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KNOWLEDGE AND ATTITUDES AS INFLUENCING FACTORS FOR ADOPTING HEALTHCARE TECHNOLOGY AMONG MEDICAL STUDENTS IN GERMANY

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Abstract

Telemedicine services are increasingly being tested in pilot projects and integrated into standard care. One of the primary reasons for the failure of such innovation processes is the lack of user acceptance. This will soon affect doctors who will have to use telemedicine but will be unfamiliar with it. Knowledge and attitudes prevalent amongst medical students in Germany were surveyed and their perceived relevance for medical practice analysed.

METHODS: In an online-based approach 524 medical students in Germany were interviewed. The participants (63.6% women, average age 25 years) were randomly selected. Correlations were tested within a linear regression model between the expressed expectations (independent variables) and the perceived importance of telemedicine for their future medical practice (dependent variable).

RESULTS: The students surveyed showed great interest in telemedicine. The increasing mechanisation of care processes is generally viewed positively. The sooner medical students develop a positive attitude towards the impact of telemedicine for a given medical treatment (p=0.006), diagnostic and therapeutic efficiency (p=0.008) and public health-related costs (p=0.002), the more they tend to assign technology a high value for their future professional practice. There is, however, a lack of information about the potential use of technology.

CONCLUSIONS: There is an urgent need to eliminate knowledge deficits in order to develop treatment-related telemedicine services. This would include more professional publications and furthering education, as well as training more physicians in telemedicine in Germany.

Keywords: Telemedicine; acceptance, attitudes of medical students

Introduction

The challenges facing health systems in developed countries now and in the future are well known: demographic change, ageing societies and a rise in chronic diseases which leads to an increased need for health and nursing care.[1] At the same time, the proportion of people working decreases. This in turn leads to less revenue for the national social security funds.[2] In recent years eHealth, and telemedicine in particular, has advanced greatly. This is, in no small part, thanks to the European Union (EU), with its national and regional strategic funding under the "eHealth Action Plan 2012-2020". Information and communication technologies (ICTs) are gaining the notice not only of society, but also of health policy makers. By 2020, telemedicine services should be available nationwide.[3] This is also due to an increase in research which scopes health and economic end points of employing technology in healthcare.

The development and implementation of telemedicine applications and the resolution of technical problems are still key challenges in many European countries and include prohibition of remote treatment, delegation of medical services, legal liability issues (which can arise from both medical and technical errors), adequate consideration of self-determination regarding data security and privacy, and joint development of quality standards.[4-6] Research and development in telemedicine cannot be done in a top-down manner. The developments so far make it clear that eHealth and particularly telemedicine must be developed with the users and align with their individual and objective needs for its successful adoption and acceptance.

Acceptance research in social innovation goes back to the 1960's. In the 1980's the first multifactorial theory models evolved to explain acceptance of technology.[7] The Technology Acceptance Model (TAM), which was expanded by Venkatesh and Davis,[8] and

particularly the Unified Theory of Acceptance and Use of Technology (UTAUT) ,[9] are of central importance. Factors such as "expected performance", "expected effort", "social influence", and "usage facilitating framework" are used to operationalize acceptance. The models were well tested in different technology-assisted care settings,[10-13] with gender,[14-16] age,[17-20] cultural background,[21] experience, and individual technology-related user competence profiles[22] as modulating factors. In addition to verbalised attitudes and opinions, these social-psychological approaches try to explain individual and/or group-specific acceptance of individual technology applications by including cognitive patterns, psychological dispositions, and rational motives.

