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Master Of Business Administration

**Digital Transformation and Predictive Supply Chain Analytics in
Community Pharmacies: Toward Operational Excellence and
Sustainable Healthcare**

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Abstract

For healthcare, the imperative to deliver medicines efficiently and sustainably is no longer a choice, but a necessity. Coming hotfooting to the forefront of the issue is digital transformation, and one of the most practical ways this can be achieved in the field of community pharmacies is through supply chain digitalization. Sending them down the path of predictive inventory systems and a complete absence of waste.

Community pharmacies in Saudi Arabia play a vital role as the connection between patients, healthcare workers and suppliers, but they are plagued by stockouts, overstocking, expired medication and slow ordering cycles. Well-known technologies like Artificial Intelligence, Internet of Things, Enterprise Resource Planning and Big Data Analytics offer the chance to turn these problems around, with real-time visibility, accurate forecasts and automated restocking being the keys to achieving this.

This research takes a descriptive and analytical approach to test the possibilities of digital supply chain tools in catapulting the performance and sustainability of pharmacies, and is in line with the Saudi Vision 2030, which is all about coming up with new ideas, transforming the healthcare sector, and cutting down on waste.

Introduction

Speaking of the operation of pharmacies, timely access to medications, management of chronic conditions and patient satisfaction are key, yet, traditional supply chains in many community pharmacies in Saudi Arabia are reactive, disjointed and out of date. They don't use predictions and analytics, they go by last year's sales data and hand-counting, and that leads to either too much stock sitting around or not enough.

Well-known global trends in the pharmacy business are leading towards more logical decision-making and slicker supply chains. Artificial intelligence, Internet of Things technology and cloud-based management systems have given pharmacists and bosses the ability to see what's coming, and coordinate supplies to meet real-time demand. This is reducing waste, freeing up space and making sure that life-saving medications are available exactly when patients need them.

Coming hotfooting in line with the Kingdom's Health Sector Transformation Program under Vision 2030, this shift towards a more efficient and patient-friendly healthcare

system is being seen in the country's ambitious initiatives like Wasfaty, Nafith, and Seha Virtual Hospital. But community pharmacies in Saudi Arabia still aren't doing much in this area.

Our proposal will investigate how taking the digital route can help community pharmacies in Saudi Arabia predict what they'll need, get their stock levels sorted and send nothing to landfill.

Research Problem

For digital health in Saudi Arabia, many community pharmacies are still running on traditional, fragmented, and reactive inventory systems. These systems are usually dependent on manual inputs and point-of-sale data that don't give a clear picture of real-time consumption trends and supply fluctuations.

The problems that arise are two: stockouts where patients can't get the medication they need and overstocking, where tons of drugs go to waste and are expensive to throw away.

Unlike hospitals and large distributors who have moved ahead with predictive analytics and automation in their supply chains, community pharmacies have not made much progress in the same area. They're left exposed to market ups and downs, incorrect forecasts and, more importantly, throwing away expensive medications that could have been used.

There aren't well-defined structures or checklists for pharmacies to follow to migrate to digital supply chain systems either.

Well-known researchers want to fill this hole by looking at how digitization can cut down errors in inventory, eliminate waste, and supercharge the day-to-day running of community pharmacies in Saudi Arabia.

In the case of the community pharmacies in Saudi Arabia, the country's broader transformation of the healthcare system is not reflected in the same way, due to the relatively fragmented state of their supply chain. Coming from the hospital and large distributor side, these entities have basically adopted cutting-edge digital platforms, but community pharmacies are still stuck on the fringes of the information network. This operational divide leads to crippling inefficiencies in inventory management.

Something that's critical to the survival of these pharmacies, requiring real-time visibility and forward-thinking planning. One of the biggest gaps in the system is the lack of a national digital framework that ties community pharmacies together, their suppliers, regulatory bodies and central stores. Well-known issues in the country, including patchy software and manual counting make it impossible for pharmacies to have a complete view of their current inventory levels, how quickly they're being used up and how well their suppliers are performing, and without that kind of information they're throwing away money on ordering too much of the wrong products and running out of the things that are in demand.

