

**Management of Overcrowding in OPDs of Public Hospitals using Health Information Technology: An Evaluation of Telemedicine Technology using UTAUT Model in Tertiary Care Public Hospitals in Pakistan**

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**Abstract**

The healthcare around the globe is neither equitable nor proficient. The technologically advanced countries have now incorporated IT sector for sustainable delivery of efficient healthcare delivery. Empirical findings suggest that Telemedicine have the potential to be raised as institutionalized healthcare delivery mechanism for underprivileged communities. However, technical and logistical issues, organizational resources, healthcare users' perceptions and lack of applicable strategies remain the main contributors of failed telemedicine projects. Literature exists regarding evaluation of telemedicine in developed as well as developing countries. However, studies exploring Telemedicine in public health sector in Pakistan are nonexistent. To study this research gap, researchers in this study have analyzed UTAUT with additional constructs in the social context of Pakistan. Two multi-item questionnaires separately for healthcare providers and seekers derived from previous studies are used to assemble information from a sample constituting 427 healthcare providers and 554 healthcare seekers. Statistical techniques of correlation & regression analysis and sample t-test using PLS-SEM are employed as required. The results of this study confirmed Performance Expectancy, Effort Expectancy, Cost Effectiveness, E-Health Literacy positively related to Behavioral Intention and Actual Use of Telemedicine which in turn augments Healthcare Seekers Satisfaction and Healthcare Providers Clinical Productivity. The role

of e-Health Readiness and moderation of Implementation Leadership on Performance Expectancy to generate Behavioral Intention needs further evaluation. The hypotheses and the conceptual model, in general are empirically validated.

**Key Words:** E-Health; Telemedicine; Healthcare delivery; UTAUT Model.

### Introduction

Although societies of today remain well-connected, but still there subsists a privation of prospects that jeopardize comprehensive growth for the entire world populace. Consequently, reducing disparities (UN-SDG 10) symbolizes as capitalizing in assisting those susceptible societies that are devoid from access to any of the basic rights (World Health Organization, 2019) such as health, education, protection or any decent job. Provision of Health for all and its sustainability seem to be one of the most vital prerequisites for combatting discriminations. But with the tragedy that almost half of the world population being deprived of access to essential healthcare services and adding to it the aging population, upsurge in chronic sicknesses, with new syndromes and viruses, all together are making it even more tougher to promise accessibility to valued healthcare services globally across all social classes and in all regions. The management of delivery of effective healthcare is a key societal objective for all governments.

Technical and logistical issues (Nouri et al., 2020), organizational resources (Brunetto et al., 2022), healthcare seekers and healthcare provider's perceptions all combine in predictable and unpredictable ways to shape the delivery of healthcare services. The task gets more challenging when considered with limited economic resources, with diverse communities, with different sociocultural background and in need of different healthcare requirements. Adding to the gravity of the situation is the inexorable rise in the cost of medical care that also has been traced unrelenting since the mid-20th century. In consistency with the value-based healthcare philosophies and the UN SDG 3 and SDG 10 guidelines, the healthcare delivery has been experiencing

noteworthy and swift alterations that necessitate healthcare organizations to tussle for the advancement for "accessibility to all" (Harikumar & Saleeshya, 2020). However, delivery of efficient healthcare remains an unsolved issue around the globe.

The integration of technology in healthcare delivery is one very considered methodology to overcome such like barriers to efficient healthcare delivery. A range of new healthcare concepts having support and supplemented by technological environment has emerged during last era (Zahid et al., 2021). One such, "E - health" is commonly used umbrella term to pronounce the mutual consumption of Information Communication Technologies (ICT) in the healthcare sector (Wong et al., 2022). Despite the promises introduced by ICT, the basic argument that still persist with different aspects in changing environments remains as how to shape the appropriate design and how to sustain this promise for long term delivery as sustainability in healthcare provision, specifically when focused on developing state like Pakistan.

### Significance of the Study

**Applied Perspective:** A model for readiness assessment explored in this study will offer a useful basis for healthcare management for successfully opting and adopting Telemedicine in specific environment of Pakistan. With such strategic planning evaluations effectually, there can be a circumvention of enormous losses of effort, time, money and deferrals for healthcare policy makers, providers and the users. Hence, the results derived from this study will be multidimensional and problem solving on a range of complex issues important to healthcare seekers, healthcare providers, policy makers as well as researchers. From an applied perspective, this study will enhance the knowledge about the impact of advance technological services in our conventional practices with overcrowded OPDs of public hospitals in developing world. Hence fore with, it will address the issue of healthcare accessibility not only for rural and remote but also underserved urban communities. It will also provide an opportunity to

facilitate patient-to-clinician and clinician-to-clinician communiqué, which are critical to an integrated but badly missing in Pakistan's healthcare system.

**Theoretical Perspective:** This study will have significant theoretical implications as well. The study will add significant theoretical evidence on the role of telemedicine in relevance to OPD overcrowding, which is not sufficiently available in existing literature. From theoretical perspective, it will also instigate scholars to authenticate and add in this extended UTAUT model in different more departments of hospital. Researchers will also incline to further refine and add context and variables for theoretical model development for the employment of telemedicine in OPDs of hospitals of developing countries.

### Literature Review and Research Gaps

An alarmingly high percentage of population in developing countries like Pakistan does not have access to appropriate health services (Shoib et al., 2022). It not only deprives large number of people from access to clinicians but simultaneously compromises the care quality and patients' experiences for those who could get an access. Overcrowding in OPDs in public care hospitals of developing countries (Chatterjee et al., 2021) is a regular and overt concern. Such congestion leads to several distressing effects like shoddier health outcomes, delays in treatment, increased dissatisfaction and decreased clinician productivity with increased financial costs of unnecessary diagnostic investigations and administrative arrangements. Regrettably, the healthcare system in Pakistan has been since long facing resources struggle due to mismanagement, pessimistic approach to innovative technology and financial constraints (Ahmed & Abbas, 2022). The researchers find it high time when IT which has already revolutionized most of sectors of industry and daily life, should digitalize the medical care as well.

