

HLTH – 807

# INNOVATION: FUTURE OF HEALTH

Paper on Remote Patient Monitoring



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# Introduction

Remote Patient Monitoring (RPM) devices represent a transformative approach in healthcare, offering continuous, real-time health data transmission from patients to healthcare providers. These devices, ranging from wearables that monitor vital signs to implanted devices providing more complex data, enable healthcare professionals to track patient health metrics outside traditional clinical settings (Patel & Park, 2021). The significance of RPM in the current healthcare landscape is multifaceted. It addresses the growing demand for healthcare services amidst an aging population and increasing prevalence of chronic diseases, while also aligning with the shift towards value-based care models that emphasize preventative measures and patient engagement (Bashshur et al., 2020).

In the context of the COVID-19 pandemic, RPM's importance has been further amplified, demonstrating its ability to maintain continuity of care while reducing exposure risks for patients and healthcare workers (Smith et al., 2020). This technology also aligns with current trends toward patient-centric care, enabling personalized treatment plans based on real-time data. Furthermore, RPM offers potential cost savings by reducing hospital readmissions and the need for in-person visits (Patel & Park, 2021).

The objective of this paper is to explore the potential of RPM devices as a disruptive business model in healthcare. It aims to examine how RPM's new disruptive model can reshape the healthcare delivery landscape, focusing on necessary changes in technology, payment structures, regulation, and professional education. By understanding these elements, the paper seeks to provide a comprehensive view of how RPM could be effectively integrated into future healthcare systems, enhancing patient outcomes and operational efficiency.

# Disruptive Business Model

Develop the disruptive business model for remote patient monitoring, let us delve into each component in detail:

## 1. Product and Service Offering:

***Integrated Health Monitoring System:*** A suite of compatible devices and apps for monitoring vital signs, physical activity, sleep patterns, diet, and environmental factors.

***AI-Driven Health Analytics:*** Advanced algorithms analyze data in real-time, offering insights and alerts for health risks, lifestyle recommendations, and personalized health reports.

***Telehealth Services:*** On-demand access to medical professionals for consultations, advice, and emergency responses.

***Online Community and Support:*** A platform for patients to connect, share experiences, and access peer support.

## 2. Target Market:

***Patients with Chronic Conditions:*** Individuals requiring continuous monitoring like diabetes, heart conditions, or respiratory issues.

***Elderly Population:*** Seniors who need regular monitoring and quick access to healthcare services.

***Health and Wellness Enthusiasts:*** Individuals focused on maintaining an optimal health and wellness lifestyle.

***Rural and Remote Communities:*** Areas with limited access to healthcare facilities.

### 3. Revenue Streams:

**Subscription Fees:** Monthly or annual fees for access to premium features like advanced analytics, telehealth consultations, and personalized health plans.

**Device Sales:** Revenue from the sale of proprietary health monitoring devices.

**Data Analytics Services:** Offering anonymized data analysis and reports to healthcare providers, researchers, and insurance companies.

**Partnership and Sponsorship:** Collaborating with healthcare providers, fitness brands, and wellness programs.

### 4. Key Partnerships:

**Healthcare Providers:** Partnerships for referrals, shared care plans, and data integration.

**Technology Companies:** Collaborations for device development, software integration, and AI analytics.

**Insurance Companies:** Cooperating for patient monitoring plans, leading to reduced insurance claims through preventative healthcare.

### 5. Cost Structure:

**Research and Development:** Continuous investment in technology, AI, and product development.

**Manufacturing and Supply Chain:** Costs associated with producing and distributing monitoring devices.

**Marketing and Sales:** Expenses for branding, advertising, and customer acquisition.

**Platform Operation and Maintenance:** Costs for hosting, maintaining, and updating the digital platform and services.

## **6. Unique Value Proposition:**

**Comprehensive Health Monitoring:** A one-stop solution combining various health aspects into a single platform.

**Proactive Health Management:** Leveraging AI to predict health issues and recommend preventative actions.

**Accessibility and Convenience:** Easy access to healthcare services, especially for underserved or remote communities.

## **7. Marketing and Sales Strategy:**

**Digital Marketing:** Targeted online advertising, content marketing, and social media campaigns.

**Partnership Marketing:** Joint marketing initiatives with healthcare providers and wellness brands.

**Community Engagement:** Hosting webinars, health workshops, and community events for engagement and education.

## **8. Scalability and Growth Plan:**

**Geographic Expansion:** Gradually expand services to new regions, adapting to local healthcare systems and regulations.

