Implementation of Apnea Monitor with Telemedicine Smartphone System (TMSS) for diagnosis and management of sleep-disordered breathing in Cases of Respiratory Disorders in Indonesia

I Dewa Gede Hari Wisana[1], Her Gumiwang Ariswati[1], Lusiana[1], Farid Amrinsani[1], Rahmawati[2]

[1] Department of Electro Medic Technology, Poltekkes Kemenkes Surabaya, Indonesia

[2] Department of Midwifery, Poltekkes Kemenkes Surabaya, Indonesia

Corresponding author: Her Gumiwang Ariswati (e-mail: hergum@poltekkesdepkes-sby.ac.id)

ABSTRACT In connection with the increase in patients with respiratory problems in the Kenjeran Health Centre area of Surabaya City and the cases of respiratory problems in Covid 19 patients which caused a lack of treatment for these patients due to limited health workers and insufficient monitoring equipment, resulting in an impact on the health service system for patients being disrupted. The Community Service Programme with the PKM scheme is carried out in the form of synergistic cooperation between the Poltekkes Kemenkes Surabaya and the Surabaya City Health Office which is oriented towards community independence through counseling and mentoring, especially in the application of the use of Apnea Monitor at the respiration rate using the Telemedicine Smartphone System (TMSS). These problems are obtained from supporting data about the general description, health degree situation, health resource situation, health service efforts and disease cases at the Kenjeran Health Centre obtained from the Surabaya City Community Satisfaction Survey 2016-2021 so that they can be analysed for problem solutions. With the concept of methodology, a design / flow of extension activities and assistance in the application of the use of Apnea Monitor with Telemedicine System carried out by a team consisting of 3 lecturers and 3 students in accordance with their fields of expertise as well as participants from Kenjeran Health Centre and the community in the area, so that the Community Service activities to be carried out are expected to help solve the problems faced by Kenjeran Health Centre. The results of activities that have been achieved are: 1).The results of SPO2 and BPM values on 40 workers are recorded.2). Identification of 40 workers who do not experience respiratory problems; 3). Identification of workers with respiratory problems (none); 4) Implementation of the TMSS apnea monitor system by measuring SPO2 and BPM in smoking workers in the Kenjeran Health Centre area. Future development plans for the Apnea Monitor -TMSS tool can be accessed via the web. After using the Apnea Monitor - TMSS tool, Community Service workers will be able to carry out routine monitoring of their respiratory conditions, so as to prevent chronic respiratory diseases which can cause dangerous conditions if exposed to covid-19.

INDEX TERMS: Apnea Monitor, Telemedicine Smartphone System, SPO_2, BPM

I. INTRODUCTION

Community Service[1] of Poltekkes Kemenkes Surabaya with the Community Partnership Program scheme aims to empower the community in realising community independence and welfare based on optimising community potential in order to be able to use and optimise the potential of existing resources.

The Community Service Programme with the PKM scheme is carried out in the form of synergistic cooperation between the Poltekkes Kemenkes Surabaya and the Surabaya City Health Office which is oriented towards community independence through counseling and mentoring, especially in the application of the use of the Apnea Monitor [2] [3] [4] at the respiration rate using the Telemedicine Smartphone System (TMSS). In connection with the increase in patients with respiratory distress cases in the Kenjeran Health Centre area of Surabaya City and the cases of respiratory distress in Covid 19 [5] patients which caused a lack of treatment for these patients due to limited health workers and insufficient

monitoring equipment, resulting in an impact on the health service system for patients disrupted.

With the application of the use of Apnea Monitor with Telemedicine Smartphone System (TMSS) [6], it is hoped that it can help people in Indonesia, especially in the Surabaya city area, to be able to conduct early examinations independently and can provide information to medical personnel if there are things that are outside the specified parameters.

The PKM activities that will be carried out intend to help solve the problems faced by rural communities, especially in the Surabaya city area, which are comprehensive, multi-sectoral in an institution, namely at the Kenjeran Health Centre in the Surabaya city Health Office Region which is used as a partner. So to support these activities, supporting data is needed about the general description, the situation of health status, the situation of health resources, health service efforts.