Despite all the enthusiasm, the literature very simultaneously discloses that the healthcare industry in particular faces inherent complexities (Aloini et al., 2023) in

comparison with other industries towards the implementation of digital initiatives. The accuracy and the safety of technology, the sustainability of e-health interventions / telemedicine in developing countries still remain questionable (Zhou et al., 2019). This is primarily because of dissimilar organizations of varying sizes, with diverse organizational cultures and backgrounds, geographically, socially and culturally different areas and people, with unlike systems in place and at different stages of proficiency.

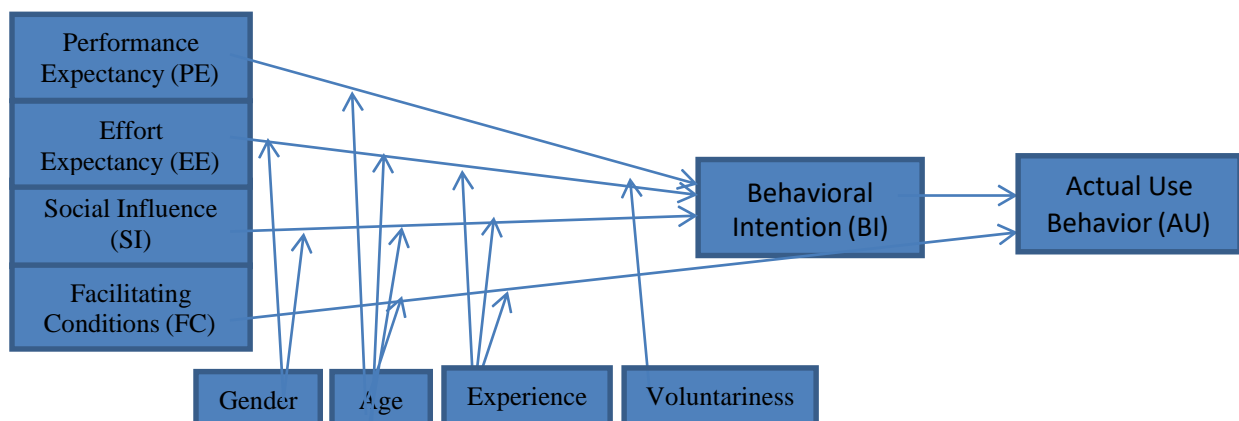
Adding to this perspective, Zoghalmi & Ben (2022) suggested that forthcoming growth of e-Health should embrace healthcare seekers and healthcare providers in a collaborative approach allowing better conjunction between technical and contextual factors influencing adoption and effectiveness of e-Health interventions. Upcoming research should also deliberate a broader coverage of consumers from nonacademic background to establish the associations between the considered variables in bigger demographic settings (Koivumäki et al., 2017). Literature review finds that large number of studies employed remote or rural populace; without employing the underprivileged populace from the urban areas which debar the opinion of a significant community also in need of equitable healthcare access despite being the residents of urban and suburban localities. Hence urban underserved populace can explore additional barriers and constructs for establishing Telemedicine centers (Zobair et al., 2020). Literature also suggested that even the commonly explored dynamics in the preceding studies for each technological context and user groups should be verified empirically in real settings (Rahimi et al., 2018).

Lee et al (2021) referred as most of the studies on telehealth interventions relate to chronic diseases and that too studying only the specific conditions e.g. heart failure, Diabetes Mellitus, etc. Kahn (2019) found that research is needed for a model with a centralized telemedicine facility. A series of studies in the literature have discussed telemedicine applications for various ailments (Kadir, 2020), however limited / no

evidence is available about its application for OPD overcrowdings. Future researchers should also consider recruiting respondents from diverse specialties (Hah & Goldin, 2019). The literature reviews also identified a need to evaluate the association between actual use and the outcomes (Dou et al., 2017).

Research is also invited to use different existing, as well as developing and refining more variables, and incorporating those variables in UTAUT model for telemedicine to further extend / enhance the model’s predictive power (Mengesha & Garfield, 2019). This study aims to achieve a better understanding of the causal impacts of different constructs towards adoption and actual use of telemedicine for routine OPD healthcare delivery in backdrop of developing country like Pakistan.

