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RESEARCH ARTICLE

ELECTRONIC HEALTH RECORD IN THE GENERAL HEALTH SYSTEM OF CYPRUS: EVALUATION OF USERS' SATISFACTION LEVELS

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Abstract

Background: The Electronic Health Record (EHR) is a technological tool for eHealth that is a strategic priority internationally in health systems. Since 2019, Cyprus has universally applied the EHR in the General Health System (GHS). This study aimed to assess the levels of satisfaction among EHR users in the GHS of Cyprus.

Material and Method: During the period from October to December 2022 the first cross-sectional study was carried out to evaluate users' satisfaction levels of EHR through an online self-reporting questionnaire. The questionnaire was distributed electronically using the convenience sampling method and included questions about demographic characteristics and satisfaction. A total of 429 physicians participated in the study.

Results: According to the results, moderate users' satisfaction levels of the EHR were found. There was also a statistically significant relationship between satisfaction with the EHR and factors such as age, years of professional practice, familiarity with the use of ICT and familiarity with EHR, education/training provision prior to the use of EHR and support during the daily practice. The study's limitations include the absence of a comparative sample of other healthcare professionals, such as nurses, and the reliance on international data for comparison, owing to the lack of relevant scientific evidence from Cyprus.

Conclusions: To fulfill Cyprus' strategic goals for eHealth, within the European framework, health policy makers should implement EHR improvements in the context of GHS. Users' training, support and equal access for all health professionals are essential. Finally, new studies must be conducted in the rapidly changing field, so that new developments can be identified and results compared so that enhancements, new services and functionalities are implemented for the benefit of the citizens.

Keywords: Cyprus, electronic health record, general health system, satisfaction, user.

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INTRODUCTION

In 2004, when Cyprus joined the European Union (EU), only very basic pillars for the development of e-health services existed.[1] The absence of a coherent legal framework for electronic applications, appropriate infrastructure for technical devices and the acceptance of professionals and citizens were crucial issues.[2] The EHR was instituted in Cyprus by law of the Ministry of Health in 2019 and with specific guidelines to its content and potential use. In parallel, the necessary legislative initiatives were implemented in relation to the structure and operation of the Cyprus GHS itself, the State Health Services Organization and the Cyprus Health Insurance Organization (HIO) were established.[3]

At this stage, Cyprus is complying with European guidelines as defined by the national contact point for cross-border care and has adopted European Union Directive 2011/24/EU. However, the completion of its interoperability system has not been achieved, despite being a constant national priority.[4] At the same time there is no development of telemedicine services and telecommunication systems and telephone follow-up of patients. One of the challenges with implementing eHealth innovations in Cyprus is the awareness of health professionals on issues such as the use of standardization during the implementation of EHR and issues of data exchange and data security. For this purpose, no relevant national initiative has been implemented.[2] Although Cyprus' score in the 2022 edition of the Digital Economy and Society Index (DESI) has improved compared to its past scores, Cyprus still ranks below the EU average for basic digital skills and one in two Cypriots lacks basic digital skills. Cyprus ranks 21st in the EU in terms of human capital DESI 2022.[5]

Five years after the successful introduction of the GHS and the use of the EHR in Cyprus, it is notable that there is no relevant study data on the level of satisfaction of the use of EHR by healthcare professionals and studies on the implementation of EHR in Cyprus are limited. Pattichis et. al.[6] emphasized the need to develop telemedicine applications, while Theodorou et. al.[7] pointed out the lack of digitization systems of health structures and related tools. Other studies confirmed the need for infrastructure improvements for EHR development[8,9] and described a design and implementation framework. Furthermore, the eENERCA survey by Antoniou et. al.[10] presented a proposal for the development of an EHR system, while Antoniou et. al. described the framework for the development of general cross-border e-health services.[11] In their study Stylianides et. al. evaluated the implementation of the Integrated Health Information System in two public hospitals in Cyprus, located in Nicosia and Famagusta provinces.[12] A recent study by Papaioannou et. al. presents the first results of the eHealth4U program with the aim of designing the architecture of the EHR system in Cyprus.[4]

Various social, demographic and occupational factors have been reported in the international literature that shape positive or negative opinions and attitudes of EHR users.[13,14] EHR user satisfaction has also been the subject of other studies.[15-22] In a large recent study by Hendrix et. al.[23] the satisfaction levels of EHR users are related to the special characteristics of the system with both human and technological factors contribute to user satisfaction as well.[24,25] It has also been reported that appropriate transition planning and user support in an EHR system is related to their satisfaction levels[26], while experience in using the EHR[27], available time and support to users are factors that shape increased levels of user satisfaction.[28] Also, Elkefi and Onur[29] emphasize that when user needs are taken into account with emphasis on health information management, their satisfaction levels increase while improving functionalities in EHR systems leads to more positive attitudes of its users.[30]

