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CLASSIFICATION OF ONLINE CONSUMERS ON HIGH/LOW USAGE: A STUDY BASED ON TECHNOLOGY ADOPTION MODEL

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INTRODUCTION

The emergence of e-pharmacies, particularly in India, has been one of the most significant revolutions in the pharmaceutical industry in recent years. Online pharmacies are growing increasingly popular for a variety of reasons, including the ability to purchase prescription medications without visiting a physical shop, contactless delivery, and convenience (Dcruz et al, 2022; Gupta et al, 2022). Despite these advantages, there are concerns about how online pharmacies are controlled, such as the selling of illegal drugs, ambiguous legislation, and counterfeit medications. As a result, more rules and certification processes are necessary to protect public health (Saraswat et al., 2020; Shaikh et al., 2019). The increasing reliance of customers on online platforms for pharmaceutical needs, notably during the pandemic, has accelerated the shift to e-pharmacies due to the increase in internet usage. This indicates changing patterns in pharmaceutical purchasing and consumer behaviour (Sharma, 2022).

Several challenges faced by e-pharmacies are emphasised in the study papers. Consumer fraud, the sale of prescription-only medications without a prescription, the possibility of counterfeit and subpar medications, data privacy concerns, and regulatory issues caused by a lack of specialised regulatory frameworks in low- and middle-income countries (LMICs) (Miller et al, 2021). The transition to electronic prescribing (e-prescribing) systems introduces new challenges, such as incorrect medication selection, concerns about security and safety perceptions, system costs, patient awareness, and the need for education to mitigate the negative effects of technological inexperience on workflow efficiency (Alzahrani et al, 2024; Tan et al, 2023). To solve these challenges, novel regulatory measures, collaboration with law-abiding enterprises, and assurance that authorities have the expertise to effectively supervise e-pharmacy operations will be required (Miller et al, 2021).

People throughout the world are increasingly turning to e-pharmacy services, especially during times of crisis, like as the COVID-19 outbreak. According to research, a sizable portion of respondents favour telepharmacy services over conventional in-person consultations since they can save money, reduce the risk of communicable infections, and save time (Moulaei et. al, 2022). Furthermore, licenced retail chemists in emerging nations are becoming more interested in e-commerce and e-pharmacy services; important factors influencing this development include consumer norms, socio-technological trends, competitive pressure, and regulatory compliance preparedness (BAKAR et. al, 2022). Additionally, research indicates that consumers, especially in nations like Romania, are increasingly using online pharmacies due to their benefits, which include reduced costs, simplicity of use, privacy, a larger range of products, and speedy access to things and information (Cherecheș & Popa, 2021). Additionally, even if a large number of people are aware of online pharmacies, their choice for offline purchases is influenced by worries about the reliability of websites and the quality of the medications they offer, highlighting the need for user education, awareness, and guidelines (Bansal et. al, 2022). In general, it is anticipated that the trend of using e-pharmacy services would continue to expand due to factors

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including convenience, contactless delivery, and the evolving healthcare service environment (Gupta et. al, 2022).

LITERATURE REVIEW

There are a number of variables that might increase the danger of utilising e-pharmacies, including perceived risk, perceptions of trust, and possible prescription mistakes. Research indicates that clients view dangers when buying prescription pharmaceuticals online, in particular, since they have doubts about the legitimacy of the website and the validity of the product (Savant & Kareppa, 2022). Electronic prescription systems provide additional difficulties such as erroneous drug selection and increasing death rates, especially in paediatric patients, even if they are helpful in decreasing medication mistakes and improving patient safety (Turki et. al, 2024). Additionally, an evaluation of the hospital's e-prescribing systems' usability revealed that inputting clinical data presents challenges and that further development is necessary to ensure user satisfaction and effectiveness (Heed et al., 2022). In pharmacy contexts, risk assessments of e-prescription technologies have shown difficulties such as the lack of required software capabilities and the probability of errors caused by email phishing efforts (Bowman & Acharya, 2019). In conclusion, while e-pharmacies are handy, they pose risks that should be addressed by better system design, user education, and regulatory actions.

