



EXPLORING THE EFFICACY OF SMART PILLS IN NURSING CARE

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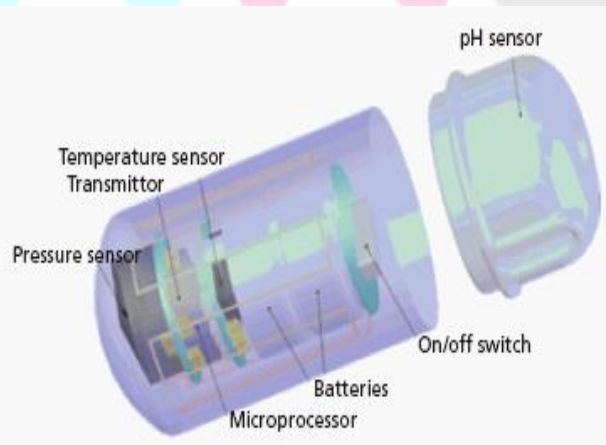
ABSTRACT

Smart pills, also known as digital pills or e-pills, which is a ingestible sensing capsules represent a significant advancement in digital medicine with substantial implications for nursing care. These ingestible sensors track medication intake and monitor physiological parameters in real-time, enhancing patient adherence and care quality. The smart pill, Abilify MyCite was first conceptualized in 1957 and received FDA approval in 2017, which offer precise drug delivery and continuous health monitoring. Their integration with wearable devices and telemedicine promises a more connected healthcare ecosystem. Smart pills can assist nurses in improving patient outcomes, ensuring medication adherence, providing accurate data, and ultimately, enhancing the overall quality of care. Through the adoption of smart pills, nurses are empowered to deliver more informed, responsive, and patient-centered care, addressing the evolving needs of modern healthcare environments.

Keywords: Smart pills, Digital Pills, Ingestible sensing capsules, Nursing Care

INTRODUCTION

A smart pill also known as digital pill is a type of medication containing an ingestible sensor. Once ingested, the sensor starts sending medical data. This technology falls under digital medicine and helps to track medication intake, ensuring compliance. The integration of smart pills into healthcare represents an advancement in patient care. These innovations have the potential to revolutionize the way nurses manage and monitor patients, providing a range of benefits that enhance both the efficiency and effectiveness of nursing practice. Smart pills are equipped with sensors that can monitor and report on medication adherence, physiological parameters, and internal conditions, offering real-time data that is crucial for timely and accurate medical interventions. As healthcare systems increasingly prioritize personalized and precise care, smart pills emerge as a valuable tool in achieving these goals.



Smart Pills Structure

HISTORY OF SMART PILLS

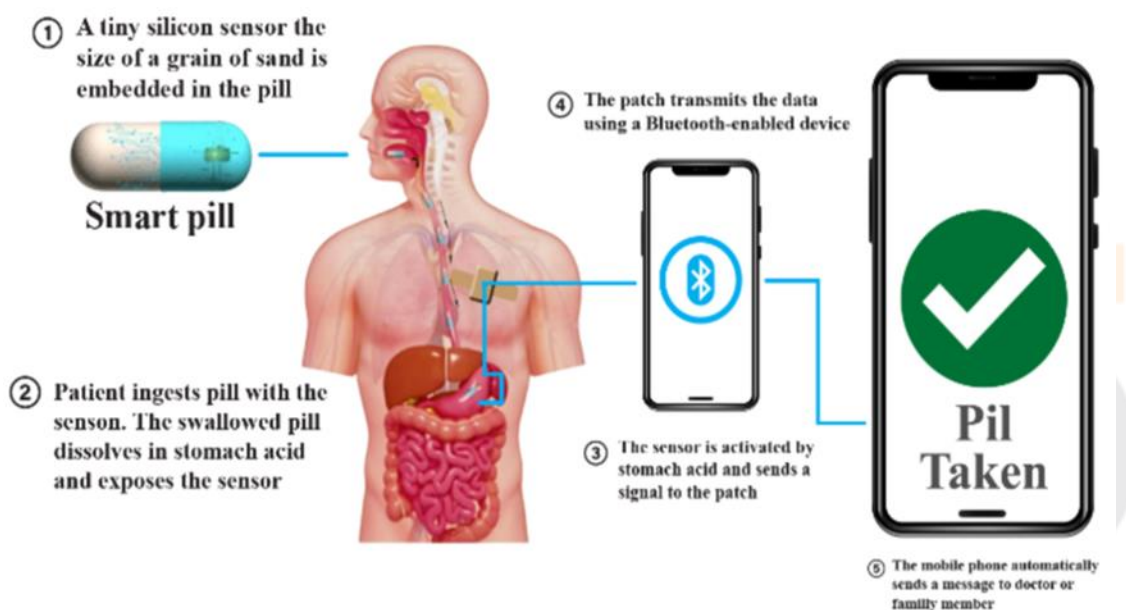
The first emergence of a swallowable electronic device was in 1957, which used radio frequency to transmit temperature and pressure readings. The field remained stagnant until the 1990's when technology caught up with the invention.

