

Understanding the determinants of online pharmacy adoption: A two-staged SEM-Neural network analysis approach

Abstract

Purpose: The current study aims to understand the determinants of online pharmacy or epharmacy adoption among young consumers in Bangladesh using an extended Unified Theory of Acceptance and Use of Technology (UTAUT) model.

Design/methodology/approach: A structured Google Docs questionnaire was sent out to 420 respondents using messenger service; 285 useable responses were finally extracted. Data were empirically validated using the two-staged SEM-Neural network analysis approach.

Findings: The robustness of the classical UTAUT model remains intact in the context of online pharmacy adoption. Among the integrated variables, while perceived trust and health literacy were found significant, perceived risk and personal innovativeness were found insignificant in determining consumers' intention to adopt online pharmacy. The neural network analysis provided further verification of these findings derived from the structural equation model.

Practical implications: The findings of this study would facilitate in devising better strategies for entering or expanding online pharmacy business in developing countries like Bangladesh.

Originality/value: The originality of the current study relates to the twofold contributions of this study. First, while this study extended the classical UTAUT model by incorporating perceived risk, perceived trust, personal innovativeness, and health literacy, the inclusion of the following two variables is fresh within extant online pharmacy literature. Second, by employing a two-staged SEM-Neural network analysis approach, this study advances the past studies on e-commerce adoption in pharmaceutical settings and provides a general understanding of the customers of developing countries.

Keywords: UTAUT, Health literacy, Personal innovativeness, Neural network analysis, Online pharmacy.

Paper type: Research paper

1. Introduction

Rapid development in information and communication technology, and an increasing number of internet users are opening new doors for businesses. With the benedictions of the Internet, currently, tremendous growth has been observed in online purchasing for diverse commodities such as, grocery, clothing, jewelry, e-banking, and e-health. In line with this, online pharmacy, otherwise known as epharmacy, is about to create a massive demand in the upcoming days. The online pharmacy is an Internet-based merchant that vends medicines over the Internet, including prescription-only and over the counter (OTC) medicines, and delivers them through mail at consumers' doorstep (Bessell *et al.*, 2002; Desai, 2016).

Selling medicine over the Internet was started in the USA in the late 1990s (Orizio *et al.*, 2011). From then, its growth and popularity are expanding throughout the world. In 2018, the global epharmacy market was about \$42.32 billion that is projected to be \$107.53 billion by 2025, estimating a compound annual growth of about 14.26% from 2019 to 2025 (Zion Market Research, 2019). Online pharmacies offer lower price and transaction costs, increased access from remote areas with greater anonymity for consumers. Moreover, online pharmacies offer discounts and fast delivery services at consumers' doorstep (Desai, 2016). These are the reasons that trigger the increased popularity of online pharmacies around the world.

Due to COVID-19, people are accepting a new way of life with social distancing and self-isolation. Hence, while particular sectors like tourism, aviation, offline retail sales are experiencing a decline in sales, online retailing is facing a new wave of increased demand. In response to COVID-19, healthcare sectors have adjusted with the augmented digital transformation of healthcare services (Nicola *et al.*, 2020). In line with this, online pharmacies are continuously replacing traditional offline pharmacies at an accelerating rate. However, it is difficult to exploit the opportunities of ICT application in different service sectors until consumers accept and take full advantage of those new systems (Rogers, 2003; Awa *et al.*, 2015; Sivathanu, 2019). In this context, while it is essential to comprehend the factors influencing consumers' adoption of online pharmacy, extant studies in this regard are still in its infancy (Yin *et al.*, 2016). Given that circumstances, it becomes imperative to have integrated explorations on the particular factors that critically explain consumers' behavioral intentions and predict such an adoption process.

In Bangladesh, the online pharmacy market is growing as the number of internet users is increasing. A few decades ago, Bangladesh was entirely dependent on imported medicine; however, presently, 97 percent of medicines are produced locally, while the country is exporting medicines to 147 countries (Ahmed, 2019). Furthermore, during the current decade, the domestic market for pharmaceutical products has expanded at a rate of around 15 percent, and it is expected to be worth between BDT 400 and 500 billion by the year 2022-2023 (Ahmed, 2019). Besides, the government's vision of 'Digital Bangladesh' has made significant improvements in the ICT sector. These are the key parameters that make the epharmacy market a burgeoning market for the future. Banglameds is the first online pharmacy in Bangladesh that delivers OTC and prescription

medicine all over the country (Khan, 2020). Some other online pharmacies such as, biomed.com, dhakapharma.com, lazzpharma.com, healthshopbd.com, ousud.com, are also getting popularity (Sarker *et al.*, 2019). Having such prospects in Bangladesh, online pharmacy still lacks sufficient research attention.

Investigating consumers' perception of values and risks associated with e-pharmacy usage Wiedmann *et al.* (2010) identified four clusters of e-pharmacy users. Svorc (2012) concluded that perceived risk and usefulness are significant predictors influencing consumers' intention to purchase medicaments online. In the context of China, Su *et al.* (2011) focused on the business models and management of online pharmacies, and Yin *et al.* (2016) inferred that performance expectancy, social influence, perceived risk, and trust have a significant influence on consumers' adoption intention of online pharmacy. Besides, recent studies focused on consumers' readiness to purchase medicine online in Saudi Arabia (Abanmy, 2017; Alsadoun *et al.*, 2020), integrating contemporary marketing practices within the e-pharmacy context (Ignjatović and Stanić, 2019), and impacts of e-pharmacy on society in India (Singh *et al.*, 2020). In the context of Bangladesh, past studies analyzed the prospects and challenges of e-pharmacy (Ferdous and Ishtiaque, 2013; Sarker *et al.*, 2019).

While these are significant contributions to extant online pharmacy literature, a few research gaps are still evident. First, until 2011 most of these studies are primarily based on the US, Europe, and South America (Orizio *et al.*, 2011). Afterward, a few studies were conducted in other regions (e.g., Yin *et al.*, 2016); however, the findings of those studies are not entirely applicable in Bangladesh as cultural differences among countries have a significant influence on consumers' intention (Karakaya *et al.*, 2014). Second, while most of the past studies are qualitative, less attention was drawn on factors affecting consumers' intention to adopt online pharmacy. Third, whereas it is essential to study an individual's health literacy, the inadequate focus has been acknowledged in considering health literacy as a determinant of online pharmacy adoption (Orizio *et al.*, 2011). It would appear that no past study has yet measured health literacy as a predictor in the context of online pharmacy adoption. Fourth, while a few past studies adopted a two-staged modeling approach, including SEM (structural equation model) and Neural network in m-commerce (Chong, 2013) and m-payment (Liébana-Cabanillas *et al.*, 2018) acceptance, the application of such an approach remains scarce in existing online pharmacy literature. In this regard, recent studies on online purchasing urged to use such an approach instead of using only classical statistical data analysis (e.g., Multiple regression analysis, SEM) (Brusch and Rappel, 2020; Soh *et al.*, 2020).

This study intends to address the mentioned research gaps and contribute to the extant literature on online pharmacy in four significant ways. Firstly, as a consumer-centric study, this will use the Unified Theory of Acceptance and Use of Technology (UTAUT) model as the theoretical framework underpinning the study to explore the factors affecting consumers' behavioral intention to adopt online pharmacy. The success of any technological innovation requires consumers' acceptance (Rogers, 2003) that is influenced by technological and individual characteristics and

traits (Otto and Harst, 2019). In this context, UTAUT clearly explains technological “characteristics at the individual (performance expectancy and effort expectancy), organizational (facilitating conditions), and social (social influence) levels” (Isaac *et al.*, 2019, p. 336). Secondly, perceived risk, perceived trust, personal innovativeness, and health literacy will be added as additional factors to the UTAUT model to better explain consumers’ behavioral intention to adopt online pharmacy. Thirdly, this study will adopt a sequential multi-method study design suggested by Scott and Walczak (2009), whereby the SEM will explain causal relationships, and the significant factors from SEM analysis will further be used as inputs of neural network analysis to predict online pharmacy adoption. This will improve the validity and confidence in the study findings (Chong, 2013). Finally, the study will contribute to the general understanding of consumers of developing countries pertaining to online pharmacy adoption.

2. Theoretical background and hypotheses

Information system (IS) research is widely used to predict how and why people adopt new information technologies (Rana *et al.*, 2016). Past scholars have adopted different models and theories to study consumers’ behavioral intention to adopt new technologies. Some of these models are, the Technology Acceptance Model (TAM) (Davis, 1989), the Technology Acceptance Model 2 (Venkatesh and Davis, 2000), the Technology Acceptance Model 3 (Venkatesh *et al.*, 2008), the Theory of Planned Behavior (TPB) (Ajzen, 1991) and the Innovation Diffusion Theory (IDT) (Rogers, 1995).