Customers can benefit from e-pharmacies' many offerings, including competitive pricing, home delivery, affordability, and convenience of use (Agarwal & Parkhi, 2021; Agarwal & Bhardwaj, 2020). These advantages are especially beneficial to chronically sick patients, the elderly, and others who are unable to visit physical pharmacies (Agarwal & Parkhi, 2021). The COVID-19 epidemic has compelled people to accept digital solutions, hastening the introduction of e-pharmacies (Agarwal & Parkhi, 2021). Perceived usefulness, ease of use, dependability, and health literacy are all characteristics that influence client acceptance of e-pharmacies. However, there are still problems with drug security, reliability, and accuracy (Agarwal & Bhardwaj, 2020). To address these issues and speed up medication delivery, certain e-pharmacy systems employ GPS technology to find nearby pharmacies and expedite deliveries (Devulapalli Praneetha et al., 2023). Despite certain challenges, e-pharmacies are progressively overtaking traditional pharmacies due to their simplicity of use and increased accessibility (Devulapalli Praneetha et al., 2023).

E-pharmacies provide clients more accessibility and convenience, which is especially beneficial for long-term patients and people with limited mobility (Agarwal & Parkhi, 2021). They provide benefits such as cost-effectiveness, free home delivery, quick service, and 24/7 availability (Savant & Kareppa, 2022), as well as competitive prices that make medications more accessible (Agarwal & Parkhi, 2021). Customers enjoy features such as product availability, customer service, discounts, user experience, and purchasing ease (Agarwal & Parkhi, 2021). However, e-pharmacies can have disadvantages, such issues with reliability, security and payment, and the potential for making the incorrect purchase (Agarwal & Bhardwaj, 2020). Furthermore, there are risks associated with drug misuse and self-medication, particularly with Schedule H and X medications (Savant and Kareppa, 2022). Despite these concerns, e-pharmacies have grown in popularity, particularly during the COVID-19 pandemic, when clients switched to online services (Agarwal & Parkhi, 2021; Soboleva et al., 2022).

High levels of patient satisfaction with e-pharmacy services have been reported in recent research.

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According to a Romanian survey (Etidal-Mihaela Manoliu-Hamwi et al., 2022) 67.8% of respondents were happy with online chemist's services overall, with a specific appreciation for the professional abilities of chemists (77.7%) and pharmaceutical pricing (70.9% E-pharmacies in India provide advantages including affordable prices, ease of use, and enhanced accessibility, particularly for individuals with chronic conditions and restricted mobility (Agarwal & Parkhi, 2021). User experience, accessibility to medications, discounts, and convenience of purchase are all factors that affect consumer approval (Agarwal & Parkhi, 2021). Nonetheless, issues with security, dependability, and prescription mistakes continue to exist (Agarwal & Bhardwaj, 2020). Telepharmacy services were more well-known during the COVID-19 pandemic; according to one survey, patient satisfaction for self-home treatment was 76.5% (Muliana et al., 2022). There is still room for development despite these encouraging results, especially in the areas of patient counselling and service maximisation (Etidal-Mihaela Manoliu-Hamwi et al., 2022; Muliana et al., 2022).

The tendency to use e-pharmacies in India has been studied recently. According to research, there is an increasing trend in the usage of e-pharmacies; 46.34% of respondents said they are presently using them, and 89.03% said they will use them in the future (Gupta et al., 2022). Convenience, contactless delivery, competitive price, and better access for long-term patients and individuals with restricted mobility are factors that impact the use of e-pharmacies (Gupta et al., 2022; Agarwal & Parkhi, 2021). According to Yadav et al. (2020), although 91.76% of doctors were aware of e-pharmacies, only 22.35% had ever used them, and 56.47% thought they were unsafe. The adoption of e-pharmacies and referral intention are favourably correlated with performance expectation, effort expectancy, social influence, and hedonic motivation (Srivastava & Raina, 2020). But there was no relationship between adoption and gender or educational attainment (Srivastava & Raina, 2020). It is critical for doctors to keep up to date with e-pharmacies while upholding ethical standards, as the practice becomes more widespread (Yadav et al., 2020).