Jerome Schentag, a Professor of Pharmaceutical Science at the University of Buffalo, and David D'Andrea (co-inventor) invented the computer-controlled "smart pill," which can be electronically tracked and instructed to deliver a drug to a predetermined location in the gastrointestinal tract. (Popular Science magazine, 1992).

The first digital pill to be approved by the United States Food and Drug Administration (FDA) was a version of aripiprazole (Abilify) manufactured by Otsuka Pharmaceutical. Abilify MyCite received regulatory approval from FDA in November 2017, becoming the world's first "smart pill" to digitally track whether patients had taken their medication. This product is approved for treating schizophrenia, acute treatment of manic and mixed episodes associated with bipolar I disorder, and as an add-on treatment for depression in adults. The system works by sending a message from the pill's sensor to a wearable patch, which transmits the information to a mobile application. Patients can track their medication ingestion on their smartphone and permit their caregivers and physicians to access the information through a web-based portal.

ACTION OF SMART PILLS

Smart pills contain the actual medication needed to treat the patient's condition. Within the pill, there is a tiny ingestible sensor, often made from materials like silicon or magnesium, which is safe for consumption. The ingestible sensor is equipped with wireless communication capabilities that allow data transmission. Patients wear a receiver or use a smartphone app provided by a healthcare provider that detects and records data transmitted by the sensor. The sensor tracks when the pill is ingested and transmits this information to the receiver or app. Healthcare providers can access the data remotely to monitor patient adherence and response to medication.



Action of Smart Pill -Steps

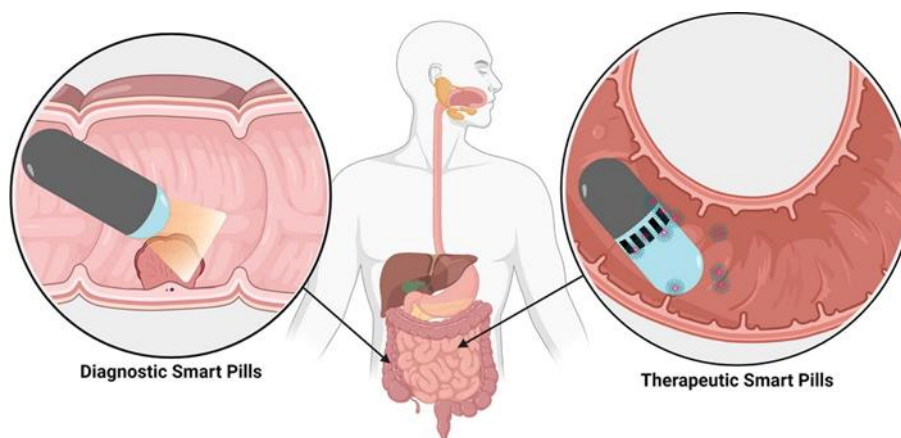
BENEFITS OF SMART PILLS

- Smart pills have the ability to track a wider range of physiological parameters with greater accuracy.
- Integration with wearable devices allows for seamless monitoring of patient health and medication adherence, providing a more comprehensive view of patient health.
- Advanced data analytics enable the healthcare providers to interpret the data collected by smart pills, leading to more personalized and effective treatment plans.
- Smart pills become more connected, allowing for real-time data transmission and remote monitoring, which will be particularly beneficial for patients in remote areas.

