MIDTERM PAPER

PICO Question - For patients with cardiovascular diseases (P) will mobile health applications (I) as compared to non-users of mobile health applications (C) help in generating health promotion and prevention of disease(O)?

P – Population – Patients with cardiovascular diseases

I – Intervention – Mobile Health Applications

C – Comparison – non-users of the mobile health applications

O – Outcome – help in generating health promotion and prevention of the disease

Article 1

Complete Bibliographic citation:**(APA format)**

Wang L, Guo Y, Wang M, Zhao Y. A mobile health application to support self-management in patients with chronic obstructive pulmonary disease: a randomized controlled trial. *Clinical Rehabilitation*. 2021;35(1):90-101. doi:10.1177/0269215520946931

Full Link to the article: https://pubmed.ncbi.nlm.nih.gov/32907384/

Summary: Study is a randomized controlled trial comprising 78 inpatients who had COPD which were divided into two groups. The Intervention group were given a mobile medical application-based program with routine care and control group were given routine care only. At the end of 12 months, there was seen a significant improvement in COPD assessment score. Along with that it increased the patients exercise and smoking cessation behavior.

Relevance to PICO question: - This study has relevance to the PICO question because mobile health application has been a great contributor in the field of health informatics as providing early detection and prevention of the disease is important for the field. Here, in this study, mobile health application serves as a tool for tele-health and in turn increasing health promotion. Self-management of the disease is one of the aims of this study which efficiently increases the quality of life and reduce the hospitalization of the patient.

The uniqueness of the study:

It is a single-blind trial where all the patients knew which group, they belonged to whether it was a control group or an intervention group. The Interventionist knew which participants were added to the intervention group.

Strength: According to researchers, this study is first of its kind as it investigates the effect of the application on self-management of COPD. It also is one of the few studies which researches on smoking cessation among the patients of COPD.

Weakness: It is a single-unit/ single-center study and along with that this study belonged to the inpatients of the hospital. 78 patients were only included in this study, but there were long follow-ups as well. Attention was not given to the control group and intervention group equally which was one of the weaknesses as well.

Bias: None noted. The work was funded by science and technology department of the Province of Guizhou, China

Evaluation of the authors: (Research Interests)

1) LianHong Wang, - Researcher has interest in Signal/image processing, data mining, and modern network communication technology.
2) YunMei Guo,
3) Meili Wang,
4) Yan Zhao, - Researcher has interest in Collaborative biomedical research as a biostatistical contributor as well as independent statistical research.

Article 2

Complete Bibliographic citation: **(APA format)**

Kim, M., Kim, Y., & Choi, M. (2022). Mobile health platform based on user-centered design to promote exercise for patients with peripheral artery disease. *BMC medical informatics and decision making*, *22*(1), 206. https://doi.org/10.1186/s12911-022-01945-z

Summary: This study specifically is for a patient with a type of cardiovascular disease – Peripheral Artery Disease. Here, the study aims to help the patients with PAD by promoting exercise with the help of a mobile smartphone application which is synchronous with the wearable activity tracker and a web-based portal with a mission of alleviating health promotion among those individuals and in turn lead to behavioral changes among them related to their health.

Relevance to PICO question: - Increasing awareness of exercise in PAD patients through an iterative development process where user experience is considered for the development of a smartphone application, which in turn directly promotes health is the relevance to PICO question.

The uniqueness of the study: An Iterative development process is used in the study where analysis, design and implementation were a part of that process. A design approach which was user-centered was executed in the study to understand the needs and requirements of the user.

Strength: Exercise through goal visualization, messages and videos in the application which was a unique factor. The HOBBIT-PAD is used to have real time interaction with the patients and thus leading to greater efficiency and effectiveness.

Weakness: The app was available for android smartphones only. The Portal was not evaluated in the phase 4, only smartphone was evaluated. The app was made to work with FitBit Charge 4 only.

Bias: No bias was found/reported. The study was funded by IRB of The Yonsei Universal Health System.