Previous studies opined that the TAM and UTAUT are widely recognized for analyzing IS adoption behavior (Isaac *et al.*, 2019; Aref and Okasha, 2020). Although TAM has high acceptability in predicting an individual’s acceptance of innovation, some scholars found it as an inappropriate model in the healthcare context (e.g., Holden and Karsh, 2010). Besides, theoretical models mentioned above have been used along with different independent variables to explain an individual’s behavioral intention to adopt new technology. However, most of these theories and models are developed from the organization’s perspective (Venkatesh *et al.*, 2012). In contrast, the UTAUT model (Venkatesh *et al.*, 2003), aims to achieve a unified view of influential factors in adopting new technologies from the end-users’ perspective. Moreover, UTAUT has been a robust model for examining the users’ acceptance of online shopping (Soh *et al.*, 2020) and health information technology, including mHealth (Alam *et al.*, 2020) and e-Health (Boontarig *et al.*, 2012). It is also worth noting that the UTAUT model explains as much as 70% of the variation in behavioral intention (Nuq and Aubert, 2013). Consistent with this research foundation, the UTAUT model has been employed as the theoretical framework of this study.

However, several past studies have put forward the reasonableness for extending the basic UTAUT model in the context of accepting online shopping (Soh *et al.*, 2020) and health information technology (Hossain *et al.*, 2019; Alam *et al.*, 2020). In this regard, Hossain *et al.* (2019) broadened the basic UTAUT model by including personal innovativeness as one of the additional factors for predicting physicians’ adoption of the electronic health record. Besides, Yin *et al.* (2016) extended

the classical UTAUT model by including perceived risk and perceived trust to examine consumers' intention to purchase medicine online in China. Moreover, a few recent studies have argued that perceived risk (e.g., Ofori and Appiah-Nimo, 2019), perceived trust (Rahman *et al.*, 2018), and personal innovativeness (Natarajan *et al.*, 2017) is important in determining consumers' behavioral intention toward online purchasing. Since several extant studies (e.g., Yin *et al.*, 2016; Natarajan *et al.*, 2017) reported the relevance of perceived risk, perceived trust, and personal innovativeness in the case of adopting new technology (e.g., online purchasing), examining of such factors as determinants of online pharmacy adoption seems suitable. Thus, building on these empirical arguments by previous studies, this study added perceived risk, perceived trust, and personal innovativeness to the basic UTAUT model. Furthermore, in response to the call for inclusion by Orizio *et al.* (2011), this study included health literacy as a determinant within the original UTAUT model. Following this, the arguments for the proposed hypotheses are presented.

2.1. Performance expectancy (PE)

Performance expectancy is the degree to which a person believes that using the technology will enable him or her to gain in job performance (Venkatesh *et al.*, 2003). When technology becomes more beneficial and suitable in everyday life, customers become interested in accepting and using it (Alalwan *et al.*, 2017; Sivathanu, 2019). Previous studies found performance expectancy as one of the significant and positive determinants of consumers' behavioral intention to accept mHealth services (Alam *et al.*, 2020) and online shopping (Soh *et al.*, 2020). In this regard, it would be interesting to see whether such an influence of performance expectancy exists in the context of online pharmacy. Thus, it is postulated that:

H1. Performance expectancy has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

2.2. Effort expectancy (EE)

Effort expectancy refers to the extent to which users enjoy ease related to the use of a system (Venkatesh *et al.*, 2003). Consumers are likely to use new technologies that are simple and convenient in using (Alalwan *et al.*, 2017; Shareef *et al.*, 2017). In the context of online pharmacy, former studies confirmed that effort expectancy is an essential predictor in predicting consumer acceptance of e-health (Boontarig *et al.*, 2012) and mHealth (Hoque and Sorwar, 2017) services. In line with this, this study hypothesizes that:

H2. Effort expectancy has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

2.3. Social influence (SI)

Social Influence refers to “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh *et al.*, 2003, p. 451). In the context of technology

acceptance, people often act according to their social interactions with others (Ratten, 2015). Professional caregivers, friends, and family members, even children, can influence the acceptance of new technology (Porter and Ganong, 2002). A significant positive impact of social influence has been reported on consumers' behavioral intention to accept online shopping (Soh *et al.*, 2020) and health information technology such as, e-health (Boontarig *et al.*, 2012) and mHealth (Alam *et al.*, 2020). This discussion has led this study to conjecture that social influence might have a positive impact on consumers' intention to adopt online pharmacies. Thus, the following hypothesis is formulated:

H3. Social influence has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

2.4. Facilitating conditions (FC)

Facilitating condition refers to supporting organizational and technical infrastructures that assist an individual in using a system (Venkatesh *et al.*, 2003). The higher the level of organizational support, the more the positive inclination toward acceptance of health information technology (Steele *et al.*, 2009). Past studies demonstrated facilitating condition as a positive determinant of consumers' behavioral intention in the context of e-health (Boontarig *et al.*, 2012) and mHealth (Alam *et al.*, 2020) adoption. Furthermore, facilitating conditions has been illustrated as positively influential in consumers' acceptance of online shopping (Soh *et al.*, 2020). Thus, drawing on these discussions, this study proposes the following hypothesis:

H4. Facilitating conditions has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

2.5. Perceived risk (PR)

Perceived risk refers to the subjective feelings of uncertainty and harmfulness associated with the usage of new technologies or services (Yin *et al.*, 2016). Consumers perceive more risks and uncertainties in the event of online purchasing than offline ones (Aref and Okasha, 2020), meaning consumers often fear that a third party could misuse their personal and financial information shared in online purchasing (Wei *et al.*, 2018). Perceived risk, therefore, negatively influences consumers' intention to purchase online (Featherman and Pavlou, 2003; Koufaris and Hampton-Sosa, 2004). Past studies also reported that perceived risk is an important negative determinant of actual online shopping behavior (Aref and Okasha, 2020) and online medicine purchases in China (Yin *et al.*, 2016). Thus, in line with previous studies (Yin *et al.*, 2016; Wei *et al.*, 2018), this study has considered that product quality, personal health, and information leakage risk comprise perceived risk in the context of online pharmacy, and therefore, hypothesized that:

H5. Perceived risk has a significant and negative influence on consumers' behavioral intention to adopt online pharmacies.

2.6. Perceived trust (PT)

In the context of online purchase, perceived trust refers to the trust in online settings, the vendors, product quality, the transaction method, and the delivery system (Yin *et al.*, 2016). While consumers' trust is important in the event of any business operation (Dowell *et al.*, 2015), it is more crucial in online markets than offline ones (Grewal *et al.*, 2004). Several past studies illustrated the influence of perceived trust on consumers' intention to adopt new technologies (Childers *et al.*, 2001; Pipitwanichakarn and Wongtada, 2019). A significant and positive effect of perceived trust has also been confirmed on consumers' intention to shop online (Rehman *et al.*, 2019) and purchase medicine online (Yin *et al.*, 2016). It is, therefore, hypothesized that:

H6. Perceived trust has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

2.7. Personal innovativeness (PI)

Personal innovativeness refers to the extent to which a person is relatively earlier than others in adopting new technologies (Rogers, 1995). Personal innovativeness is an essential factor in determining consumers' behavioral intention to adopt any new technology (Agarwal and Prasad, 1998). Personal innovativeness is positively related to physicians' adoption of electronic health record (Hossain *et al.*, 2019), consumers' adoption of internet banking (Yiu *et al.*, 2007), and mobile shopping applications (Natarajan *et al.*, 2017). However, such a relationship is yet to be tested in the context of online pharmacy adoption. Consequently, the following hypothesis is put forward in this study:

H7. Personal innovativeness has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

2.8. Health literacy (HL)

Health literacy is defined as “the personal, cognitive and social skills which determine the ability of individuals to gain access to, understand, and use the information to promote and maintain good health” (Nutbeam, 2000, p. 263). Health literacy drives an individual to improve self-reported health status, search for lower healthcare costs (Speros, 2005; Mancuso, 2008), and acquire new knowledge and skills influencing self-care (Paasche-Orlow and Wolf, 2007). Nutbeam's schema, one of the dominating approaches in European and Asia-Pacific public health segments (Nutbeam, 2000), distinguished between three types of health literacy, namely functional health literacy, interactive health literacy, and critical health literacy. In this study, we only considered functional health literacy since it is related to fundamental knowledge required for solving everyday health-related issues (e.g., looking for solutions to regular health problems and risks and lower healthcare costs) (Sørensen *et al.*, 2012). Despite its benefits (e.g., perceived convenience, time-saving, and anonymity), online pharmacy poses several health-related risks (e.g., drug quality, prescription requirement, delivery of wrong medicine) that require an individual to have basic health literacy

to make proper medication choices and be aware of risks. With risk recognition and benefits identification, health literacy might have a significant influence in the context of online pharmacy adoption (Orizio *et al.*, 2011). In line with this, our study is interested to see whether such an influence could be positive, and hypothesizes that:

H8. Health literacy has a significant and positive influence on consumers' behavioral intention to adopt online pharmacies.