The literature review indicates that use of online pharmacy is associated with knowledge about its benefits, ease, risks and satisfaction. How strongly these are associated is yet to be explored. It is proposed that on the basis of scores that are assigned to the benefits, use and satisfaction, one can correctly classify the buyers of online pharmacy into high and low categories. The theoretical basis for this hypothesis is rooted in theory of technology adoption model (TAM) (Figure-1)

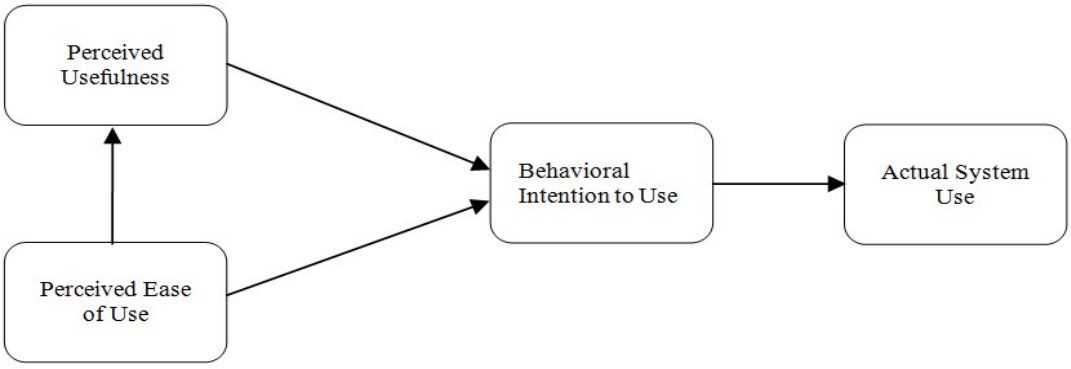

Figure-1: Technology Adoption Model.

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The acceptance or rejection of technology is still up for debate given its rapid advancement, especially in the area of information and communication technologies (ICT), and its pervasiveness in both personal and professional spheres. Many theories and models of technology acceptance and effective use have been developed in the previous few decades as a result of the scientific community's interest in answering this topic. More than 25 years after its introduction by Fred Davis, the technology acceptance model (TAM) has gained traction as a leading paradigm for analysing the variables influencing users' adoption of new technology. Perceived usefulness and ease of use are two variables that the TAM assumes have a mediating function in the complex link between potential system utilisation and external variables, or system features. TAM, which is based on the psychology-based theories of planned behaviour (TPB) and reasonable action (TRA), has become a key tool for understanding how people behave when using technology. Comprehensive and thorough research in the topic is impossible without an awareness of the model's beginnings, development, and adjustments, as well as its limitations.

TAM has emerged as a leading framework in Information Systems, largely due to its clarity and straightforwardness. Nonetheless, it is not without flaws, and not every TAM relationship is replicated across all research; there is considerable diversity in the estimated outcomes across various studies involving different user groups and systems.

Methodology: This study aims to investigate the relationship between the frequency of relying on online pharmacies and the benefits that online pharmacies provide, as reported by their customers. It is being hypothesized that more people find it beneficial, more will be their inclination to rely on online pharmacies. Presumably, people who are convinced about the advantages of online pharmacies are also the ones who use them more often. The study's goal is to determine whether online pharmacy customers can be categorized as high or low frequency buyers based on their perceptions of the risks, rewards, convenience, satisfaction, and frequency of use associated with these services. A measurable questionnaire was created in order to accomplish the goal. To achieve the purpose a questionnaire was developed to measure latent constructs namely risk (7 items), ease (5 items), benefits (8 items), satisfaction (6 items) and frequency (5 items) of use. But by maintaining high/low values, the sum of frequency continuous scale has been made categorical. This has been done to make classification on this scale possible. Online and offline methods were used to conduct the survey in Northeast India, with the exception of Sikkim. The information was gathered between June 22 and August 23. By considering the opinions of five healthcare researchers, the questionnaire's face validity was established. There has been data analysis using multi-layer perception networks. For the analysis Frequency of ordering medicines from online pharmacy (categorical) is the dependent variable and risk, ease, benefits and satisfaction are independent variables.