Pharmacies also don't get a warning sign that a shortage is coming. Automated alerts, which are now standard in the international pharmaceutical market, allow healthcare facilities to spot unusual consumption patterns, delivery delays, and seasonal changes in prescription demand, something that is missing in the Saudi community pharmacy network, forcing them to play catch-up rather than being proactive.

Another problem is the lack of a single, unified, national database that logs the movement of medication all the way from the manufacturer to the patient, which makes it impossible for community pharmacies to track their performance, forecast potential problems and coordinate with their suppliers to prevent stockouts. The COVID-19 pandemic brought the problem into sharp relief, in particular the rapid change in demand left community pharmacies scrambling to stock up on what they didn't have, leading to serious consequences.

The current workforce in community pharmacies also doesn't have the digital know-how or the special training they need to operate the sophisticated supply chain management systems, and this resistance to new ideas means they are stuck with old ways of doing things.

Problem Statement:

How can supply chain digitalization enhance predictive inventory optimization and minimize waste in community pharmacies, particularly within the context of Saudi Arabia's healthcare transformation?

Research Objectives

In terms of community pharmacies in Saudi Arabia, the integration of digital technologies in their supply chains could be the key to predictive inventory management and zero waste.

The aim of our study was to investigate the current state of supply chain digitalisation in Saudi community pharmacies, to identify the digital tools and systems in use in inventory operations.

Such as AI, IoT, ERP, and Big Data, how digitalisation affects the accuracy of forecasting, lead times and medication waste, to ascertain the preparedness of community pharmacies to adopting predictive inventory systems, and finally, propose a strategic framework that helps them achieving zero waste, with more accurately managed inventory supply and distribution networks.

Research Questions

1. What are the main digital tools currently applied in community pharmacy supply chains?
2. How can digital integration improve demand forecasting, inventory control, and waste reduction?
3. What challenges prevent community pharmacies from adopting predictive digital systems?
4. How prepared are Saudi community pharmacies for digital transformation within Vision 2030?
5. What framework can guide the implementation of predictive, data-driven inventory systems in pharmacies?

- **Theoretical Significance**

Concerning the future of healthcare, the concept of digital supply chain transformation is a game-changer, and community pharmacies in Saudi Arabia are no exception.

This study, with the aim to extend the theoretical understanding of the Digital Supply Chain Maturity Model (DSCMM) and the Technology Acceptance Model (TAM) in the community pharmacy setting, adds a vital inter disciplinary dimension to the literature by bridging healthcare with supply chain management principles.

From a practical standpoint, this thesis was developed with pharmacy managers, Saudi Vision 2030, healthcare, supplier's and distributors' needs in mind.

For pharmacy Managers, it supplies information on how predictive analytics and instant monitoring can dispose of waste and perfectly arrange stock supplies.

Healthcare Policymakers are supported in their objectives of Saudi Vision 2030, by this research that pushes the boundaries of efficiency and sustainability in drug distribution.

Suppliers and distributors are also able to coordinate more effectively through digital linking and shared data systems.

- Strategic Importance

Community pharmacies are likely to shift from being reactive and manual to proactive, predictive, and sustainable digital entities, when this research is fully implemented.

Coming in line with the country's sustainability plans, it's a great step that's going to improve the healthcare landscape and provide patients with more reliable access to care.

Literature Review

Regarding the healthcare supply chain, digital transformation has become the norm in the 21st century. The confluence of artificial intelligence, internet of things, blockchain, and big data analytics in the industry has given us a brand new way of looking at the medical products we need, store and send out.

In the healthcare world, digital supply chains allow us to track in real time, predict and automate the re-stocking of goods, leading to improved transparency and patient satisfaction. According to Deloitte's 2023 report, hospitals and pharmaceutical

distributors that took the plunge with advanced analytics, saw their inventory turnover go up by 30-50% and had a 20% reduction in waste.

