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RESEARCH ARTICLE

# TAM MODEL FOR E-HEALTH IMPLEMENTATION IN RURAL AREAS OF UTTARAKHAND, POST COVID-19 PANDEMIC

## *---TAM Model for E-Health Implementation: A Study of Rural Areas of Uttarakhand During Post Covid*

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## ABSTRACT

### OBJECTIVE:

The present study aim to find out the factors that has an influence and impacts the actual use of e-Health during post COVID-19 pandemic on the lines of TAM (technology acceptance model) and further suggest ways for effective implementation and adoption of e-Health by the rural patients.

### DESIGN & SETTING:

The study was conducted on a total of 243 rural patients who had experienced e-Health services. Structural Equation Modeling has been used for analysis of data.

### RESULTS:

The analysis revealed that 'perceived usefulness', 'perceived ease of use', 'privacy' and 'trust', all had considerable impact on the 'intention to use' which further significantly impacts the 'actual use'.

### CONCLUSION:

Using in-depth interviews, both patients and physicians, practice of evidence-based e-Health interventions was identified for effective implementation and adoption of e-Health, which further helps to provides an equitable healthcare services to both urban and rural population.

### KEYWORDS

e-Health, Uttarakhand, rural population, evidence-based e-Health.

## INTRODUCTION

The holistic development of an economy majorly depends on a healthy and skilled and productive workforce [1]. The advent of technology in health has substantially transformed the health system in the country. E-Health has played a significant role in reaching to human aid including those who cannot afford basic healthcare services [30]. A lot of research work has been conducted in health sector for delivering a seamless experience with e-Health facilities. [25] For effective utilization of e-Health, it is important to study factors that affect the acceptance and adoption of e-Health services by both the patients and the medical practitioners. [5] [17] [25] Researches in this field have explored numerous models to deliver effective e-Health services in the rural and interior areas as a social measure. [5] [22] Uttarakhand being a hilly state, provision of e-Health services to the entire state sometime poses a major challenge. Hence the 'Technology Acceptance Model' has been explored to determine factors influencing the adoption of the e-Health model for rural and interior areas of Uttarakhand in creation of trust and comfort level among the patients.

## THEORETICAL BACKGROUND AND HYPOTHESES FORMULATION

The study aims to find out the vital factors that influence the adoption of e-Health in the rural areas of Uttarakhand by utilizing the TAM during the post Covid-19 pandemic. The Technology Acceptance Model (TAM) is a popular model to understand and recognize "why users/customers accepts or rejects a technology and also how user/customer acceptance can be enhanced through technology." The *TAM* was originally developed by Fred D. Davis in 1980s. [12] Further the basic TAM has been added other extensions to reduce the limitations with the traditional model. [11] [14]

The basic TAM model includes 'Perceived Usefulness' and 'Perceived Ease of use' that the users have experienced with the technology which contributes to their 'intention to use' e-Health services. [25] Perceived usefulness is defined as the "degree by which a person considers that by using a specific technology leads to enhancement ones performance" while perceived ease of use is believed as the extent to which a person understands that by using a particular system will result in free of efforts or less effort". Thus, TAM has provided a framework to understand that the patient's 'intention to use' get converted into actual use of e-Health.[29] In addition to factors 'Perceived Usefulness' and 'Perceived Ease, other factors in TAM that the study has investigated to study were 'privacy' and 'trust'. [2] Researchers highlighted few other factors in addition to the ones included in basic TAM model - acceptance of users, attitude of the doctors, adoption by doctors, social and cultural factors, technological infrastructure, supporting healthcare structure, etc. [15][16] The patients, especially those residing in rural areas hesitated to use e-Health services with the viewpoint that using technology can expose their private information in jeopardy leading to lack of trust in e-Health. [26-28] Patients were comfortable to share their medical history and information with only the doctors or medical associates. [15-16] Further the relationship between trust and the acceptance of technology by the user was realized. [7] The trust on technology is based on the experience and the probable threat that it entails. Therefore, it has been found that during post Covid-19 situation, acceptance of technology significantly impacted the trust and vice versa. Sharing medical information through digitalized process created discomforts among patients due fear of information leak.

