



Using **Remote Patient Monitoring** for Underwriting **Health Insurance**

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1. Introduction

Health insurance companies are promoting prevention and management of chronic conditions by choosing healthy lifestyles as opposed to expensive therapies and medication. This trend began with John Hancock, one of the largest and oldest insurers in the United States, unveiling its first interactive life insurance policy in 2015. The first implementation of this policy was using wearable devices to track physical activity and calorie intake. In 2018, John Hancock announced it will stop selling traditional life insurance and will only market interactive policies that record the physical activities and health data of its customers through wearables such as Fitbit or Apple Watch. They are currently selling these policies through its subsidiary Vitality.

In this health insurance model, the Policyholders score premium discounts for hitting exercise targets tracked on wearable devices such as a Fitbit or Apple Watch. This model is beneficial for both policyholders and insurance enterprises. It directly provides incentives for the policyholders to adopt healthy habits, and insurance companies, in turn, can collect more premiums and pay less in claims if customers live longer and healthier. Studies have claimed that these can benefit society in general if they result in fewer hospitalizations due to chronic conditions and incidents of preventable cardiovascular disease.

Though activity tracking based health insurance underwriting is becoming more mainstream with the large - scale adoption of wearables, there are concerns over the risk of tampering of software or physically altering parameters such as attaching a fitness wristband to pets. In such a situation, insurance companies may use biometric data to recognize owners of devices and enforce correct usage. Incorporating biometrics also enables insurers to generate highly individualized data sets that allow them to continue developing new and innovative products tailored to individuals.

Havensrock's group income protection plan in the UK incorporates wearables to assist employers in maximizing employee productivity. In this context, improved health is perceived to lead to increased employee productivity through less stress, improved cognitive ability, less fatigue, and reduced absenteeism. As part of this product, each insured employee gets a free activity tracker and a free annual health check-up at their place of work. Data from activity trackers and health check-ups are combined on an online health portal that offers employees advice, annual reports, and notification of any health issues which should then be discussed with their doctor. Employers get an annual collated and anonymized report on the health status of their employees. Employees from chronic conditions also get practical and emotional support tailored to their needs.

2. Remote Patient Monitoring (RPM) for Underwriting Health Insurance

In this whitepaper, we propose a remote patient monitoring based approach for health insurance underwriting that is an improvement over the current wearable based solutions. An RPM platform uses a medical-grade wearable device, which can collect biometric as well as activity-based information from the policyholder. The medical data is then stored in HIPAA compliant servers and can be reviewed by clinicians in their EHR dashboard. This continuous acquisition of clinically relevant data will allow health insurance companies to predict the onset of chronic conditions, quantitatively measure the impact of active living on the policy holder's health, manage chronic conditions with digital therapeutics, and ensure policy holder's adherence to medication and exercise routines. RPM will allow medical data and insights to be securely and continuously shared between patients, their

clinicians, and the payors (health insurance), and provide early warning for detecting and managing chronic conditions. RPM also has biometric tracking, which can be used to detect tampering or fraudulent usage and remains a major challenge with wearable based insurance underwriting.

The technical feasibility of this proposed model has been established as a collaborative effort between two companies, Think Biosolution and Empeal. Think Biosolution is a digital health technology provider building privately labeled RPM platforms for digital health enterprises in the USA and EU. The RPM platform consists of the QuasaR™ device and the chest strap. The QuasaR™ device is 5cm x 4.5cm x 1.6cm in size, with a curved surface that sits against the skin over the user's sternum. The QuasaR™ device attaches to a breathable, elasticated chest strap. The strap can be adjusted to hold the QuasaR™ device in place comfortably. The QuasaR™ device can measure heart rate, heart rate variability, respiratory rate, and blood-oxygen saturation. It has additional sensors to measure temperature, movement, and location. The data from the QuasaR™ device is sent via Bluetooth to a Smartphone App, then from the Smartphone to the cloud. The data can be visualized by clinicians using a web-based EHR integrated dashboard.

Empeal is a software as a medical device (SAAMD) based digital therapeutics company providing global organizations and their employees with cloud-based employee health programs to improve employee health outcomes, reduce stress, saving costs, and increasing productivity. Empeal's already deployed platform provides a complete assessment of the employees/individuals combining medical, nutrition, lifestyle behavior, and personal goals data. Empeal has now tested its technical capability to add Think Biosolution's remote patient monitoring platform on to their existing platform.

This new SAAMD plus RPM platform will help insurance companies,

- (1) suggest individualized digital therapeutics for the policyholder (such as to reduce daily stress levels),
- (2) quantify the clinical impact of the digital therapeutics on policy holder's health,
- (3) ensure policy holder's adherence to medication and exercise routines.
- (4) predict the onset of chronic conditions,
- (5) develop customized insurance underwriting models based on 2-3, and
- (6) reduction in health insurance claims in the longer term.