Well-known for being at the forefront of patient interaction, community pharmacies in particular are still operating with limited digital infrastructure and their processes, unfortunately, fall into the semi-automated category, counting on sales history rather than precision forecasts.

Predictive inventory systems, though, are a total game-changer, they use machine learning algorithms and AI forecasting to see what's going to be needed and by when. Traditionally, pharmacists have used manual reorder thresholds that are slow and get it wrong a lot.

According to PwC's 2022 report, AI-based forecasting tools can nail the mark up to 90% of the time, banishing overstock and stockouts and, in the case of community pharmacies, would be especially helpful when paired with Enterprise Resource Planning systems and supplier databases sending automatic reminders when it's time to restock and monitor expiration dates. In Saudi Arabia, such systems can be hooked up to the national electronic prescription service, Wasfaty, making sure everything runs like clockwork.

In some parts of the world, we're seeing fully digitalized pharmacy supply chains with truly global reach.

In the United Kingdom's NHS Model, pharmacies are hooked up to centralized digital ordering systems that monitor the entire stock level across the country, in Germany, pharmacists use predictive analytics and electronic prescription data to forecast need and cover up shortages, and in Singapore, cloud-based dashboards provide a crystal-clear view of who has what, reducing waste by nearly 40%.

Speaking of the digital transformation of healthcare supply chains, it's not just about installing new software, it's a complete overhaul of how we run, analyze and manage our operations. In order to make this transformation a success, there are three fundamental pillars that need to be put in place: Data Governance, Advanced Predictive Analytics and Systems Interoperability.

1. Data Governance

In relation to community pharmacies, a weak data governance can cause problems like inaccurate stock counts, irregular product names and a discrepancy between what's reported and what's actually in the store. Research has shown that no matter how sophisticated the system is, it can't provide reliable forecasts without a robust data

governance. On the other hand, good governance in pharmacy management sets the stage for auditing, compliance and hooking up to national platforms like Wasfaty.

2. Advanced Predictive Analytics

Speaking of forecasting the future, modern predictive analytics gives pharmacies a major boost, by using machine learning, statistical models and past data to nail down the demand. Coming hotfooting out of the box, predictive models take into account things that regular reordering doesn't, like the health trends of the population, the cycles of seasonal diseases, the effectiveness of marketing campaigns and how long suppliers need to get goods to the shelves.

Research has shown that pharmacies that use predictive analytics deliver higher service levels, cut down on waste and turn over their stock a lot faster. In Saudi Arabia, where Wasfaty is widely used, predictive tools allow pharmacies to get right on top of what's coming in, based on real-time prescription patterns.

3. Systems Interoperability

In the case of digital transformation in community pharmacies, interoperability stands out as the key to success. Studies show that data must flow across the entire supply chain and in the UK and Singapore we're seeing that perfectly timed ordering, automated stock replenishment and country-wide insight into pharmacy performance are all thanks to interoperability.

Unfortunately, in Saudi Arabia, many community pharmacies are running on standalone systems that just can't talk to their suppliers, nor can they hook up with the regulatory databases, and that creates silos that ruin the accuracy of our forecasts. Well-known scholars say that digital transformation also relies on a company's readiness, the know-how of its employees and the backing of its leaders, and that fancy digital tools won't sort out any problems unless there's a culture that prioritises data-driven decision-making and making things better all the time. We have a gap in the literature here that shows that we desperately need frameworks tailored specifically to community pharmacies, especially in developing markets where digitalisation levels are very uneven.

Coming out of this study, we're expecting to see huge improvements in operational efficiency, strategy, and management in community pharmacies, and one of the biggest boons will be the transformation from firefighting, manual stock management to being proactive and using real-time data to predict and plan.

- **Enhanced Managerial Decision-Making**

When pharmacy managers look to get the pulse of their business they're turning to digital dashboards and business intelligence tools, which deliver instant access to key performance indicators, such as inventory turnover, demand velocity, wastage rates and the reliability of their suppliers. With this information, leaders can back their decisions with data and reorganise their resources accordingly, and even modify their ordering patterns in response to market changes. Gone are the days when they'd have to rely on gut feelings and post-event sales reports.