Although adoption and acceptance of technology is basically affective, and hence difficult to objectify, individual and institutional knowledge (e.g., attribution of certain technology characteristics and consequences) appears to be central for opinion-forming and decision-relevant processes regarding the influence of individual factors on acceptance.[22-24] This is compounded by the considerable lack of information about eHealth among many physicians practicing in Germany. It was recently reported that only 36% of physicians feel well or very well informed about telemedicine, while almost two thirds describe their level of information as inadequate.[25] Due to demographic trends in the medical profession in Germany further dissemination of this knowledge in the health sector is crucial, given that telemedicine will be of the utmost importance for future generations of physicians. Fifty-six percent of doctors in Germany are already over 50 years of age, with 16% over 60. By 2020 at least 71,600 physicians will be retiring.[26] Little is known in Germany about medical students' knowledge of telemedicine.

The aims of this study were to determine medical students' knowledge of telemedicine, their attitudes and opinions or the potential of telemedicine and challenges facing its use and attitudes towards future development of telemedicine.

Methods

A questionnaire was developed through review of the literature. It covered the following domains a) assessment of personal knowledge, b) information behaviour, c) positive and negative attitudes towards telemedicine and d) attitudes towards the development of telemedicine in the future. The survey was developed using EFS Survey and administered online.

Each of the 36 medical schools in Germany was contacted and invited to participate. Theoretically 86,376 students were reached and invited into study. Through a software-controlled random process, only one in three medical students who opened the hyperlink to the survey were given access to the survey. The others were automatically rejected.

Statistical analysis was done using IBM SPSS Statistics 19 with α set at 5%. A multivariate regression model was used to quantify the association between independent and dependent variables (assessment of the value of telemedicine for professional medical practice) through relative risks (RRs) and 95% confidence intervals (CIs) and to adjust for co-factors. A total of 457 cases were considered for the regression model. The corrected coefficient of R^2 is 37.7%.

The values of Pearson's Chi-square test and Spearman's correlation coefficient (bivariate analysis) were used to check the association of independent variables with the dependent variable. Twelve predictors (independent variables) were included in the multivariate analysis: more effective diagnosis and treatment; better treatment options; higher healthcare costs; confidentiality of patient data; facilitated integrated care; improved communication between doctor and patient; higher quality of information; increased costs for the physician; deterioration in the doctor-patient relationship; improved interdisciplinary cooperation; increased administrative workload; workload expected from telemedicine. The association between the dependent variable "value of telemedicine for future physicians" and the predictors can be described statistically.

Results

Five hundred and twenty-four randomly selected medical students who had passed their preliminary medical examination in Germany were surveyed. The gender distribution of the survey group of 63.6% women corresponds to the distribution of medical students in Germany. The average age was 25 years and socio-economic variables were not recorded.

Knowledge and information

In total, 63% of the students responding indicated they knew what telemedicine is. The level of information correlates positively with a student's age and the num-

ber of semesters completed. The majority of students (59%) obtained their information about telemedicine from lectures and seminars on human medical studies. Furthermore, news media is a source of information for students with 43.5% consulting it for information about telemedicine, while journals (28.4%) and newspapers (26.2%) were less common sources of information.

Telemedicine is also a topic of conversation among students, with 20.4% of those surveyed obtaining information about telemedicine applications from fellow students in conversations outside the regular courses. Only 9% of students attended external events and lectures to increase their knowledge in this field. Academic courses constituted a substantial source of information for many students, despite telemedicine being represented as of marginal relevance in the curriculum of various disciplines. Only 2.6% reported that there was a required course where telemedicine was a priority. A further 5% attended courses which dealt with telemedicine topics as an elective. Thus, telemedicine only seems to be implicitly integrated as a topic within other lectures. About 21% of the students had attended lectures on telemedicine by visiting other sessions. At the same time, they felt that telemedicine should be included in the regular curriculum. In total, only 7.9% expressed no interest in lectures on telemedicine, whereas 8.5% felt sufficiently informed by their studies on telemedicine.

Opinions and attitudes on future developments

About 80% of the medical students surveyed believed that telemedicine is gaining in importance. At the same time, 14% thought that they could not make an assessment based on their current knowledge.