- Smart pills increasingly focus on preventive care, helping to identify and address health issues before they become serious.
- Patients have more control over their health data and treatment plans, leading to greater empowerment and engagement in their care.
- Smart pills become more integrated into healthcare systems, with seamless data sharing between healthcare providers and institutions.

SMART PILLS IN THERAPEUTIC AND DIAGNOSIS AREAS

Smart pills are used in various therapeutic and diagnosis areas which includes Neurological Disorders, Cancer Therapy, GI Disease Diagnosis, Tissue Biopsies and Sampling, Pillcams for Small Bowel Disorders etc. In the neurological disorders, Smart pills could be customized to monitor and treat conditions like Alzheimer's disease or epilepsy, providing precise drug delivery and continuous monitoring of brain activity. In cancer therapy, Smart pills have the potential to revolutionize cancer care by delivering chemotherapy directly to tumors and monitoring treatment response, thereby reducing side effects and improving outcomes. Smart pills can aid in the diagnosis of GI diseases and enhance understanding of their causation. Smart pills can be used to conduct tissue biopsies or sample the GI environment, offering benefits such as reduced invasiveness and minimal patient recovery time. Pillcams, a type of smart pill, are used to diagnose small bowel disorders like gastrointestinal bleeding and Crohn's disease.



Smart pills in therapeutic and diagnosis areas

INTEGRATION OF SMART PILLS IN HEALTHCARE

The synergy between smart pills and other emerging healthcare technologies, such as wearables, remote patient monitoring devices, and telemedicine, promises to create a more connected and responsive healthcare ecosystem. Data from smart pills could be seamlessly integrated with wearable devices, such as fitness trackers and smart watches, providing a comprehensive view of patient health and enabling more proactive healthcare interventions. Smart pills can complement remote patient monitoring devices, allowing healthcare providers to track patient health parameters in real-time through mobile, tab or computer and intervene when necessary, improving patient outcomes and reducing hospitalizations. The real-time data provided by smart pills can enhance telemedicine services, allowing for remote monitoring and management of chronic conditions without the need for frequent in-person visits. This can improve access to care, especially for patients in remote or underserved areas.

Long-term Impact on Healthcare

The widespread adoption of smart pills could lead to precise drug delivery and continuous health monitoring, can prevent complications and improve treatment efficacy, leading to better patient outcomes. Early detection of health issues and reduced hospitalization, can result in significant cost savings in healthcare. Smart pills encourage active patient participation in healthcare by providing data-driven insights, leading to better compliance and overall health management

EFFICACY OF SMART PILLS IN NURSING PRACTICE

- Smart pills can monitor and report when a patient has taken their medication. This information helps nurses to ensure patients are adhering to their prescribed medication schedules, reducing the risk of complications from missed doses.

- Smart pills can provide real-time data on a patient's physiological parameters, such as pH levels, temperature, and blood pressure. This data allows nurses to closely monitor patients' conditions and make timely interventions if needed.
- Smart pills can track the exact dosage taken by a patient. This helps the nurses to verify that patients are receiving the correct dosage, reducing the risk of underdosing or overdosing.
- Nurses can use data from smart pills to educate the patients about their medication routines and the importance of adherence. Visualizing adherence data can help the patients to understand the impact of their actions on their health.
- Data collected from smart pills can be used to tailor treatment plans to individual patients' needs. Nurses can adjust care plans based on how well a patient is responding to their medication.
- Smart pills can detect issues such as gastrointestinal bleeding or other internal problems early on. This allows nurses to intervene before the issues become severe and improving patient outcomes.
- By ensuring better medication adherence and monitoring patients closely, smart pills can help to reduce hospital readmissions, improving overall patient care and reducing healthcare costs.
- Automated monitoring and reporting reduce the need for manual checks, freeing up the nurses to focus on more critical tasks and providing direct patient care.
- Smart pills provide accurate and objective data, reducing the potential for human error in medication administration and monitoring.
- Patients who use smart pills can be more engaged in their healthcare, as they receive feedback and can see the impact of their adherence to treatment plans. This increased engagement can lead to better health outcomes.