This PKM is the application of research in accordance with the road map (Road map Research) which has been carried out, among others, about apnea monitors in 2019 designing Apnea monitors to detect respiration rates in infants and adults using Piezoelectric sensors. 2020 is to detect the respiratory rate, especially detection in the event of respiratory failure or sleep apnea in adults as one of the important parameters for determining human health status. The 2020 research emphasises on designing sensors using piezo electricity and adding vibrations to the patient's chest to prevent respiratory failure.s based on the results of measuring bio-electrical signals (EMG) [7] [8] [9]. Then in 2021, we will develop pulse oximetry [10] which is integrated with google maps and the messenger application for sending measurement result data. The method used in this PKM activity is the mass outreach method used to convey information to society that is mass or public in nature, where in essence it is counseling is a non-formal activity in order to change society towards better conditions as aspired [10]

II. METHOD

The method that will be used in carrying out PKM activities is the application of apnea monitor tools by measuring SPO2 [11] and BPM [12] values to the community of smoking workers in the Kenjeran area is shown in FIGURE 1. The method used in this study is the mass counseling method, where the mass counseling method is used to convey information to society that is mass or public. Where Counseling is an activity to educate something to individuals or groups, provide knowledge, information and various abilities so that can shape the attitude and behavior of life that should be.

The activity begins with planning by collecting and analysing partner data and then submitting a PKM proposal which is known by the Head of PPM and approved by the Director of the Poltekkes Kemenkes Surabaya. Furthermore, the Head of the PKM Team of the Poltekkes Kemenkes Surabaya identified participants by asking the Head of the Kenjeran Health Centre to appoint

2 health workers / technical personnel and 40 people from community worker groups as participants who would take SPO2 and BPM measurements as the implementation of the application of the TMSS [13] apnea monitor tool from the PKM Team of the Poltekkes Kemenkes Surabaya. Next, the PKM Team carried out the implementation stage starting from the PKM Team Training itself. (according to the division of tasks)

Furthermore, the PKM Team began to carry out technical implementation by providing assistance (education) with health centre staff by means of direct demonstration. Activities begin with recording identity, measuring equipment according to the worksheet. Participants fill out the attendance list and identitygiven by the PKM Team.Data processing is carried out from participant evaluations (measurements) and worksheets and then verified.Furthermore, reporting is carried out to the Head of Kenjeran Health Centre and Poltekkes Kemenkes Surabaya shown in FIGURE 1.
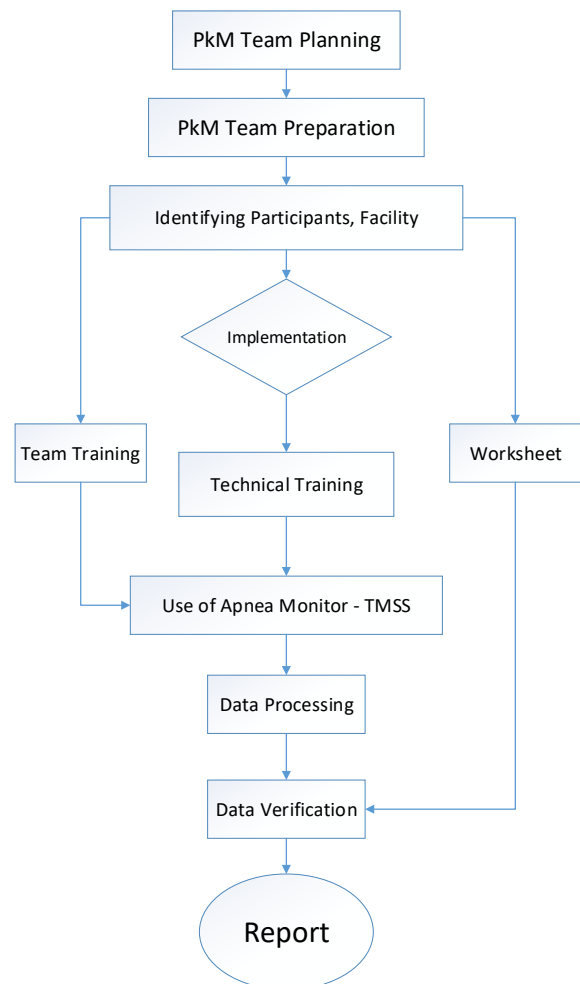

FIGURE 1. Flowchart of PKM Activity Stages

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III. IMPLEMENTATION

The implementation of PkM PKM theme in the activity of applying the use of Apnea Monitor with Telemedicine Smartphone (TMSS) in cases of respiratory disorders in the

Kenjeran Puskesmas area, namely in the smoking area. The results that have been achieved in this PkM PPDM activity are: the results of SPO2 values on 40 workers were recorded; the results of BPM values on 40 workers were recorded; identification of 40 workers who do not experience respiratory problems; identified workers who have respiratory problems. (None); implementation of the TMSS apnea monitor system by measuring SPO2 and BPM in smoking workers in the Kenjeran Health Centre area shown in FIGURE 2.