**Product Diversification:** Introduce new monitoring devices and health services.

**Strategic Partnerships:** Form alliances with larger healthcare entities for broader market reach.

#### **9. Compliance and Regulation:**

- ❖ Ensure strict adherence to healthcare regulations like HIPAA, GDPR, etc.
- ❖ Regular audits and updates to meet changing legal requirements.

#### **10. Sustainability and Social Responsibility:**

- ❖ Implement eco-friendly practices in manufacturing and operations.
- ❖ Engage in community health initiatives and contribute to public health education.

This model emphasizes a holistic approach to health monitoring, leveraging technology for personalized care, and focusing on preventive healthcare. It aims to be a leader in the remote patient monitoring industry by offering innovative, accessible, and comprehensive health management solutions.

# Technological Overview

## **Description of RPM Devices and How They Work**

Remote Patient Monitoring (RPM) devices are designed to remotely collect and transmit health data from patients to healthcare providers. These devices include a wide range of technology, from basic wearable sensors that track vital signs like heart rate and blood pressure, to more sophisticated systems capable of monitoring blood glucose levels, respiratory rates, or even electrocardiograms (Majumder & Deen, 2021). The fundamental operation of these devices involves sensors that collect physiological data, which is then transmitted, often via wireless technology, to a healthcare provider for monitoring and analysis.

## **Recent Technological Advancements in RPM**

Recent technological advancements in RPM have been significant. One key development is enhancing data accuracy and the capability for real-time analytics. Advanced algorithms and machine learning techniques are now being utilized to provide more accurate interpretations of health data, leading to more precise and timely interventions (Istepanian, Jovanov, & Zhang, 2020). Additionally, the miniaturization of technology has made RPM devices more user-friendly and less obtrusive, encouraging wider adoption among patients.

## **Integration with Other Digital Health Tools**

The integration of RPM with other digital health tools represents a significant trend in healthcare technology. RPM devices are increasingly being connected with electronic health record (EHR) systems, allowing for seamless data flow and integration into a patient's overall health profile. This connectivity ensures that data collected via RPM can be easily accessed and utilized by healthcare



providers alongside other patient information. Furthermore, the integration of RPM with telehealth platforms has been accelerated, particularly in response to the COVID-19 pandemic, enabling a more comprehensive and continuous care model that combines remote monitoring with virtual consultations (Keesara, Jonas, & Schulman, 2020).

The combination of these technological advancements in RPM is driving a more connected, efficient, and patient-centered healthcare system. By leveraging the power of digital technology, RPM is not only improving the management of chronic diseases but also transforming the approach to preventive healthcare and overall patient wellness.

# Market Analysis

## **Current Market Size and Growth Projections**

The Remote Patient Monitoring (RPM) market is experiencing significant growth, driven by the increasing adoption of digital health technologies and a greater focus on patient-centered care. As of recent estimates, the global RPM market size is substantial and is projected to expand at a robust growth rate over the next few years (MarketsandMarkets, 2020). This expansion is attributed to factors such as the rising prevalence of chronic diseases, the aging population, and the increasing need for remote healthcare services, especially in the wake of the COVID-19 pandemic.

## **Key Players in the Market**

Key players in the RPM market include established healthcare technology companies and emerging startups. Major companies often mentioned include Philips Healthcare, Medtronic, GE Healthcare, and Cerner Corporation. These companies are known for their innovative health monitoring devices and software solutions. In addition to these, there are numerous startups and smaller firms that are making significant strides in the RPM space, offering specialized and advanced monitoring solutions (Grand View Research, 2021).

## **Trends and Drivers of Market Growth**

The trends and drivers of market growth in RPM are diverse. One of the primary drivers is the shift in healthcare models from traditional in-person visits to value-based care, which emphasizes preventative measures and continuous monitoring. The integration of artificial intelligence and machine learning in RPM devices has also been a key driver, enhancing the efficiency and accuracy of patient monitoring. Additionally, policy changes and increased reimbursement for remote patient

monitoring services in various regions have further propelled the market's growth (Research and Markets, 2021).