Drawing on the abovementioned hypothesized relationships, Figure 1 below exhibits this study's proposed research model:

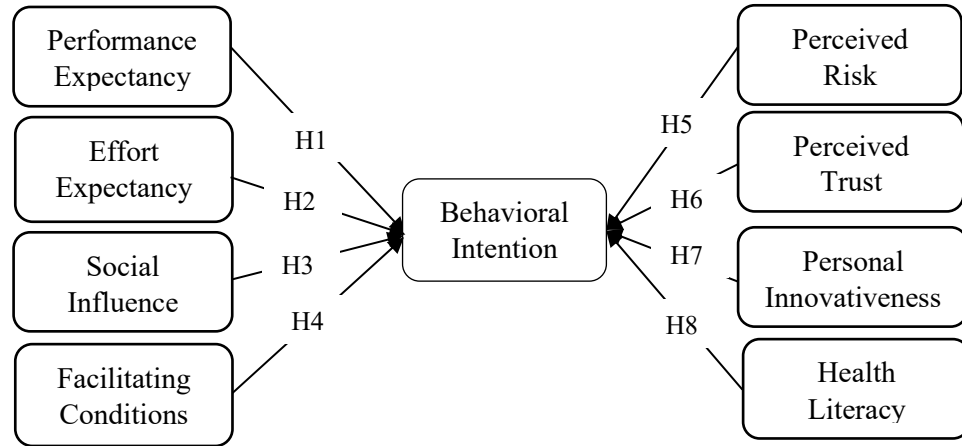


Figure 1: Proposed research model

3. Methods

3.1. Measures

This study has adopted previously validated measurement items to ensure the content validity (Hair *et al.*, 2014). In doing so, the measurement items were adjusted a little, taking the current research context into account. Following the Hinkin's (1998) recommendations, all items were written in a simple, easy-to-understand language. Two voluntary academicians from the marketing and psychology department of the University of Barishal, Bangladesh, were recruited to review and evaluate the measurement items for confirming precision and avoiding redundancy. A pretesting of the questionnaire was performed with 24 undergraduate students from the University of Barishal. At this stage, further changes were made to some of the question-wording based on respondent's feedback. A five point Likert type scale was used (1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree) for estimating all measures. A list of the measurement items, together with their sources is presented in Appendix A.

3.2. Target population

The target population of this study is the young generation, who are more likely to adopt and exploit the benefits of any technological changes (Aref and Okasha, 2020). Besides, this generation

accounts for a large percentage of the total users of healthcare services (Alam *et al.*, 2020). It is highly probable that young consumers will take their current behaviors to older age (Vermeir and Verbeke, 2006) that makes them an important consumer segment for the next 50 years (Brusselsaers *et al.*, 2020). Thus, this segment could be an attractive segment to target and persuade to the adoption of any technological changes.

3.3. Sample and data collection

In the context of developing countries like Bangladesh, most of the older family members are somewhat dependent on their younger ones in using any electronic devices (e.g., mobile phones) (Hoque and Sorwar, 2017) or getting healthcare services. Besides, online shopping adopters are relatively young and educated (Rehman *et al.*, 2019; Aref and Okasha, 2020). This is also evident in the case of online pharmacy adoption (Orsolini *et al.*, 2015; Fittler *et al.*, 2018). Therefore, a sample of university students was chosen for data collection as they belong to the young generation, and are considered as more technology prone than other demographic groups in the society (Lee, 2014). In line with past studies (e.g., Alam *et al.*, 2020), this study employed a convenience sampling technique, and primarily selected probable respondents from this study's investigators' social media network (i.e., Facebook) members (Bangladeshi and university students only). Afterward, two of this study's investigators contacted 511 probable respondents via mobile phone or messenger services. After postulating the primary objectives of this study, probable respondents were enquired for their willingness to partake in the study. A structured Google Docs questionnaire was developed and sent out to 420 willing respondents using messenger service. After finishing the data collection period, which was from February to April 2020, 310 responses were received with a 74% response rate. After cross-checking for completeness, 285 useable responses were finally extracted, and this sample size is comparable to previous similar studies (e.g., Yin *et al.*, 2016) and satisfactory given this study's context (Hair *et al.*, 2014).

3.4. Data analysis

Our study used a two-staged SEM-neural network analysis approach. SEM is the mixture of factor analysis and multiple regression analysis, and it is primarily utilized in analyzing the structural and linear relationships between measured variables and latent constructs (Yang *et al.*, 2016). However, consumers' behavioral intention to adopt online pharmacy might involve both linear and non-linear relationships that might be overgeneralized if we only use SEM. Besides, SEM is unable to "learn" and tolerate noisy data (Hew *et al.*, 2016). These shortcomings of SEM are better overcome by neural network analysis (NNA) (Chong, 2013). In contrast, due to its 'black-box' operation, NNA is not appropriate for hypothesis testing (Chan and Chong, 2012). That means, NNA is not able to estimate path coefficients and *p-value* compared to the SEM method. With this representation, a two-staged SEM-neural network analysis approach is suggested by extant researchers (Hew *et al.*, 2016; Liébana-Cabanillas *et al.*, 2017). Given that the current study examines the classical UTAUT model with four related variables (i.e., perceived risk, perceived

trust, personal innovativeness, health literacy) and the associated intricacies of the consumers' decision-making process, a two-staged SEM-neural network analysis approach seems to be an appropriate application.

4. Analysis and results

The study used principal component analysis (PCA) and structural equation modeling (SEM) with confirmatory factor analysis (CFA). The significant factors derived from SEM were then used as input of neural network analysis for measuring the relative importance of the factors affecting online pharmacy adoption. For analytical purposes, both SPSS (version 23) and AMOS (version 23) software packages were used.

4.1. Demographic analysis

Table I presents the demographic characteristics of the respondents.

[Please insert Table I here]

4.2. Principal component analysis

The study performed principal component analysis (PCA) using the varimax rotation method with Kaiser Normalization in order to estimate the factor structure of the measurement items. The calculated Kaiser-Meyer-Olkin (KMO) measure is 0.84, and Bartlett's Test of Sphericity is significant ($.000 < 0.05$). Both the KMO measure (Tabachnick and Fidell, 2014) and the significance of Bartlett's test of sphericity (Hair *et al.*, 2014) are within the suggested threshold, indicating the acceptance level of sampling adequacy.

The analysis retained a total of nine factors, with eigenvalues exceeding 1.0 and explaining 81.44% of the total variance. Since factor loadings surpassing 0.70 indicate distinct factor structure (Hair *et al.*, 2014), this study used 0.70 as a threshold for factor loadings. Moreover, alpha values are higher than the commonly accepted recommended value of 0.70 (Nunnally, 1978), suggesting satisfactory internal consistency of the items. The summary of the results is reported in Table II.

[Please insert Table II here]

4.3. Measurement model

The overall goodness-of-fit indicators (i.e., $\chi^2_{(df=314)}=563.022$, $p=0.000$, GFI=0.88, CFI=0.95, TLI=0.94, RMSEA=0.05, SRMR=0.04) are within the recommended threshold satisfying acceptable fit for the measurement model (Doll *et al.*, 1994; Hu and Bentler, 1999). Construct reliability, convergent validity, and discriminant validity are assessed in the measurement model. The analysis estimated 28 items of nine constructs. As of Table II, the composite reliability (CR) and Cronbach's alpha of all estimated constructs are greater than 0.82, which is well above the acceptable threshold of 0.70 (Fornell and Larcker, 1981), signifying adequate constructs'

reliability. Besides, composite reliability ranges between 0.82 and 0.91, average variance extracted (AVE) ranges between 0.62 and 0.77, factor loadings (λ) range between 0.73 and 0.94. All these values are higher than the suggested values that confirm the requirements of the convergent validity of measurement scales, as recommended by Fornell and Larcker (1981) and Hair *et al.* (2014).

[Please insert Table III here]

As reported in Table III, non-diagonal elements represent inter-correlation among constructs, and diagonal elements are the square root of AVE. All diagonal elements are greater than the non-diagonal elements in the corresponding rows and columns, meeting the conditions for adequate discriminant validity, as suggested by Fornell and Larcker (1981). Besides, all inter-correlation elements are well below the threshold value of 0.85, indicating the analysis is avoiding multicollinearity (Kline, 2015).

4.4. Structural model

The goodness-of-fit indicators (i.e., $\chi^2_{(df=314)}=563.022$, $p=0.000$, GFI=0.88, CFI=0.95, TLI=0.94, RMSEA=0.05, SRMR=0.04) are within the recommended threshold confirming acceptable fit for structural model (Doll *et al.*, 1994; Hu and Bentler, 1999).