IMPLEMENTATION OF SMART PILLS IN NURSING CARE

Implementing smart pills in nursing care requires careful consideration to ensure their effective and ethical use. Patient privacy and data security are paramount, necessitating strong encryption and restricted access to confidential information. The cost and accessibility of smart pills should be manageable for both healthcare providers and patients, with efforts to secure insurance coverage. Patient acceptance can be improved through education on the benefits and functions of smart pills, ensuring they are user-friendly and comfortable. Integration with existing electronic health record systems is essential, and nursing workflows must adapt to incorporate the technology seamlessly. Comprehensive training and ongoing technical support for healthcare providers are crucial for successful implementation.

ETHICAL CONSIDERATIONS IN IMPLEMENTING SMART PILLS

- Ensure patients fully understand smart pills, including their benefits and risks, and voluntarily agree to use them.
- Implement strong measures to keep patient data confidential and secure.
- Use encryption and regular security audits to protect data from unauthorized access.
- Ensure smart pills provide clear benefits to patients and do not cause harm.
- Honour patients' choices regarding their use of smart pills and empower them with information to make informed decisions.
- Make smart pills accessible to all patients, regardless of their socio-economic status, to prevent healthcare disparities.
- Develop clear policies on the use and management of smart pill data and ensure healthcare providers adhere to ethical standards.
- Communicate openly with patients about how their data will be used and who will have access to it.
- Follow all relevant laws and regulations and obtain necessary approvals from regulatory bodies like FDA.
- Regularly assess the impact of smart pills on patient care and adjust practices to address any ethical concerns.

LIMITATIONS OF SMART PILLS

- Smart pills can be expensive
- Reliance on smart pills may lead to over-reliance on technology, potentially reducing the role of human judgment and interaction in patient care.
- The collection and transmission of patient data by smart pills raise privacy concerns, especially regarding who has access to this information and how it is used.
- Ethical issues related to informed consent, autonomy, and the potential for coercion in using smart pills.

- Smart pills may encounter technical challenges such as connectivity issues, battery life limitations, and data transmission errors.
- Regulatory approval and compliance can be complex and time-consuming, delaying the adoption of smart pills in clinical practice.
- The technical nature of smart pills may exacerbate existing health disparities, as they may not be accessible to all patients.
- Interpreting the data provided by smart pills, accurately and effectively can be challenging, and requiring specialized knowledge and skills for health care providers.

FUTURE DIRECTION OF SMART PILLS

The landscape of healthcare is rapidly evolving, and smart pills are at the forefront of this transformation. By looking towards the future, exciting prospects and predictions emerge regarding the integration which includes nano sensors, AI integration and energy harvesting technologies. Future smart pills will likely incorporate more sophisticated sensors capable of detecting a wider range of physiological parameters, like nano sensors which enable real-time monitoring of biomarkers, providing deeper insights into patient health. Innovations in energy harvesting technologies will allow smart pills to operate more sustainably, potentially using the body's own energy to power the devices. The integration of artificial intelligence (AI) will enhance the data analysis capabilities of smart pills, enabling more accurate diagnoses and personalized treatment recommendations.

CONCLUSION

Smart pill technology is a promising reality that holds immense possibilities by enabling real-time monitoring, precise diagnosis, and personalized treatment plans. As the field continues to evolve and innovate, smart pills can play an increasingly significant role in healthcare and ability to communicate, track, and improve our health, shaping the future of nursing care and paving the way for a healthier world.

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