

Analysis of Technology Acceptance in Healthcare using Modified UTAUT2 Model

Ayush Murarka¹ Keerthana V² Mansi Agarwal³ Navya B⁴
1,2,3,4Student

1,2,3,4Symbiosis Institute of Business Management Bengaluru, constituent of Symbiosis International (Deemed University), Pune, India

Abstract— One of the major aspects of the paper is the purpose of study of Technology in Healthcare. The main reason why we carried out this study was because with the technological advancement there have been certain improvements as well as gaps which are caused due to natural human response to it. To some extent there is not enough data available to check for the effect on technology on healthcare as a whole and people's reaction to it. This paper looks into different factors that are responsible for a varied acceptance and among which group is this accepted. The study highlights the key motive of checking for the attitude of the professional experts as well as the general public which is our sample for the study. The model used for the study has helped bridge the gaps in previous researches in terms of factors that were overlooked. The behavioral model has enabled identify in detail different technology types ranging from wearable technology to LVAD device and how this has affected the users for the better or worst. Several statistical tools have been used to assess this change and behavior and predict the future trends on the basis of this analysis. The UTAUT2 Model was tailored according to the research that was conducted for the paper which had factors like Income, Price, Age, Experience, Effort Expectancy etc. There has been seen a necessity to improve the quality, cost, efficiency and capacity of healthcare services. However, adoption and benefits have not been uniformly distributed and reliability of success has been difficult.

Keywords: Healthcare, LVAD, UTAT Model

I. INTRODUCTION

Over the years technology has been advancing in almost every sector and it has resulted in many positive implications for the people as a whole. Some tools like big data analysis for pharmacogenomics are still being developed, but data analytics and technological advancement for the purpose of population health may be the next big step on the horizon. "Understanding and connecting all these variables is going to be profound as it relates to moving forward in healthcare and designing interventions and analyzing patient populations and ultimately improving the lives and health of the population. This Research Model revolves around this concept in order to indicate how much of a change is reflected in people's acceptance of technology, particularly in the healthcare industry. The availability of newer treatment technologies leading to better outcomes has enhanced the quality of life of the patients as well. Technological developments are better adopted into the healthcare fields in some parts of the world than others. Developed nations have been able to harness technology more efficiently for improved patient care; however, developing nations are catching up quickly.

Healthcare providers who haven't yet adopted the tools technology places at their disposal are realizing their vast untapped potential and are making the changes and the investments required to streamline processes, lower costs, increase efficiency and most importantly, to improve quality of care.

II. RESEARCH OBJECTIVES

- To analyze human responses to healthcare equipment (chatbots, MHealth, Electronic Health Records) and summarizing the variables that has been found to influence responses.
- To check whether interventions through healthcare technology is improving the scenario in the healthcare industry.
- To study various focus groups (on the basis of Age, Gender, Type of Disease etc.) for the same and their perception to healthcare technology.

III. EXPECTED BENEFITS OF RESEARCH

Our study would be around the suitability and acceptance of healthcare robots and technology as a whole, in the healthcare industry. The purpose of technology in Healthcare is to provide better care for patients and help achieve health equity. Healthcare Technology supports recording of patient data to improve healthcare delivery and allow for analysis of this information for both healthcare practitioners and ministry of health/government agencies. This data is used for the implementation of policies in order to better treat the patients. Technology is impacting lives by:

- Improved Public Health
- Ease of Workflow
- Lower Healthcare Costs
- Greater Patient Care

Not everyone responds to this advancement in the similar way. People have different perceptions and we have studied those differences on the basis of demographic segments and different forms of technologies being studied.

IV. HYPOTHESIS

- H₀: There is no acceptance of technology in health care industry among the medical professionals.
- H₁: There is acceptance of technology in health care industry among the medical professionals.
- H₀: There is inefficiency in taking care of chronic (heart) diseases.
- H₁: There is efficiency in taking care of chronic (heart) diseases.
- H₀: Social demographic factors are not related with patient's propensity to engage with technology
Example: Left Ventricle Assisted Device.

