromedical until now is still limited. For the government, the lowest level of electromedical personnel is in type C hospitals. So that for health centers, maintenance and repair activities have not been reached. Furthermore, there is no training for users in the use



**FIGURE 2.** Situation analysis and proposed the solution

of Electro Cardiography (ECG) tools [9] [10]. The role of the user or operator is very important to keep the tool in a usable condition. However, technical training for users has never been carried out. Furthermore, the basic problem that must be faced is the unavailability or limited budget of using third party services in carrying out maintenance and repair activities.

Based on the problems faced by partners, through a community service program with the "Partner Village Development Program (PPDM)" scheme, especially counseling and assistance at the Deket Lamongan Health Center, the proposer offers several solutions including, providing counseling for health workers or those responsible for operating ECG machine in carrying out repair steps, providing examples of ECG machine repair activities by involving partners and providing continuous assistance on a regular basis to Partner health workers in carrying out ECG machine maintenance steps as shown in **FIGURE 2**.

## II. MATERIAL AND METHOD

### A. MATERIALS

This community service activity uses several materials and tools used for calibration and repair of the ECG machine. A phantom ECG (Fluke, PS410, USA) was used to test an ECG machine whether the BPM and amplitude readings were correct based on the settings specified in the Phantom ECG [11] [12]. In testing the ECG machine, several BPM options

are used, starting from 60, 80, 90, 100, 120, and 150 [13]. Meanwhile, the tested amplitudes are from 1 mV, 1.5 mV and 2 mV [14]. The test is done by installing paper according to the size of the ECG machine. Some other materials used for maintenance purposes are 80% alcohol and cloth.

### B. METHOD

The steps of the activity plan in providing solutions to partners are outlined in the steps as shown in **FIGURE 3**. After observing and discussing the following steps:

#### 1) PREPARATION.

To carry out Counseling and Assistance in the ECG (Electro Cardiography) Repair Process, several preparations are needed. Damage to the block or what part of the ECG. For further preparation of the required spare parts.

#### 2) IMPLEMENTATION.

Communicate with the head of the Deket Health Center, Lamongan Regency to prepare the right day and target participants to receive ECG improvement counseling activities at partners. Analyzing the damage that occurred, after that the health worker or person in charge of the ECG was given counseling [15], the next step was to carry out repair activities together (lecturers, students, and partners). Learning partners do an analysis if there is damage as stated during the counseling and discuss when there are problems in making repairs. Lecturers and students regularly provide assistance to partners in carrying out repair activities for 7

months so that partners are expected to carry out repair activities independently.

### 3) EVALUATION.



(a)



(b)

**FIGURE 3.** The EKG machine maintenance implementation (a) checking the cable (b) checking the malfunction software.

After conducting counseling, repair and mentoring activities. The community service team evaluates the improvement of SOPs on partners whether they are appropriate or not. The output signal is appropriate or not after calibration with Phantom.

### 4) OUTDOOR.

After the process of implementing the PKM, the next step is to make the output of the supervisor in the form of: a) Trained employees/health workers. b) Appropriate ECG equipment c) SOP for operation and repair of ECG machines at the Puskesmas, d) Video of Community Service activities at the Deket Health Center, e) Publishing community service results in the form of publications to books or journals.

At the PPDM implementation stage at the Deket Lamongan Health Center, for every ECG machine we received, we asked for information regarding the problem with the ECG device, whether it was still in normal condition, moderately damaged, or completely damaged. Figure 3 (a) shows the steps for handling damage to the ECG machine with display complaints for one channel that does not come out, which is channel 2. a bit loud when operating the ECG

machine (Cardiotouch 3000, Bionet) [16]. As a first step, we made repairs by cleaning the female connector using a needle moistened with 80% alcohol. The next step is to test the ECG