[Please insert Table IV here]

Table IV exhibits that determinants in the model explain 54.7% ($r^2=0.547$) variations in behavioral intention. Among the determinants, EE ($\beta=0.26$, $p<0.001$) is found to have a significant positive impact on the behavioral intention that is consequently followed by FC ($\beta=0.22$, $p<0.001$), SI ($\beta=0.16$, $p<0.05$), and PE ($\beta=0.14$, $p<0.01$). Accordingly, H1, H2, H3, and H4 are supported. These results infer that constructs of the classical UTAUT model (i.e., PE, EE, SI, FC) are successful predictors of online pharmacy adoption. That is, potential users are interested in the online pharmacy due to PE, EE, SI, and FC. Further, PT ($\beta=0.18$, $p<0.001$) and HL ($\beta=0.13$, $p<0.05$) have a positive and statistically significant relationship with e-pharmacy services, supporting hypothesis H6 and H8. As e-pharmacy services are still in its initial stage in many developing countries like Bangladesh, PT might play a vital role in the acceptance of online pharmacy among the young generation. Moreover, potential users' adoption intention of online pharmacy is related to HL, urging online medicine sellers to have careful attention to address an individual's primary health literacy. Nonetheless, the relationship between PR and BI ($\beta=0.12$, $p>0.05$) and PI and BI ($\beta=0.11$, $p>0.05$) are found insignificant. Therefore, H5 and H7 are not supported. These results uncover that PR and PI do not affect the young consumers' perception with regard to online pharmacy adoption.

4.5. Neural network analysis (NNA)

Standard linear statistical analysis, e.g., SEM, can only detect linear relationships that might oversimplify intricate decision-making procedures (Chan and Chong, 2012; Sim *et al.*, 2014; Tan *et al.*, 2014). Consequently, an application of the neural network analysis, which can determine both the linear and non-linear relationships, is often recommended (Liébana-Cabanillas *et al.*, 2017). It was determined that the application of NNA could better identify the complex linear and non-linear associations between antecedents and behavioral intention (Chan and Chong, 2012). Besides, the robustness of NNA is reported in providing greater prediction precision (Tan *et al.*, 2014), which, therefore, might out-perform conventional linear statistical analyses, such as Multiple Regression Analysis (Chong, 2013; Sim *et al.*, 2014). However, NNA involves a “black-box” operational system, meaning it is inappropriate for testing causal relationships (Chan and Chong, 2012). Thus, in line with past studies (e.g., Liébana-Cabanillas *et al.*, 2017; Tan *et al.*, 2014), this study adopted a two-staged analysis thereby firstly, SEM tested the underlying causal relationships between the determinants and dependent variables, and secondly, NNA detected the relative importance of each determinant confirmed significant in SEM.

In this study, the multi-layer perceptron technique of neural networks was employed using SPSS (version 23) (Liébana-Cabanillas *et al.*, 2017; Nawaz and Ahsan, 2018) with the input layer comprising of six significant independent variables from SEM (i.e., performance expectancy, effort expectancy, social influence, facilitating conditions, perceived trust, and health literacy), and the output layer includes one output variable (i.e., behavioral intention). Sigmoid was applied as the activation function for both the hidden and output layer of the NNA. Ten-fold cross-validation was performed to avoid over-fitting of NNA (Liébana-Cabanillas *et al.*, 2017; Nawaz and Ahsan, 2018). A ratio of 90:10 data for training and testing of prediction precision was used to determine the relative importance of antecedents (Liébana-Cabanillas *et al.*, 2017). Further, to illustrate the predictive precision of the model, Root Mean Square of Error (RMSE), corresponding means and standard deviations of both training and testing data for ten neural networks were estimated and reported in Table V. As of Table V the mean RMSE values of the model are 0.108 and 0.104 for training and testing data, respectively, representing satisfactory predictability of the model. The reported standard deviation was 0.005 for training and 0.013 for testing data, illustrating a fewer error in the model.

[Please insert Table V here]

The relative importance of each predictor is an indicator of how much the value anticipated by the network model contrasts with different values of the predictors (Chong, 2013). In the sensitivity analysis, the relative importance of the predictors was used to measure normalized importance that involves the ratio of the relative importance of each predictor with its highest relative importance (Liébana-Cabanillas *et al.*, 2017; Nawaz and Ahsan, 2018). The normalized importance of predictors is reported in Table VI.

[Please insert Table VI here]

According to the results displayed in Table VI, social influence contradicts the SEM results as it was illustrated as the most significant predictor of behavioral intention toward online pharmacy adoption by NNA (whereas it was fourth by SEM results), subsequently followed by health literacy, effort expectancy, facilitating conditions, performance expectancy, and perceived trust. Notably, the relative importance of health literacy is almost the same as social influence, implying that health literacy could be an important consideration in the context of online pharmacy. Besides, while ranked third and fourth, effort expectancy and facilitating conditions are close in relation to their relative importance. Furthermore, performance expectancy and perceived trust are the least important predictors, as revealed by NNA. Though these findings are somewhat inconsistent with SEM findings in terms of rankings, the relevance of the estimated predictors is irrefutable in the current context.

5. Discussions

This study tested an extended UTAUT model by including four additional variables (i.e., perceived trust, perceived risk, personal innovativeness, and health literacy) to understand the antecedents of online pharmacy adoption among the young generation in Bangladesh. Current results suggest that PE is a significant determinant for the adoption of online pharmacy among the young generation. Essentially, positive experience with technology is related to comfort and ease of using the technology (Alalwan *et al.*, 2017). This indicates that if the online pharmacy is useful that increases the ability to purchase medicine online efficiently, the young generation would frequently use it. According to the result of hypothesis 2, EE has a positive and significant effect on BI, implying that if the usage of online pharmacy is simple, clear, and justifiable, then youngsters are more likely to use it. Moreover, SI is a crucial determiner for consumers' adoption intention of online pharmacy. That means, influence from friends, families, near and dear ones in the case of accepting a new technology like online pharmacy is significant. In line with Alam *et al.* (2020) that demonstrated the significant positive impact of FC on generation Y's adoption of mHealth, our study reports that FC has a positive impact on young citizen's adoption intention of online pharmacy. Therefore, as with other technology-related services such as online shopping (Soh *et al.*, 2020) and digital payments (Sivathanu, 2019), adequate organizational and technical infrastructures (e.g., an improved technology platform) would have a significant impact on the young generation in adopting online pharmacy.

Surprisingly, PR has no significant impact on the behavioral intention to adopt online pharmacies. This finding is incongruent with extant findings, such as those uncovered by Yin *et al.* (2016) and Aref and Okasha (2020). However, this result is in line with Ofori and Appiah-Nimo (2019) and Wei *et al.* (2018) that illustrated the adoption intention of online purchasing among the young generation. Being the dominant users of online purchasing (Wei *et al.*, 2018) with adequate health literacy, the young generation might not recognize PR as a significant factor in revealing the adoption intention of online pharmacy. This finding might differ in the context of the actual usage of online pharmacy. That means, with their articulation of adoption intention, the current respondents are considering PR to be insignificant; however, PR could be a significant factor to

consider if consumers would make actual usage of online pharmacy. Likewise, within the current study context, PI is found to have no significant impact on the intention to adopt online pharmacies. Though contrasting with the results reported by Natarajan *et al.* (2017), such finding is congruent with the findings of Lu *et al.* (2005) and Sabbir and Jahan (2018). However, this inconsistent finding might relate to the fact that younger citizens often use the Internet to gather information, socialize, and perform different activities, making the use of the Internet as an essential part of their lives (Liébana-Cabanillas *et al.*, 2017). Thus, being frequent users of the Internet and online purchasing, the young generation might consider adopting online pharmacy as something that is assumed as usual and the way it is in their lives.

Afterward, the influence of PT on BI is positive and significant, which is supported by Yin *et al.* (2016) and Rehman *et al.* (2019). This implies that if the young generation perceives the online pharmacy as reliable and safe, then they would be more interested in adopting it. Moreover, this study reports a positive association between HL and BI that is relatively new in the context of online pharmacy adoption. As online pharmacy poses different risks like poor medicine quality, and delivery of wrong medicine that may have adverse consequences on health, fundamental knowledge about everyday health-related issues is necessary. Thus, the adoption of online pharmacy is greatly influenced by an individual's health-related knowledge.

In addition, findings and ranking of the significant determinants by the NNA are different from that of SEM results. This is because NNA can analyze both the linear and non-linear relationships, while SEM can only detect linear relationships (Chong, 2013). However, NNA provides further confirmation of findings by SEM, calling for thoughtful attention to those findings by online pharmacy developers.

6. Theoretical contributions

From a theoretical perspective, this study has extended the basic UTAUT model by incorporating perceived risk, perceived trust, personal innovativeness, and health literacy in the context of online pharmacy adoption. In this regard, by including and testing the impact of personal innovativeness and health literacy, this study goes beyond what Yin *et al.* (2016) proposed in analyzing consumers' intention to purchase medicine online. More precisely, testing of these two vital determinants is unprecedented in extant literature relating to online pharmacy adoption.

