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Assessing the Impact of Digitalization and Technology on Patient Compliance in Healthcare Services

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Abstract

Nowadays, technology is omnipresent and an integral part of everyday life. Because patient compliance is a determinant of the treatment outcome, it is therefore essential for medical staff to know and understand how technology can cause patients to rightly or poorly adhere to their treatment. The objectives of this research were to investigate the major technology-related factors, which affect patient compliance, assess patients` reactions which are associated to poor adherence to treatment and determine the right measures, attitudes and behaviors for healthcare professionals to adopt to optimize patient compliance. The research was undertaken using a mixed methods approach whereby the quantitative data collected was analyzed using descriptive statistics while the qualitative data collected was analyzed using the Grounded Theory method. It was found that the vast amount of information and communication services offered by technology nowadays can adversely influence certain factors such as patients` trust, attitude, comprehension, apprehension, confusion, frustration, and personal emotions, which in turn can affect patient compliance. It was also found that technology could positively affect patient compliance as it offers interesting tools that can, for example, remind patients about their appointments, medications, and routines while they are undergoing treatment. This paper presents major insights on the impact of technology on patient compliance and helps healthcare organizations optimize the patient experience in the digital age.

Keywords: Technology; Private Healthcare; Mauritius; Patient Compliance.

1. Introduction

Patient compliance can be defined as the extent to which the patient's behavior in terms of taking medications, following diets, or executing other lifestyle changes coincides with medical or health advice [1]. Nowadays, technology is evolving very rapidly, healthcare services are increasingly relying on highly sophisticated systems, and patients are becoming more connected and empowered as they are provided with extensive medical content online. Considering that patient compliance is a determinant of the treatment outcome, the aim of this research was to investigate how technology may affect the extent to which patients will adhere to their treatment. The main objectives set were as follows:

Objective 1: To expose the major factors related to the use of technology which directly or indirectly affect patient compliance in the Mauritian private healthcare sector.

Objective 2: To assess patients` reactions which are associated to a poor adherence to treatment throughout the healthcare service delivery.

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Objective 3: To determine the right measures, attitudes, and behaviors for healthcare professionals to adopt to improve patient compliance.

Fulfilment of these objectives provides to private healthcare organizations in Mauritius powerful insights to optimize the patient experience.

1.1. The Mauritian Context

The healthcare sector is gradually becoming an important contributor to economic growth in Mauritius [2]. How healthcare is generally regarded nowadays in Mauritius is very different from how it was regarded a decade ago. While healthcare was traditionally seen as a sector focused primarily on curing diseases and saving lives, today it is also considered a highly innovative sector, providing numerous curative as well as preventive services for the long-term well-being of its citizens. By being well-informed, citizens expect good and reliable healthcare services. There are two possibilities for people living in Mauritius to obtain healthcare services; they have the choice to either opt for the public healthcare sector offering free services or the private healthcare sector offering paid services but with a great number of additional facilities, including private rooms, Wi-Fi, and guest beds, among others. While the former choice remains very relevant, the increase in income coupled with a greater panoply of amenities offered has caused a significant increase in customer preference for private healthcare services over the past decade. As a result, the competition among private healthcare organizations has eventually increased, which highlights the need for them to continuously optimize patient care while improving compliance, as an integral part of the process.

1.2. Empirical Studies on Patient Compliance

Healthcare is a complex service with several actors taking part in service provision and with the patient playing an active role in this process [3]. Poor patient compliance to a medication can have a consequent impact on the success of patient care, conduct and results of clinical trials [4]. Clinical studies have demonstrated that low patient compliance may result in increased probability of hospitalization for patients suffering from hypertension [5], poorer improvements in hypercholesteremic patients [6] and increased mortality rate in patients with acute myocardial infarction [7]. Reasons for poor patient compliance are complex and multilayered [8]. For instance, patients can unintentionally fail to adhere through forgetfulness, misunderstanding, or uncertainty about clinician's instructions, or intentionally due to their own expectations of treatment, side-effects, and lifestyle choice [9]. While good compliance may be associated with lesser side effects of the medication of acute and symptomatic diseases and with regular diagnoses [10] and is an indication of an interesting and highly educated medication system [11], partial or poor compliance might be a hindrance if there is a causative relation between not taking a medication and the clinical status of the patient [12]. Poor adherence to treatment may cause diagnosis to become difficult for physicians as it adds to the complexity of treatment and results in waste of resources in the healthcare system [13]. These points highlight the fact that effectively managing patient compliance by healthcare providers is therefore of tremendous importance for ensuring a positive patient experience and treatment outcome. In fact, there are various strategies suggested for managing patient compliance, however, these highly depend on the reasons why a patient has not adhered to the clinician advice in the first place [14]. The traditional medical model propounds that once the medication protocol is recommended by the clinician, it is then the responsibility of the patient to follow it; if patients do not adhere to the protocol, then the reasons for such non-adherence need to be examined. In other words, the problem lies with the patient [15]. Eventually, since increasing patient compliance is estimated to be more critical to improving the health of a population than any advancement in medical treatment [16, 17], it remains of the utmost importance to comprehend the determinants of patient compliance, especially in the era of the medical internet [18] where the digitization of health care holds promising perspectives for improving patient commitment and compliance [19].