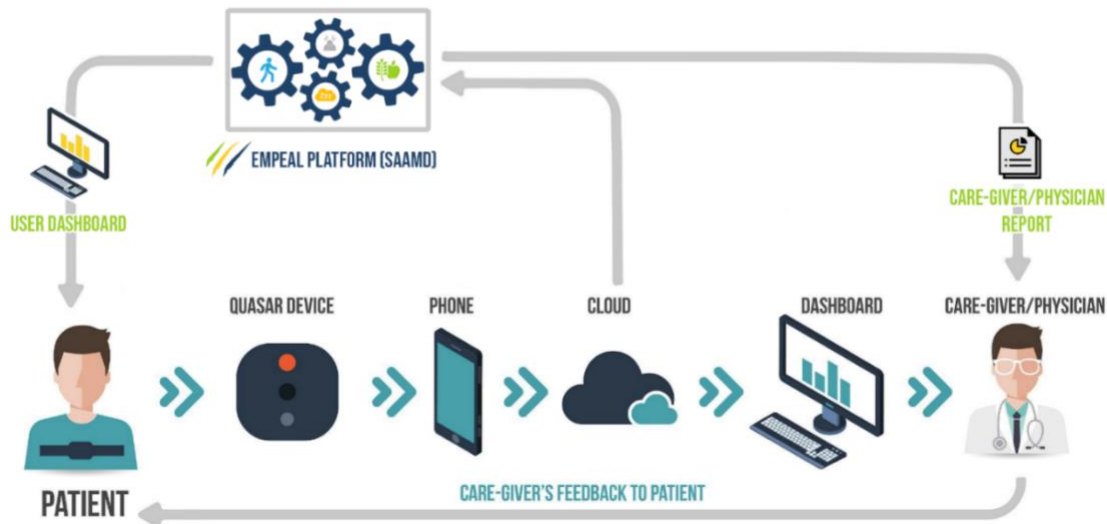


Fig. 1. Proposed SAAMD plus RPM platform.

3. Study - Technical Feasibility of new SAAMD plus RPM platform

A joint study was conducted by Think Biosolution and Empeal to gather primary data to show the working efficacy of the SAAMD plus RPM platform. Two healthy male volunteers were selected for the study, and it was conducted in an office environment. The study consisted of three parts

1. Biometric monitoring in an office environment with the QuasaR™ platform - The QuasaR™ device with the strap was worn by the two volunteers while they were working in their office. Each volunteer wore the strap for one hour, and they were instructed to carry on their normal daily activities while keeping the phone with the QuasaR™ app with them. The data collected was directly synced to the cloud and presented on the dashboard instantaneously.
2. Comparing the accuracy of the QuasaR™ platform - To compare the accuracy of the QuasaR™ platform, the data obtained were plotted against the heart rate data from an FDA approved pulse-oximeter – Nonin 3250. One of the volunteers wore the Nonin pulse-oximeter for 30 minutes during the time they wore the QuasaR™ device.
3. The user experience of the QuasaR™ platform - User experience of the QuasaR™ strap and device was collected in a feedback form after each study from the volunteers.
4. Nutritional and Lifestyle Recommendations for prevention and management of chronic conditions with SAAMD – The data generated from QuasaR™ is passed through SAAMD which analyses the data based on unique recommendation models designed using machine learning.
5. Personalized Reports with SAAMD – Further developments to the study involves Empeal’s SAAMD which generates reports for the volunteers involved in the study. These reports are comprehensive and are based on the data provided by QuasaR™ which could be printed, downloaded or shared right from Empeal’s SAAMD dashboard. The purpose of these investigations involves the incorporation of services which would be provided to practitioners, organizations and their employees.

4. Results

4.1. Biometric Monitoring

The results from the study have been presented as reports from the dashboard. The various elements of the dashboard also have been presented in the reports.