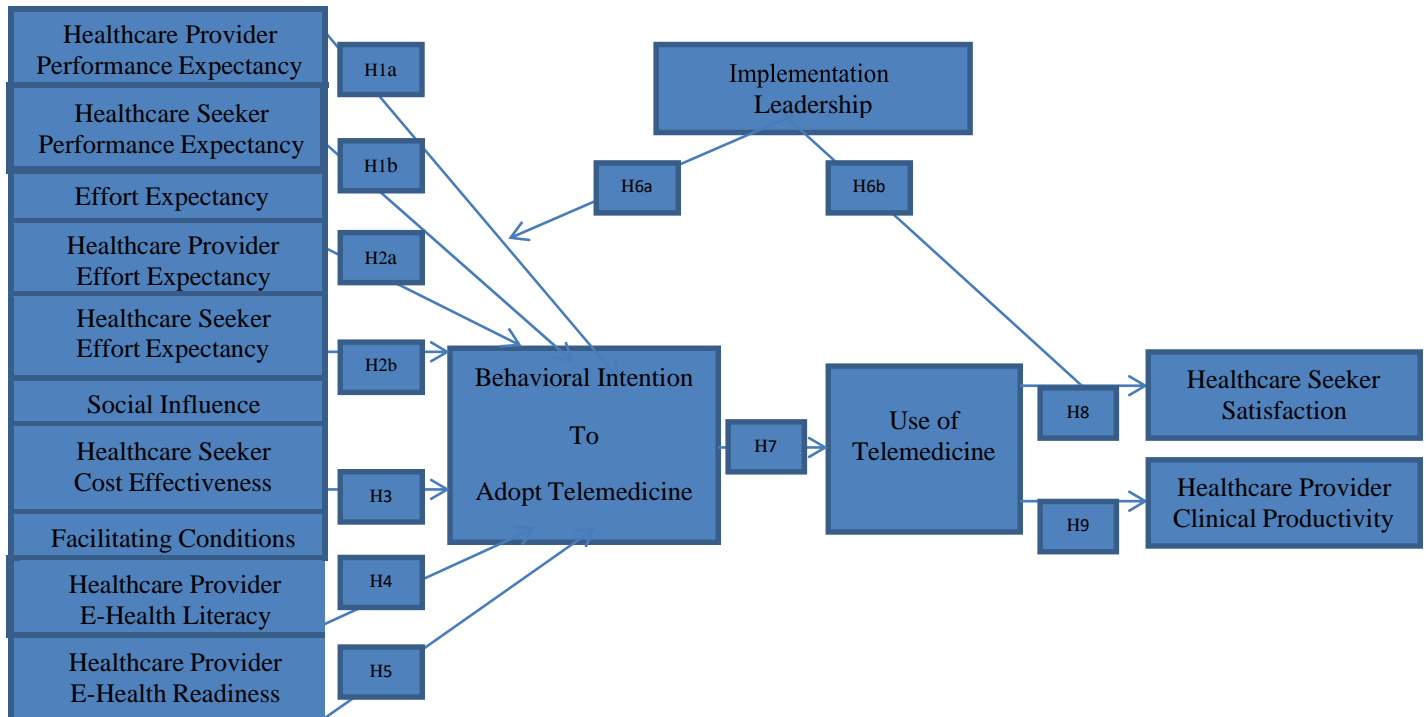
**UTAUT Model:** Venkatesh et al (2003) assimilated 8 models of technology acceptance as Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is a technology acceptance model towards a unified view to explicate consumers’ intention to practice an information system and consequent usage behavior. UTAUT is a significant step forward in the technology acceptance literature (Tang et al., 2021) suggesting four main constructs which include: 1) Performance Expectancy 2) Effort Expectancy 3) Social Influence and 4) Facilitating Conditions. Age, Gender, Experience and Voluntariness of Use are posited to moderate the impact of the four keyconstructs on usage intention and behavior.



### Model of Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT has proven its viability in several studies on e-health acceptance (Philippi et al., 2021). However, Lee et al. (2017) advocated that it would be essential to modify the UTAUT model over period. A large number of researchers hence applied additional constructs in their research models to testify variables as per the context of the study environment. Dissanayake et al (2019) suggested that Self-Efficacy is a salient driver of the healthcare seekers expectancy towards telemedicine adoption. Zobair et al (2019) noted that customers' personal needs and past experiences are important predictors of online customers' anticipations in different service settings. Similarly, scholars have incorporated Prior Satisfaction (Chao, 2019), Computer Anxiety (Cimperman et al., 2016), Telemedicine Experience (Suki & Suki, 2017) and Knowledge (Isaac et al., 2019) and several other variables as important constructs creating different UTUAT models.

**Study Research model:** A myriad of studies focusing on the personal and organizational readiness and intention / adoption of e-Health with special focus on Telemedicine were collected. The literature search identified the related variables of this study environment. The literature reviews also explored the scales of identified variables from previous studies. Present study model is a hybrid model incorporating the viewpoints of healthcare seekers as well as healthcare providers as explored from previous studies.



Modified UTAUT Model with added variables in this study

Extended Model of

study

Research Study Model

**Theoretical Background:** The UTAUT model is created by testing 32 variables of 8 models / theories (Khechine et al., 2020) namely - Theory of Reasoned Action (TRA), Technology Acceptance Model, Motivation Model, Theory of Planned Behavior (TPB), Combined Model, Model of PC Utilization, Innovation Diffusion Theory and Social Cognitive Theory. The Theory of Reasoned Action proposed by Ajzen & Fishbein, in 1980 is the primary theory that has underpinning role in this model. The vital postulation in the TRA is that behaviours are under individual's volitional control. However, this postulation is likely unrealistic in certain contexts, as volitional control of behaviours may differ across diverse situations. Identifying that not all behaviours are in volitional control, TPB was pronounced by suggesting a new element, "Perceived



Behavioral Control". With this, TPB has actually protracted the TRA to shield non-volitional behaviors as well for forecasting user Intentions and Actual Behavior.