2. Method

Considering the sensitive and unpredictable nature of patient compliance, the research presented in this paper was undertaken using a mixed-methods approach. Using mixed-methods research presents many advantages, for instance it combines the strengths of each methodology and minimizes the weaknesses [20] while enhancing the findings [21] and increasing the generalizability of the results [22]. It also provides a more balanced perspective [23] as well as more breadth, depth, and richness as compared with either quantitative or qualitative methods alone [24].

A two-phased exploratory study was conducted which involved unstructured face to face interviews, focus group discussions and overt observations in four private healthcare organizations in Mauritius. All of these organizations provide both inpatient and outpatient care in a variety of medical fields including but not limited to obstetrics, gynecology, urology, dermatology, endocrinology and general medicine. Following the exploratory study, a semi-structured questionnaire was developed which attempted to investigate most factors, associated to technology adoption, which were observed or suggested by healthcare professionals to have an impact on patient compliance. Same questionnaire was tested during a pilot study to verify its effectiveness and to subsequently finalize the research instrument. The main study was eventually undertaken whereby participants were selected using non-probability quota

sampling (stratification by 'gender' and 'age') whereby snowball sampling was also considered as a way to fulfill all the quotas set in the sampling plan. All quotas set for each category has been done according to the response rate obtained during the pilot study. The corresponding number of units/ cases required to satisfy the quota set for every stratum was then calculated. The main study lasted over a period of five months and was done using online means including email, social media and mobile instant messaging applications. A formula [25] was used to calculate the sample size which considered a confidence level of 95%, a margin of error of 5% and a Standard Deviation (p) of 0.5. Eventually 385 participants` responses were selected, out of the 411 responses received, whereby the quantitative data collected were analyzed using descriptive statistics while the qualitative data collected were analyzed using the Grounded Theory method (Figure 1).