- **Improved Forecast Accuracy and Reduced Waste**

Looking at to the future, advanced AI-powered forecasting will be a game-changer in community pharmacies. These models will be able to provide so much more accurate demand forecasts that the likelihood of pharmacies having either too much or too little stock will be a thing of the past. Coming hotfooting on the heels of this improved forecasting is the ability to spot slow-moving items, and with that, pharmacies can re-distribute stock before it goes to waste, renegotiate return agreements with suppliers and even adjust their orders to avoid running out of the things they need most. Medication waste, one of the most pressing problems in community pharmacies, will all but disappear, and as a result, pharmacies will be able to save money and patients will get the medication they need.

- **Stronger Supply Chain Transparency and Coordination**

When using Smart Tracking Technologies, such as RFID and IoT sensors, the pharmaceutical supply chain will see a major increase in visibility. Pharmacies will be able to monitor the real-time movement of their shipments, oversee the storage conditions and, very quickly notice any delays, and can therefore be more confident in the safety and efficacy of the products they distribute. This greater transparency, also means that pharmacy, distributors and government agencies can work much more effectively together, building a more secure and reliable supply chain system.

- **Higher Digital Readiness Among Pharmacy Staff**

Workers are expected to step up their digital game, when digital systems are implemented in the workplace. Well-designed training programs, user-friendly interfaces and supportive leadership will help to get everyone on board with new technologies and kick resistance to the curb.

Over time, employees will move away from mundane, repetitive tasks, and towards analytical, supervisory and patient centred roles. The results of this study will show that digitalisation isn't just a technical update, it's a game changer that makes healthcare operations more efficient, gives patients better results and puts Saudi Arabia on the map as a leader in the use of data-driven healthcare systems.

- **The Saudi Context: Progress and Challenges**

When Saudi Arabia's Vision 2030 kicked in, the country's healthcare system started to see a massive digital transformation, thanks to initiatives like Wasfaty which lets people order their medications and pick them up at their local pharmacies, Nafith that sorts out the logistics of getting pharmaceuticals to the right place, and Seha Virtual Hospital that showed the country's potential for all-out digital healthcare.

Despite these leaps forward, the community pharmacies still aren't fully digitized. Most rely on piecemeal systems provided by regional suppliers and don't talk well to each other's software, the wholesalers, and the Ministry of Health's systems.

Well-known problems in the system include inaccurate forecasting and restocking, medication expiration and returns, and communication breakdowns between pharmacies, branches and suppliers.

According to a study by Alnasser back in 2022, more than 60% of Saudi community pharmacists still live in the stone age, using manual reorder systems, and less than 20% have gone with fully integrated ERP or AI-powered forecasting tools.

Implementing digital supply chain systems can give community pharmacies lots of benefits.

From instant inventory awareness to zero waste, from safer patient care to streamlined communication between pharmacies and suppliers. Speaking of the concept of

sustainability, community pharmacies have a significant role in the reduction of waste, a WHO report in 2023 stressed.

Coming hotfooting from that report, the digital transformation of healthcare supply chains isn't just making things cheaper.

It's also boosting the resilience of the healthcare system and ensuring that medication is more accessible to the public.

As of now, there are 3.6 obstacles to adopting digital systems in community pharmacies. Cost, technical know-how, resistance to change, incompatibility and slow regulatory approval are the main hurdles.

Well-known ways to get over these hurdles is for governments, pharmacy owners and tech suppliers to work together, standardizing, securing and making sure all the different systems talk to each other.

Now, existing studies have shown the benefits of digitalisation in healthcare, but have neglected to give much attention to community pharmacies in developing regions, the Saudi Arabian pharmacy scene specifically and theoretical frameworks that don't get applied to real-world operational data. This research goes some way to filling these gaps.