The increasing use of telemedicine for care is generally well accepted. About 60% of those surveyed expected telemedicine to ease the physician's workload, while about 20% gave no opinion, and another 20% saw little or no benefit to be gained from telemedicine. The reponses to the question, "I am of the opinion that telemedicine will help me in my future profession are shown in Figure 1.

The better informed students were, the more likely to offer a positive assessment of the implications for their work ($p<0.05$).

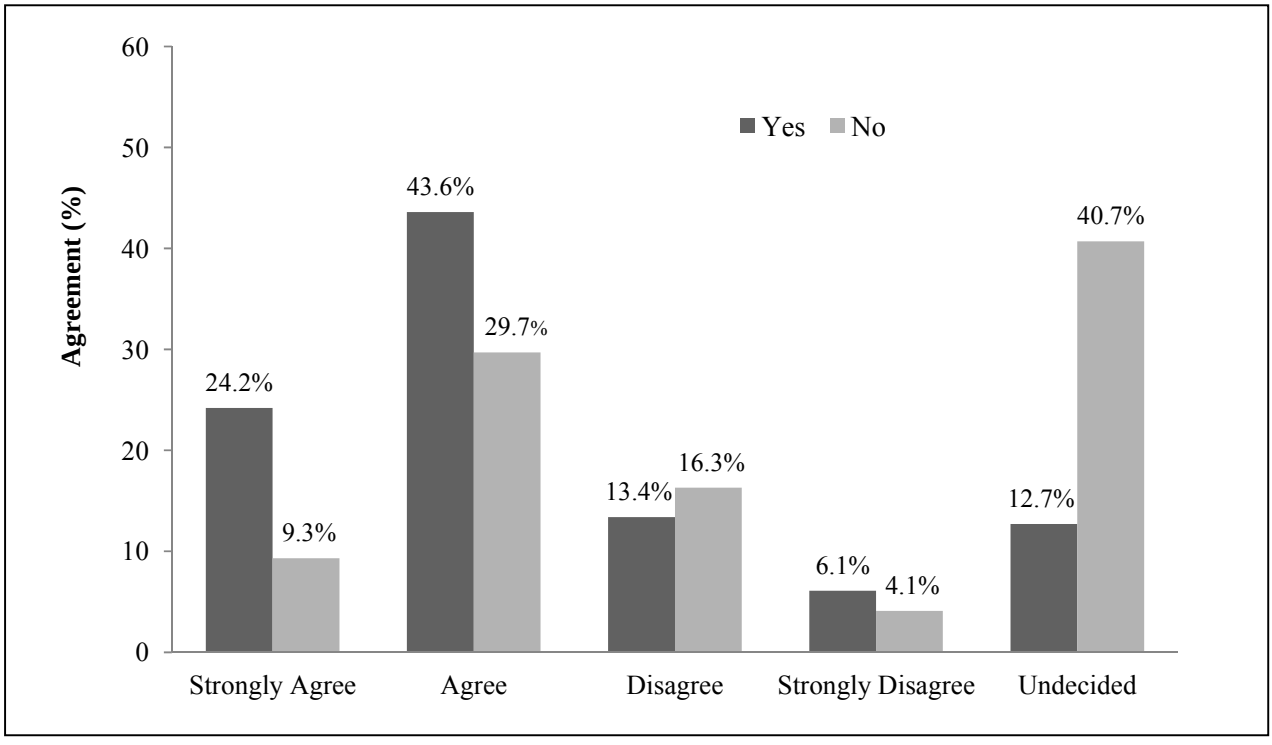

Figure 1. Relationship between the knowledge of telemedicine and the value of telemedicine for later professional practice; (n=524).

Opinions in response to the question, "Which of the following telemedical applications has in your opinion the greatest potential" also varied considerably. Less than 10% saw a significant potential in the applications of teleprevention and telesurgery. About 40% saw a potential in telemonitoring and the electronic health card, and 59.3% saw great potential for the electronic patient record and teleconsultations. Most students (74.5%) thought that the greatest gain of telemedicine lies in teleradiology (Figure 2).