The above discussion reveals that more studies on EHR in Cyprus were published prior to its introduction as opposed to just a few studies published after its implementation in 2019. Out of these, only one has set a population target for health professionals in the GHS of the Integrated Information System of Nicosia and Famagusta Hospitals.[12] All in all, these studies focused on the need to apply EHR to GHS, as well as on the architecture of the EHR system with emphasis on its functionality and interoperability, especially in terms of data safety and cross-border healthcare. This is exactly where the gap in literature exists in relation to the EHR in Cyprus, and the uniqueness and importance of this study lies, to the fact that the views of health professionals have not been taken into consideration and their attitudes were not investigated following the implementation of

the EHR in the GHS.

The importance of this study also extends beyond the narrow context of the Republic of Cyprus, as it enriches the existing literature in the field by presenting the unique case of a small country with just one million population, within the wider geographical, social and cultural area of the Mediterranean and European space. This is a first study undertaken with the aim to investigate the satisfaction levels of EHR users within the framework of the GHS in Cyprus.

METHODS

Study design

This is the first cross-sectional study relating to the use of the EHR in Cyprus after its implementation in 2019. The study was carried out during the period of October to December 2022.

Sampling Strategy

The participants were selected using convenience sampling. The G-Power software was used to calculate the final differential force (power). As a minimum required number of sample observations, 282 people were calculated (for a minimum power of 80%). So, with 429 participants, the power of the present study exceeds 92%.

Data collection tools and approach

Data were collected using anonymous self-report questionnaire.[31] The specific tool was designed from the perspective of the clinical work of health professionals, but it provides the possibility of controlling the individual functions of the EHR. Although there are several validated tools to assess EHR satisfaction among healthcare professionals available in the literature, this study used this research tool because it meets certain conditions. Initially, the tool served to carry out the research in a period of restrictions due to the covid-19 pandemic. It has also been translated and weighted into Greek recently, while the reliability of the questionnaire is very strong, as all coefficients (Cronbach-a) are greater than 0.8 and some greater than 0.9. It has also been tested in a related population in Greece.[32]

An original questionnaire was not created based on bibliographic references, but the Greek translated and weighted version of the original questionnaire was used. All the questions of the questionnaire were adopted, and some additions were made only to the section on social, demographic and work characteristics, in order to serve the needs of the research in the social and cultural context of Cyprus (e.g. health system, specialties and specializations of health professionals, province of practice). The questionnaire used in this study included the following 2 sections:

a. The social, demographic and occupational data explored by the original questionnaire were: gender, age, status, specialty, field of work, professional experience, typing speed, familiarity with PC - ICT and EHR, experience using EHR, use of EHR on registered citizens). Also, modifications were made regarding the status and specialties of physicians. The following were also added: education level, province of work, education related to EHR, support from HIO). This section is a group of questions that was not based on any weighted scale, but includes questions that would be correlated at the statistical analysis stage to produce results and conclusions regarding the subject of the study.

b. It is a seven-point Likert-type scale with 10 questions and sentences concerning the satisfaction level of EHR users.

The internal consistency analysis of the EHR Satisfaction questionnaire's conceptual construct (Cronbach's Alpha index) was measured at 0.97, and its validity (SRMR index) was measured at 0.077. It was also piloted, since it was completed by 20 participating physicians, who were excluded from the overall research sample.

All Likert-type questions were converted to a percentile scale to make it easier to understand and compare the aggregated scores. Responses indicating “task not supported by EHR” or “don’t know/not applicable” were treated as missing values. Values approaching closer to 0 indicate, proportionally, a more negative scaling of the studied variable, while closer to 100 indicate a more positive scaling.

The questionnaires were administered and was forwarded to both the Presidents of the Scientific Associations and Societies of Cyprus and to individual users, via e-mail using mail merges to save time and to ensure a personalized and direct approach.

All participants were informed about the purpose and evaluation activities of the study and were informed that they could withdraw at any time without obligation. Initially, all the people selected for the study signed a consent form, which guaranteed their participation and anonymity. Anonymity was maintained both throughout the study and after its results are made public, due to sensitive personal data.