Moreover, patient demand for convenience and the desire to manage health conditions from the comfort of their homes have significantly contributed to the market growth. Technological advancements in wireless communication and smartphone proliferation have also played a critical role in making RPM solutions more accessible and user-friendly. In conclusion, the RPM market is poised for continued growth and expansion, driven by technological advancements, changing healthcare models, and an increasing emphasis on patient-centric care solutions.

# Clinical Applications

## Use Cases in Chronic Disease Management

Using digital devices to monitor chronic diseases like diabetes and heart disease, remote patient monitoring, or RPM, is transforming clinical treatment. Wearable technology, like Holter monitors and pulse oximeters, allows medical professionals to monitor patients when they are not in the typical setting, encouraging patient participation. RPM has effectively managed chronic illnesses efficiently by decreasing emergency room visits and hospital readmissions. Its applications also encompass managing acute illnesses and monitoring COVID-19 symptoms. Potential clinical misdiagnosis is one of the challenges, along with obstacles like complicated billing procedures and technology infrastructure. With ongoing studies addressing cost-effectiveness and its effects on patient safety and experience, researchers anticipate that RPM will continue to increase in home-based and diversified healthcare settings (*Remote Patient Monitoring*, 2023).

## RPM in Post-operative Care and Elderly Care

By enabling patients to get better at home with cutting-edge medical technology, remote patient monitoring, or RPM, is completely changing postoperative treatment. Fewer hospital visits are required thanks to RPM, which gives patients the ability to follow progress, check vital signs, and interact with healthcare personnel in real time. The RPM technology from DrKumo is a prime example of this shift, providing constant real-time monitoring for prompt treatments, improving postoperative care, and changing the way healthcare is delivered. Inc, D. (2023, February 9). By providing real-time health monitoring, lowering human error, and saving healthcare expenditures, remote patient monitoring (RPM) apps are essential for helping senior patients. These apps are convenient since they enable at-home monitoring and may be able to save senior citizens money and the hassles associated

with travel. Elderly patients spend less time in hospitals thanks to RPM's promotion of family connectivity, assistance with everyday duties for distant caregivers, and proactive approach to health management (*RPM Apps: Aiding Elderly Health Monitoring Benefits*, 2023).

### **Impact on Patient Outcomes and Healthcare Efficiency**

The use of digital equipment to monitor patients outside of traditional settings has revolutionized the delivery of healthcare. Remote patient monitoring, or RPM, has improved care for chronic disorders including diabetes and heart ailments. Especially amid the COVID-19 pandemic, RPM has shown promise in treating acute illnesses, cutting down on hospital stays, and enhancing patient security. Notwithstanding its advantages, drawbacks include the possibility of misdiagnosis and obstacles including technical constraints and payment problems. Expanding RPM's application in a variety of contexts, resolving access inequalities, and conducting additional research on patient outcomes and cost-effectiveness are all necessary for its future (*Remote Patient Monitoring*, 2023).

# Healthcare System Integration

## **Changes Needed in Healthcare Infrastructure**

Prioritizing unified data repositories, scalable cloud architectures, and strong security measures is essential for the effective implementation of Remote Patient Monitoring (RPM) systems in the healthcare infrastructure. Complying with Fast Healthcare Interoperability Resources (FHIR) standards and integrating various data formats are crucial. Workflows need to change to accommodate remote care, and healthcare personnel need to be trained in the proper use of telemedicine. It is crucial to have user-friendly mobile apps that encourage patient adherence and precise regulatory criteria. All things considered; widespread adoption of RPM systems necessitates significant investment in IT infrastructure (Khizhniak, 2021).

## **Role of RPM in Shifting from Reactive to Proactive Care**

RPM, or remote patient monitoring, is transforming healthcare by using wearables, artificial intelligence, and machine learning to move from reactive to proactive care. Real-time monitoring, early problem detection, and better patient outcomes are made possible by this transition. Due in large part to the rise in chronic illnesses and the growing use of telehealth, particularly in the wake of COVID-19, the global market for RPM devices is expanding rapidly. Notwithstanding its potential, RPM encounters obstacles such as data security concerns, technical difficulties, patient participation barriers, provider workloads, and unpredictability in reimbursement. To realize RPM's full potential and make sure it integrates successfully into the quickly changing healthcare landscape, these issues must be resolved.