- H₁: Social demographic factors are related with patient's propensity to engage with technology
Example: Left Ventricle Assisted Device

V. EXISTING MODELS

A. UTAUT and UTAUT2

The UTAUT Model helps check the user acceptance of Information Technology or Technology in case of the research topic being studied. Aims to explain user intentions to use an information system and subsequent usage behaviour. The theory holds that there are four key constructs: performance expectancy, effort expectancy, social influence and facilitating conditions. The theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain information systems usage behaviour. In addition to this model we have also used UTAUT 2 Model which is an extension to the UTAUT Model. This model incorporates 3 additional constructs that are:

- 1) Hedonic Motivation-the fun or pleasure derived from using a technology, and it has been shown to play an important role in determining technology acceptance and use
 - 2) Price Value-Cost and pricing structure is a key highlight which impacts consumers technology use.
 - 3) Experience and Habit- The extent to which people tend to perform behaviours automatically because of learning.
- First, habit is viewed as prior behaviour.
 - Second, habit is measured as the extent to which an individual believes the behaviour to be automatic

B. UTAUT Model

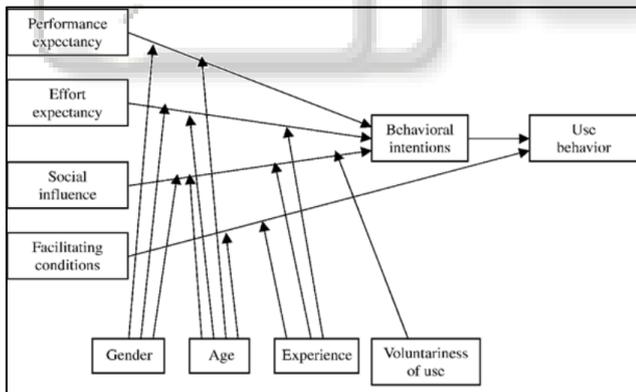


Fig. 1:

C. UTAUT2 Model:

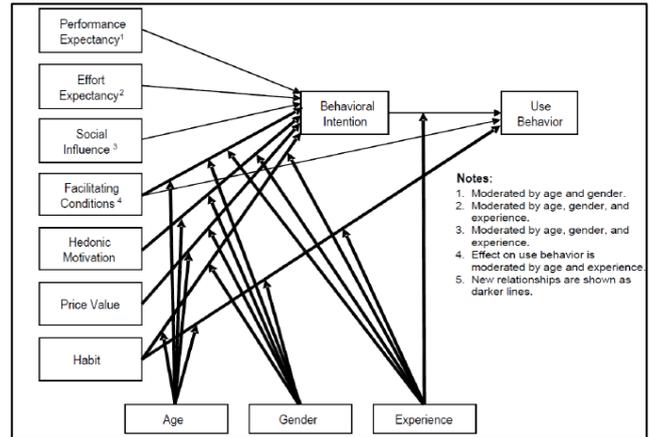


Fig. 2:

VI. PROPOSED MODEL

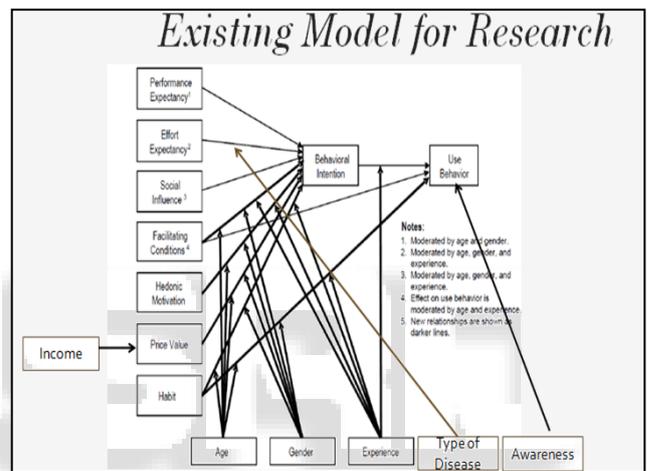


Fig 3:

In our own model, we have added three more factors which increase the relation between human acceptance and technology. The three factors added are:

A. Income:

Income is added as it is directly proportional to price. It explains us the fact that higher income people can spend considerably more amount on technology.

B. Type of disease:

Technology treatment depends on the type of disease such as chronic and seriousness of the diseases. People suffering with less severe diseases might not opt for technology-based treatment. Chronic diseases like kidney related diseases, heart diseases might go for technology-based treatment.

C. Awareness:

People who are aware of the technology- based treatment might opt for it, while other people who aren't aware of such technology treatments might find it scary and not reliable. Hence awareness is an important factor in our model.

Some of the studies employ qualitative analysis due to the perceived inability of quantitative analysis to meet the purpose of the study, or the sample size may be viewed as being too small to perform the relevant quantitative analysis.

Using our methodology to construct a better analysis of Technology in Healthcare. Other limitation is the ability to draw a statistical conclusion in each research examined. This is due to a great variety of research topics, methods, constructs and contexts. In order to avoid a small sample size which gives incorrect results we are using secondary data to widen the reach to the greater population to be researched. We have considered professional acceptance and getting data from hospital staff to obtain more accurate data.