**Hypothesis**

$H_{01}$=There is no significant impact of perceived usefulness on intention to use

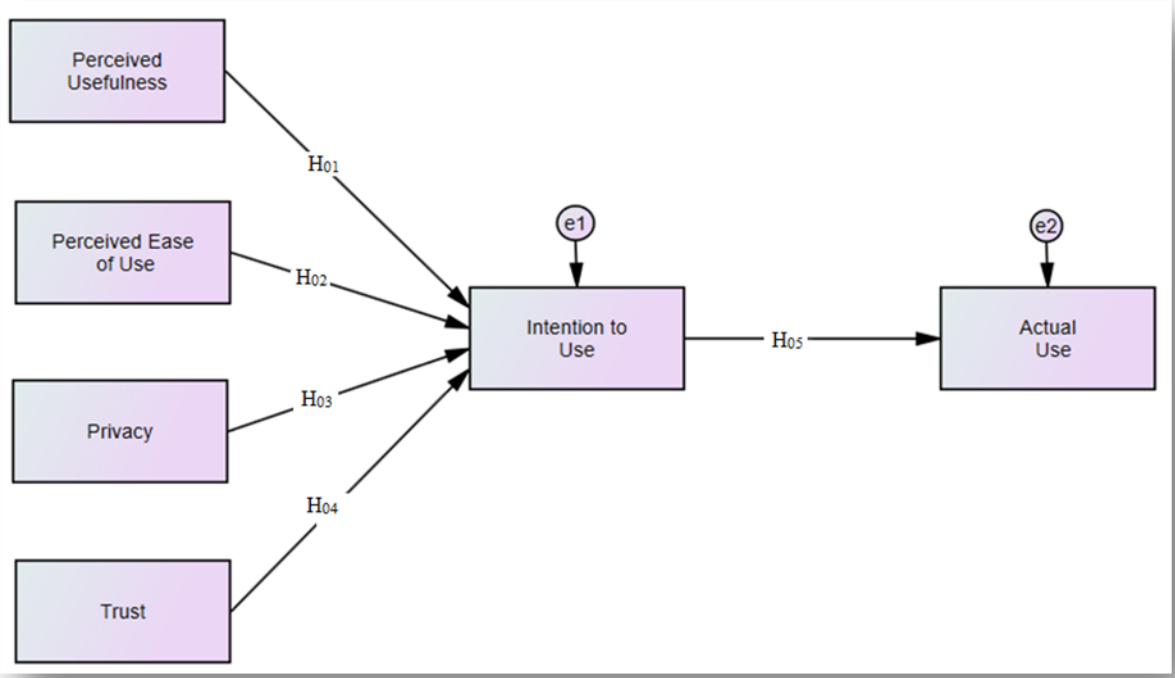
$H_{02}$= There is no significant impact of perceived ease of use on intention to use

$H_{03}$= There is no significant impact of privacy on intention to use

$H_{04}$= There is no significant impact of trust on intention to use

$H_{05}$= There is no significant impact of intention to use on the actual use

FIGURE 1: THEORETICAL MODEL FOR ADOPTION OF E-HEALTH




## RESEARCH METHODOLOGY

### RESEARCH SETTING

The present research intended to study significant factors that affects the 'intention to use' and 'actual use' of the e-Health services during post pandemic situation and to design a suitable model for optimum utilization of e-health services among rural patients in Uttarakhand; for which positivist approach proved appropriate.[17] The TAM model in the present study included privacy and trust in addition to perceived usefulness and perceived ease of use.