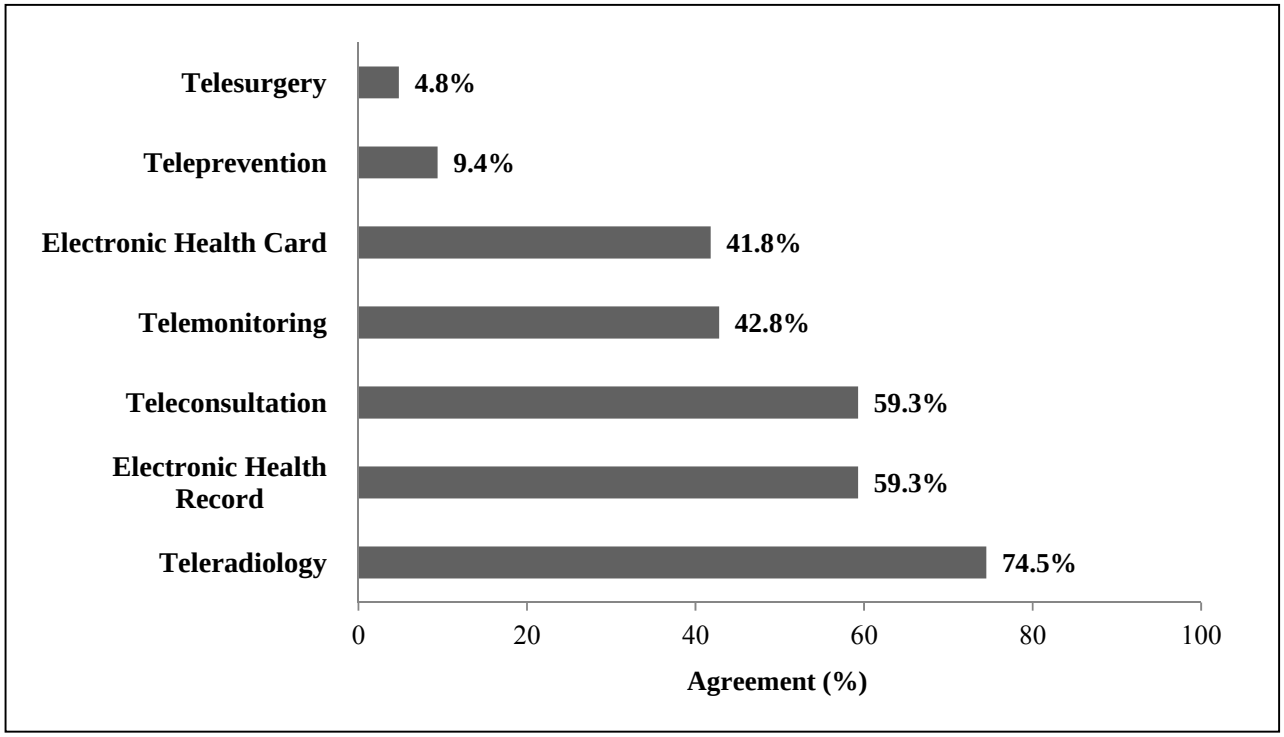

Figure 2. Perception of telemedicine applications in terms of their potential in the future; (n=524).

Expectations towards the use of telemedicine

The expectation dimensions were categorized into positive and negative attitudes towards the use of telemedicine. The results showed that medical students generally have a positive attitude towards the use of telemedicine. The majority saw no additional workload arising from telemedicine services, and 70% agreed that it substantially improved treatment options. Implications for integrated care in Germany were also seen as positive. Almost 90% saw the implementation of integrated care concepts greatly facilitated by technical support. The students also saw a potential in the increasing quality of information, the quality of professional interdisciplinary collaboration, and more efficient diagnosis and therapy.