Recently, using an extended UTAUT model, Alam *et al.* (2020) studied the determinants of mHealth acceptance among generation Y in Bangladesh, and Yin *et al.* (2016) analyzed the influential factors in determining the adoption intention of online medicine purchase in China. Notably, our study complements and extends the findings of those studies by elucidating the significant impacts of classical UTAUT constructs (i.e., PE, EE, SI, FC) on online pharmacy adoption. Further, the current study complements and extends the findings of Yin *et al.* (2016) by validating the extended UTAUT model in a developing country context. Another important contribution relates to the finding of the significant positive influence of health literacy on online

pharmacy adoption. This presents an essential link between the health literacy concept (a fundamental concept in public health) (Nutbeam, 2000) and technology adoption in healthcare services. It would appear that this study is one of the first of its kind that demonstrated such a robust link, which could further be tested in examining the adoption of different health information technology (e.g., telemedicine, mHealth, e-health).

Additionally, by focusing on a two-staged SEM-neural network analysis approach, the findings of this study make an incremental contribution to the current understanding of the determinants of online pharmacy adoption. In doing so, our study compares the accuracy and explorative power of both approaches, and captures the linear and non-linear associations between the dependent and independent variables. Thus, in addition to providing an enriched understanding of the topic studied, this study presents a new perspective of analysis for studies relating to online purchasing.

7. Practical implications

In addition to theoretical contributions, the empirical findings of this study offer some practical guidelines related to the development of the online pharmacy platform, which the decision-makers (e.g., online pharmacy developers) might consider thoughtfully to hasten the uptake of online pharmacy among the young consumers. As of current findings, PE and EE are significant drivers of online pharmacy adoption. Therefore, while promoting online pharmacy, it is relevant to emphasize the advantages and ease of using the service that they provide to the users in managing their daily health-related activities more efficiently. Policy-makers and service providers should promote the conviction that online pharmacy is an easy-to-use and innovative channel of receiving necessary medicine within a short time. Besides, positive word-of-mouth generated by friends, peers, relatives, and family members might accelerate the role of SI. Therefore, online pharmacists and retailers could make the full use of the word-of-mouth effect through publishing newspaper articles and creating social media groups (e.g., Facebook page, online pharmacy user community). FC has also received particular attention from young customers who are expected to purchase medicine from online pharmacies. Hence, it is important to focus on the role of FC in the adoption of online pharmacies by confirming supporting infrastructures (e.g., online platforms) and guidelines are in place.

Moreover, the empirical findings illustrate the positive impact of PT on BI. Therefore, to establish trust among the young generation, online medicine providers should ensure an error-free delivery process, making sure that the right medicine in the right quantity is delivered to the right address. Besides, online retailers are recommended to obtain specific official certificates from authorities or governmental organizations that would establish trust among the young customers. Furthermore, the current study indicates that HL has a significant impact on online pharmacy adoption among the young generation. In order to address such concerns related to health, service providers can share information on their websites regarding how to use medicine properly, how to check the expiration dates that would augment customers' health literacy.

However, the pharmaceutical industry requires innovation that involves different parties such as, organizations, research firms, financial bodies, government interventions, and consumers (Yu *et al.*, 2014). Accordingly, in the context of online pharmacy, government interventions (e.g., policy formulations) are necessary apart from initiatives of online medicine sellers and subsequent consumers' adoption. Without proper policy formulation and implementation, young customers might purchase illegal drugs, and sellers might have the opportunity to sell harmful medicine (e.g., date expired medicine, illegal drugs).

8. Limitations and future research avenues

The current study acknowledges a few possible limitations, which might confine the implications of the current findings. First, this study collected data from young, university students that could further be enhanced by incorporating respondents from diversified mid-aged and older generations. Second, using a self-reported response, the study followed a cross-sectional research design. A future study might address this limitation by following a longitudinal research design that involves collecting data at multiple time points. Third, the current study found that perceived risk and personal innovativeness have no significant influence on consumers' intention to adopt online pharmacy. In this context, further investigation is needed to examine whether such outcomes remain persistent in the event of actual usage of online pharmacy. Fourth, it would be interesting to examine whether consumers' adoption intention varies based on their demographics (e.g., gender, Internet usage experience), which might be included as moderating variables in future studies. However, the adoption model offered by the current study can be applied in other developing countries with thriving information technology sectors. Furthermore, the current model can be used in examining consumers' adoption intentions of different forms of healthcare services such as, telehealth, mHealth.

9. Conclusions

Due to the rapid advancement in information technology, now online purchasing has got much acceptance. Hence, the concept of online pharmacy is getting the way of going beyond. In the study of consumers' behavioral intention to adopt online pharmacies, this empirical study tested a unified model that included additional constructs within the widely recognized UTAUT model. This has uncovered that as with the basic constructs of the UTAUT model, perceived trust and health literacy are vital in the context of online pharmacy adoption in Bangladesh. The accelerating percentage of internet usage among the young generation in developing countries like Bangladesh has opened new doors for the business of health-related products. In this regard, this study would make an incremental contribution by examining and reporting the significant determinants of online pharmacy adoption, which would facilitate in devising better marketing strategies in the upcoming days.

References

Abanmy, N. (2017) "The extent of use of online pharmacies in Saudi Arabia", *Saudi*

- Pharmaceutical Journal*, Vol. 25 No. 6, pp. 891–899. doi: 10.1016/j.jsps.2017.02.001.
- Agarwal, R. and Prasad, J. (1998) "A conceptual and operational definition of personal innovativeness in the domain of information technology", *Information Systems Research*, Vol. 9 No. 2, pp. 204–215. doi: 10.2307/23010927.
- Ahmed, H. U. (2019) *Pharmaceutical sector flourishing*, *Financial Express*. Available at: <https://www.thefinancialexpress.com.bd/views/pharmaceutical-sector-flourishing1574867109> (Accessed: 4 April 2020).
- Ajzen, I. (1991) "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179–211. doi: 10.1016/0749-5978(91)90020-T.
- Alalwan, A. A., Dwivedi, Y. K. and Rana, N. P. (2017) "Factors influencing adoption of mobile banking by Jordanian bank customers: Extending UTAUT2 with trust", *International Journal of Information Management*, Vol. 37 No. 3, pp. 99–110. doi: 10.1016/j.ijinfomgt.2017.01.002.
- Alsadoun, A. A., Iskandar, Y. H. P. and Tangiisuran, B. (2020) "Exploring the factors that influence the adoption of online pharmacy in Saudi Arabia: A conceptual review" *International Journal of Advance Science and Technology*, Vol. 29 No. 10s, pp. 262–269.
- Alam, M. Z., Hoque, M. R., Hu, W. and Barua, Z. (2020) "Factors influencing the adoption of mHealth services in a developing country: A patient-centric study", *International Journal of Information Management*, Vol. 50, pp. 128–143. doi: 10.1016/j.ijinfomgt.2019.04.016.
- Aref, M. M. and Okasha, A. E. (2020) "Evaluating the online shopping behavior among Egyptian college-educated community", *Review of Economics and Political Science*, Vol. 5 No. 1, pp. 21–37. doi: 10.1108/revs-10-2018-0013.
- Awa, H. O., Ojiabo, O. U. and Emecheta, B. C. (2015) "Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs", *Journal of Science and Technology Policy Management*, Vol. 6 No. 1, pp. 76–94. doi: 10.1108/JSTPM-04-2014-0012.
- Bessell, T. L., Silagy, C. A., Anderson, J. N., Hiller, J. E. and Sansom, L. N. (2002) "Quality of global e-pharmacies: Can we safeguard consumers?", *European Journal of Clinical Pharmacology*, Vol. 58 No. 9, pp. 567–572. doi: 10.1007/s00228-002-0519-5.
- Boontarig, W., Chutimaskul, W., Chongsuphajaisiddhi, V. and Papasratorn, B. (2012) "Factors influencing the Thai elderly intention to use smartphone for e-Health services", *SHUSER 2012 - 2012 IEEE Symposium on Humanities, Science and Engineering Research*, pp. 479–483. doi: 10.1109/SHUSER.2012.6268881.
- Brusch, I. and Rappel, N. (2020) "Exploring the acceptance of instant shopping – An empirical analysis of the determinants of user intention", *Journal of Retailing and Consumer Services*, Vol. 54. doi: 10.1016/j.jretconser.2019.101936.
- Brusselaers, J., Verbeke, W., Mettepenningen, E. and Buysse, J. (2020) "Unravelling the true drivers for eco-certified wood consumption by introducing scarcity", *Forest Policy and*