### MEASURES

The variables used in the model were adapted as per the need of the study. The traditional f TAM model included perceived usefulness, perceived ease of use, intention to use and actual use which were extracted from Davis [10], Venkatesh and Davis, [27] Taylor and Todd. [24] The additions of trust and privacy were adapted from Featherman and Pavlou [9], Giovanis et al. [11] Chellappa and Pavlou [4] and Korgonkar andWolin [19] respectively.

### DATA COLLECTION

Primary data has been collected using a structured questionnaire from respondents which primarily consisted patients/ patients' attendant group. The data has been collected from district hospital at Tehri Garhwal and from community health centers (CHCs) each at Beleshwar and Devprayag, Srinagar in Garhwal and Almora & Rudrapur districts of Kumaun regions. A total 350 respondents were contacted out of which 243 responses were chosen for analysis due to completeness and error free feedback. Further factors of e-health were first reviewed and verified through both internal checks and delphi technique. The secondary data has been collected from statistics and literature available with the government and non-government bodies.

## STATISTICAL TOOLS & DATA ANALYSIS

The data collected was analyzed using AMOSS- SEM using TAM (Technology Acceptance Model) model. Multiple Regression Analysis tool has been explored in the study. Data analysis is covered in two sections: Measurement model and structural model.

### MEASUREMENT MODEL

The measurement model has been run to check the construct validity which included both discriminant as well as convergent validity along with checking the model fit as well. The factors along with their variables were run to

check for model fit and construct validity which provided the following results. The model fit indices included CMIN/df=1.526; GFI= 0.913; NFI=0.966; CFI=0.988; TLI=0.985 and RMSEA=0.047 which were all according to the recommended guidelines. [3],[11]

**TABLE 1: MODEL FIT INDICES**

| MODEL FIT INDICES | VALUES | RECOMMENDED GUIDELINES |
|---|---|---|
| GFI | 0.913 | ≥ 0.90 |
| $X^2$ /DF | 1.526 | < 5 |
| RMSEA | 0.047 | < 0.08 |
| NFI | 0.966 | ≥ 0.90 |
| CFI | 0.988 | ≥ 0.90 |
| TLI | 0.985 | ≥ 0.90 |

**TABLE 2: MEASUREMENT MODEL**

| CONSTRUCTS | ITEMS | LOADINGS | CR | CRONBACH ALPHA | AVE |
|---|---|---|---|---|---|
| Perceived Usefulness (PU) | PU1<br>PU2<br>PU3<br>PU4 | .940<br>.948<br>.888<br>.946 | 0.963 | 0.87 | 0.866 |
| Perceived Ease of Use (PEU) | PEU1<br>PEU2<br>PEU3<br>PEU4 | .956<br>.953<br>.969<br>.956 | 0.984 | 0.89 | 0.940 |
| Privacy<br>(PRI) | PRI1<br>PRI2<br>PRI3 | .951<br>.972<br>.968 | 0.927 | 0.91 | 0.810 |
| Trust<br>(TRU) | TRU1<br>TRU2<br>TRU3 | .959<br>.959<br>.966 | 0.970 | 0.91 | 0.916 |
| Intention to Use<br>(INT) | INT1<br>INT2<br>INT3 | .921<br>.840<br>.939 | 0.974 | 0.81 | 0.925 |
| Actual Use<br>(ACT) | ACT1<br>ACT2<br>ACT3 | .963<br>.970<br>.926 | 0.966 | 0.84 | 0.904 |