Evaluation of the authors: (Research Interests)

1) Mihui Kim – Research interests are Information and Communication Technology.
2) Yesol Kim -. Nursing Informatics, Nursing education, Critical care nursing
3) Mona Choi - Electronic patient record, Public Health Informatics, Emergency care

Article 3

Complete Bibliographic citation: **(APA format)**

Payne Riches, S., Piernas, C., Aveyard, P., Sheppard, J. P., Rayner, M., Albury, C., & Jebb, S. A. (2021). A Mobile Health Salt Reduction Intervention for People With Hypertension: Results of a Feasibility Randomized Controlled Trial. *JMIR mHealth and uHealth*, *9*(10), e26233. https://doi.org/10.2196/26233

Summary: This study is for the patients who have hypertension – one of the most common factors of cardiovascular disease. Patients with hypertension are advised for lower salt intake. To do this intervention and achieve the results, a randomized control trial study was done which aims to reduce the salt intake in their diet with the help of SaltSwap mobile health application which helps individuals to identify lower-salt options while grocery shopping. It also includes behavioral changing techniques guided with the help of General Practitioner. The application also allows the individuals to share the swaps with different social media websites. It was divided into an intervention group who were exposed to the application and other group was given control booklet. At the end of the trial, the participants were showing knowledge related low salt dietary intake and showed that patients with high blood pressure were more acceptable towards the application.

Relevance to PICO question: The mobile health application SaltSwap helps the patients with hypertension to reduce the dietary salt intake in their diet, leading to health promotion and behavioral changes. This is an example of health education and health promotion. Due to the application,

patients with high blood pressure were benefitted by doing dietary modifications and changing their lifestyle leading to a healthy life.

The uniqueness of the study – The study was approved by clinicians, and they also agreed to the fact that the non-specialist staff of primary care can also assist the patients without any training. The uniqueness of the application was that it sent messages to the individual's phone if the application was not used for 10 days after the use of an application for the first time.

Strength: Knowledge was increased about salt intake among the intervention group, made the participants more conscious for their diet. The study has qualitative analysis and behavioral analysis for the patients. Additionally, it proved the feasibility ratio of the SaltSwap application which was in relation to the UK grocery market. It can help the patients with hypertension or cardiovascular diseases to make an informed decision about their low-salt diet intake.

Weakness: Breach of Data privacy, misdiagnosis and patients can have lack of trust for the mobile health application. Along with that, the response rate to the study was 5% hence it shows that the people might have lesser interest in reducing salt in their diet and patients might have taken lesser salt in their diet the day they had to get tested indirectly leading the results to null.

Bias: The group of patients were selected as per convenience; they had the same class of socio-economic background along with that wider ranger of ethnicity and cultural background was not considered leading to bias. Food products which were covered in the application had lesser coverage leading to a barrier in identification of lower-salt products hence leading to bias in the outcome.

Evaluation of the authors: (Research Interests)
Sarah Payne Riches, MPH, DPhil, - Public health, maternity care,
Carmen Piernas, MSc, PhD, - prevention and management of non-communicable chronic disease through dietary improvements, in particular, obesity and cardiovascular disease.
Paul Aveyard, PhD, - Behavioural medicine
James P Sheppard, BSc, PhD, - Cardiovascular disease prevention
Mike Rayner, BA, DPhil, - Population health, Non-communicable disease prevention
Charlotte Albury, BA, MSc, DPhil, - Medical Sociology, Health Experiences research
Susan A Jebb, DPhil – Translation of nutrition science into policy, public health nutrition

Article 4

Complete Bibliographic citation: **(APA format):**

Santala, O. E., Halonen, J., Martikainen, S., Jäntti, H., Rissanen, T. T., Tarvainen, M. P., Laitinen, T. P., Laitinen, T. M., Väliaho, E. S., Hartikainen, J., Martikainen, T. J., & Lipponen, J. A. (2021). Automatic Mobile Health Arrhythmia Monitoring for the Detection of Atrial Fibrillation: Prospective Feasibility, Accuracy, and User Experience Study. *JMIR mHealth and uHealth*, *9*(10), e29933. https://doi.org/10.2196/29933