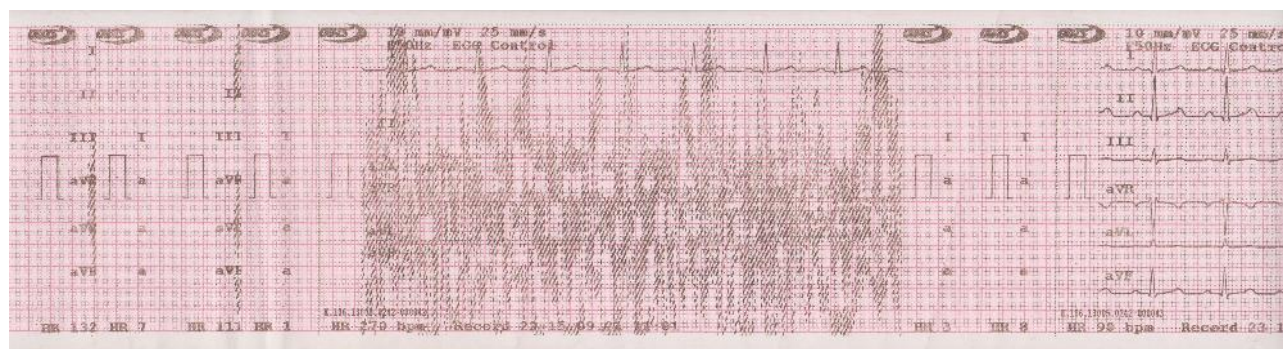
machine by providing input in the form of an ECG signal from the Phantom ECG. Another EKG machine had a complaint that it always issued an alarm to the doctor. Functionally, the ECG machine is in good condition, it can record and print ECG recordings on ECG paper. However, the alarm is very annoying if it goes off continuously (Figure 3(b)). The trouble shooting step is to check all the connected connectors and operate some of the available menus. One of the menus in the GSM section has a malfunction so that the alarm on the EKG machine cannot be stopped and the final solution is to invite the vendor providing the product (Electrocardiography, UCARD 100).

At this stage, we also conduct counseling activities for related ECG machine operators in the event of a malfunction in the ECG machine, namely by testing the output using ECG Phantom and testing using an ECG cable in good condition..

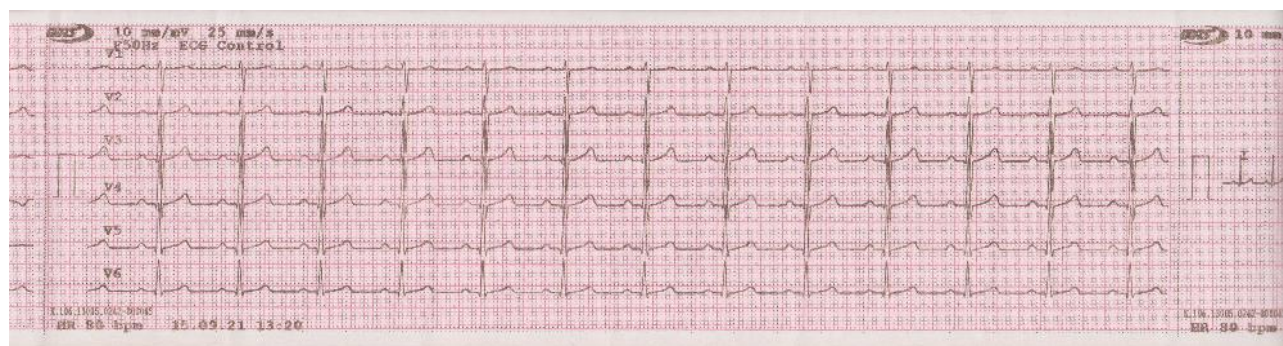
### III. RESULT

The CardioTouch 3000 ECG machine malfunctioned when outputting the recorded ECG signal on the liquid crystal display (LCD) screen where the Lead II channel could not





(a)



(b)