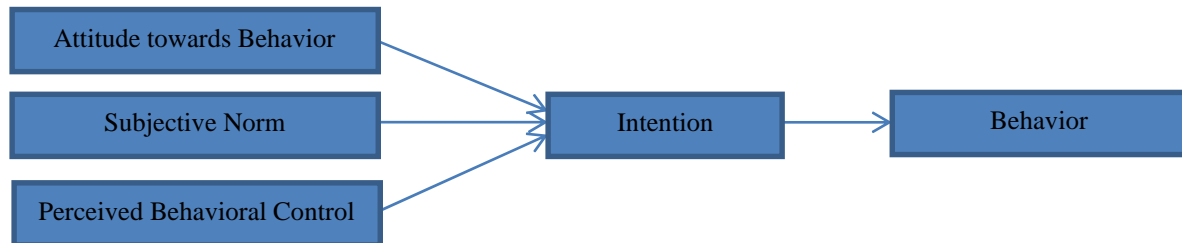


Diagram of Theory of Planned Behavior adopted from Ajzen (1991)

### Hypotheses

Expectancy constructs in UTAUT model are predominantly cognitive assessments (Celik, 2016) i.e. predictions as how well users will acquire, organize and apply any innovative technology like telemedicine in their working environment. PE of telemedicine in OPDs of tertiary care public sector hospitals is the amount to which users believe that telemedicine will facilitate users to manage gains in execution of health / disease related consultations. In general, PE is composed of five sub-facets: 1) Perceived Usefulness 2) Extrinsic Motivation 3) Job-fit 4) Relative Advantage and 5) Outcome Expectation.

Presently, the use of telemedicine system is novel in public care hospitals in Pakistan. In this context, PE refers to the scope to which healthcare providers and healthcare seekers believe that this technology will enhance efficient healthcare service delivery. Researchers have produced data of significant influence of PE on users' BI to embrace new technology (Chao, 2019). To validate the effect of PE in telemedicine usage intention in OPDs of tertiary care public sector hospitals in Pakistan, this study posited:

**H1a: Healthcare providers' PE positively influences their BI of adoption of telemedicine.**

**H1b: Healthcare seekers' PE positively influences their BI of adoption of telemedicine.**

EE relates to the user expectations toward ease of use. Rahi et al (2018) established that when users sense that innovative technology is easy to practice and does not necessitate much effort, there exist higher probabilities to develop intention and adoption of that technology. De Sena Abrahão et al (2016) identified three variables to explain the concept of EE which are: Perceived Ease of Use (TAM), Complexity and Ease of Use. Previous studies have also confirmed significant positive relationship between EE and users' Intention (Chaouali et al., 2016). There is yet another dimension for the intention, efficient adoption and sustainable use, which is the perception about the compatibility of telemedicine with the providers' work practices as well as seekers' needs and skills making it easy to utilize. All stakeholders are influenced by their own familiarity and experience. In this context, EE refers to the scope to which an individual believes that it will enhance practice of technology being easy and convenient. Therefore based on existing literature, EE in this study is hypothesized as:

**H2a: Healthcare providers' EE positively influences their BI of adoption of telemedicine.**

**H2b: Healthcare Seekers' EE positively influences their BI of adoption of telemedicine.** SI is also considered a significant determinant of BI in UTAUT model and is critical in the formation of individual's behavior as it directly or indirectly influences the mental state, thought processes followed by actions. The previous studies depict telemedicine as cost effective (Nord et al., 2019). In fact, telehealth services affect the healthcare costs for healthcare providers as well as healthcare seekers. Sorwar et al (2016) presented statistics that the telemedicine significantly reduces the healthcare cost for healthcare seekers. There is diminutive evidence that if or not telemedicine is a cost effective than standard healthcare delivery. Studies indicate that home-based telemedicine programs reduce expenses but comprehensive cost statistics were either incomplete or not presented (Michaud et al., 2018). A privation of decisive confirmation of the impact of telemedicine technology on financial and clinical results has prohibited investment in

developing states. As a developing country, healthcare seekers attending public hospitals in Pakistan lack sufficient monetary resources to shift for any novel technology which is not cost effective and will be considered as potential financial resource barrier to telemedicine adoption for healthcare seekers. Thus, researcher posit: **H3: Cost effectiveness (CE) increases the BI of adoption of telemedicine in Public care hospitals OPD services amongst Healthcare seekers.**

FC is defined as the degree to which one perceives that organizational and technological infrastructure exists to facilitate the practice of the system (Venkatesh et al., 2003). E-Health literacy (EHL) consists of core skills / literacies including the traditional, health, information, scientific, media and the computer literacies. This composite skill of amalgamating medical knowledge with computer sciences enables smooth communication of disease and treatment by technological means of delivery. The digital training / e-health literacy is important (Kim & Xie, 2017) for adopting HIT into an effective process. Fact that some healthcare providers do not find e-health tools as easy-to-use may have implications for HIT adoption. Hence there is a pressing need to understand how e-health literacy is related to BI to telemedicine adoption amongst healthcare providers. Therefore this research study hypothesizes that:

**H4: E-health literacy generates positive impact on the BI of adoption of Telemedicine amongst healthcare providers.**

Execution of e-health applications are reported with high failure rates in developed as well as developing countries, most of which are the consequence of deficient e-Health Readiness (EHR) i.e. the preparedness of healthcare organizations and societies for the anticipated change brought by HIT. E-health readiness is an extensive, all-encompassing term that covers multiple domains (Kiberu et al., 2017) and includes organizational, technical and infrastructural, engagement, societal and core readiness, etc. Research has confirmed that healthcare providers' e-health readiness assessment is an imperative step not to be undervalued prior to the adoption of

evidence-based practices (Kiberu et al., 2017). Reasons for inappropriate e-health readiness in developed and developing countries may be similar but may also diverge based on distinctive environments of different countries. E-health readiness assessment can serve, as an immediate step in reducing telemedicine projects failure rate. To analyze this argument, following hypothesis is proposed:

**H5:** Adequate "e-health readiness" of healthcare providers improves the **BI of adoption** of Telemedicine.

Healthcare organizations are globally facing a variety of challenges of growing demands with limited resources (Figueroa et al., 2019). Under such circumstances, leadership plays a key role for employees' and organizational performance (McSherry & Pearce, 2016). Zobair (2020) recommended that adoption of telemedicine relies on hospital realigning of its internal processes and patient care policies. Hospital protocols are largely dependent on its leadership. For effective leadership, leaders focus their actions on the specific practices and hence demonstrate domain-specific leadership, which the researchers call Implementation Leadership (IL). The characteristics of IL includes supporting the employees, providing feedbacks, communicating about the implementation plans, influencing the work context and serving as role models themselves. However, there exists no empirically validated effort to evaluate IL. The organizational leadership is found an important construct which can provide moderating strength to the intention and the actual use of Telemedicine, hence impacting hospital service performance (Shanafelt & Noseworthy, 2017) with stakeholder's job satisfaction. On the contrary, the implementation managers' constraint role demotivates clinicians and hampers the speed and quality of change process. Hence the study hypothesizes as:

**H6a:** **Implementation Leadership** will positively moderate the impact of healthcare provider's PE towards **BI of adoption** of Telemedicine.

**H6b: Implementation Leadership** will positively moderate the influence of the **actual use of Telemedicine** on healthcare seekers' **satisfaction** in public care hospitals.

Based on the TRA, the UTAUT model postulates a connection from attitude to BI and from BI to AU. In addition, when a stakeholder believes that HIT system will positively influence users PE or EE, they form a stronger BI to use telemedicine. Eventually, the actual technological use is directly proportionate to the stronger or weaker BI to use the technology. Another study indicated that successful implementation of telemedicine practices require an understanding of the effects of social and human variables related to adoption attitudes which subsequently correlates with the actual use (Campbell et al., 2017). Correlational studies show that intentions are reliably associated with behavior (Neneh, 2019). The TPB has successfully predicted and explained the wide range of health behaviors and intentions including health services utilization. Several studies have also applied umbrella theoretical models to understand the elements of use intentions transforming into actual use (Zhang et al., 2018). Hence this study hypothesizes as: **H7: BI to adopt** telemedicine has positive influence on **Actual Use** of Telemedicine.

Healthcare seekers Satisfaction (S) is the back bone for all healthcare quality assessments and also vital to any healthcare technology adoption. Patient satisfaction is a subjective assessment that represents patient's cognitive and emotional responses triggered by the interaction with the required healthcare services. Such an evaluation is being utilized not only to gauge the quality of healthcare service but also a parameter to design health care services (Chung et al. 2020). Healthcare seekers' satisfaction is a multifaceted construct. Different dimensions that influence healthcare seekers' satisfaction commonly include communication, patient-provider relationship, convenience, accuracy, waiting time, reliability, efficiency, ease of use and usefulness.

Inaccessibility to health services is one primary cause of healthcare seekers' dissatisfaction.

Since telemedicine overcomes the physical barriers and enables real-time communication between healthcare seekers and off-site healthcare providers by eliminating the transportation time and cost, it can potentially improve healthcare seekers' satisfaction. Literature also shows healthcare seekers' satisfaction is considerably increased in telemedicine projects having continual access to telemedicine clinical team (Lurie & Carr, 2018). It is but also perceived that in practice patients may opt to other providers (Jim et al., 2020) if find telemedicine is unable to satisfy them hence turning the project a failure. To analyze the construct in the scenario of developing countries like Pakistan, following hypothesis is proposed: **H8: Successful Use of Telemedicine OPD consultation services are associated with appreciable healthcare seeker Satisfaction.**

Healthcare providers' Clinical Productivity (CP) used in many of the studies as the number of patient visits managed in a standard time period. Shuaib et al. (2021) defined the productivity as number of patients seen, number of minutes spent with patients, indirect patient care, service management and other such like activities performed. Using telemedicine, healthcare delivery organizations can deliver adequate healthcare to patients from distance resulting in increased productivity and efficiency. Technological limitations can result in restrained clinicians' capacity to adequately diagnose in absence of sensory information (e.g., touch, smell) which cannot be conveyed through telemedicine, thereby slowing down the diagnosis, treatment and productivity. Hence it is important to endorse that telemedicine supports organizational workflows and boosts productivity. To directly test this empirical question, following hypothesis is proposed:

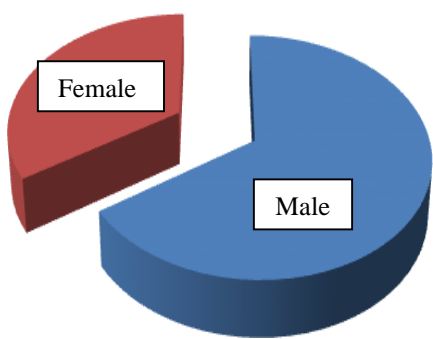
**H9: Actual Use of Telemedicine will deliver an increase in Clinical Productivity of healthcare providers in Public care hospitals.**

**Research Method**

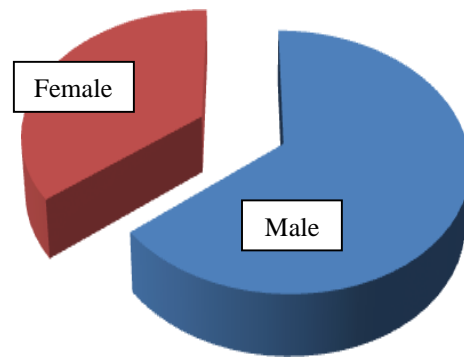
The study is a Descriptive Cross Sectional study which mainly used a Quantitative research approach conducted at selected secondary / tertiary care hospitals of major cities of all provinces of Pakistan, capital city and Azad Kashmir using a purposive sampling. Randomly selected 427 healthcare providers and 554 healthcare seekers participated in the study. Data is collected by using adapted multi-item questionnaire incorporating structured questions for each construct. The researcher employed a 5 point Likert-scale to evaluate all suited items in questionnaire. Results are presented using Statistical Package of Social Sciences (SPSS) version 25.0.