Data analysis method

We conducted the statistical analysis using SPSS version 26.0. Continuous variables are expressed (presented) as the mean ± standard deviation, and categorical variables are expressed as frequencies and percentages. The Spearman correlation index was utilized to examine the relationship between a continuous variable and an ordinal variable. The point-biserial correlation index was used to examine the relationship between a quantitative variable and a dichotomous variable. Analysis of variance (ANOVA) was employed to study the relationship between a quantitative variable and a categorical variable with >2 categories. The normality of the data was tested by the Shapiro–Wilk test. In all tests, differences were considered to be significant at $p < 0.05$.

Ethical considerations

Permissions to use the questionnaire were obtained from the authors and the competent committee granted approval for initiation of the study. All participants in the study provided explicit consent to participate, after reading an introductory note explaining the study context. Issues of anonymity and confidentiality were preserved throughout the research process, before data collection. Additionally, the participants were also informed about the voluntary nature of the research and their right to withdraw from the study at any time without any consequence. Since the study involved human participants, all procedures performed were in accordance with the 1964 Helsinki declaration and its later amendments.

RESULTS

The sample response rate was 16.2%. Table 1 presents the social, demographic and occupational characteristics of the 429 participants. Regarding participants' gender, more women participated in the survey at a rate of 57.6% (N=247) while in terms of age, 33.8% (N = 145) of the participants were physicians aged 31-40 years. On the other hand, the educational level, 44.5% (N=191) had a master's degree. About the province of activity, 38.7% (N=166) of the respondents came from Nicosia. Also 52.4% (N=225) were medical specialists. Also, the work sector 44.8% (N=192) declared themselves self-employed in a private practice. Beyond these length of time in the profession, 29.8% (N=128) reported 11-20 years of experience. Regarding education/training related to the use of the EHR, 56.2% (N=241) stated that they had been adequately trained. A total of 59.2% (N = 254) use the EHR in 81% to 100% of registered citizens. A total of 51.5% (N=221) of respondents reported using the EHR for more than 24 months. Also, 79.5% (N=341) of the participants stated that they had high to very high familiarity with computer use. Similarly, 56.4% (N=242) of physicians reported typing speeds ranging from high to very high. In terms of familiarity with the EHR, 79% (N=339) of participants reported having a high to very high familiarity. Finally, only 32.6% (N=140) had sufficient support from the HIO.

The average score of the scale "Satisfaction with the EHR" is 53.1/100, a value that indicates moderate users' satisfaction levels with the use of the EHR. Half of the participants scored between 38.3/100 and 73.3/100. According to the results recorded in detail in table 2, for users' satisfaction levels of the EHR in the practice of clinical work, the factors found to be statistically significant are: a) Younger age is associated with more positive user satisfaction levels ($p<0.001$), b) Less work experience is associated with more positive user satisfaction levels ($p<0.001$), c) Greater familiarity with PCs and ICT is associated with more positive user satisfaction ($p<0.001$), d) Higher education/training is associated with more positive user satisfaction levels ($p<0.001$), e) Greater familiarity with the use of the EHR is associated with more positive user satisfaction levels ($p<0.001$), and f) More familiarity with support from the HIO is associated with more positive user satisfaction levels ($p<0.001$).

DISCUSSION

The aim of this study was to investigate the satisfaction levels of EHR users in the context of GHS in Cyprus and is considered unique and original research in the specific field, following the implementation of the EHR in GHS in Cyprus in 2019, as no similar study has been undertaken. It is expected that the findings of the study will serve as a warning bell to the policy makers and motivate them towards planning actions for the advancement of the satisfaction of the EHR users, who are considered the cornerstone of the GHS. While it is accepted that there exists a rich set of research data on EHR globally, enriching this set with related data from a country with the cultural, social and economic characteristics of Cyprus is considered a contribution to the scientific community with interest in the field.

As there are no relevant Cypriot studies in the respective field it is not possible to provide a detailed comparative explanation of the findings at this point. However, the moderate levels of satisfaction of EHR users in Cyprus are confirmed by a study that was conducted in the context of the evaluation of the Integrated Information Systems of Nicosia and Famagusta hospitals[12] prior to the implementation of the EHR in 2019.

The study identified that the average satisfaction level of EHR users was linked to specific demographic and work-related factors in a positive way. More specifically, factors such as "Age", "Years of exercise of the professional status", "Familiarity with the use of PC and ICT", "Familiarity with the use of EHR", "Education/training in relation to the use of EHR" and "Support while using the EHR" are statistically significantly related to the score of the scale "Satisfaction with the EHR".