A possible negative effect was a potential increase in the administrative workload. More than 60% of the respondents doubted that telemedicine would improve communication between doctor and patient, with the implications for the doctor-patient relationship remaining unclear. They likewise found it difficult to predict economic effects of telemedicine such as cost reduction in medical care, the cost of implementation and possible litigation costs. Approximately 40% gave no opinion on this. Regarding data security, no clear trends emerged from the results and opinions on and positive and negative opinions on expectations of confidentiality of patient data were distributed about evenly. There was no significant gender difference throughout the questionnaire.

Multivariate linear regression was used to test correlations between the expectations expressed (independent variables) and the general assessment of the value of telemedicine for medical practice (dependent variable) (Figure 3).

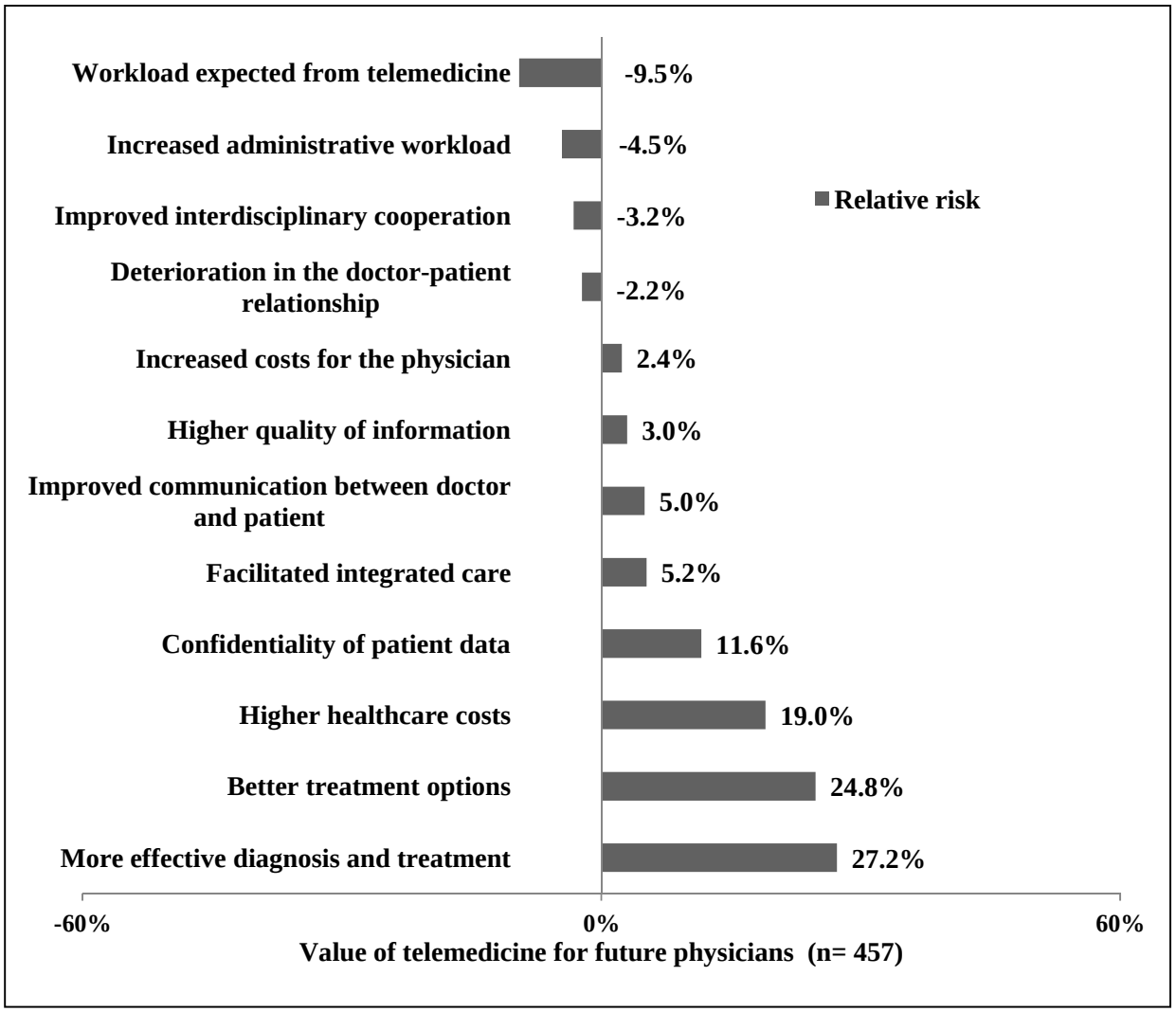

Figure 3. Multiple linear regression to estimate the value of telemedicine for future physicians expressed as relative risk.

Of the 12 independent variables, the following predictors were found to be statistically significant: healthcare costs (p=0.002; 95%; CI 0.069-0.311), treatment options (p=0.006; 95%; CI 0.073-0.422) and diagnostic and therapeutic effectiveness (p=0.008; 95%; CI 0.073-0.472). The predictor "data confidentiality" (p=0.063; 95%; CI -0.006-0.238) bordered on significance.

Discussion

The individual assessment of telemedicine as a tool to improve the efficiency of diagnosis and therapy and improving treatment options appears to be the strongest predictors of the dependent variable. Another predictor found to be significant was “the use of telemedicine could reduce healthcare costs”, with nearly 19% variance. Although patient data confidentiality was not significant, (p=0.063), it seems to be crucial to ensure that medical students attribute a high value to patient data confidentiality in the use of telemedicine in their future professional medical practice.

This study yielded preliminary data, but more research is needed. While the attitudes and opinions of students regarding the potential use of telemedicine technology and the existing barriers to implementing it proved to quite differentiated, much remains to be elucidated.