Theoretical Framework

Assessing how digitalization is changing the face of community pharmacies, the researchers took a deeper look at the underlying theories. They relied on the Technology Acceptance Model, a 1989 framework by Davis, to see how people perceive and take to new technologies.

The Digital Supply Chain Maturity Model (DSCMM) allowed them to evaluate the level of digital integration and readiness within the supply chain. Combining these two perspectives gave them a whole new insight into the digital transformation happening in community pharmacies.

- Technology Acceptance Model (TAM)

Looking at how people adopt new technologies, the Technology Acceptance Model, or TAM, has proven to be a reliable framework.

Two major drivers that make us want to use a new system are its perceived usefulness, how much we think it will improve our job performance, and perceived ease of use, how much effort we believe it will take to get started.

Well-known, pharmacists and managers who believe that a digital tool, like an AI-based inventory system, is both useful and easy to use are likely to really want to adopt it, which has been seen in the study of community pharmacies in Saudi Arabia.

Now, the factors such as training, management backing, and the usability of a system can also significantly affect the willingness to accept change in this context.

To be more precise, researchers used the following parameters in this study.

Perceived usefulness and perceived ease of use, with the aim of explaining the adoption of digital supply chain systems, and were assisted by organisational support, the people's level of digital literacy, and the state of the infrastructure.

- Digital Supply Chain Maturity Model (DSCMM)

The Digital Supply Chain Maturity Model, or DSCMM, is used to see where an organisation is on the path to a fully digital and self-sufficient operation, when measuring the maturity of digital transformation in a supply chain.

The DSCMM, which is broken down into five stages, describes an organisation's digital journey. Stage 1, 'Traditional' is characterised by manual operations and no digital tools, stage 2, 'Digital Awareness' is marked by the introduction of isolated digital tools that don't talk to each other, stage 3 'Integration' starts to bring systems into play with partial data exchange, stage 4 'Collaboration' has real-time data sharing between partners and systems and stage five 'Autonomous' is a fully digital, pre-programmed and self-learning supply chain.

Community pharmacies in Saudi Arabia are at a place that's roughly between stages two and three, indicating that they have digital tools, but they're not yet fully integrated or predictive.

The DSCMM gives us the ability to measure the maturity of pharmacy supply chains, and the steps they need to take to become more accurate and have zero waste, as well as evaluates how much data is available and connected, automated ordering and tracking and how smooth the communication is between different pharmacy management systems and government platforms such as Wasfaty.

- Integrating TAM and DSCMM

When combining the Technology Acceptance Model (TAM) and the Digital Supply Chain Management Maturity Model (DSCMM) a dual structure is created that breaks down the barriers to adopting digital technologies in the supply chain. It looks at the psychological aspect of workers accepting digital tools and the organisational capacity of the supply chain.

Well-known as TAM takes charge of the psychological part, DSCMM measures the technical and operational maturity of the supply chain. By combining these two, we can delve deeper into the reasons why digitalisation succeeds, and make it work in real life, thanks to technical and operational enablers.

The study's conceptual model takes a holistic approach to linking human behaviour to technological capacity, Inputs, Process and Outcomes.

Inputs contain the digital tools, infrastructure, training, and management support. The Process includes the merging of AI, IoT and ERP systems. And Outcomes consist of predictive inventory, efficiency, and zero waste.

Research Methodology

A descriptive-analytical, qualitative approach was used, delving into the theoretical aspects and linking digital maturity, inventory precision, and zero-waste goals in the community pharmacy field, when conducting this study.

Given the ability to dissect existing knowledge and reveal the relationships between the concept in the community-pharmacy setting is exactly why this method was selected,

with the support of deep analysis of present day operations and international benchmarks, and the power to equate them to the Saudi healthcare framework. This synthesis of approaches gives a well-balanced groundwork for constructing a theoretical framework that is well-suited to community pharmacies.

This research will employ a deductive reasoning method, basing its arguments on established theories, Technology Acceptance Model (TAM) and Digital Supply Chain Maturity Model (DSCMM) and using them to tell us about the real-life stories of community pharmacies. The study predicts that boosting digital maturity and acceptance will result in more accurate predictions and fewer medications being wasted, a belief that will be grounded in the logical deduction of the data.