Summary: This study is about the patients who have atrial fibrillation (AF) and are at a risk for stroke. AF is misdiagnosed as it is asymptomatic in nature. Researchers want to evaluate that how a mobile health application, an artificial intelligence algorithm along with a single lead ECG heart belt can record and detect AF. Here, the application and cloud service record, the data from the belt for two different groups – one group of patients have AF and others have Sinus Rhythm (SR). After recording the ECG for 24 hours with the heart belt the outcome after analysis is that the heart belt recorded higher percentage of accuracy for AF detection. The algorithm of AI detected AF accurately in the AF patients and 4 SR patients were detected as well. Users have also accepted the new Mobile Health methods in comparison to traditional devices because their user experience was satisfactory.

Relevance to PICO question: This study predicts the AF with the help of Artificial Intelligence (AI) and mobile health applications which are huge part of Health Informatics. AF is a type of cardiovascular disease and lesser studies have been done for this disease as it is asymptomatic and intermittent in nature. The results advocates health promotion as clinicians can detect AF with the help of AI by using existing heart belts.

The uniqueness of the study – The uniqueness of the study is that it solves real time problems for a dangerous disease which can lead to fatality and use of AI is supported in this study along with mHealth application. The algorithm has achieved greater sensitivity and specificity for AF detection.

Strength: This study fulfills the requirement of automatic AF detection with the help of advanced technology. The mHealth devices are stronger and has higher compliance than the traditional devices which are used in this study. New technology used is cost effective and less burdensome.

Weakness: Obesity of the patient can degrade the quality of the signal to the device. This study happened in a hospital setting along with that size of both the groups is smaller because of the issues in telecommunication system.

Bias: No bias was reported. Funding of the study was done by Kuopio University.

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Article 5

Complete Bibliographic citation: **(APA format):**

Lamberigts, M., Van Hoof, L., Proesmans, T., Vandervoort, P., Grieten, L., Haemers, P., & Rega, F. (2021). Remote Heart Rhythm Monitoring by Photoplethysmography-Based Smartphone Technology After Cardiac Surgery: Prospective Observational Study. *JMIR mHealth and uHealth*, *9*(4), e26519. https://doi.org/10.2196/26519

Summary: Post-operative atrial fibrillation (POAF) is a major complication after a heart/cardiac surgery. In this study, photoplethysmography (PPG) technology is used with the help of a smartphone application named "Fibricheck" which uses optical sensors with light intensity variations. They are then transmitted through tissue and the rhythm can be recorded. This application will determine POAF which may or may not be missed during regular follow-up checkups with the healthcare professional. The recordings are done when the patient places his finger on the camera for about 1 minute and variations are detected by the optical sensors and finally records the R-R interval. The algorithm detects the measurements and categorizes it. Detection of irregularities are done by a healthcare professional within 48 hours and attention is given to the patient. Hence, this application provides great help in the prediction of any major complication after the surgery and detection of AF.

Relevance to PICO question: This study is an example of early detection of POAF where AI along with mobile health application is used by the patient which helps in prevention of a major stroke or major complication post operation. The patients who used this application found it helpful and hassle free which is the aim of Health Informatics. Along with that, Integration of new technology in order to increase early detection and preventing the disease leads to health education and health promotion in a direct way as it reduces the fatality in a patient with cardiovascular disease.

The uniqueness of the study – This study is unique as much few research has happened for complications or AF occurring after a cardiac surgery along with that the accuracy of detection of POAF increases due to the application.

Strength: The application can be used anytime and anywhere in the day by the patient hence ease of usage is what the application provides. Along with that, it provides knowledge of post cardiac surgery complications.

Weakness: AV block cannot be diagnosed via this application, Follow-ups of the patient is needed as inconvenience can be caused by reviewing time.

Bias: Selection bias was observed for the patient who did not possess smartphone mainly geriatric/elderly patients.