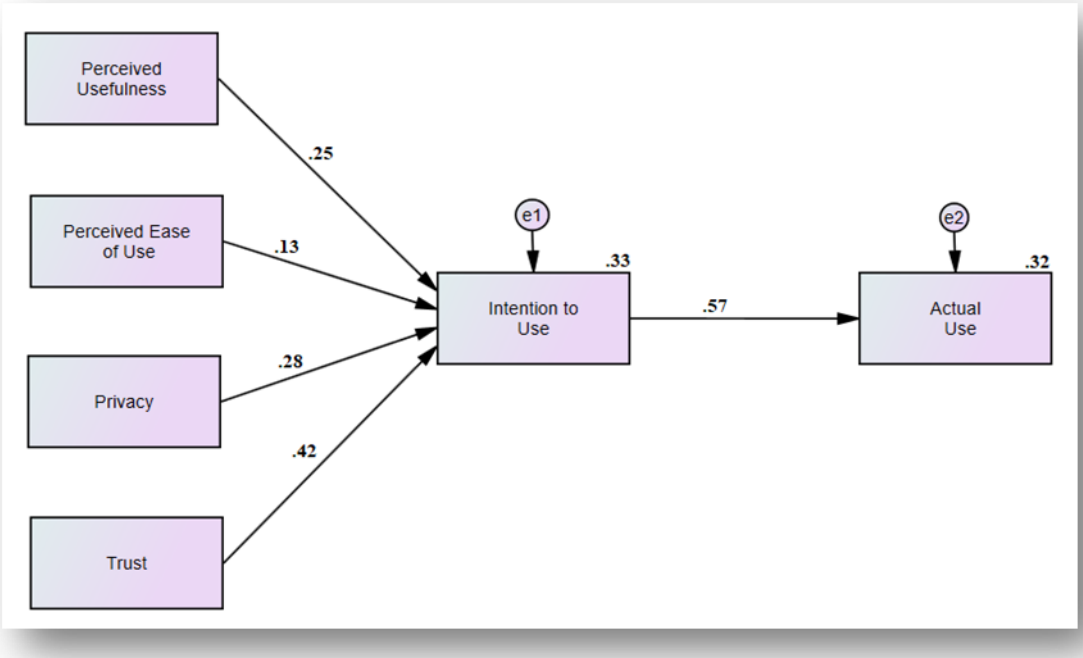
Table 2 below shows items under each factor along with their corresponding factor loadings. The variables under each factor had a factor loading above 0.70 indicating a strong convergence with their respective factors. To examine the internal reliability, Cronbach alpha and composite reliability were calculated, Values obtained were above 0.70 mark, proving it to be acceptable indicator of internal reliability.

The construct validity was calculated with the help of Dr.Gaskin's stats tool package, which provided us with the table 2 and Table 3. The criteria for convergent validity was met as the AVE values so obtained were more than 0.05 (Perceived Usefulness=0.866; Perceived Ease of Use =0.940; Privacy =0.810; Trust =0.916; Intention to Use=0.925 and Actual Use= 0.904).

**TABLE 3: CORRELATION MATRIX AND SQUARE ROOT OF AVE**

| | PEU | INT | PU | TRU | PRI | ACT |
|---|---|---|---|---|---|---|
| PEU | 0.970 | | | | | |
| INT | 0.014 | 0.962 | | | | |
| PU | 0.325 | 0.041 | 0.931 | | | |
| TRU | -0.055 | -0.165 | -0.038 | 0.957 | | |
| PRI | 0.266 | 0.122 | 0.321 | -0.045 | 0.900 | |
| ACT | -0.013 | -0.229 | -0.051 | -0.155 | 0.077 | 0.951 |

**FIGURE 2: STRUCTURAL MODEL**



The above table depicts the correlation matrix and square root of AVE. The discriminant validity of the variables in each factor is established as the values of square root of AVE for each factor is more than the correlation value that exists between them.

### STRUCTURAL MODEL

To test the hypotheses so framed, the theoretical model was explored as to examine the impact of each independent factor on 'intention to use' and further analyses the impact of intention to use on actual use (Given in Fig 2- Structural Model).

Hypothesis one intended to examine whether 'perceived usefulness' has any significant impact on 'intention to use' in the present study. The result obtained a C.R. value of 4.651 with corresponding p-value to be less than 0.05, indicating that there is a significant impact of perceived usefulness on intention to use. Hence it proved that patients residing in rural areas of Uttarakhand found e-Health useful for them in influencing intention to use such e-health services.