FIGURE 2. Explaination of Kenjeran Health Center

The Head of the PKM Team of the Poltekkes Kemenkes Surabaya identified participants by asking the Head of the Kenjeran Health Centre to appoint 2 health workers / technical personnel and 40 people from community worker groups as participants who would take SPO2 and BPM measurements as the implementation of the application of the TMSS apnea monitor tool from the PKM Team of the Poltekkes Kemenkes Surabaya shown in FIGURE 3.

FIGURE 3. Implementation of activities to residents' homes

The team makes a plan by collecting and analysing partner data and then submitting a PKM proposal which is known by the Head of PPM and approved by the Director of Poltekkes Kemenkes Surabaya.

PkM Team doing a Implementation shown in FIGURE 4.

FIGURE 4. Explaination of Comunnity workers Group

starts from the PKM Team Training itself. (according to the division of tasks) Furthermore, the PKM Team began to carry out technical implementation of mentoring (education) with health centre officers by means of direct demonstration. The activity starts with recording identity, measuring the device according to the worksheet shown in FIGURE 5.

FIGURE 5. Data collection to residents' homes

Participants filled in the attendance list and identity provided by the PKM Team. Data processing is carried out from participant evaluations (measurements) and worksheets and then verified. Furthermore, reporting was carried out to the Head of the Kenjeran Health Centre regarding the implementation of PKM activities in the form of applying apnea monitor devices by measuring SPO2 and BPM values to the community of smoking workers in the Kenjeran area shown in FIGURE 6.

FIGURE 6. PKM participants consisting of lecturers and students of the Department of Electromedical Engineering, Poltekkes Kemenkes Surabaya

FIGURE 7. Reporting the results of the implementation of PKM to Health Center officials

FIGURE 8. Reporting the results of the implementation of PKM to Health Center officials

IV. RESULTS

The implementation of PkM PKM theme in the activity of applying the use of Apnea Monitor with Telemedicine Smartphone (TMSS) in cases of respiratory disorders in the Kenjeran Puskesmas area, namely in the smoking area. The results that have been achieved in this PkM PPDM activity are the recording of the results of SPO2 values in 40 workers;

recording the results of BPM values in 40 workers, identifying 40 workers who do not experience respiratory problems; identifying workers who experience respiratory problems. (None); the implementation of the TMSS system apnea monitor tool by measuring SPO2 and BPM in smoking workers in the Kenjeran Puskesmas area shown in FIGURE 6 and FIGURE 7.

A. Results of Recording and Measurement

The place of the measurement is in Kenjeran Health Centre Area (Kenjeran Fish Smoking) especially in Kenjeran Urban Village Area on 31 August 2022 with SPO2 and BPM Measurement Procedure in range 0 to 100 (SPO2); 0 to. 200 (BPM) using Mobile Tool seril No. A01. The result of measurement is decribed in TABLE 1.

TABLE 1. **Temperature and Humidity Measurement**

Condition	Temp (°C)	Humidity (%)
Begining	30	4
End	3	4

B. Physical Condition and Function of Measuring Instruments

The tools for measuring is used Fingertip Pulse Oximeter LK88 Oximetry LED LK88 for SPO2 and BPM Measurement Results of Smoking Workers Tool A. The result of measurement is good physical and function condition.

C. Recording and Measurement Results with the Tool

From the TABLE 2, it is obtained that the apnea monitor A can be applied to the measurement of 10 workers with an age range between 30 to 75 years; 9 women and 1 man with SPO2 values between the lowest 92, the highest 99 and the lowest BPM value 72; the highest 91, all of whom are not in apnea.