**Data and Analysis**

**Demographic Analysis:** 427 Healthcare Providers participated in the study, with 281 (65.81 %) males and 146 (34.19 %) females. Whereas 554 Healthcare Seekers participated in the study with 356 (64.26 %) males and 198 (35.74 %) females. 251 (45.31 %) of the healthcare seeker participants were patients themselves whereas 303 (54.69 %) were the attendants.



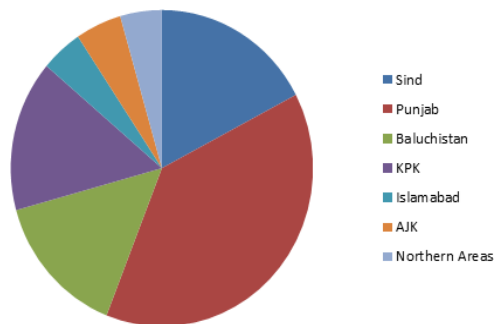
Healthcare Providers



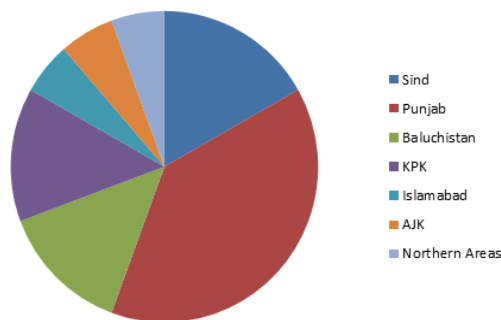
Healthcare Seekers

Gender Distribution of Participants 74 (17.33 %) healthcare providers and 93 (16.79 %) healthcare seekers, randomly chosen participated from Sindh (Karachi, Hyderabad and Sukkur), 165 (38.64 %) healthcare providers and 215 (38.81 %) healthcare seekers from Punjab (Rawalpindi, Lahore, Gujranwala, Multan, Bahawalpur and Rahim Yar Khan), 63 (14.75 %) healthcare providers and 76 (13.72 %) healthcare seekers from Baluchistan

(Quetta, Khuzdar and Turbat), 66 (15.46 %) healthcare providers and 77 (13.90 %) healthcare seekers from Khyber Pakhtunkhwa (Peshawar, Mardan and Kohat), 19 (4.45 %) healthcare providers and 30 (5.42 %) healthcare seekers from Islamabad, 21 (4.92 %) healthcare providers and 32 (5.78 %) healthcare seekers from Azad Kashmir (Muzaffarabad) and 19 (4.45 %) healthcare providers and 31 (5.60 %) healthcare seekers, from Northern Areas (Gilgit).



Healthcare Providers

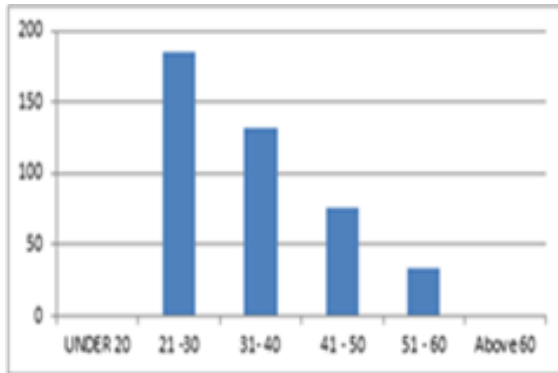


Healthcare Seekers

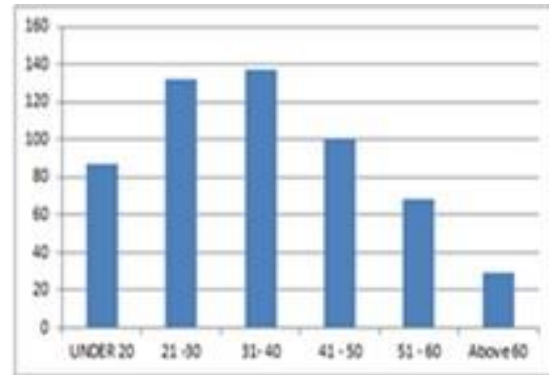
Geographical Distribution of Participants

The mean age of healthcare providers is found to be 34. The minimum age of any participant is 23 whereas maximum age is found to be 59. The mean age of healthcare seekers study participants is found to be 43. The minimum age of any participant is 18 whereas maximum age is found to be 75.





Healthcare Providers



Healthcare Seekers

### Age Distribution of Participants

A summarized Univariate analysis of additional variances of demographic data is as under:

Department	Gynecology	57
	Surgery & Allied	81
	Medicine	113
	Emergency	14
	General OPD	52
	Diagnostics	29
	Administration	81
Experience as Professional	0 – 10 years	126
	11 – 20 years	109
	21 – 30 years	121
	31 – 40 years	60
	41 – 50 years	11
Experience using Telemedicine	Yes	162
	No	265
Experience using	Yes	398

WhatsApp		
	No	29

Healthcare Providers

Education Level	Illiterate	42
	Middle	68
	Matric	128
	Higher Secondary	83
	Bachelor	168
	Masters	23
	MBBS	29
	Post Masters	13
Patient / Attendant	Patient	251
	Attendant	303
Health Status	Acute	210
	Chronic	312
	Acute on Chronic	32
Experience using Telemedicine	Yes	346
	No	208
Experience using WhatsApp	Yes	468
	No	86

### PLS Analysis of Research Model

The results of the hypothesis 1a & 1b suggest that PE is a dominant predictor of both users' intentions of adopting telemedicine and that user contemplate using telemedicine when they sense that telemedicine is valuable for addressing their health concerns. The results of the structural model explain the path coefficient, t-statistics and p-values of the hypotheses. PE showed a positive effect in influencing both healthcare providers' and healthcare seekers' BI ( $t = 4.712$ ,  $p = 0.007$  for providers) and ( $t = 6.316$ ,  $p < .001$  for seekers), confirming hypotheses H1a and H1b.