When it comes to the data, the study can draw from primary insights, though mainly theoretical, via semi-structured interviews or surveys with Saudi pharmacists, supply-chain executives and healthcare administrators. The primary aim of these primary data is to gain understanding into the perception of utility, readiness and blockages to adopting digital systems.

The main body of analysis is based on secondary data taken from: peer-reviewed academic journals (Elsevier, Scopus, PubMed), official reports from the Saudi Ministry of Health, the Saudi Food and Drug Authority, and the World Health Organization, as well as, insights from the consulting firms Deloitte, PwC and Harvard Business Review in regards to digital change and predictive analytics, and will be thoroughly assessed for reliability, publication year and sound methodology.

The collection of data was done in a systematic way, through four stages, in particular: identity, screening, analysis and synthesis, which helps in the organisation of our results.

A qualitative thematic analysis will allow us to cut through the noise and see the relationships between the adoption of digital tools, waste reduction and accuracy in our forecasts, when digging through the data.

We'll group the themes into three major buckets: Digital Readiness, Operational Performance and Sustainability Impact.

If we ever get access to quantitative data, we'll use it to apply descriptive statistics and correlation analysis to understand numerical relationships between the variables.

- Coming from three different directions.

Academia, the private sector and the government, we'll be able to triangulate the accuracy of our results. We also double-check our validity with research that has been reviewed by our peers,

Clear definitions of digitalisation, zero waste and predictive inventory will make sure we don't interpret our findings wrongly, we'll keep those definitions at the forefront of the way we work with the data.

Our policy will be to treat the confidentiality and reputation of any research participants with care and give proper credits, will use the Mid Ocean University Research Ethics Policy.

The researcher, me, takes pride in my commitment to doing nothing less than honest, open and respectful, handling the work done by others.

- Expected Findings and Discussion

We can expect to see a tremendous boost in operational efficiency, accuracy of forecasts and positive sustainability outcomes, when community pharmacies embrace digital supply chain systems. Coming from a place of reactivity to a position of proactivity, the use of data-driven decision-making will now be the norm instead of intuition based guesswork.

Our study has grouped the expected results of this research into four main areas and they are better forecasting, squashing out medication waste, making supply chains more efficient and boosting the entire chain of communication between pharmacies, suppliers, and government agencies.

Better forecasting will be made possible by artificial intelligence-based and Internet of Things-enabled tools, and is predicted to be more accurate by 20 to 40 percent according to hospital supply chain implementations, and this precision will prevent overstocking and empty shelves.

We also expect a reduction in expired or surplus medication through digital systems by virtue of being able to predict future needs and automate reorders, and smart inventory models that pick up on slow-moving products and send them to where they're needed before they expire.

Digital supply chains will be the backbone of a more connected and resilient pharmacy network, allowing real time tracking of orders, and swift reaction to any stock shortages.

We're also counting on a perception shift in the pharmacists and managers who will be making use of these digital systems, with our findings showing those who believe the systems will be helpful and easy to use will be much more committed to the digital cause.

The management of a successful digital transformation will be a key component, via training and motivational programs, so that we can see this digital health revolution stick. In addition we see community pharmacies being able to work towards full maturity on the Drug Supply Chain Maturity Model.

Discussion

For the digitalisation of community pharmacies, we're not just talking about a technical update, but a complete shift in how these pharmacies operate.

The studies showed that there's a very strong relationship between a pharmacy's digital readiness and its ability to accurately forecast demand and manage stock. The more pharmacists buy into the digital way, the more effective they'll be in eliminating waste and running their operations with maximum efficiency.

Well-known as the Technology Acceptance Model, it's clear that the more pharmacists perceive the digital tools they use as having the ability to be used and found easy to get to know, the more committed they'll be to not squandering them.

Collaboration and flexibility go hand-in-hand, and in these community pharmacies, will mean that when there's a disruption to the supply chain the network can better absorb it, by sharing real-time visibility over stock levels across different pharmacies.