TABLE 2. **Measurement Report of Community of Smoking Center**

No	Respondent	Age	Gender	SPO2	BPM
1	01A	43	P	97	85
2	02A	50	P	99	77
3	03A	37	P	98	84
4	04A	74	P	99	72
5	05A	68	L	97	81
6	06A	68	P	92	78
7	07A	37	P	97	81
8	08A	33	P	97	82
9	09A	53	P	99	77
10	10A	38	P	99	86
11	01B	31	P	97	86
12	02B	47	P	99	75
13	03B	37	P	99	82
14	04B	63	P	99	83
15	05B	51	P	92	78
16	06B	30	L	98	72
17	07B	45	P	99	72
18	08B	50	P	98	80
19	09B	39	P	99	91
20	10B	71	L	99	74
21	01D	49	P	99	103

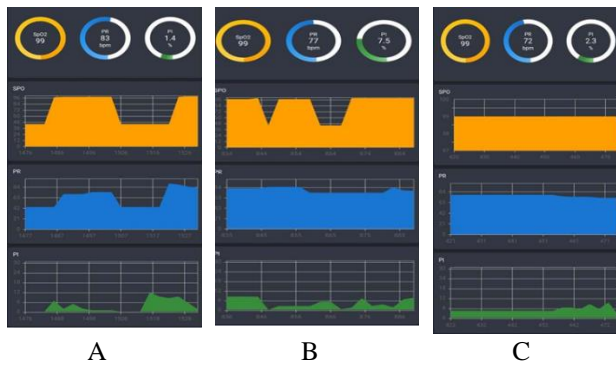| 22	02D	61	P	99	97
23	03D	42	P	99	91
24	04D	36	P	99	93
25	05D	32	L	99	84
26	06D	52	P	99	80
27	07D	31	P	98	83
28	08D	48	P	99	87
29	09D	45	P	99	83
30	10D	38	P	99	96

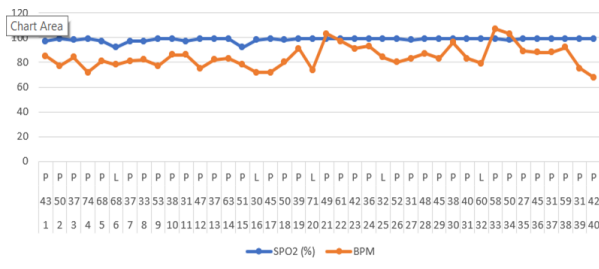**FIGURE 2.** Display of Results 1 Measurement Tools A, B and C on Android

FIGURE 3. Graph of Measurement SPO2 and BPM of Smoking Workers in Kenjeran Health Center

To see the distribution of 40 SPO2 and BPM measurement data of smoking workers in the age range of 30-75 years Woman and men in the kenjeran health centre area on the tools woman and men in the Kenjeran Health Centre area on the tools A, B and C shown in FIGURE 2 above can be seen in the following graph connected to pulse oximetry fast response to measurements given by applications described in FIGURE 3.

V. DISCUSSION

With the application of the use of Apnea Monitor with Telemedicine Smartphone System (TMSS), it is hoped that it can help people in Indonesia, especially in the Surabaya city area, to be able to conduct early examinations independently and can provide information to medical personnel if there are things that are outside the specified parameters. based on the results of the spo2 and bpm measurements of the fumigation workers in the Kenjeran Health Center area, it can be concluded that the SPO2 measurement results show good results but are not comparable to the BPM value, so an in-depth evaluation

VI. CONCLUSION

The implementation of PkM PKM theme in the activity of applying the use of Apnea Monitor with Telemedicine Smartphone (TMSS) in cases of respiratory disorders in the Kenjeran Puskesmas area, namely in the smoking area. The results that have been achieved in this PkM PPDM activity are: The results of SPO2 values on 40 workers were recorded; the results of BPM values on 40 workers were recorded; identified 40 workers who did not experience respiratory problems, identified workers who experienced respiratory problems. (None); the implementation of the TMSS system apnea monitor tool by measuring SPO2 and BPM on smoking workers in the Kenjeran Puskesmas area. From the results of the mentoring and counselling activities, it is suggested to paramedics and technical personnel as well as cadres at Kenjeran Health Centre; use Android hand phones that support the software application, for further community service activities the TMSS Apnea Monitor tool development tool can also be accessed on the web. For further work it is hoped that it can improve the speed of map access and the speed for the stability of measurement results.

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