Hypothesis two has been used to analyze the impact of 'perceived ease of use' on 'intention to use'. The analysis result provided a C.R. value of 2.488 and a p-value of 0.013 (less than 0.05) indicating a significant impact of the former on the latter. After having an experience with the e-Health services it became plausible for the rural patients to adopt these facilities with ease. Hence proving perceived use of e-Health services significantly impacts the intention to use e-health services in the state.

Hypotheses three and four (privacy and trust) were additions to the TAM model, which was taken as the base for measuring the impact of various factors on the intention to use and actual use of e-Health. The results obtained showed a C.R of 5.175 and 7.856 respectively, with their corresponding p-values less than 0.05. Both privacy and trust had a significant impact on the intention to use of e-Health services. The rural patients were established to be reluctant while using e-Health services due to the privacy of their health data. While existing users of e-Health services had no issues with the privacy and trust factors. Hence the combined impact of all the four independent factors shown a variance of 33% in 'intention to use'

Hypothesis five examined the impact of 'intention to use' on 'actual use'. The final result showed a C.R. value of 10.617 and p-value found to be less than 0.05, indicating a significant impact. The R square value 0.323, depicting that actual use had a variance of 32.3% due to intention to use. The value of R square has been significant, but the variance brought about was not very high, as the respondents belonged to the rural regions of Uttarakhand, who had little exposure to e-Health facilities.

## CONCLUSION & SUGGESTIONS

E-health in Uttarakhand during post Covid -19 situation has gained popularity but not impressively impacted the functional areas based on ICT like patient care, laboratory, pharmacy and online registration etc. The patient registration and online appointments have been covered satisfactorily under e-health concept. Improvement in e-Health includes encouraging more online professional fellow system, informed approval process, privacy and empowerment and equity to be encouraged [12][16] for equitable access to health services in rural deprived states of Uttarakhand. [15]

### LIMITATIONS & SCOPE FOR FUTURE RESEARCH:

The present study is not a comprehensive analysis of the entire health care system in Uttarakhand; it excludes traditional medicine like, AYUSH and Homeopath. But the present empirical study can be further studied by implementing the proposed TAM model to other hilly states of India for effective implementation of e-health services.

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## APPENDIX

| CONSTRUCT | MEASUREMENT ITEMS |
|---|---|
| Perceived Usefulness(PU) | PU1: Using the e-Health services will improve my life quality<br>PU2: Using the e-Health services will make my life more convenient<br>PU3: Using the e-Health services will make me more effective in my life<br>PU4: Overall, I find the e-Health services to be useful in my life |
| Perceived Ease of Use (PEU) | PEU1: Learning to operate the e-Health services will be easy for me<br>PEU2: I can easily become skillful at using the e-Health services<br>PEU3: I can get the e-Health services to do what I want it to do<br>PEU4: Overall, the e-Health services are easy to use |
| Privacy (PRI) | PRI1: I believe that privacy of e-Health participants is protected<br>PRI2: I believe personal information stored in e-Health system is safe<br>PRI3: I believe e-Health systems to keep participants' information secure |
| Trust (TRU) | TRU1: Based on my experience with the e-Health in the past, I know it is trustworthy<br>TRU2: Based on my experience with the e-Health in the past, I know it is not opportunistic<br>TRU3: Based on my experience with the e-Health in the past, I know that it keeps its promises to its patient |
| Intention to Use (INT) | INT1: I have high intention to use the e-Health service<br>INT2: I intend to learn about using e-Health services<br>INT3: I plan to use e-Health services to manage my health |
| Actual Use (ACT) | ACT1: e-Health service is a pleasant experience<br>ACT2: I use e-Health service currently<br>ACT3: I spend a lot of time on e-Health service |