In particular, younger age of participants is associated with higher user satisfaction and this may be explained by the fact that younger physicians are more exposed to the technology and are considered technologically savvy. Similarly, the low number of years of professional experience is positively correlated with user satisfaction.

The results of the study indicating the positive association of young age and few years of professional experience with the satisfaction of EHR users are confirmed by the results of a qualitative study with focus groups of primary care physicians in the United Arab Emirates[33] and questionnaire survey of primary care physicians in Brazil.[20] On the other hand, the decrease in satisfaction levels as users' EHR age increasing, is also confirmed by a study of geriatrics clinicians in the US and Canada[34], with a study among obstetricians/gynecologists in the USA confirming the existence of an increased level of satisfaction among younger physicians.[35] On the other hand, Norwegian mental health physicians who participated in a mixed study did not find a significant relationship between age and satisfaction regarding their use of EHR.[16]

In addition, it has been found that the more familiar people are with PC usage and ICT, the more satisfied they are with the use of EHR. On the other hand, lack of or limited ICT skills is linked to lower satisfaction, which confirms findings in previous studies.[24,33,36,37] Also, a questionnaire survey with a sample of medical specialties[21] and in a qualitative survey with focus groups of primary care physicians[14] in the United Arab Emirates, confirm this study's results on this specific issue. The study results are also supported by a related questionnaire survey among pediatricians in Saudi Arabia.[15]

The results also indicated that the more familiar users were with using the EHR, the more satisfied they were with it. In a related longitudinal study involving primary care physicians in the USA[39] participants improved satisfaction levels while using the EHR per unit of time. The results are confirmed by studies involving inpatient and outpatient care physicians[38] as well as geriatrics specialty clinicians in the USA.[34]

On another study item, the higher the level of education and training related to the EHR, the more satisfied the users tend to be and this is vital for wider digital transformation.[40] This finding was supported by a study conducted by Lakbala and Dindarloo[41] on physicians from three University Hospitals in Iran, where it was observed that users reported higher satisfaction levels with the EHR, when they had received targeted education related to its use. The results are also supported by a questionnaire survey of medical specialties in Greece[42], a similar survey conducted by Secginli et. al.[37] among primary care family physicians in Istanbul and in a survey of a sample of clinicians in the USA.[30] On the other hand, in the same type of study as the one mentioned above, which included a sample of pediatricians from a univer-

sity hospital in Saudi Arabia, moderate user satisfaction was recorded in relation to the EHR. It was noted that prior EHR training did not have a positive effect on user satisfaction[15], a finding that was also confirmed in a study involving Norwegian mental health physicians.[16]

In various studies with healthcare professionals from different countries it has been consistently found that the availability of technical support for EHR systems is strongly linked to higher levels of user satisfaction. The positive correlation of users' technical support and their reported levels of satisfaction with the EHR is also confirmed in a questionnaire survey by Abed and Kharroubi[43] on Lebanese physicians, in the qualitative survey of primary care physicians in the United Arab Emirates[20], in See's survey[44] of general practitioners and in Jha et. al.'s survey[45] in US minority physicians. An international survey of experts from thirteen countries (Denmark, Austria, Sweden, Norway, United Kingdom, Germany, Netherlands, Switzerland, Canada, USA, Israel, New Zealand and South Korea), further supports this, emphasizing that the lack of support is a critical factor in customer satisfaction of EHR users.[46] The presence of technical support was positively associated with the reported satisfaction of EHR users, according to survey data among pediatricians in Saudi Arabia.[15]

In addition, a greater systematic in-depth study of questionnaire items is required, which can establish separate indicators for study. Thus, subsequent studies should aim to investigate in-depth user satisfaction levels with reference to quality attributes. Also, the levels of efficiency of the users and the obstacles they face in using the functions of the EHR should be studied. Suggestions for improving the EHR system based on the experiences of its users since its implementation in 2019 to date should also be explored.

As part of the recovery and resilience plan, in December 2021, Cyprus adopted the “Digital Skills – National Action Plan 2021-2025” to develop and improve the digital skills of its population by creating a critical mass of ICT experts in the country. The "Cyprus Recovery and Resilience Plan" that facilitates the digital transition with investments and reforms that promote connectivity, improving access to communication infrastructure and promoting an inclusive digital transformation[5] presents a unique opportunity and challenge for the GHS to successfully achieve its goal of being a modern sustainable "ecosystem" health system and it is initially essential to revisit and perhaps modify the existing architecture of the EHR system. This will enable equal access and participation of other health professionals allowing it for a holistic care model with an interdisciplinary approach to meet the needs of the citizen. However, to achieve the vision of eHealth, there is still significant progress to be made in the areas of cross-border care and the development of telemedicine systems. In particular, the HIO could provide continuous feedback through a special user support platform, thereby implementing the EHR as a technological innovation to the GHS.