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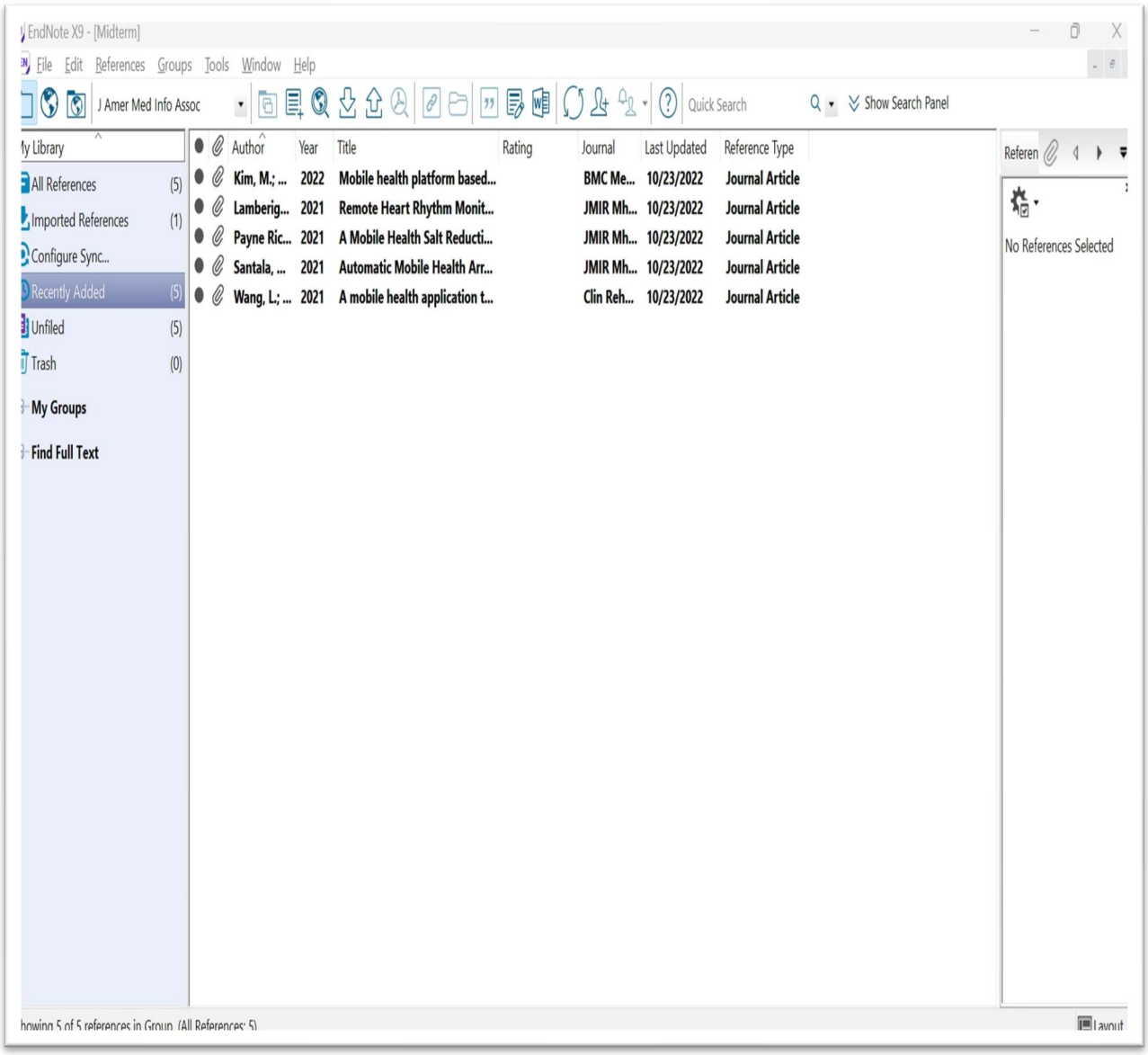
- Article 5 - Lamberigts, Marie et al. “Remote Heart Rhythm Monitoring by Photoplethysmography-Based Smartphone Technology After Cardiac Surgery: Prospective Observational Study.” *JMIR mHealth and uHealth* vol. 9,4 e26519. 15 Apr. 2021, doi:10.2196/26519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