**FIGURE 4.** The ECG signal printout using ECG phantom (a) before the trouble shooting, (b) after trouble shooting

show the ECG recording when the cable was connected to the ECG Phantom [17]. The simplest trouble shooting step is to replace the ECG cable from another ECG machine. The results showed that the cable broke in the middle, causing one record that could not be displayed. After the replacement, the ECG machine can run normally. **FIGURE 4(a)** shows the printout of the ECG signal coming from a phantom on the CardioTouch 3000 ECG machine [18]. The printout on the ECG paper shows an improper recording of the ECG signal, i.e. issuing a random signal printout. This is because the ECG engine is not receiving data correctly on the Lead II channel. After replacing the electrode cable with the same model, the ECG machine can show a printout on the ECG paper as expected, which is to issue a printout for all leads, both leads I, II, III, aVL, aVR, aVF, V1, V2, V3, V4, V5 and V6. The printout on ECG paper can be seen in **FIGURE 4 (b)**. Based on the calculation of the number of squares for both amplitude and beats per minute (BPM), it shows that there is no error in the output. This indicates that the CardioTouch 3000 ECG machine can be used for normal ECG signal measurement purposes. In addition to the problem with the electrode cable that causes errors in the printout on the ECG paper, this ECG machine also has problems with the output on the LCD,

namely the loss of one Lead II channel. After doing the trouble shooting process, the results show the CardioTouch 3000 ECG machine can run normally **FIGURE 5 (a) AND (b)**.

#### IV. DISCUSSION

This community service activity is an effort to improve health services for the community in the Deket Health Center area, Deket sub-district, Lamongan district by providing counseling and assistance on maintenance and minor repairs of the EKG machine. In addition, this activity is also carried out monitoring the function of the ECG machine whether it is still in accordance with the standard or must be calibrated by the authorized body. Overall, this activity has added value to the Deket Health Center, especially for the ECG machine. Some ECG machines (ECG CardioTouch 3000 and Electrocardiography, UCARD 100) can be repaired so that they can work normally for the purposes of measuring ECG signals. Another problem that has been successfully solved is the maintenance of the ECG dry electrode. Most of the dry electrodes experienced the addition of scale on the surface due to gelly drying on the electrode surface. The maintenance step that can be done is to soak the electrode in hot water for 30 minutes, then clean it with soap and a dry cloth.



(a)



(b)

**FIGURE 5.** Hasil perbaikan konektor pada machine EKG CardioTouch 3000 (a) sebelum dan (b) sesudah

However, several things that become limitations or weaknesses of this activity are that we have not been able to provide intensive training for medical personnel at the puskesmas, in this case nurses, to carry out maintenance and repair activities for the ECG machine because this is beyond the competence of the nurses. So for this activity we only provide brief instructions in case of malfunction on the EKG machine, such as replacing the cable with another EKG machine cable, cleaning dry electrodes regularly and checking the connector that connects the electrode and the EKG machine. Mentoring activities are one of the activities that we offer to the Deket Community Health Center, which is to provide assistance on how to maintain and repair the correct ECG machine periodically until one day medical personnel or ECG machine operators carry out maintenance and repair steps independently.

This activity is expected to be a motivation for medical personnel or operators at the Puskesmas level to be directly involved in simple maintenance and repair efforts. This aims to maintain the continuity of service delivery to the community. Especially for people who will do a heart check. Furthermore, for policy makers at the regional or central level, they can provide encouragement to provide electromedical personnel up to the Puskesmas level. After medical personnel or EKG machine operators have the ability to carry out minor

maintenance and repair steps, a change is needed in terms of budgeting for the maintenance of consumables and spare parts to replace the ECG machine.

## V. CONCLUSION

This community service activity aims to provide counseling and assistance for medical personnel or ECG machine operators so that they can carry out minor maintenance and repair activities on the ECG machine when they encounter problems. The result of the implementation of community service activities is that they can provide simple counseling for ECG machine users, regarding the steps that must be taken when the ECG machine is in a malfunction state. The results of the activity show that malfunction on the EKG machine can be caused by dirty dry electrodes, broken electrode cables and loose connectors, especially on the female connector. In the future, this activity can be increased by providing mini workshops for medical officers or ECG operators so that they have more capabilities, especially in terms of maintenance and minor repairs on ECG machines. Periodic monitoring can be carried out after the implementation of this community service activity.

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