Results and Analysis:

The details of this study are outlined below. An artificial neural network is made up of interconnected layers. Multi-layer perceptron networks, a type of neural network, have multiple layers and are trained

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using the backpropagation method. This kind of neural network is a deep learning algorithm. The network comprises three main layers: input, hidden, and output, forming a complete Artificial Neural Network. Table 1 summarizes the case processing. Of the 501 valid examples, 357 (71.3%) were used for training and 144 (28.7%) were used for final testing.

Table-1: Case Processing Summary

		N	Percent
Sample	Training	357	71.3%
	Testing	144	28.7%
Valid		501	100.0%
Excluded		1	
Total		502	

Table-2 presents details about the network configuration. It includes input layers such as Risk, Ease, Benefit and Satisfaction, with a single hidden layer. The dependent variable, Frequency, is divided into two categories: high and low. The activation function employed is softmax, which is advantageous because it normalizes the output to a range of 0 to 1 and ensures that the sum of all outputs equals 1, thereby forming a probability distribution. The error function used to measure the disparity between the desired and predicted outputs is cross-entropy, expressed mathematically as:

$$\text{Loss} = -(y log(p) + (1-y) log(1-p))$$

where:

- p is the predicted probability, and
- y is the indicator (00 0 or 111 in the case of binary classification)

The Binary Cross Entropy Loss imposes substantial penalties on inaccurate predictions, particularly those that diverge further from the true y label, utilizing the negative logarithm

Table-2: Network Information

Input Layer	Factors	1	Risk
		2	Ease
		3	Benefit
		4	Satisfaction
	Number of Units		87
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1[a]		3
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	Freqcat
	Number of Units		2
	Activation Function		Softmax
	Error Function		Cross-entropy

a. Excluding the bias unit

The model summary (Table-3) indicates a cross-entropy value of 208.786, with a corresponding training incorrect prediction rate of 31.9%. For testing, the cross-entropy value is 83.707, with a corresponding

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incorrect prediction rate of 29.9%.

Table-3: Model Summary		
Training	Cross Entropy Error	208.786
	Percent Incorrect Predictions	31.9%
	Stopping Rule Used	1 consecutive step(s) with no decrease in error[a]
	Training Time	0:00:00.19
Testing	Cross Entropy Error	83.707
	Percent Incorrect Predictions	29.9%
Dependent Variable: Freqcat		
a. Error computations are based on the testing sample.		