Limitations of this study

Although a satisfactory sample of physicians as EHR users was secured, a larger number of research participants would have been desirable. The participants were selected using convenience sampling. A convenience sampling method was employed, as selecting a random sample from a large population—such as EHR users with diverse medical specializations—was deemed too time-consuming. On the other hand, due to the large size of the target population, it was expected that the subjects' participation in the research would be voluntary, since members of the target population, it was judged that they would not be easily available or would probably be reluctant to take part in the research due to the physicians’ workload.

In addition, data collection occurred during the covid-19 pandemic, a period marked by extraordinary demands on healthcare providers. This unprecedented pressure could have affected physicians' willingness to participate in the study and therefore the response rate. Thus, the results of the survey can be generalized only to populations that have characteristics similar to those in the sample.

Finally, due to the lack of comparable Cypriot studies, this study’s findings were only benchmarked against international literature. If further studies are conducted within this field, it will be possible to compare the results of our study with those of related research.”

CONCLUSION

The implementation of EHR at GHS since 2019, has not met the

eHealth goals outlined in the Cyprus National Strategy Framework, according to the moderate opinions and attitudes of its users. The findings of the study lead to the conclusion that EHR does not meet the needs of users, health providers and potentially expressed citizens who benefit from their services. This is derived from the study results that indicate just an average level of user satisfaction of EHRs. In order to achieve the strategic goals for eHealth the digital training of healthcare professionals must be strengthened to bridge the digital divide. The technology-based systems supporting the GHS need to be modernized with an emphasis on digital infrastructure architecture to promote inclusive connectivity and access for all health professionals and cross-border e-health services must be developed to enhance and extend the health services provided to the citizens. Considering all health professionals as EHR users their training and educational needs must be identified and a national digital literacy program based on the Adult Education methodology should be designed and implemented.

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ANNEX

TABLE 1. Social, demographic, and occupational characteristics of the sample (N = 429)

		N	N %
Gender	Female	247	57,6%
	Male	182	42,4%
Age	≤30	92	21,4%
	31-40	145	33,8%
	41-50	80	18,6%
	51-60	68	15,9%
	61-70	31	7,2%
	>70	13	3,0%
Educational level	BSc	157	36,6%
	MSc	191	44,5%
	PhD	81	18,9%
Professional status	Personal Physician	204	47,6%
	Outpatient Specialist	225	52,4%
Province of professional activity	Famagusta	26	6,1%
	Larnaca	52	12,1%
	Limassol	122	28,4%
	Nicosia	166	38,7%
	Paphos	63	14,7%
Labor sector	Public hospital	33	7,7%
	Private hospital	25	5,8%
	Health Center	179	41,7%
	Private clinic	192	44,8%
Years of exercise of the professional status	<5	92	21,4%
	5-10	74	17,2%
	11-20	128	29,8%
	21-30	56	13,1%
	31-40	66	15,4%
	>40	13	3,0%
Your familiarity with PC and ICT usage is:	Very small - Small	10	2,3%
	Moderate	78	18,2%
	Large - Very large	341	79,5%
Your typing speed is:	Very small - Small	19	4,4%
	Moderate	168	39,2%
	Large - Very large	242	56,4%
	Very small - Small	13	3,0%

Your familiarity with the use of EHR is:	Moderate	77	17,9%
	Large - Very large	339	79,0%
Education/training in relation to the use of EHR	I have not been trained in this	37	8,6%
	I have been poorly trained	151	35,2%
	I have been adequately trained	241	56,2%
How long have you been using EHR?	<6 months	26	6,1%
	6-12 months	45	10,5%
	13-24 months	137	31,9%
	>24 months	221	51,5%
I use the EHR as a percentage (%) of registered citizens:	<20%	67	15,6%
	21% - 40%	29	6,8%
	41% - 60%	37	8,6%
	61% - 80%	42	9,8%
	81% - 100%	254	59,2%
Support from HIO	I am not supported about it	138	32,2%
	I am inadequately supported	151	35,2%
	I am adequately supported	140	32,6%