VII. DATA INTERPRETATION

For checking the acceptance level of healthcare technology by doctors, we have used a secondary source as Accenture Consulting 2018 Consumer Survey on Digital Health conducted in U.S and Heart Failure data from Kargil Database. From the Accenture’s survey which was conducted over seven country with 7,905 consumers with age 18+ to assess their attitudes towards healthcare technology, modernization and service innovation. The demographics used in this survey were gender and age, education, income, race/ethnicity, health status and health insurance status. It was clearly seen that there is an increase in the people acceptance of technologies like wearables, electronic health records etc. It was seen that people were ready to adopt robot assisted surgery after realising the benefits of it. From the heart failure data collected from Kargil database, we performed regression using SPSS, a statistical tool to analyse the statistical data. Regression was implemented on parameters which were useful to substantiate our research.

A. Kargil Database – Heart Failure Database

AGE	SEX	CP	TRESTBPS	CHOL	FBS	LVAD	THALACH	EXANG	OLDPEAK	SLOPE	CA	THAL	TARGET
63	1	3	145	233	1	0	150	0	2	0	0	1	1
37	1	2	130	250	0	1	187	0	4	0	0	2	1
41	0	1	130	204	0	0	172	0	1	2	0	2	1
56	1	1	120	236	0	1	178	0	1	2	0	2	1
57	0	0	120	354	0	1	163	1	1	2	0	2	1
57	1	0	140	192	0	1	148	0	0	1	0	1	1
56	0	1	140	294	0	0	153	0	1	1	0	2	1
44	1	1	120	263	0	1	173	0	0	2	0	3	1
52	1	2	172	199	1	1	162	0	1	2	0	3	1
57	1	2	150	168	0	1	174	0	2	2	0	2	1
54	1	0	140	239	0	1	160	0	1	2	0	2	1
48	0	2	130	275	0	1	139	0	0	2	0	2	1
49	1	1	130	266	0	1	171	0	1	2	0	2	1
64	1	3	110	211	0	0	144	1	2	1	0	2	1

Fig. 4:

This database of 330 tuples and 14 attributes explains the number of people who go for LVAD treatment. Factors like age, sex, intensity of CP- chest pain will be the factors which will influence people whether to go for treatment or not. For the null hypothesis “There is inefficiency in taking care of chronic (heart disease)”, we took TARGET and LVAD as dependent and independent variables to perform regression. TARGET indicates the people who are diagnosed with heart disease. ‘1’ indicates (high) that is there is high risk and ‘0’ (low) that there is low risk. LVAD is left ventricular assist device is a mechanical pump that is implanted inside a person’s chest to help a weakened heart pump blood. After performing regression, we were able to prove that there is a strong relationship between LVAD and TARGET. With 95% significance, we get a p-value of 0.017 which is less than 0.05. This indicates that TARGET is

dependent on LVAD (people with high risk go for LVAD treatment). Hence, we rejected null hypothesis and accepted alternate hypothesis.

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.476	.040		11.799	.000	.396	.555
	LVAD	.130	.054	.137	2.404	.017	.024	.237

a. Dependent Variable: TARGET

Residuals Statistics ^a					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.48	.74	.54	.068	303
Residual	-.736	.524	.000	.494	303
Std. Predicted Value	-1.004	2.799	.000	1.000	303
Std. Residual	-1.487	1.059	.000	.998	303

a. Dependent Variable: TARGET

Fig. 5:

For proving this second null hypothesis “Social demographic factors are not related with patient’s propensity to engage with technology which is LVAD”, we took AGE and SEX as independent variables and LVAD as dependent variable. After performing regression, we were able to see that it was age which had more significance. At 95% significance level, p- value of age was equal to 0.033 which is less than 0.05. The p- value of sex was equal to 0.22 which is greater than 0.05. So, we rejected null hypothesis and accept alternate hypothesis which states that “Social demographic factors are related with patient’s propensity to engage with technology which is LVAD”.

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.970	.193		5.030	.000	.590	1.349
	AGE	-.007	.003	-.123	-2.142	.033	-.014	-.001
	SEX	-.079	.065	-.070	-1.223	.222	-.207	.048

a. Dependent Variable: LVAD

Residuals Statistics ^a					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.34	.73	.53	.071	303
Residual	-.684	1.572	.000	.521	303
Std. Predicted Value	-2.615	2.795	.000	1.000	303
Std. Residual	-1.308	3.007	.000	.997	303

a. Dependent Variable: LVAD

Fig. 6:

B. Accenture Consulting 2018 Consumer Survey on Digital Health

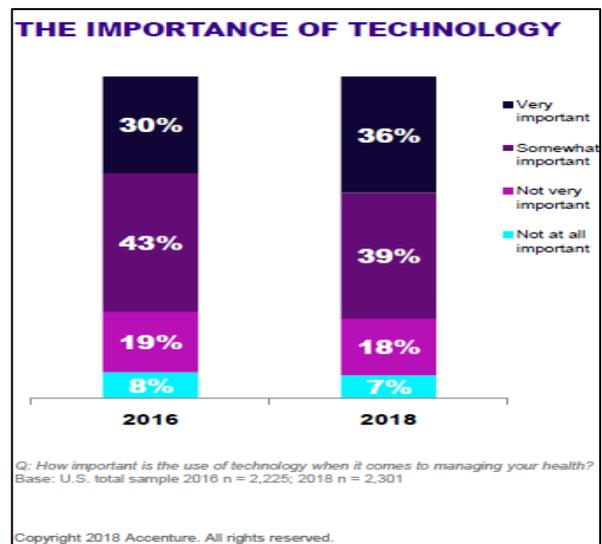


Fig. 7:

In order to more substantiate our research hypothesis, we have taken a consumer survey conducted on digital health by Accenture Consulting in 2018. This survey primarily focused on U.S citizens. The survey methodology which Accenture Consulting used was in the form of 15-20minute online questionnaire to be filled by respondents. The sample size was 2,301 US residents over the age of 18. 21.2%, 23.4%, 21.3%, 34.1% of respondents were from east, west, Midwest, south respectively. The data collected was weighed by region, education level, income, and ethnicity. This was done to match the weighing profile applied to the 2016 edition of research series and thereby ensured that valid comparisons were made between the surveys. From the figure 3, it can be seen that in 2016 – 2018, it can be clearly seen that there is an increase in the level of importance given to the technology by the U.S people.

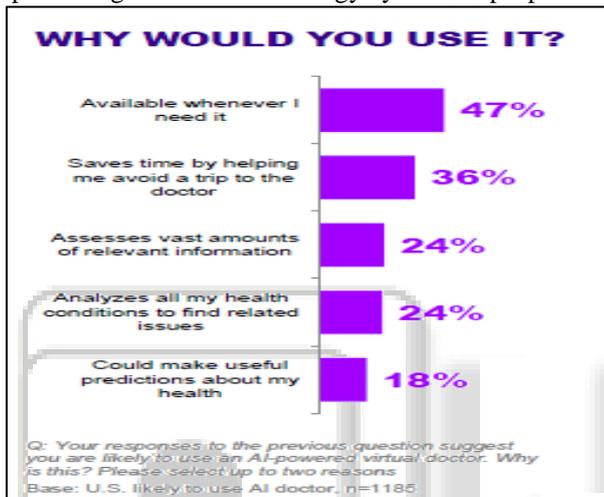


Fig. 8:

When a question “Why AI for healthcare? Why would you use it” was posed to respondents, 47% of respondents felt comfort in the availability, 36% responded that AI was time saving instead of going to a doctor. It can be clearly seen that people were in need of huge amounts of relevant information, analysis of their health conditions to find related issues and accurate prediction which will be satisfied by AI. This gives us a major hint that consumers are more attracted towards AI powered health services.

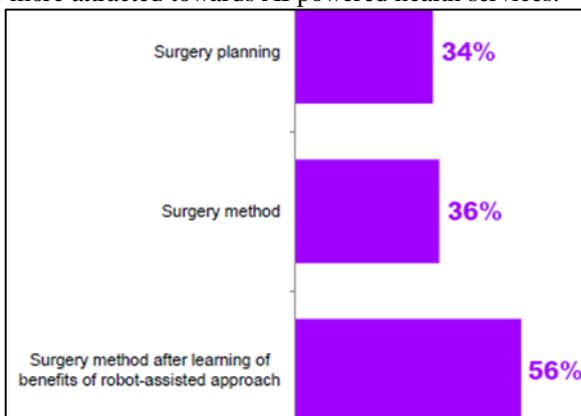


Fig. 9:

When it comes to robot assisted surgery, a question “When will you choose robot surgery”, 34% responded to surgery planning, 36% responded to surgery method and 56% responded to surgery method after learning of benefits

of robot-assisted approach. The reason why people have changed their minds about robot assisted surgery is that robot assisted surgeries have less complication rates and more accurate.

VIII. CONCLUSION

Acceptance of technology is influenced by multiple factors. However, post-implementation research on technology acceptance by community-dwelling older adults is scarce and some of the factors in this review have not been tested by using quantitative methods. Further research is needed to determine if and how the factors in this review are interrelated, and how they relate to existing models of technology acceptance. This review provides an overview of factors, but it does not differentiate between types of technology. Furthermore, moderating or mediating relationships between factors have not been investigated due to a lack of available data. Overall study has resulted in findings which help us conclude that Healthcare technology is being accepted throughout, irrespective of the demographic factors. Analysing responses has helped us interpret the positive relation between people’s acceptance towards technology and how they consider it beneficial.

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