- Economics*, Vol. 111. doi: 10.1016/j.forpol.2019.102026.
- Chan, F. T. S. and Chong, A. Y. L. (2012) "A SEM-neural network approach for understanding determinants of interorganizational system standard adoption and performances", *Decision Support Systems*, Vol. 54 No. 1, pp. 621–630. doi: 10.1016/j.dss.2012.08.009.
- Childers, T. L., Carr, C. L., Peck, J. and Carson, S. (2001) "Hedonic and utilitarian motivations for online retail shopping behavior", *Journal of Retailing*, Vol. 77 No. 4, pp. 511–535. doi: 10.1016/S0022-4359(01)00056-2.
- Chong, A. Y. L. (2013) "Predicting m-commerce adoption determinants: A neural network approach", *Expert Systems with Applications*, Vol. 40 No. 2, pp. 523–530. doi: 10.1016/j.eswa.2012.07.068.
- Davis, F. D. (1989) "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319–340. doi: 10.2307/249008.
- Desai, C. (2016) "Online pharmacies: A boon or bane?", *Indian Journal of Pharmacology*, Vol. 48 No. 6, pp. 615–616. doi: 10.4103/0253-7613.194865.
- Doll, W. J., Xia, W. and Torkzadeh, G. (1994) "A confirmatory factor analysis of the end-user computing satisfaction instrument", *MIS Quarterly: Management Information Systems*, Vol. 18 No. 4, pp. 453–460. doi: 10.2307/249524.
- Dowell, D., Morrison, M. and Heffernan, T. (2015) "The changing importance of affective trust and cognitive trust across the relationship lifecycle: A study of business-to-business relationships", *Industrial Marketing Management*, Vol. 44, pp. 119–130. doi: 10.1016/j.indmarman.2014.10.016.
- Featherman, M. S. and Pavlou, P. A. (2003) "Predicting e-services adoption: A perceived risk facets perspective", *International Journal of Human Computer Studies*, Vol. 59 No. 4, pp. 451–474. doi: 10.1016/S1071-5819(03)00111-3.
- Ferdous, M. and Ishtiaque, A. (2013) "Prospects of E-Commerce in Pharmaceutical Industry of Bangladesh: Lessons from the Case of Drugstore. com", *Journal of Business Studies*, Vol. 34 No. 3.
- Fittler, A., Vida, R. G., Káplár, M. and Botz, L. (2018) "Consumers turning to the internet pharmacy market: Cross-sectional study on the frequency and attitudes of hungarian patients purchasing medications online", *Journal of Medical Internet Research*, Vol. 20 No. 8, pp. 1–11. doi: 10.2196/11115.
- Fornell, C. and Larcker, D. F. (1981) "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error", *Journal of Marketing Research*, Vol. 18 No 1, pp. 39–50. doi: 10.2307/3151312.
- Grewal, D., Lindsey-Mullikin, J. and Munger, J. (2004) "Loyalty in e-Tailing: A Conceptual Framework", *Journal of Relationship Marketing*, Vol. 2 No. 3–4, pp. 31–49. doi: 10.1300/J366v02n03_03.

- Hair, J. F., Black, W. C., Babin, B. J. and Anderson, R. E. (2014), *Multivariate Data Analysis*. 7th edn. Edinburgh Gate, Essex: Pearson Education Limited.
- Hew, T. S., Leong, L. Y., Ooi, K. B. and Chong, A. Y. L. (2016) "Predicting drivers of mobile entertainment adoption: A two-stage sem-artificial-neural-network analysis", *Journal of Computer Information Systems*, Vol. 56 No. 4, pp. 352–370. doi: 10.1080/08874417.2016.1164497.
- Hinkin, T. R. (1998) "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", *Organizational Research Methods*, Vol. 1 No. 1, pp. 104–121. doi: 10.1177/109442819800100106.
- Holden, R. J. and Karsh, B. T. (2010) "The Technology Acceptance Model: Its past and its future in health care", *Journal of Biomedical Informatics*, pp. 159–172. doi: 10.1016/j.jbi.2009.07.002.
- Hoque, R. and Sorwar, G. (2017) "Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model", *International Journal of Medical Informatics*, Vol. 101, pp. 75–84. doi: 10.1016/j.ijmedinf.2017.02.002.
- Hossain, A., Quaresma, R. and Rahman, H. (2019) "Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study", *International Journal of Information Management*, Vol. 44, pp. 76–87. doi: 10.1016/j.ijinfomgt.2018.09.016.
- Hu, L. T. and Bentler, P. M. (1999) "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives.", *Structural Equation Modeling*, Vol. 6, pp. 1–55. doi: 10.1080/10705519909540118.
- Ignjatović, D. and Stanić, M. (2019) "Contemporary Marketing in Pharmacy With the Focus on the E- Pharmacy Concept", in FINIZ, pp. 78–84. doi: 10.15308/finiz-2019-78-84.
- Isaac, O., Abdullah, Z., Aldholay, A. H. and Ameen, A. A. (2019) "Antecedents and outcomes of internet usage within organisations in Yemen: An extension of the Unified Theory of Acceptance and Use of Technology (UTAUT) model", *Asia Pacific Management Review*, Vol 24 No. 4, pp. 335–354. doi: 10.1016/j.apmr.2018.12.003.
- Karakaya, F., Quigley, C., Bingham, F., Hari, J. and Nasir, A. (2014) "Business Students' Perception of Sales Careers: Differences Between Students in Switzerland, Turkey, and the United States", *Journal of Education for Business*, Vol. 89 No. 1, pp. 13–19. doi: 10.1080/08832323.2012.740520.
- Khan, J. J. (2020) *Online medicine delivery services in Dhaka during quarantine*, *The Daily Star*. Available at: <https://www.thedailystar.net/toggle/news/online-medicine-delivery-services-dhaka-during-quarantine-1896028> (Accessed: 7 May 2020).
- Kline, R. B. (2015) *Principles and Practice of Structural Equation Modeling*. 4th edn. New York, USA: Guilford publications.
- Koufaris, M. and Hampton-Sosa, W. (2004) "The development of initial trust in an online

- company by new customers", *Information and Management*, Vol. 41 No 3, pp. 377–397. doi: 10.1016/j.im.2003.08.004.
- Lee, S. Y. (2014) "Examining the factors that influence early adopters' smartphone adoption: The case of college students", *Telematics and Informatics*, Vol. 31 No. 2, pp. 308–318. doi: 10.1016/j.tele.2013.06.001.
- Liébana-Cabanillas, F., Marinković, V. and Kalinić, Z. (2017) "A SEM-neural network approach for predicting antecedents of m-commerce acceptance", *International Journal of Information Management*, Vol. 37 No 2, pp. 14–24. doi: 10.1016/j.ijinfomgt.2016.10.008.
- Liébana-Cabanillas, F., Marinkovic, V., Ramos de Luna, I. and Kalinic, Z. (2018) "Predicting the determinants of mobile payment acceptance: A hybrid SEM-neural network approach", *Technological Forecasting and Social Change*, Vol. 129, pp. 117–130. doi: 10.1016/j.techfore.2017.12.015.
- Lu, J., Yao, J. E. and Yu, C. S. (2005) "Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology", *Journal of Strategic Information Systems*, Vol. 14 No 3, pp. 245–268. doi: 10.1016/j.jsis.2005.07.003.
- Mancuso, J. M. (2008) "Health literacy: A concept/dimensional analysis", *Nursing and Health Sciences*, Vol. 10 No. 3, pp. 248–255. doi: 10.1111/j.1442-2018.2008.00394.x.
- Natarajan, T., Balasubramanian, S. A. and Kasilingam, D. L. (2017) "Understanding the intention to use mobile shopping applications and its influence on price sensitivity", *Journal of Retailing and Consumer Services*, Vol. 37, pp. 8–22. doi: 10.1016/j.jretconser.2017.02.010.
- Nawaz, A. and Ahsan, K. (2018) "Factors Affecting Retailer's Adoption of Mobile Payment Systems : A SEM-Neural Network Modeling Approach", *Wireless Personal Communications*, Vol. 5. doi: 10.1007/s11277-018-5945-5.
- Nicola, M., Alsaf, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., ... Agha, R. (2020) "The socio-economic implications of the coronavirus pandemic (COVID-19): A review", *International Journal of Surgery*, Vol. 78, pp. 185–193. doi: 10.1016/j.ijssu.2020.04.018.
- Nunnally, J. C. (1978) *Psychometric theory*. 2nd edn. New York, NY: McGraw-Hill.
- Nuq, P. A. and Aubert, B. (2013) "Towards a better understanding of the intention to use ehealth services by medical professionals: The case of developing countries", *International Journal of Healthcare Management*, Vol. 6 No. 4, pp. 217–236. doi: 10.1179/2047971913Y.0000000033.
- Nutbeam, D. (2000) "Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century", *Health Promotion International*, Vol. 15 No. 3, pp. 259–267. doi: 10.1093/heapro/15.3.259.
- Ofori, D. and Appiah-Nimo, C. (2019) "Determinants of online shopping among tertiary students in Ghana: An extended technology acceptance model", *Cogent Business and*