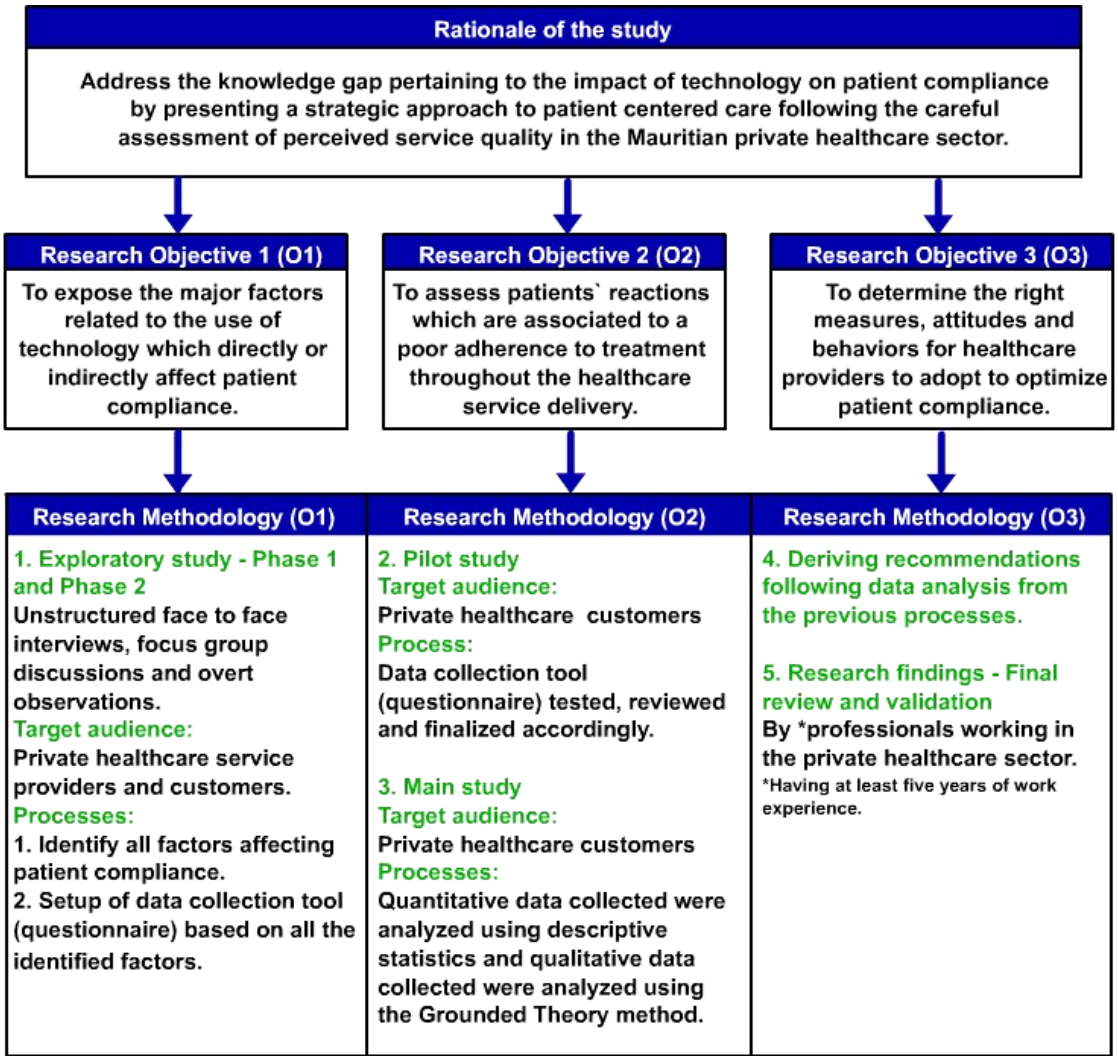

Figure 1. Research Methodology

3. Results and Discussions

This section presents the responses of 385 validated questionnaires whereby most participants were female (57 percent). The age group '35 to 44 years old' was represented by the highest amount of participants (32 percent) and was followed by age groups '45 to 54 years old' (26 percent), '26 to 34 years old' (25 percent) and '18 to 25 years old' (11 percent).

Only 5 percent of the participants were aged 55 years old or more. 57 percent of the participants were undergraduate degree holders and 23 percent were postgraduate degree holders. 68 percent of the participants were married as compared to 3 percent who were single. The remaining participants were either divorced (1 percent) or widowed (1 percent).

The majority of participants (63.4 percent) also reside in the district of Plaines Wilhems where are found most of the largest private healthcare organizations on the island. As with regard to the participants` occupational group, 75 percent were professionals or executives and the minimal percentage applied to the general workers group (1%). Finally, 23.1 percent of the participants have a monthly income of more than 1100 USD as compared to 6 percent who have a monthly income of less than 250 USD.

3.1. Role of Technology in Healthcare

It is undeniable that technology has got a crucial role in patient care in the digital age. Following the exploratory study, major roles of technology were identified in the qualitative data collected as detailed in the following table.

Table 1. Role of technology in healthcare

No.	Role of technology	Description
1	Electronic Health Record (EHR)	• Fast services (admission/ discharge formalities) • Medical history (archiving system) • Effective medical investigation (based on quality data)
2	Increase Communication	• Emails, online requests from website • Social networks, online forums
3	On Site Facilities	• Wifi and smart TV • Automated wheelchairs and bed • Digital security systems
4	Online Facilities	• Access to lab results and large pool of medical information and advices (Forums or specialized websites) • Access to customer account (medical history and payment history among others)
5	Advanced Medical Services	• Telemedicine • Better equipment for screening and diagnosis • Robotic assisted surgery
6	Medical Mobile Apps	• Large pool of clinical resources for medical practitioners and patients. • Large pool of tools facilitating treatment adherence and setup of healthy routines (medication reminders and health apps among others)
7	Increase Brand Awareness	• Increase visibility and accessibility (online 24/7) • Satisfying growing number of online users • Patients are more confident and trustful
8	'Green' Environment	• Paperless processes. • Patients, visitors and organisations are becoming more environmentally conscious

