REMOTE PATIENT MONITORING

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REMOTE PATIENT MONITORING: MECHANISM AND ADVANTAGES

This section will introduce Remote Patient Monitoring (RPM) and its role in health care. Furthermore, it will cover the tools involved in RPM and its advantages over the in-person hospital/clinic visits in patients suffering with chronic diseases.

RPM IN HOME DIALYSIS PATIENTS

This section will highlight the application of RPM in chronic kidney disease (CKD) patients mainly focusing on Peritoneal Dialysis (PD) patients. Additionally, it will discuss the challenges and future implications of RPM in dialysis patients.

DISCLOSURE:

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Introduction

RPM is a type of telehealth monitoring that allows healthcare professionals (HCPs) to monitor patients outside the traditional care setting, using non-invasive digital healthcare tools such as weight scales, blood pressure monitors, pulse oximeters, glucose meters, etc. (1,2). It uses technologies such as wireless networks, data storage, and diagnostic applications to transfer patients' data to the HCPs, with the potential to maximize patient care and treatment effectiveness as well as time and cost savings (1,3).

The information collected has been reported to be more accurate than self-reported outcomes (4) and therefore can help in the early detection of complications and/or suboptimal adherence. This can help patients improve therapy compliance and increase their comfort level, knowing that supervision and care are readily available (5).

Tools in RPM

RPM has benefited from increased access to complex technologies and, in the course of the COVID-19 pandemic, has gained significant momentum (6). Commonly used tools in RPM include smartphones, tablets, and smartwatches (2).

Most of the RPM software uses cloud-based servers, making it possible to collect and upload certain patient treatment data, including treatment loss, non-adherence to prescription, blood pressure, and weight, and they transfer the data afterward to the clinic/center. It is a two-way communication system, as HCPs can provide timely intervention to the patients based on the information collected. The patients can then see the treatments and prescriptions suggested by the HCPs, thereby increasing their awareness (7) (Figure 1).

The specific tools and RPM systems may vary depending on the HCP and region. Both HCPs and patients should follow the guidelines and protocols to ensure safe and effective RPM management.

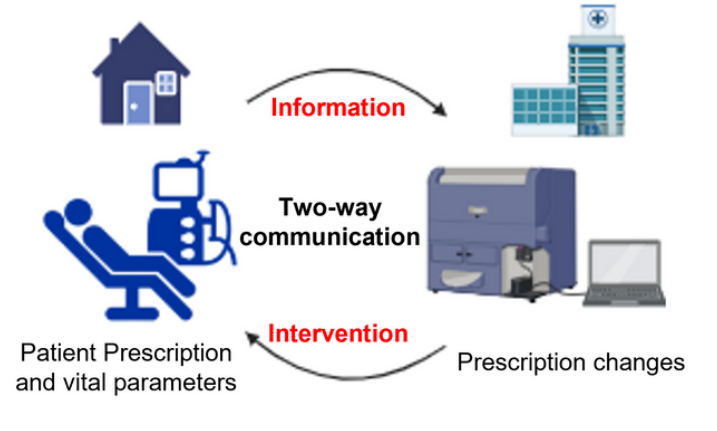

Figure 1: Overview of RPM for patients. (adapted from *CJASN* 2017;12:1900-1909) (8)

Advantages of RPM

RPM has revolutionized healthcare and has been applied traditionally to monitor patients remotely in rural areas or even elder patient monitoring (9).

RPM comes with several benefits and is now a reliable option to manage patient care in the comfort of home (1). It has positively impacted chronic patient treatments including hypertension, heart failure as well as acute illness such as COVID-19 (10). RPM is perceived to have the potential to increase patient knowledge on the disease and to enhance the patient-clinician partnership. While patient privacy protection and the establishment of boundaries for use are important, RPM is also perceived to potentially increase patient-focused care (13). Moreover, RPM can reduce the healthcare costs as it cuts down on travels as well as the amount of time spent on to manage health (8). Figure 2 lists the potential benefits of RPM for patients and HCPs.