Lastly, the integration of predictive tools in these pharmacies will see them directly contribute to the aims of the Saudi Vision 2030 plan.

Namely a healthcare system that is both sustainable and innovative.

Implications

Companies will need to invest in digital platforms that can work with the Wasfaty and SFDA systems and also train their pharmacists on how to understand and manage the data, when implementing the new pharmacy systems.

In order to encourage small and medium-sized pharmacies to adopt digital supply chain systems, policymakers need to establish incentive programs. Integration between public and private pharmacy systems, on the other hand, will help us have consistent data flow across the industry.

The study's findings could be used as a basis for future empirical research into the tangible effects of digitalization on pharmacy metrics.

Limitations, Recommendations, and Conclusion

- Limitations of the Study

One of the major hurdles is the difficulty in obtaining access to operational data, when delving into the world of supply chain digitalization in the community pharmacy sector in Saudi Arabia. Community pharmacies in the country tend to keep their performance and inventory data private, commercial sensitivity and regulations forcing this secrecy.

This limited access to data severely reduces the reliability of the study's predictive models because it is unable to be tested, and, given its pre-existing predictions.

Another issue is the disparity in the extent of digital adoption, in this case, between urban and rural pharmacies. Although some community pharmacies are utilising sophisticated ERP systems, others remain to rely on traditional manual record-keeping. In the event that comparative analysis is made, these differences in levels of digital maturity will be difficult to account for.

The study of digital trends in Saudi community pharmacies is rapidly developing, rendering tools and software out of date before we can make and apply them.

As a deterrent to the adoption of digital systems, pharmacists' resistance is due to fear, skepticism, or perhaps a dread of being made redundant, does not necessarily hinder their effective implementation.

Because this is, to some degree, a theoretical proposal, this investigation has given up field research or numerical verification, and is concentrated on theoretical comprehension and general recommendations.

Recommendations

As for the digital transformation of community pharmacies, the literature and theoretical analysis suggest several recommendations that can be taken into account for a successful adoption.

The government and policy level recommendations are to introduce a national level digital standards for making data from all pharmacy systems talk to each other, back financial incentives for smaller pharmacies so they can afford the latest predictive tools, and team up software companies with healthcare administrators to blast through any resistance to change.

Coming down to the pharmacy management level, investing in AI forecasting systems that can track sales as they happen, sending pharmacists to training sessions to get them up-to-speed on digital, and establishing a set of clear measures such as forecast accuracy, waste rate and reduced time to see how well the new systems are working are also advised.

Operational improvements at the pharmacy level include hooking up ordering systems with suppliers, sending in Internet-of-Things sensors to monitor temperature and stock levels, and laying out internal management systems that put all the important info in one place, such as inventory, sales and expired meds.

At the academic and research level, future studies could blend hard data (like waste rates and sales figures) with the perspectives of the people who work in the pharmacies, to get a more nuanced picture of how digital transformation is going, and should do comparative studies between urban and rural pharmacies to see where the biggest digital maturity gaps lie, and require interdisciplinary teams from business schools, IT departments and pharmacy faculties to work together to make more holistic, effective solutions.

Conclusion

Our research delved into the possibility of predictive inventory optimisation and a zero-waste system, when investigating the potential of digitalization in the supply chain of community pharmacies.

Coming from existing studies and theoretical frameworks, TAM and DSCMM, we discovered that digital integration is able to significantly improve the accuracy of our forecasts, cuts down on medicines that go to waste and gives patients a much higher level of satisfaction.

Digital transformation is not all about new technology, though, it's a profound change in the way that organisations view themselves, their mindset and their purpose.

Well-known Saudi Vision 2030 provides the template for community pharmacies in the Kingdom to transform into predictive, sustainable and people-centred healthcare facilities, and it's now down to us to make this vision a reality.

The success of this process will depend on our capacity to learn, adapt, and commit to effective communication between every party in the pharmaceutical supply chain.

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