3.2. Main Factors Associated to Technology that Directly or Indirectly affect Patient Compliance

Even though the use of technology appears to be very beneficial to healthcare organisations, its impact on patient compliance still had to be investigated given the observations made and insights provided by healthcare providers during the study. The table below describes the main factors associated to the use of technology, which were found to affect patient compliance directly or indirectly.

Table 2. Main factors that were found to affect patient compliance

No.	Impact of Technology	Description
1	Arrogance/ 'Know it all' attitude	As a result of having made researches online about their illnesses and required treatments.
2	Lack of trust	Believe more in online content rather than information provided by a medical practitioner.
3	Anxiety/ Depression	Look for data online and is exposed to serious or extreme information.
4	Self-medication	Look online for over-the-counter medicines based on experienced symptoms.
5	Cost consciousness (Availability and Accessibility)	Patients believing that it costs more to have an appointment with a clinician than to consult "Dr. Google".
6	Confusion/ Exposed to false information (misinformed)	Online medical forums and websites. Online medical *advice (without physical examination) Internet trolls **Advice from people who are not practitioners but just giving information/ recommendations based on their personal experience*
7	Deception/ Discouragement	Patients discuss and compare their respective treatment (routines, medication, outcome etc…) online. While this can be reassuring for some patients, it can also cause discouragement for others who for instance have more complex medical regimens to follow or whose treatment outcomes are negative.
8	High Exigency	Due to sophisticated devices, patients think that it is more the work of the provider rather than their work (thus neglect their part to adhere to the treatment) to ensure a positive treatment outcome.

3.3. Other Factors Affecting Patient Compliance

It was found that fast advances in healthcare technology make it possible nowadays to have various types of treatment for almost all kinds of health problems; however to which extent a patient will adhere to a particular treatment was observed to be totally unpredictable. Other factors that were found to affect patient compliance are described in the following table.

Table 3. Other factors observed to affect patient compliance throughout the patient care process

No.	Factors observed to affect patient compliance	Description
1	Lack of trust	Failing to believe in the competence and abilities of the medical staff as well as the effectiveness of the treatment. **"***The medical practitioner taking care of me appeared so young. I wondered if he knew what he was doing. Definitely he should have been accompanied by an older doctor who is more experienced as I, personally, did not trust him***"** (Female patient - Obstetrics/ gynaecology services)
2	Treatment and its side effects	When the treatment required is much significant in terms of duration and complexity (e.g. cancer and fertility treatments). When the side effects associated are also difficult to bear (affecting daily activities). Moreover, when the treatment`s chances to succeed are poor or when its impact and outcome are unpredictable. *"Often when my white blood count was too low prior to my chemotherapy session, I had to inject myself a substance (Neupogen) for two days before being admitted. Then I felt so weak all day long. So often I was fed up and I really wanted to stop everything."* (Female patient - Oncology services)
3	Arrogance/ 'Know it all' attitude	Often as a result of having made researches (primarily on the internet) about their illnesses and required treatments based on their symptoms. Believe more in online content than in medical practitioner. **"***At times patients argue or challenge practitioners with things they have learned from the internet.***"** (Male nurse working in a Mauritian private clinic)
4	Lack of understanding	Not understanding the illness and/ or its seriousness. *"I was given antibiotics for 10 days due to my urinary tract infection. However, after about a week I felt totally well, no more symptoms, so I stopped my medication."* (Female patient - Obstetrics/ gynaecology services)
5	Forgetfulness (Forgetful patient) (Primarily concerning medication adherence)	Often as a result of not considering the treatment as serious or simply due to having a very busy life. *"My dentist asked me if I took all my medicines accordingly. I replied positively but in fact my prescription was still in the car since my previous appointment."* (Male patient - Dental services)
6	Forgetfulness (Forgetful staff) (Primarily concerning medication adherence of admitted patients who are under their responsibility)	Often as a result of tiredness, inattention or simply due to having a very busy work schedule. *"I asked the nurse for a spoon to take my gastric syrup after breakfast as required. She never returned, the specialist came around 11am and was furious at her."* (Female patient – General surgery)
7	Moral values, religious values and/ or personality traits.	Having values or traits that go against the treatment`s procedures or medications (e.g. some religious groups were found to prohibit blood transfusion). *"On that day the obstetrician told me that I would be having a transvaginal ultrasound rather than an abdominal ultrasound. I refused. He eventually did an abdominal ultrasound."* **(**Female patient – Obstetrics/ gynaecology services**)**
8	Frustration	Often as a result of being impatient to get/ see results following the treatment or when patient is not reassured enough regarding the treatment or when the bill does not reflect the services received. *"I paid almost 95 USD for both the consultation and medicines, no improvement at all. Therefore, I stopped using all the products he prescribed and after 3 months went to see another dermatologist. The cost involved was far less but with big improvements in a short time!"* (Female patient - Dermatology services)
9	Confusion (observed especially when relatively complex treatments are involved, for instance fertility, orthodontic or cancer treatments)	Patients may be confused by all the routines, timings to respect, methodologies and recurrent medical tests associated to particular treatments. As such they may not adhere to their treatment accordingly. *"IVF treatment itself is quite difficult and since I am also a diabetic, I often got confused will all self-injections and medications involved daily regarding both my fertility treatment and diabetes treatment. Some days I was very discouraged due to that."* **(**Female patient - Fertility services**)**