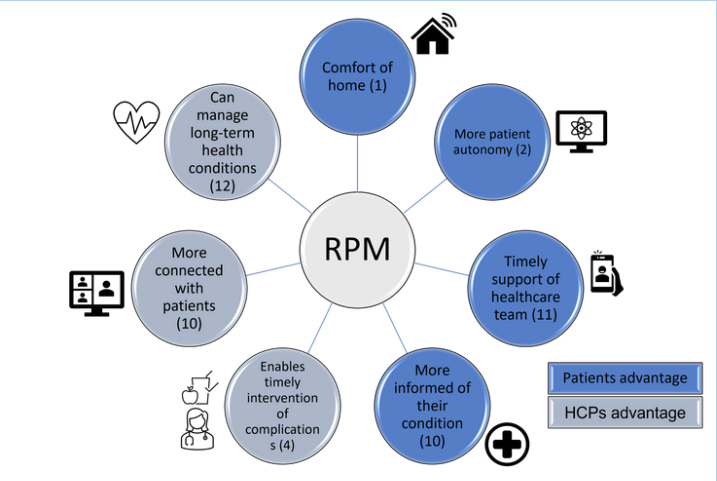

Figure 2: Advantages of adapting RPM patients and HCPs.

RPM IN HOME DIALYSIS PATIENTS

CKD is an advanced condition affecting more than 10% of the global population, equivalent to about 800 million people (14). It is also associated with a high overall economic burden, particularly after reaching end stage kidney disease (ESKD), and hence requires resources to perform kidney replacement therapy (KRT) resulting in high healthcare costs and social burdens (15). Hemodialysis (HD) is the standard of care for most patients with ESKD (16,17). Both home HD and PD can be performed in home settings after patients (and care partners) have received appropriate training from their healthcare team. Home dialysis can help patients save considerable time and also improve health-related quality of life (HRQOL) (11). Nonetheless, CKD requires close monitoring as it can lead to poor health outcomes and can be burdensome for society as well as for the patients (18).

Advantages of RPM

While most of the literature available is focused on PD, there are several potential benefits of RPM in home-based dialysis including decreased hospitalization and technical failure, reduction in traveling time, decreased healthcare resource consumption, and patient expenses (5). Table 1 lists some of the studies conducted to observe the benefits of RPM in dialysis patients. Some studies have reported that RPM is also perceived to potentially improve the feeling of safety (19) and to increase patient-focused care (13).

While most of the RPM systems require patients to enter their vitals such as blood pressure and pulse rates, with Bluetooth technology, this could be easily obviated. Furthermore, even remote visual examination via video calls can be integrated into the existing systems (4). This could improve the outcomes as well as attract patients to consider home dialysis.

Challenges for RPM

To achieve optimal outcomes, significant improvement is required in the implementation of RPM. From the home dialysis perspective, several aspects are needed to enhance its uptake, such as increasing its basic infrastructure: for example, more hospitals and nursing home supporting this therapy modality, more dialysis solution production or online fluid production technologies, and further surgeons trained to place catheters (23). Besides, there are socio-economic barriers, language barriers, personal data protection and health illiteracy, that needs to be overcome (24).

Finally, most of the current studies showing RPM benefits in healthcare outcomes are observational cohort studies which are limited by significant confounders. Therefore, additional RCTs to demonstrate reduction in resource utilization and overall health care outcomes and costs with RPM would be needed (4).

Study	Parameter	Treatment Comparison	Outcome
Sanabria et al (20)	Hospitalization rate and hospitalization length	APD patients with and without RPM (n=63)	0.36 less hospitalization rate in RPM group (p=0.029); Hospitalization days reduced by 6.57 (p=0.028)
Uchiyama et al (21)	Patient satisfaction; healthcare resource consumption	APD with (n=8) and without RPM (n=8)	Improvements in TSQM-9 subscales of Effectiveness {64.4± 18.8 vs 57.8±18.8 (p=0.006)} and Convenience {76.3 ± 15.4 vs. 63.3 ± 17.3 (p<0.001)} in RPM group ; reduced healthcare resource consumption in RPM group= 0.80±1.32 vs 1.87±2.39 times/12 week (p=0.02)
Centellas-Perez et al (22)	Technique failure	APD-RPM (n=176); APD (n=56)	Greater technique survival rate in the APD-RPM group: 21.6% vs 5.6% (p=0.001)

Table 1: observational and clinical studies showing RPM benefits in PD patients. CAPD: Continuous Ambulatory Peritoneal Dialysis; APD: Automated Peritoneal Dialysis; TSQM-9: 9-item-Treatment Satisfaction Questionnaire for Medication

Remote Therapy management platform at FME

A cloud based tool to remotely manage patients anytime by the HCPs after the treatment is performed has been generated for PD therapy management. It allows HCPs to review and manage PD patients' prescription data. It does not provide medical diagnosis/treatment but creates a more personalized care environment (25). Based on preliminary data, it has shown that it could reduce the risk of PD patient dropout and increase in average patient length of stay (26).

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