- Management*, Vol. 6 No. 1. doi: 10.1080/23311975.2019.1644715.
- Orizio, G., Merla, A., Schulz, P. J. and Gelatti, U. (2011) "Quality of online pharmacies and websites selling prescription drugs: A systematic review", *Journal of Medical Internet Research*, Vol. 13 No. 3, pp. 1–25. doi: 10.2196/jmir.1795.
- Orsolini, L., Francesconi, G., Papanti, D., Giorgetti, A. and Schifano, F. (2015) "Profiling online recreational/prescription drugs' customers and overview of drug vending virtual marketplaces", *Human Psychopharmacology*, Vol. 30 No. 4, pp. 302–318. doi: 10.1002/hup.2466.
- Osborne, R. H., Batterham, R. W., Elsworth, G. R., Hawkins, M. and Buchbinder, R. (2013) "The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ)", *BMC Public Health*, Vol. 13 No. 1. doi: 10.1186/1471-2458-13-658.
- Otto, L. and Harst, L. (2019) "Bringing Telemedicine Initiatives into Regular Care: Theoretical Underpinning for User-Centred Design Processes", *PACIS 2019 Proceedings*. Available at: <https://aisel.aisnet.org/pacis2019/2> (Accessed: 9 April 2020).
- Paasche-Orlow, M. K. and Wolf, M. S. (2007) "The causal pathways linking health literacy to health outcomes", *American Journal of Health Behavior*, Vol. 31, pp. 19–26. doi: 10.5555/ajhb.2007.31.supp.S19.
- Pipitwanichakarn, T. and Wongtada, N. (2019) "Mobile commerce adoption among the bottom of the pyramid: a case of street vendors in Thailand", *Journal of Science and Technology Policy Management*, Vol. 10 No. 1, pp. 193–213. doi: 10.1108/JSTPM-12-2017-0074.
- Porter, E. J. and Ganong, L. H. (2002) "Considering the use of a personal emergency response system: An experience of frail, older women", *Care Management Journals*, Vol. 3 No. 4, pp. 192–198. doi: 10.1891/cmaj.3.4.192.57452.
- Rahman, S. U., Khan, M. A. and Iqbal, N. (2018) "Motivations and barriers to purchasing online: understanding consumer responses", *South Asian Journal of Business Studies*, Vol. 7 No. 1, pp. 111–128. doi: 10.1108/SAJBS-11-2016-0088.
- Rana, N. P., Dwivedi, Y. K., Williams, M. D. and Weerakkody, V. (2016) "Adoption of online public grievance redressal system in India: Toward developing a unified view", *Computers in Human Behavior*, Vol. 59, pp. 265–282. doi: 10.1016/j.chb.2016.02.019.
- Ratten, V. (2015) "A cross-cultural comparison of online behavioural advertising knowledge, online privacy concerns and social networking using the technology acceptance model and social cognitive theory", *Journal of Science and Technology Policy Management*, Vol. 6 No. 1, pp. 25–36. doi: 10.1108/JSTPM-06-2014-0029.
- Rehman, S. U., Bhatti, A., Mohamed, R. and Ayoup, H. (2019) "The moderating role of trust and commitment between consumer purchase intention and online shopping behavior in the context of Pakistan", *Journal of Global Entrepreneurship Research*, Vol. 9 No. 1. doi: 10.1186/s40497-019-0166-2.

- Rogers, E. M. (1995) *Diffusion of innovations*. 3rd edn. New York: Free Press.
- Rogers, E. M. (2003) *Diffusion of Innovations*. 5th edn. New York: Free Press.
- Sabbir, M. M. and Jahan, T. (2018) "Investigating the Antecedents of Employee Attitude towards Internet Banking Adoption based on Structural Equation Modeling", *Comilla University Journal of Business Studies*, Vol. 5 No. 1, pp. 123–141.
- Sarker, S. K., Bhas, G., Paul, R., Pal, H., Yusuf, M. A. and Eva, E. O. (2019) "E-Pharmacy Utilization on the Spectrum of Digital Pharmaceutical Practices, Patterns and Challenges in Bangladesh", *Journal of Shaheed Suhrawardy Medical College*, Vol. 11 No. 1, pp. 43–47. doi: 10.3329/jssmc.v11i1.43178.
- Scott, J. E. and Walczak, S. (2009) "Cognitive engagement with a multimedia ERP training tool: Assessing computer self-efficacy and technology acceptance", *Information and Management*, Vol. 46 No. 4, pp. 221–232. doi: 10.1016/j.im.2008.10.003.
- Shareef, M. A., Dwivedi, Y. K., Kumar, V. and Kumar, U. (2017) "Content design of advertisement for consumer exposure: Mobile marketing through short messaging service", *International Journal of Information Management*, Vol. 37 No. 4, pp. 257–268. doi: 10.1016/j.ijinfomgt.2017.02.003.
- Sim, J. J., Tan, G. W. H., Wong, J. C. J., Ooi, K. B. and Hew, T. S. (2014) "Understanding and predicting the motivators of mobile music acceptance - A multi-stage MRA-artificial neural network approach", *Telematics and Informatics*, Vol. 31 No. 4, pp. 569–584. doi: 10.1016/j.tele.2013.11.005.
- Singh, H., Majumdar, A. and Malviya, N. (2020) "E-Pharmacy Impacts on Society and Pharma Sector in Economical Pandemic Situation : A Review", Vol. 10, pp. 335–340.
- Sivathanu, B. (2019) "Adoption of digital payment systems in the era of demonetization in India: An empirical study", *Journal of Science and Technology Policy Management*, Vol. 10 No 1, pp. 143–171. doi: 10.1108/JSTPM-07-2017-0033.
- Soh, P. Y., Heng, H. B., Selvachandran, G., Anh, L. Q., Chau, H. T. M., Son, L. H., ... Varatharajan, R. (2020) "Perception, acceptance and willingness of older adults in Malaysia towards online shopping: a study using the UTAUT and IRT models", *Journal of Ambient Intelligence and Humanized Computing*. doi: 10.1007/s12652-020-01718-4.
- Sørensen, K., Broucke, S. V. D., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z. and Brand, H. (2012) "Health literacy and public health: A systematic review and integration of definitions and models", *BMC Public Health*, Vol. 12 No. 1. doi: 10.1186/1471-2458-12-80.
- Speros, C. (2005) "Health literacy: Concept analysis", *Journal of Advanced Nursing*, Vol. 50 No. 6, pp. 633–640. doi: 10.1111/j.1365-2648.2005.03448.x.
- Steele, R., Lo, A., Secombe, C. and Wong, Y. K. (2009) "Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare", *International Journal of Medical Informatics*, Vol. 78 No. 12, pp. 788–801. doi:

10.1016/j.ijmedinf.2009.08.001.

- Su, L., Huang, W. and Leung, J. (2011) "Development and management of online pharmacies in China", *Journal of Medical Marketing*, Vol. 11 No. 3, pp. 197–203. doi: 10.1177/1745790411405712.
- Svorc, J. (2012) "Consumer's intentions to shop medicaments online: A survey from Czech Republic market", *Journal of Systems Integration*, Vol. 3 No. 2, pp. 3–28.
- Tabachnick, B. G. and Fidell, L. S. (2014) *Using multivariate statistics*. 6th edn. Edinburgh Gate, Essex: Pearson Education Limited.
- Tan, G. W. H., Ooi, K. B., Leong, L. Y. and Lin, B. (2014) "Predicting the drivers of behavioral intention to use mobile learning: A hybrid SEM-Neural Networks approach", *Computers in Human Behavior*, Vol. 36, pp. 198–213. doi: 10.1016/j.chb.2014.03.052.
- Venkatesh, V. and Davis, F. D. (2000) "Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies", *Management Science*, Vol. 46 No. 2, pp. 186–204. doi: 10.1287/mnsc.46.2.186.11926.
- Venkatesh, V., Brown, S. A., Maruping, L. M. and Bala, H. (2008) "Predicting different conceptualizations of system USE: The competing roles of behavioral intention, facilitating conditions, and behavioral expectation", *MIS Quarterly: Management Information Systems*, Vol. 32 No. 3, pp. 483–502.
- Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003) "User Acceptance of Information Technology: Toward a Unified View", *MIS Quarterly*, Vol. 27 No. 3, pp. 425–478. doi: 10.1103/PhysRevB.57.R14040.
- Venkatesh, V., Thong, J. Y. L. and Xu, X. (2012) "Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology", *MIS Quarterly: Management Information Systems*. Management Information Systems Research Center, University of Minnesota, Vol. 36 No. 1, pp. 157–178. doi: 10.2307/41410412.
- Vermeir, I. and Verbeke, W. (2006) "Sustainable food consumption: Exploring the consumer "attitude - Behavioral intention" gap", *Journal of Agricultural and Environmental Ethics*, Vol. 19 No. 2, pp. 169–194. doi: 10.1007/s10806-005-5485-3.
- Wei, Y., Wang, C., Zhu, S., Xue, H. and Chen, F. (2018) "Online purchase intention of fruits: Antecedents in an integrated model based on technology acceptance model and perceived risk theory", *Frontiers in Psychology*, Vol. 9, pp. 1–11. doi: 10.3389/fpsyg.2018.01521.
- Wiedmann, K. P., Hennigs, N., Pankalla, L., Kassubek, M., Seegebarth, B. and Reeh, M.O. (2010) "Online distribution of pharmaceuticals: investigating relations of consumers' value perception, online shopping attitudes and behaviour in an e-pharmacy context", *Journal of Customer Behaviour*, Vol. 9 No 2, pp. 175–199. doi: 10.1362/147539210x511362.
- Yang, S., Liu, Y. and Wei, J. (2016) "Social capital on mobile SNS addiction: A perspective