10	Personal emotions	Some patients were found to face certain emotions that were out of their control such as fear, sorrow, discouragement, despair, stress, anxiety, guilt and anger. This was observed to eventually affect their ability to think reasonably or take decisions based on sound judgment hence causing them to poorly adhere to their medical treatment. *"My wife (66 years old) has a medical condition that forces her to remain in bed and moreover requires her to have blood transfusions recurrently. Last time when she was admitted for her transfusion, she got hurt when the nurse made her an injection. So, she did not want more injections, but the nurse had to do her work. Sadly, my wife kept swearing at the nurse while she was doing other injections. This is very hard for I know that she did not want to cooperate simply because she was suffering."* **(**Accompanying person (husband) of female patient - Oncology services**)**

4. Conclusion

This study explored patient compliance from the perspectives of private healthcare providers and patients in Mauritius. Data collected has shown that patients are becoming more knowledgeable about the medical field due to the vast amount of information available online. While it was found that the same information could invoke hope and relief, it was also found that it could trigger negative emotions such as fear, frustration, despair, sadness, anger, anxiety, and distrust, which eventually adversely affected patient compliance. This study shows that it has become important for patients to be made aware that the vast amount of information available on the internet may not be totally applicable and reliable. Furthermore, the reliability of a treatment depends fully on appropriate physical examination and medical tests rather than on generic online content. Patients should also be informed of the risks and dangers of self-medication based on information available online and be reminded of the importance of adhering to their treatment plan. Insincerity during the care process should be avoided at all costs as it could be felt by patients and eventually adversely affect trust, which could in turn affect compliance [26] and health outcomes [27]. By exposing the main factors affecting patient compliance throughout the care process, this research provides healthcare providers with a strong basis for developing and adopting proper strategies to manage patient compliance effectively, in a general manner, or on a case-by-case basis, while taking into consideration the continuous change in customer behaviour as well as the accelerating technological change.

Despite the interesting insights provided, this study still has some limitations. For instance, it makes use of non-probability sampling plans, which have limitations in terms of generalizability [28]. Additionally, the study does not take into consideration an audience under 18 years old, which is normally very active online [29]. A similar study could be done to assess compliance in teenagers receiving healthcare services and the results compared with the results of the present study to obtain further insights on patient compliance and a better understanding of how to manage it efficiently. The same research could also be done to investigate patient compliance in Mauritian public healthcare settings to further expose the management of patient compliance as a fundamental aspect of healthcare in general and to obtain solid ground for future research in favour of customer service improvement and positive treatment outcomes in the entire sector.

5. Declarations

5.1. Author Contributions

All authors have equally contributed towards Conceptualization, methodology, formal analysis, investigation, resources, writing—original draft preparation, writing—review and editing, visualization. All authors have read and agreed to the published version of the manuscript.

5.2. Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

5.3. Funding

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5.4. Institutional Review Board Statement

Not applicable.

5.5. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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