## **Integration with Existing Electronic Health Records (EHR) Systems**

Simplified data administration, better care coordination, and more patient participation depend on the integration of Chronic Care Administration (CCM) and Remote Patient Monitoring (RPM) with Electronic Health Records (EHR). This interface enables smooth transmission of data from remote monitoring, real-time cooperation among healthcare practitioners, and patient empowerment through simple access to health information. Determining program objectives, picking a dependable EHR system, evaluating workflows, selecting technological options, and creating data governance principles are crucial stages toward success. Overcoming obstacles requires resolving technological problems, making sure regulations are followed, encouraging patient participation, and cultivating teamwork. By providing EHR-integrated solutions for developing scalable RPM and CCM programs, platforms such as HealthSnap play a critical role (HealthSnap, 2023).

# Regulatory and Policy Considerations

## Current Regulatory Landscape for RPM Devices

Regulations pertaining to data protection, such as HIPAA, and secure operations provide significant obstacles for remote patient monitoring (RPM) programs. FDA regulations place strict requirements on RPM hardware and software, which call for constant modification to meet changing scientific standards. Standardized data-sharing protocols are necessary to overcome interoperability problems and integrate seamlessly with the healthcare system. The sustainability and accessibility of telehealth services are significantly impacted by regulations surrounding telemedicine, such as those about licensure and reimbursement. Platforms like Health Wealth Safe are leading the way in managing these obstacles. Safety, quality, and transparency in RPM programs are contingent upon reporting and compliance (*Staying ahead with remote patient monitoring programs*, 2023).

## Policy Changes Required for Wider Adoption

Careful thought must be given to staff training, patient engagement, and workflow design when implementing remote patient monitoring (RPM). During the process, the implementation team must be involved. Current processes must be documented, and updated RPM procedures, encompassing patient identification, training, device management, data monitoring, analysis, interventions, and invoicing, must be determined. Establishing communication standards among the care team and defining clinically important data points are critical. Ensuring adherence to legislative frameworks including HIPAA, FTC Act, 21st Century Cures Act, and ACA is crucial in addressing issues regarding data privacy and security. Among the most important best practices include putting security measures in place, risk management techniques, and safe data transport and storage. Patients are



more likely to participate when they are well-trained, communicate clearly, and are assisted in overcoming any obstacles (*ama-remote-patient-monitoring-playbook.pdf*, n.d.).

### **Data Privacy and Security Concerns**

Since remote patient monitoring (RPM) entails sending patients' sensitive health data to healthcare practitioners, it raises important security and data privacy issues. RPM, which uses vital sign monitoring devices, improves patient flexibility and lowers healthcare expenses, but it also necessitates strong security measures. Ensuring data privacy and security is crucial for upholding patient rights, safeguarding against cyberattacks, and adhering to regulatory requirements such as HIPAA, FTC Act, 21st Century Cures Act, and ACA. Serious repercussions, including penalties, legal action, loss of confidence, and reputational harm, may result from noncompliance. Implementing security controls, risk management, safe data transmission and storage, staff training, ethical concerns, and striking a balance between privacy and RPM advantages are all part of best practices (Staff, P. V., 2023).

## Economic Impact

The healthcare economy has been experiencing a significant transformation, thanks to innovative technologies such as remote patient monitoring (RPM) which have had several positive economic effects and are continuously changing how patients are cared for. RPMs affect the economy through three main routes: cost-effectiveness, medical costs, and reimbursements. Firstly, RPM devices' cost-effectiveness is demonstrated in their ability to minimize hospital stays and emergency room visits by enabling real-time surveillance for early intervention. They also help to replace reactive care with proactive care, improve the effectiveness of managing chronic illnesses, and reduce overall healthcare expenses. Additionally, they provide an affordable substitute for customary in-person care, particularly when it comes to ongoing chronic condition monitoring (El-Rashidy et al., 2021).

Secondly, RPMs affect medical costs, and ultimately the economy, by improving the effectiveness of healthcare delivery by facilitating resource optimization through patient prioritization based on urgent needs. They also help reduce the financial burden on healthcare systems by preventing needless hospital readmissions through ongoing monitoring. The role they play in enhancing patient outcomes is undeniable, as they contribute to delivering high-quality care and making healthcare services more affordable and long-lasting (Upadhyay & Smith et al., 2019).