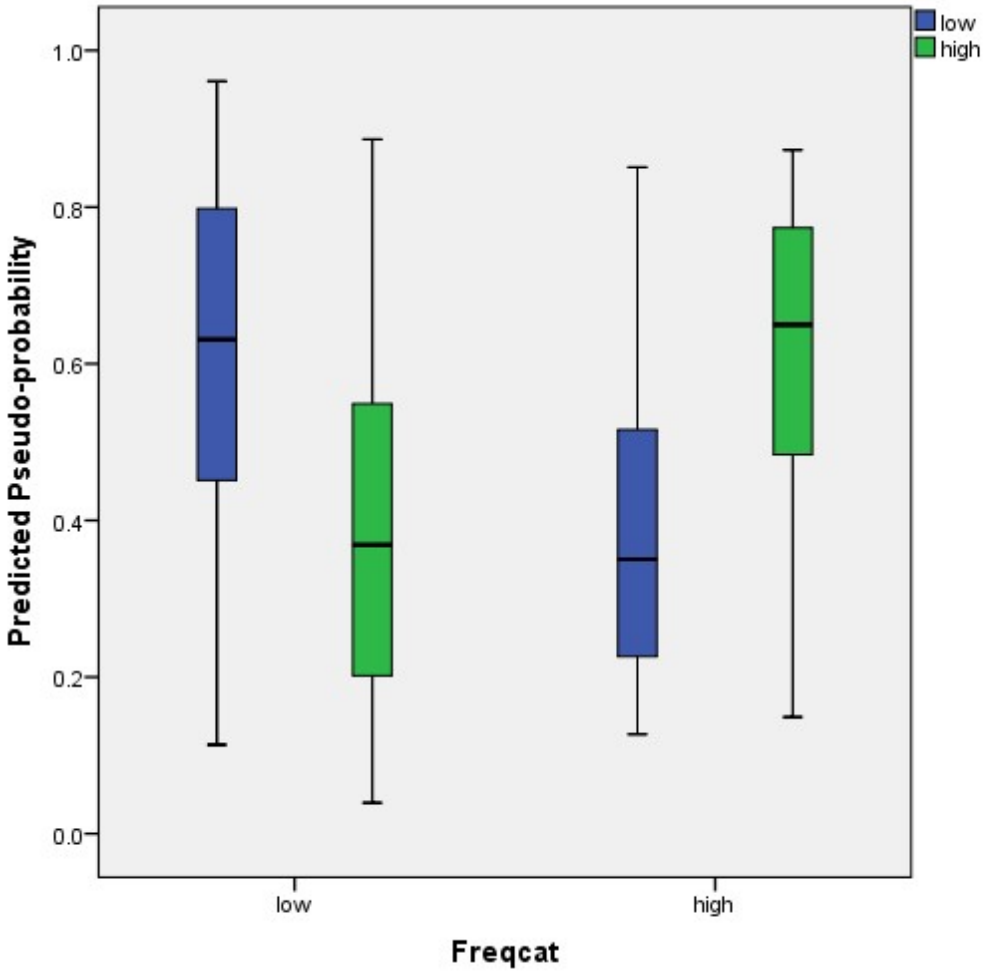

Figure-1: Predicted by observed chart

The chart comparing predicted versus observed values shows how well the model's projections match the actual outcomes for each dependent variable. In the boxplots displaying anticipated pseudo-probabilities for categorical dependent variables, the observed response category is used to group the

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data. The first boxplot, where values exceed 0.5, signifies accurate predictions. This visualization illustrates how anticipated pseudo-probabilities are categorized for the dependent variable "Frequency" across the entire dataset. The first boxplot demonstrates the model's ability to correctly predict Respondents low Frequency cases as such. Conversely, the second boxplot indicates instances where high Frequency of Respondents is incorrectly classified as low. These findings are derived from the actual data observed.