The results of the hypothesis 2a & 2b predict that telemedicine is an easy tool to learn for its useful functioning for both users. The EE also showed a significant positive effect in influencing both healthcare providers' as well as healthcare seekers' BI ( $t = 2.831$ ,  $p = 0.004$  for healthcare providers) and ( $t = 5.541$ ,  $p < .001$  for healthcare seekers), confirming hypotheses H2a and H2b.

Results of hypothesis 3 postulates that the healthcare seekers agree that telemedicine is a cheaper mode of delivering healthcare services as compared to traditional face to face interaction. Healthcare seekers' CE also displayed highly significant positive association with BI to adopt telemedicine ( $t = 9.169$ ,  $p < .001$ ) endorsing hypothesis 3.

Outcomes of the hypothesis 4 postulate that the overall rate of EHL is found significantly high amongst healthcare providers. Similarly healthcare providers' EHL displayed substantially high significant connotation with BI ( $t = -6.471$ ,  $p < .001$ ) endorsing hypothesis 4.

Aftermaths of the hypothesis 5 postulates the relationship between healthcare providers' EHR and BI. Contrary to the researchers' expectations, no significant relationship was found between EHR of healthcare providers and their BI ( $t =$

1.332, = 0.184), therefore, H5 is not supported. The rejection of this hypothesis contradicts the results of the research studies conducted by Zobair et al. (2021) and Kim et al. (2023) and others.

Hypothesis 6a & 6b postulate about the moderation impact of IL on providers' EE towards BI and AU towards seekers' Satisfaction. IL is found to have no significant moderation effect on the Healthcare Providers' PE towards BI ( $t = 1.782, = 0.076$ ), therefore H6a was rejected. However results declare significant moderation effect of IL on AU of Telemedicine towards Healthcare Seekers' Satisfaction ( $t = -3.814, = < .001$ ), thereby supporting H6 b.

Results of hypothesis 7 postulate that about the positive association between the BI to adopt telemedicine and the AU by both the users. Most of the users preferred and liked using telemedicine for OPD services in secondary / tertiary care public hospitals. BI of the adoption of the telemedicine showed a highly significant positive effect on AU of Telemedicine ( $t = 8.890, = < .001$ ), which confirmed hypothesis H7.

Outcomes of hypothesis 8 confirm that the AU of telemedicine service has positive influence on healthcare seeker Satisfaction. The AU of Telemedicine is found to have highly significant relationship with the healthcare seekers' Satisfaction ( $t = 16.046, = < .001$ ). Hence hypothesis H8 is well supported.

Aftermaths of hypothesis 9 proposes that the AU of telemedicine will result in a rise in CP of healthcare providers. With telemedicine, clinicians can focus on patients without crowd of other patients and their attendants and other unwanted / administrative activities, hence improving consultation time and services. Over all it is estimated that telemedicine causes significant increase in healthcare providers' CP ( $t = 20.026, = < .001$ ) with expectations to have even better results with trained telemedicine practitioners.

Hypothesis	Path Coefficient	T value	P value	Result	R	R <sup>2</sup>
H1a	.294	4.712	0.007	Supported	.749 <sup>2</sup>	.561
H1b	.260	6.316	<.001	Supported	.685 <sup>2</sup>	.470
H2a	.142	2.831	0.004	Supported	.739 <sup>2</sup>	.546
H2b	.214	5.541	<.001	Supported	.649 <sup>2</sup>	.421
H3	.346	9.169	<.001	Supported	.573 <sup>2</sup>	.328
H4	-.332	-6.471	<.001	Supported	.728 <sup>2</sup>	.530
H5	.084	1.332	0.184	Not Supported	.716 <sup>2</sup>	.513
H6a	.081	1.782	0.076	Not Supported	.027 <sup>2</sup>	.001
H6b	-.134	-3.814	<.001	Supported	.052 <sup>2</sup>	.003
H7	.515	8.890	<.001	Supported	.632 <sup>2</sup>	.399
H8	.567	16.046	<.001	Supported	.689 <sup>2</sup>	.475
H9	.701	20.026	<.001	Supported	.685 <sup>2</sup>	.470

#### PLS Analysis of Research Model

The outcomes of this study also reveal that in the context of developing countries too, variables like PE, EE, CE, EHL are the chief influences that affect the BI and the AU telemedicine services, which is also consistent with the preceding researches (Alexandra et al., 2021). EHR needs exclusive analysis separately for each aspect like Core Readiness, Engagement Readiness, Societal Readiness, etc. Similarly, the moderating impact of IL for Healthcare providers PE towards BI needs further evaluation with more studies before being confirmation.

**Measurement of Validity and Reliability.** The composite reliability of all variables ranged between 0.728 – 0.963. The Cronbach's alpha value varied from 0.701 to 0.915 and AVE averaged as shown in Tables, indicating high internal reliability or internal consistency of the variables. The Variance Inflation Factors is found less than the threshold value of 5.0. Hence the studied model is found free of common method bias.