Lastly, RPMs act as a catalyst for opportunities to optimize reimbursement methodologies so that the return on the economy is positive. They comply with the movement towards value-based care, which lowers costs by associating payment with outcomes and quality rather than the number of services. They offer chances for stakeholders to work together to create creative reimbursement schemes that will encourage the broad use of RPM technologies (Coffey et al., 2022).

## Challenges and barriers

RPMs are not widely used due to several challenges and obstacles related to three primary areas which are technology and operation, adoption by patients, and adoption of healthcare providers. First, challenges in technology and operation are encapsulated in the difficulty of integrating devices and systems that are already in place, the strict cybersecurity procedures that are needed to safeguard private patient information, the standardization that is required for reliable and consistent monitoring, and factors that can make the implementation difficult to succeed such as poor infrastructure and limited internet access (Williams & Woodward, 2015).

Second, challenges in the adoption by patients include inadequate knowledge about how the devices are used - particularly by elderly patients -, people's reluctance to abandon conventional care models, concerns about privacy among patients, and the difficult-to-use interfaces that can deter patients from participating (Yusif et al., 2016). Last, challenges in the adoption of healthcare providers aspect can take the form of opposition from professionals when disruption to healthcare workflows occurs, discouragement to adopt due to the ambiguities that RPMs implementation can bring, lack of education on the technology, and uncertainty created by the absence of clear evidence of efficacy (Zayas-Cabán & Okubo, 2022).

## Future Directions

### Emerging RPM Innovations

Continued advances in sensor technologies, such as wearables and implantable devices, will likely improve data accuracy and broaden the types of health parameters that can be monitored. Further, AI-driven analytics will be critical in interpreting massive amounts of patient data, allowing for more accurate predictions and personalized insights (Shaik et al., 2023). In addition, the incorporation of blockchain technology may address data security concerns by ensuring transparent, secure, and tamper-resistant patient data storage (Ali et al., 2013).

### Future Potential Applications in Healthcare

RPM will likely become more tightly integrated with telehealth services, providing patients with a comprehensive virtual healthcare experience. RPM could be extended to monitor patients after surgery, allowing for the early detection of complications and reducing the need for hospital readmissions. The use of RPM in mental health care may expand, allowing for continuous monitoring of vital signs and behavioral patterns to aid in early intervention in mental healthcare (*Remote Patient Monitoring*, 2023).

### RPM Evolution Predictions

RPM will likely concentrate heavily on managing a broader range of chronic diseases, optimizing treatment plans, and improving patient outcomes. RPM will empower patients to take an active role in their healthcare, fostering a shift toward more personalized and patient-centric care models (Pisuwala, n.d.).

# Strategic Recommendations

## **RPM Implementation Strategy**

The American Medical Association (AMA) notes that implementing digital health technology is a complex and time-consuming process. For reference, the AMA estimates that it takes at least 23 months from the time of identifying a digital innovation to scaling it to meet the healthcare needs in hospital settings. However, as more technology is introduced in healthcare, standard operating procedures are beginning to emerge that apply to the implementation of RPM in various health sectors. The multi-step procedure begins by identifying the need to be solved. For example, the advent of the COVID-19 pandemic necessitated healthcare providers to include telehealth in their list of services to reduce unnecessary interactions and exposure for both the patients and the staff.

Once the need is established and well-defined, the next step in the implementation process is defining the desired outcomes. While some healthcare providers may be looking to reduce overhead costs, another one may be after the efficiency of the processes. Depending on the outcome, the kind of RPM and implementation is determined. After this step, the next step entails evaluating available vendors and their RPM technology before determining whether to outsource the service or do it in-house. With the RPM systems already established, the institution may then proceed to form teams. The SE team should be responsible for forging a roadmap to integrate the technology into their business. Moreover, these teams should also come up with an integration plan to put patients on board the program.

With the equipment, personnel, and patients already organized, the next step of the process is to begin the practical application of the RPM. The management may opt to start with a pilot program with a few patients before scaling to cater to on-demand patients. Like any other project, the RPM implementation program must end with an evaluation process to determine its successes and failures.

The evaluation process then exposes the loopholes and problems with the program that can be modified to make it more efficient.