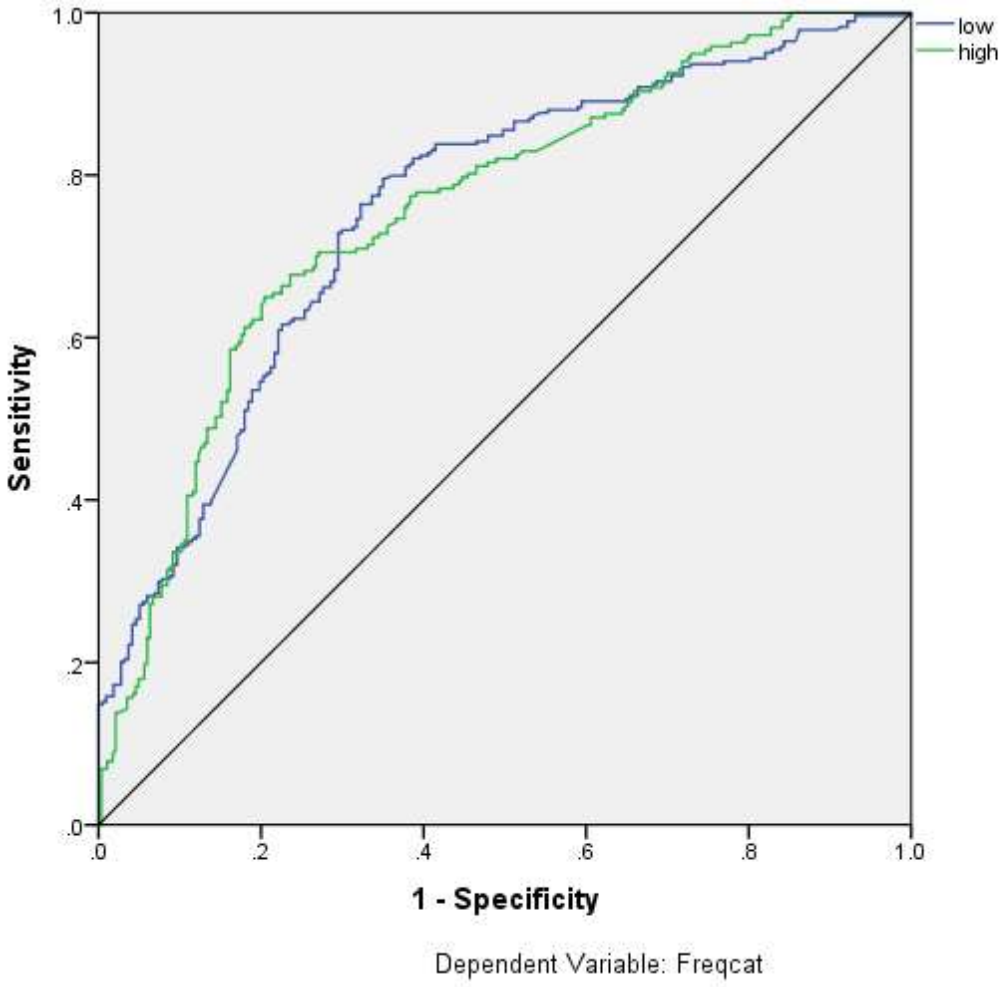

Figure-2: ROC Curve

ROC (Receiver Operating Characteristic) analysis and AUC (Area Under the Curve) are widely employed in Data Science.

Accuracy and recall, as key performance indicators (KPIs), heavily depend on correctly identifying positive instances. In contrast, ROCs and AUCs utilize True Positive Rate (TPR) and False Positive Rate (FPR) metrics, which encompass both positive and negative instances.

Precision represents the proportion of correctly predicted positive instances among all predicted positives. The ROC curve is a concise tool used to visualize the balance between precision and recall, where the x-axis plots False Positive Rate and the y-axis plots True Positive Rate.

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Table-4: Area Under the Curve		
		Area
Freqcat	low	.758
	high	.758

The Area Under the Curve (AUC) ranges between zero and one, where values typically exceed 0.5 in theory. In Fig-2, both low and high Frequency categories exhibit AUC values exceeding 0.7, suggesting effective classification. Table-4 specifies the precise AUC value as 0.758, notably surpassing 0.5, which indicates a positive outcome.

Table-5: Classification				
Sample	Observed	Predicted		
		low	high	Percent Correct
Training	low	175	30	85.4%
	high	48	104	68.4%
	Overall Percent	62.5%	37.5%	78.2%
Testing	low	65	14	82.3%
	high	24	41	63.1%
	Overall Percent	61.8%	38.2%	73.6%
Dependent Variable: Freqcat				

The table-5 shows that categorization of buyers of online pharmacies on low and high Frequency, is possible. During training, 175 (85.4%) cases of low Frequency of respondents were accurately identified, while 30 (14.6%) were misclassified. Conversely, 104 (68.4%) instances of high Frequency of respondents were correctly classified, with 48 (32.6%) misclassified. In the testing phase, the accurate classification rates were 82.3% for low Frequency and 63.1% for high Frequency. Overall, the classification success rate is 73.6%, which is considered excellent.