TABLE 2. Bivariate analysis of the scale "Satisfaction from EHR" with social, demographic and occupational factors

		Mean	Standard Deviation	Statistical test p value
Gender	Female	52,1	26,5	rpb(429) = 0,041 p = 0,401
	Male	54,3	25,9	
Age	≤30	53,4	25,5	rpb(429) = -0,013 p = 0,781
	31-40	52,7	26,9	
	41-50	59,5	19,2	
	51-60	65,9	15,2	
	61-70	53,3	29,3	
	>70	34,3	24,0	
Educational level	BSc	27,7	29,5	rs(429) = -0,394 p < 0,001
	MSc	22,1	30,2	
	PhD	51,1	27,2	
Professional status	Personal Physician	53,1	26,3	rs(429) = 0,070 p = 0,147
	Outpatient Specialist	56,7	23,8	
Province of professional activity	Famagusta	49,7	26,0	F(4,424) = 0,239 p = 0,916
	Larnaca	55,5	25,2	
	Limassol	52,4	27,3	
	Nicosia	53,2	25,8	
	Paphos	52,9	26,9	
Employment sector	Public hospital	55,3	27,7	F(3,425) = 0,442 p = 0,723
	Private hospital	49,1	26,2	
	Health Center	52,1	26,9	
	Private clinic	54,1	25,4	
Years of exercise of the professional status	<5	59,5	19,2	rs(429) = -0,332 p < 0,001
	5-10	63,4	14,9	
	11-20	59,4	24,7	
	21-30	47,2	28,5	
	31-40	31,3	27,3	
	>40	22,1	30,2	
Your familiarity with PC and ICT usage is:	Very small - Small	52,1	24,1	rs(429) = 0,006 p = 0,904
	Moderate	53,0	27,4	
	Large - Very large	53,2	25,7	
Your typing speed is:	Very small - Small	15,7	26,6	rs(429) = 0,398 p < 0,001
	Moderate	33,0	26,4	
	Large - Very large	58,7	22,9	

Your familiarity with the use of EHR is:	Very small - Small	28,7	24,5	rs(429) = 0,440 p < 0,001
	Moderate	42,8	27,6	
	Large - Very large	63,2	20,0	
Education/training in relation to the use of EHR	I have not been trained in this	52,7	24,5	rs(429) = 0,072 p = 0,135
	I have been poorly trained	50,9	27,0	
	I have been adequately trained	51,6	25,6	
How long have you been using EHR?	<6 months	54,6	26,8	rs(429) = -0,018 p = 0,715
	6-12 months	57,8	25,7	
	13-24 months	46,6	26,0	
	>24 months	51,8	25,8	
I use the EHR as a percentage (%) of registered citizens:	<20%	51,3	27,3	rs(429) = 0,382 p < 0,001
	21% - 40%	53,0	26,2	
	41% - 60%	21,8	28,7	
	61% - 80%	34,0	26,8	
	81% - 100%	58,6	23,0	
Support from HIO	I am not supported about it	28,3	21,9	rs(429) = 0,763 p < 0,001
	I am inadequately supported	53,8	17,4	
	I am adequately supported	76,7	12,0	
*rs = Spearman index, rpb = point biserial index, F = F-test (ANOVA)				
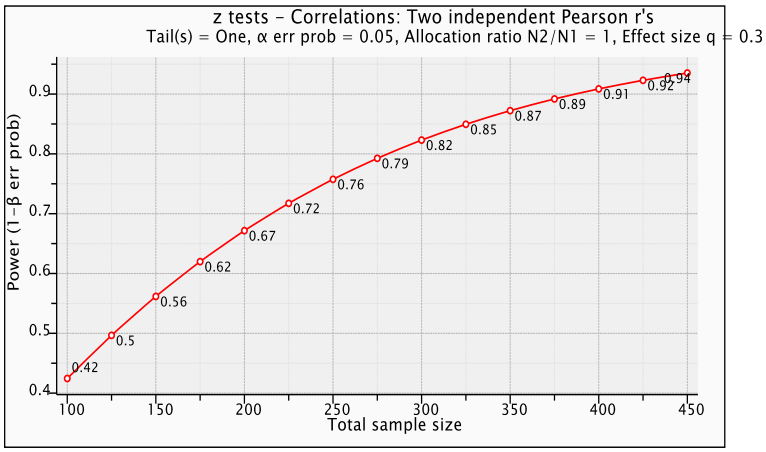
FIGURE 1. Sample power