- from online and offline channel integrations", *Internet Research*, Vol. 26 No. 4, pp. 982–1000. doi: 10.1108/IntR-01-2015-0010.
- Yi, M. Y., Jackson, J. D., Park, J. S. and Probst, J. C. (2006) "Understanding information technology acceptance by individual professionals: Toward an integrative view", *Information and Management*, Vol. 43 No. 3, pp. 350–363. doi: 10.1016/j.im.2005.08.006.
- Yin, M., Li, Q. and Qiao, Z. (2016) "A study on consumer acceptance of online pharmacies in China", in *ACM International Conference Proceeding Series*. doi: 10.1145/2971603.2971616.
- Yiu, C. S., Grant, K. and Edgar, D. (2007) "Factors affecting the adoption of Internet Banking in Hong Kong-implications for the banking sector", *International Journal of Information Management*, Vol. 27 No. 5, pp. 336–351. doi: 10.1016/j.ijinfomgt.2007.03.002.
- Yu, Y., Ma, Z., Hu, H. and Wang, Y. (2014) "Local government policies and pharmaceutical clusters in China", *Journal of Science and Technology Policy Management*, Vol. 5 No. 1, pp. 41–58. doi: 10.1108/JSTPM-02-2013-0004.
- Zion Market Research (2019) *Global E-Pharmacy Market Will Reach USD 107.53 Billion By 2025*: Available at: <https://www.globenewswire.com/news-release/2019/06/18/1870266/0/en/Global-E-Pharmacy-Market-Will-Reach-USD-107-53-Billion-By-2025-Zion-Market-Research.html/> (Accessed: 29 June 2020).

Appendix: A

Constructs	Indicators	Wording	Source
Performance Expectancy (PE)	PE1	I find online pharmacy useful for me.	Venkatesh <i>et al.</i> (2003); Venkatesh <i>et al.</i> (2012)
	PE2	Using online pharmacy service increases my chances of meeting my needs.	
	PE3	Using online pharmacies helps me in managing my healthcare efficiently.	
Effort Expectancy (EE)	EE1	Learning how to use an online pharmacy is easy for me.	Venkatesh <i>et al.</i> (2003)
	EE2	I know how to purchase using an online pharmacy.	
	EE3	I find online pharmacy service easy to use.	
Social Influence (SI)	SI1	People who are important to me think that I should use online pharmacies.	Venkatesh <i>et al.</i> (2003); Venkatesh, <i>et al.</i> (2012)
	SI2	People who influence my behavior think that I should use online pharmacies.	
	SI3	People whose opinions that I value prefer that I use online pharmacy service.	
	SI4	People in my society who use online pharmacy services have more status than those who do not.	
Facilitating Conditions (FC)	FC1	I have the resources necessary to use online pharmacies.	Venkatesh <i>et al.</i> (2012)
	FC2	I have the knowledge necessary to use online pharmacies.	
	FC3	Online pharmacy is compatible with other technologies I use.	
Perceived Risk (PR)	PR1	I'm afraid that medicines from online pharmacies are harmful to my health.	Koufaris and Hampton-Sosa (2004)
	PR2	I'm afraid that purchasing medicine online will reveal my identity.	
	PR3	I'm afraid that medicines from online pharmacies are counterfeit or poor quality	
Perceived Trust (PT)	PT1	Purchasing medicine online is trustworthy.	Featherman and Pavlou (2003)
	PT2	I believe that medicines from online pharmacies are safe.	
	PT3	I believe that medicines from online pharmacies are reliable.	
Personal Innovativeness (PI)	PI1	If I heard about new information technology, I would look for ways to experiment with it.	Agarwal and Prasad (1998); Yi <i>et al.</i> (2006)
	PI2	Among my peers, I am usually the first to try out new information technologies.	
	PI3	In general, I am not hesitant to try out new information technologies.	
Health Literacy (HL)	HL1	I have all the information to maintain good health whenever I purchase medicine online.	Osborne <i>et al.</i> (2013)
	HL2	I have the ability to find information about health problems.	
	HL3	I believe that I can read and understand all the information related to good health.	
Behavioral Intention (BI)	BI1	I would like to purchase medicine from online pharmacies.	Venkatesh <i>et al.</i> (2003)
	BI2	I would like to purchase medicine online for my friends.	
	BI3	I would like to recommend my friend to purchase medicines from online pharmacies.	

Table I: Demographics of the participants

		Frequency	Percentage
Gender	Male	148	52
	Female	137	48
Age	18-21	154	54
	22-25	85	30
	26-29	46	16
Education Level	Under Graduate	205	72
	Graduate	80	28
Experience in using the Internet	1 to 3 years	125	44
	4 to 6 years	105	37
	7 years or more	55	19

Table II: Summary of constructs' reliability and convergent validity assessment

Constructs	Indicators	α	AVE	CR	PCA load	CFA load (λ^*)
PE	PE1	0.90	0.75	0.90	0.88	0.85
	PE2				0.89	0.90
	PE3				0.89	0.85
EE	EE1	0.90	0.75	0.90	0.86	0.85
	EE2				0.84	0.87
	EE3				0.84	0.87
SI	SI1	0.89	0.67	0.89	0.81	0.83
	SI2				0.81	0.82
	SI3				0.84	0.86
	SI4				0.80	0.76
FC	FC1	0.88	0.71	0.88	0.85	0.83
	FC2				0.87	0.93
	FC3				0.88	0.77
PR	PR1	0.91	0.77	0.91	0.85	0.88
	PR2				0.86	0.94
	PR3				0.80	0.80
PT	PT1	0.83	0.62	0.82	0.83	0.74
	PT2				0.89	0.88
	PT3				0.84	0.73
PI	PI1	0.89	0.74	0.89	0.86	0.88
	PI2				0.86	0.89
	PI3				0.79	0.81
HL	HL1	0.89	0.72	0.88	0.85	0.87
	HL2				0.86	0.86
	HL3				0.77	0.82
BI	BI1	0.91	0.76	0.90	0.81	0.83
	BI2				0.82	0.92
	BI3				0.77	0.87

*All factor loadings (λ) are significant at $p < 0.001$

Note: α = Cronbach's alpha; AVE=average variance extracted; CR=composite reliability;

PCA=principal component analysis; CFA=confirmatory factor analysis

Table III: Constructs' correlation coefficients and square root of AVE (in bold on diagonal)

Constructs	HL	PE	EE	SI	FC	PR	PT	PI	BI
HL	0.849								
PE	0.198	0.868							
EE	0.414	0.398	0.865						
SI	0.509	0.199	0.327	0.817					
FC	0.228	0.122	0.234	0.154	0.845				
PR	0.437	0.204	0.306	0.454	0.498	0.877			
PT	-0.049	-0.126	-0.111	0.022	-0.074	0.020	0.787		
PI	0.459	0.361	0.460	0.457	0.175	0.339	-0.146	0.859	
BI	0.489	0.368	0.535	0.476	0.413	0.504	0.103	0.463	0.873

Table IV: Results of hypotheses tests

Hypothesis	Structural path	Std. estimate (β)	SE	<i>t</i> value	<i>p</i> -value	Results
H ₁	PE $\rightarrow$ BI	0.14	0.046	2.583	0.010	Supported
H ₂	EE $\rightarrow$ BI	0.26	0.054	4.123	0.000	Supported
H ₃	SI $\rightarrow$ BI	0.16	0.073	2.408	0.016	Supported
H ₄	FC $\rightarrow$ BI	0.22	0.056	3.689	0.000	Supported
H ₅	PR $\rightarrow$ BI	0.12	0.057	1.835	0.067	Not supported
H ₆	PT $\rightarrow$ BI	0.18	0.052	3.498	0.000	Supported
H ₇	PI $\rightarrow$ BI	0.11	0.054	1.737	0.082	Not supported
H ₈	HL $\rightarrow$ BI	0.13	0.068	2.074	0.038	Supported

Table V: RMSE values neural network analysis

NN	RMSE (Training)	RMSE (Testing)
1	0.105	0.120
2	0.113	0.126
3	0.102	0.111
4	0.103	0.100
5	0.116	0.092
6	0.110	0.103
7	0.107	0.089
8	0.113	0.084
9	0.103	0.115
10	0.105	0.104
Mean	0.108	0.104
Standard deviation	0.005	0.013

Table VI: Normalized variable importance

Factors	Relative importance	Ranking
Social influence	1.000	1
Health literacy	0.997	2
Effort expectancy	0.947	3
Facilitating conditions	0.926	4
Performance expectancy	0.631	5
Perceived trust	0.459	6