Discussion: Organizations progressively depend on innovative frameworks to drive their exercises in a profoundly digitalized and universally associated trade environment. This study's driving force was recognizing that numerous organizations must expand their budgetary frameworks, especially those in locales such as Qatar, where commerce instability is influenced by fluctuating oil costs. We pointed to contribute to this zone, cantering particularly on embracing online drug stores as a feature of e-commerce business enterprise. In arrangement with our speculations, we found that a few pivotal components altogether affected the behavioral deliberate toward embracing online drug store administrations. Among these variables, seen hope risen as a basic determinant. This result is steady with prior inquire about, which emphasizes the impact of seen hope on behavioral deliberate. When people accept that utilizing a particular innovation, in this case, online drug store administrations, will bring them unmistakable benefits or meet their needs, they are more inclined to adopt it. Believe in innovation was another pivotal determinant of behavioral deliberate. Clients who feel innovation is solid, secure and reliable are likelier to embrace it. Believe can be set up through straightforward communication around information utilization, security measures and past fruitful encounters of other clients. Those who get it dangers components superior are more likely to utilize it as well.

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There are many studies that echo the results that have been found with this study (Al Halbusi *et al* (2024); Sabbir *et al* (2021); Shrivastava & Raina (2021); Al Sideiri *et al* (2021); de & Santos (2021); Ezeudoka & Fan (2024); Ghosh *et al* (2023); TJ, V. A., George & Sivakumar (2022); Chatterjee et al (2024))

In expansion to hypothetical commitments, the observational discoveries of this consider offer a few down to earth rules related to the advancement of the online drug store stage, which the decision-makers (e.g. online drug store engineers) might consider keenly to hurry the take-up of online drug store among the youthful shoppers. As of current discoveries, Performance Expectancy (PE) and Effort Expectancy (EE) are critical drivers of online drug store appropriation. Subsequently, whereas advancing online pharmacy, it is important to emphasize the preferences and ease of utilizing the benefit that they give to the clients in overseeing their day-by-day health-related exercises more effectively. Policymakers and benefit suppliers ought to advance the conviction that online drug store is an easy-to-use and inventive channel of getting fundamental medication inside a brief time. Hence, online drug specialists and retailers seem make the full utilize of the word-of-mouth impact through distributing daily paper articles and making social media bunches (e.g. Facebook page, online drug store client community). Facilitating Conditions (FCs) have too gotten specific consideration from youthful clients who are anticipated to buy pharmaceutical from online drug stores. Subsequently, it is imperative to centre on the part of FCs in the selection of online drug stores by affirming supporting foundations (e.g. online stages) and rules are in put. Additionally, the experimental discoveries outline the positive affect of perceived Risk (PR). Subsequently, to set up believe among the youthful era, online pharmaceutical suppliers ought to guarantee an error-free conveyance handle, making beyond any doubt that the right medication in the right amount is conveyed to the right address. Other than, online retailers are suggested to get particular official certificates from specialists or administrative organizations, which would set up believe among the youthful clients.

Conclusion: The major objective of this study has been to explore the possibility of classifying the consumers of online pharmacy on their frequency of purchase (High/low) on the basis of their views on benefits, ease, risk and satisfaction. We found that almost 75% consumers can be classified correctly. This is a substantial success. The question is why only 75% of consumers can be classified correctly? Answer lies in the limitation of TAM, the model on which the hypothesis of this study is based. TAM assumes consumers to be rational. This is not absolutely true. Consumers are emotional beings to and hence some of their actions are difficult to predict. Those who score low on TAM variables may still buy from online pharmacies because of personal or social circumstances. In contrast those who still score high may not be utilizing online pharmacies for personal reasons. Nevertheless, study provides interesting insight into consumer behaviour.

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