### **Policy Recommendations**

Following the introduction of informatics and technology in healthcare, the government and its agencies must be keen to regulate the production and use of these devices and the data they collect. The data protection laws should be amended to cover data collected through healthcare-related devices used in RPM. In addition, there should be additional measures to control the manufacture of devices used in RPM. For example, the devices used in RPM must be vetted and approved by the Food and Drugs Administration (FDA) before adoption into the market. As the standard with other medical equipment, the RPM-associated equipment must undergo mandatory testing and trials before FDA approvals. It is notable to acknowledge that some of the big technology companies with breakthroughs in wearables and medical equipment have gone to the extent of attaining FDA approvals by submitting their inventions for approval. However, it is more recommendable for the government agencies to be actively involved in innovations and development of the future RPM equipment, for the benefit of the end-user. Instead of participating passively in the research and development of new equipment, procedures, and technologies for use in RPM, the FDA should participate actively through the creation of a policy that provides the agency with federal funding for the research and development in this new area of healthcare that is expected to change the landscape for the better while lowering the per capita cost of healthcare altogether.

### **Guide for Technology Developers and Investors**

Developers and investors must acknowledge that technology is a major part of the future of healthcare. Already, there have been significant strides in areas such as telehealth, RPM, informatics, and the use of AI to analyze large datasets, with unprecedented levels of accuracy. Developers and

investors should take advantage of this growing field and invest in the technology and skills required to apply the technology in large-scale applications.

Investors in the field of technology have lately noted the potential that the healthcare industry has as a market for their tech products and have actively engaged in research and development. According to researchers, the use of wearable gadgets for medical use increased by 24 percent between 2019 and 2022. These statistics indicate that technology in healthcare is a fast-growing field that they would benefit from if they invested. So far, different technology companies have come up with various versions of sensors meant to test different functions. Others have concentrated on the software perspective of the technology. It is now the time for software developers to make user interfaces of these gadgets to work with health professionals and patients to determine the most efficient layouts, interfaces, and ergonomics.

# Conclusion

## Summary of Key Findings

Two of the most important elements of modern healthcare are the quality of care given to patients and the cost of that care. On the one hand, the quality of care has been growing steadily but on the other hand, the cost has ballooned to unprecedented levels in the recent past. The coming of RPM has brought a breakthrough that may prove useful in reducing the cost of care, making it more affordable, and reducing the current disparities. One of the major strong points of RPM is that it takes a proactive approach as opposed to the reactive approach that was used in traditional care. It also reduces the stays in hospitals, creating cost savings for the patients and federal funding schemes. In terms of chronic conditions monitoring, RPM is the most affordable substitute for in-person care which ultimately results in more affordable care.

Even with the development of this technology, there have been some barriers that have slowed down its growth. They include challenges in technology and operation such as data security and device reliability. Adaptation by patients is also another major challenge, considering that the elderly are part of the larger patient population singled out to benefit from RPM. This population is particularly resistant to change, devoid of digital literacy, and concerned about privacy. What is more, the slow adaptation by healthcare providers is also considered a major challenge to the growth of this technology. However, there have been significant strides and RPM is steadily gaining traction in mainstream healthcare.

Regarding the future, there have been some recent developments that arguably contribute to RPM's future success. Notably, the improvement in sensor technology in the last decade has shown that devices can be more accurate and easily operable even for patients. The integration of Artificial Intelligence in RPM has ushered in a new frontier of evidence-based practice. AI has developed



steadily over the years to become more accurate in interpreting large data sets to make inferences. It is also a lot faster than humans, meaning it saves valuable time in the treatment process. There are also significant inventions in data security such as blockchain technologies that will help secure patients' data from malicious use.

### **Final Thoughts**

We think RPM is the perfect opportunity for the United States to redeem its image in terms of affordable care for all. Of all the developed nations, the U.S. spends the most on healthcare, yet does not provide universal health to everyone. This technology is the ultimate solution to the high healthcare costs and will make healthcare accessible to more people for less money. As a country that is known for technological breakthroughs, the U.S. can be the world leader in remote patient monitoring technologies and export this knowledge to other parts of the world. Policymakers need to create laws that support the growth of RPM within the country. On the same breath, policies should be in place to protect the consumer from exploitation by large pharmaceuticals and device manufacturers, an issue that has contributed directly to high costs of care in the U.S.

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