	$\lambda$	$\lambda \wedge 2$	$1-\lambda \wedge 2$	CR	AVE	SQRT	Cron Alpha
PE	0.801	0.643	0.357	0.963	0.643	0.802	0.844
EE	0.796	0.634	0.366	0.874	0.634	0.796	0.719
EHL	0.793	0.633	0.367	0.932	0.633	0.796	0.915
EHR	0.077	0.006	0.994	0.894	0.169	0.411	0.908
IL	0.655	0.448	0.552	0.903	0.448	0.669	0.879
BI	0.821	0.693	0.307	0.868	0.693	0.833	0.777
AU	0.874	0.764	0.236	0.728	0.764	0.874	0.701
CP	0.566	0.343	0.657	0.830	0.343	0.586	0.807

#### Measurement Model for Healthcare Providers

	$\lambda$	$\lambda \wedge 2$	$1-\lambda \wedge 2$	CR	AVE	SQRT	Cron Alpha
PE	0.801	0.643	0.357	0.878	0.643	0.802	0.812
EE	0.796	0.634	0.366	0.874	0.634	0.795	0.807
CE	0.694	0.499	0.501	0.828	0.498	0.706	0.737
BI	0.850	0.723	0.277	0.887	0.723	0.850	0.808
AU	0.917	0.841	0.159	0.913	0.841	0.917	0.811
S	0.547	0.343	0.657	0.919	0.364	0.603	0.905

#### Measurement Model for Healthcare Seekers

These results confirmed the theoretical and statistical validity of the integrated model of this study.

#### Discussion

Public hospices in developing countries are incapable to gratify to the necessities of majority, due to deficient and indecorous infrastructure, squeezed finances, scarcity of allocated resources with inadequate management and planning. Adding to the misery of emerging economies include massive population with uncontrolled growth rate, truncated literacy rate, double burden of diseases, individual and state financial and

ethical corruptions; all together resulting either in total unavailability of requisite medical care or dissatisfaction from the disseminated medical care. Under such circumstances, telemedicine can act as an effective instrument to conduit the extensive crack in the access to quality healthcare (Palozzi et al., 2020) services for rural as well as underserved urban populace. Mapping of telemedicine adoption prospects and defies in developing countries like Pakistan is extremely challenging because the dearth of empirical evidences.

Based on bulky data gathered simultaneously of healthcare providers and healthcare seekers from tertiary care hospices all across Pakistan, this research study reveals mainly a positive impact of the considered constructs. HIT can act as one, the most galloping solution for quick accessibility and effective sustainability to the healthcare system; however, its execution remains very challenging for developing countries like Pakistan. The permeating smartphone technology generates a fresh opportunity in developing countries as well for enlightening patients' self-management of chronic diseases by enabling frequent and flexible interaction with clinicians. Variety of smartphone health technologies have already been testified to support different facets of health management thereby reducing physical attendance in hospitals hence lessening the overcrowded OPDs.

Respondents strongly believed that telemedicine is compatible as well as flexible and can be relied on mapping out the technological contribution with the users' interest and needs. However, individuals with inadequate cognition or physical impairment can find it challenging to interact with any telemedicine platform, resulting in its low utility rate. According to Actor-Network Theory, triumph of any innovative technology relies on the decent interrelation and collaboration between technical and non-technical elements, human and non-human elements. While further analyzing, researcher finds statistically noteworthy association of sociodemographic, socioeconomic and healthcare service variables with WTP for telemedicine in any tertiary healthcare facility. The

present research work did not consider the discrete impact of age, gender and professional experience influencing technology use / acceptance. Taking into the norms of Pakistan's social configuration and family bonds, all 3 variables are taken as Controls or Extraneous Variables, however old age group may be resistant to use ICTs. But its impact needs verification with more studies. Since last few decades, social impact of technological innovations has validated that the construal of innovation designs and hence it should be addressed with a holistic viewpoint, considering interfaces among all of its dimensions.

Setting up any telemedicine platform necessitates intricate, multi-level conglomerates between organizations from diverse sectors. An archetypal program will be a corporation with a healthcare provider, technology firm, hardware / software vendor and the imbursement channel with the healthcare seekers. The conception of inter-sectoral associations is also not simplistic; it entails vigilant design using an all-encompassing and participatory approach. More significantly, it needs the support of not only the line departments / ministries but the community as well.

### Recommendation

- a. The poorly formalized internal processes in the public hospitals in Pakistan be subjected to incremental HIT improvements rather than radical changes in the adoption of technical means. Telemedicine program should be implemented in developing countries gradually from outdoor departments of major hospitals (Pilot Projects).
- b. M-Health is found very viable in low and middle-income states. Approximately 90 percent of Pakistanis live within areas that have cell phone coverage and having 191 million mobile subscribers in 2023; m-Health interventions emerge out to be amongst suited methodologies to our healthcare system and society.
- c. Telemedicine can act as a gateway to the tertiary care Hospitals. Telemedicine clinic should be a filter / appointment clinic for choosing patients who should come to hospitals for physical visit to clinicians.



- d. Training programs for telemedicine practice are essential and must be appropriately tailored to the necessities of different clinical roles to ensure safe and efficient operation of system.
- e. As per the data of Pakistan Social and Living Standards Measurement survey, 67.4% of Pakistanis consult private health consultants. Policy formation with roles and contributions from private sector should be studied and incorporated in future telemedicine policy recommendations of national healthcare.

### Future Studies

- a. Methodologically rigorous trials with large participants from different segments of society with different constructs from digital health should be studied for finalization of an “e-health Policy” before its practical applicability.
- b. Regional partnership with the inclusion of regional specialists is desirable if telemedicine is to strengthen healthcare systems. The studies may be directed towards a regional e-health system where the technology can aid the neighboring less developed countries.
- c. The impact of telemedicine on non-visual and non-financial outcomes like Patient Satisfaction and quality is gaining momentum. But, studies scrutinizing impacts of HIT on satisfaction are rare.

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