Due to insufficient information up to 30% of the respondents were not able to make certain attributions towards potentials and challenges of the use of telemedicine, particularly regarding costs and patient data confidentiality. Being well informed about the pros and cons of telemedicine is essential for being predisposed towards using it.[22]

The study highlights the need to close the knowledge gap, by publishing more papers on telemedicine and by giving the subject a higher priority in medical education in Germany. Raising transparency regarding target group-specific options (e.g., demonstrated improvements in the quality of medical care, more efficient processes) and setting limits to the use of tools (e.g., built-in technical limitations) can also help increase acceptance of telemedicine by building more confidence amongst users in a new area where there remains much uncertainty (and insecurity).

This study had several limitations. The survey was conducted using a non-standard online-questionnaire without control questions. Objective answers about use of data could not be collected because of the nature of the group surveyed and because the students were asked about their perception of the potential properties of telemedical services. The results could therefore show an informant bias, an error resulting from the differences between subjective perception and objective value of the subject examined. Web surveys are an interesting and attractive means of data collection, but lead to methodological problems. Various correction techniques (e.g., adjustment weighting, use of reference surveys) are needed. This was not done in the present study. Also, aspects of acceptance research (e.g., the influence of the expectations of others)[27] were not considered in this study.

The results therefore show individual facets of acceptance in the group surveyed. No significant gender differences in attitudes towards telemedical services were found. This disagrees with other studies in this field, which have found that women are less interested in technology but do not show a scepticism towards it.[28] Other studies have found that women are more likely to see the (dis)advantages of technology in healthcare against their own personal situation, whereas men are more inclined to look at potential.[15,16] These discrepancies underline the need to focus more on potential acceptance-moderating factors such as age, gender, and culture. Different social norms, gender roles and stereotypes could have an impact on the attribution of product features and the resulting attitude of acceptance.

Conflict of Interest: The authors declare no conflicts of interest.

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