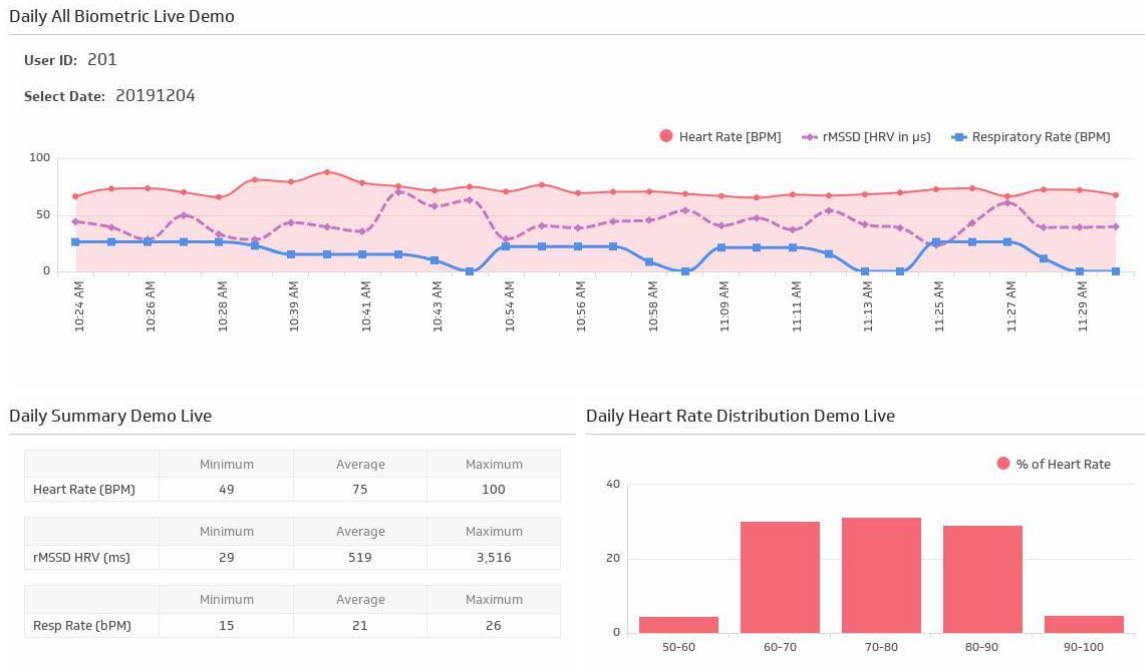


Fig. 2. RPM platform dashboard showing clinical information.

The stress since the data was collected in an office setting heart rate-activity levels were on the lower side for both the volunteers. Also, stress levels, as indicated by the rMSSD values, were low for both the volunteers.

4.2. Accuracy comparison

The results of the comparison study for Volunteer 1 have been presented in the following graph.

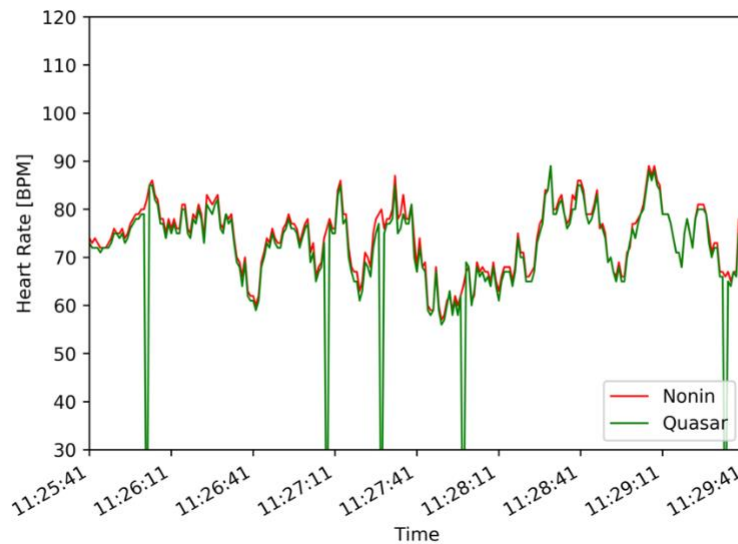


Fig. 3. Comparison of Heart Rate from the Quasar™ with Nonin device, during the technical feasibility study.

4.3. User Experience

The following observations were made from the feedback forms:

1. Both the volunteers found the instructions for usage to be clear and easy to follow.
2. Both the volunteers found the instruction for setting up and using the App to be clear and easy to follow.
3. There were mixed opinions on the process of putting on and adjusting the strap, where one of the volunteers found it to be difficult.
4. Both the volunteers found the strap to be uncomfortable while wearing it because it was tight.
5. Either of the volunteers did not have any discomfort with the device, either with the temperature of the device or the surface texture.

5. Conclusion

For health insurance enterprises, the ability to collect and process their policy holder’s health data will help them personalize both the quality of care and manage costs. For the policyholders, it can bring behavioral changes to help them adopt healthier lifestyles and pay less monthly premiums.

The proposed SAAMD plus RPM platform by Empeal for health insurance companies has the capability to deploy individualized digital therapeutics for the policyholder (such as to reduce daily stress levels) and quantify the clinical impact of the digital therapeutics on policy holder’s health. The platform also takes care of data protection and privacy requirements, as mentioned in HIPAA and EU GDPR. This whitepaper is the preliminary technical feasibility study that shows how the SAAMD plus RPM platform will work. In the future, we will conduct additional research in collaboration with health insurance enterprises to provide tailored benefits for policyholders and help quantify them for the health insurance enterprise.