

ORIGINAL RESEARCH

Electronic health information system implementation in health-care facilities in Armenia

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ABSTRACT

Introduction: During the implementation of electronic health information management systems (e-HIMS) in the form of electronic medical records (EMR), medical institutions face a variety of constraints.

Objective: This study aimed to investigate both the barriers and enabling factors encountered by the staff responsible for the implementation of national e-HIMS in health-care facilities in Armenia.

Methods: The study utilized a mixed-method design including 20 qualitative key-informant interviews and 164 cross-sectional surveys of personnel responsible for e-HIMS implementation in different outpatient and inpatient health-care facilities.

Results: Enabling factors associated with the implementation of e-HIMS in Armenia included strategic planning, resource availability, future orientation

and vision. The barriers identified were the inability to be prepared for change; uncertainty, which included concerns for the future and fear that changes would lead to extra work; financial considerations; and the attitude/motivation of health workers towards change. In addition, staff working in health-care facilities where the e-HIMS had already been implemented had a more positive attitude towards e-HIMS implementation, vision and future benefits, personal innovativeness, related knowledge, perceived usefulness, and perceived ease of use.

Conclusion: The barriers and enabling factors in the implementation of e-HIMS identified in this study both support and supplement previously published recommendations and can contribute towards a successful e-HIMS implementation, both in Armenia and beyond.

Keywords: HEALTH INFORMATION MANAGEMENT, EMR, ELECTRONIC HEALTH INFORMATION MANAGEMENT SYSTEM, ORGANIZATIONAL BEHAVIOUR, ELECTRONIC HEALTH RECORD, SOCIOTECHNICAL FACTORS

INTRODUCTION

The Electronic Health Information Management System (e-HIMS) is designed to manage health-care related data that are accessed by many; from health-care providers and patients to public policy-makers at governmental management levels. The e-HIMS is a comprehensive system that not only includes medical information but information related to health-care staff, infrastructure, finance, and health insurance, for example (1, 2). During recent years, many countries have been

working on implementing e-HIMS, particularly in the form of electronic medical records (EMR) (3–7). In Armenia, the introduction of e-health is an essential element of health-care improvement and reform, but there are multiple constraints for medical institutions in the shift from paper to electronic records, and, as with any project, proper resource allocation and planning at all stages of implementation are necessary for a smooth transition (8, 9). Although e-HIMS implementation has been shown to improve overall efficiency of a health-care system, those behind a new implementation tend to vastly

underestimate the needs and requirements necessary for its success and become frustrated when the anticipated benefits are not received (3, 5, 6, 10), with an estimated 50% of e-HIMS implementation projects failing due to mismanagement (6, 11). It is therefore important to have support from all stakeholders in overcoming the barriers behind an e-HIMS implementation, which can include IT-based system defects, data security concerns, resistance from users, lack of basic computer skills, inappropriate training, and a lack of finances to meet high costs (8, 12).

In 2010, the government of Armenia stressed the importance of e-HIMS and made the development and implementation of a national integrated e-HIMS a priority (13, 14), with the Ministry of Economy and the Ministry of Health (MOH) of the Republic of Armenia signing a memorandum of understanding with the closed joint stock company, and coordinator of e-national government projects, Ekeng, to coordinate the implementation of Armenia's e-HIMS. In 2012 the Government approved its implementation and schedule, and in 2013 selected a company to supply and implement the project (14, 15). Yet, while some pilot programmes were introduced in several hospitals, to date, no health-care facilities have successfully shifted from paper records to using the national integrated e-HIMS. During recent years, however, in Armenia, the Arabkir Medical Centre and the National Tuberculosis Control Programme have implemented their own e-HIMS and now primarily use EMR systems for outpatient care and diagnostic services (16, 17).

One study aiming to understand the barriers behind the implementation of EMR from the perspective of physicians working in Yerevan, the capital city of Armenia, identified resistance from the medical community including group level clinical concerns; impact on physicians' job performance; required effort to utilize the system; the innovativeness personality trait; interference with patient-provider relationships and resistance to change, as barriers. The study recommended further research to examine the validity, reliability and generalizability of their findings as well as identifying any additional barriers behind national e-HIMS implementation (13). The present study therefore aimed at further understanding these barriers as well as identifying the enabling factors of a successful implementation from the perspective of the involved health-care staff, including physicians, in all regions of Armenia. Such information may be useful in guiding the National e-HIMS implementation program strategy, which has yet to receive any assessment.

METHODS

DESIGN:

This mixed-method study consisted of qualitative key-informant interviews and quantitative cross-sectional surveys carried out with the staff responsible for e-HIMS implementation in different outpatient and inpatient health-care facilities in Armenia.

STUDY SETTING:

Armenia is divided into 11 different areas that cover both rural and urban populations including the capital region, Yerevan. Health-care system regulation and planning is executed by the MOH (18, 19). Health-care facilities belong either to the public or private sectors and include hospitals, outpatient clinics, dental clinics, pharmacies, non-traditional therapy centres, and regional or rural health-care facilities. Following the initial action plan in 2010–2012, the Armenian Government introduced a new road map in 2017 for the implementation of the national integrated e-HIMS, which is currently at the stage of implementation (14, 15, 20).

STUDY POPULATION:

The study population included health-care facility staff responsible for e-HIMS implementation, namely physicians, paramedics, management staff, as well as IT service providers responsible for coordinating e-HIMS. To be included in the study, managerial staff had to be familiar with the issues of health care data management within the health-care facility and aware of the national e-HIMS implementation requirements, while health care workers from the health-care facilities with implemented e-HIMS had to be actually working with and have a full understanding of the e-HIMS. In health-care facilities without implemented e-HIMS, one interview per facility was conducted. This type of selected sampling was chosen based on the aim of comparing facilities that had implemented e-HIMS to those with paper-based data management.

DATA COLLECTION:

Data collection was conducted during the first half of 2018. For the qualitative part of the study, a total of 20 key-informant interviews in different health-care centres throughout the country were conducted, which was a sufficient number to achieve information saturation. Participants were randomly selected from the study population list. Interviews were conducted with the study participants using the qualitative survey questions presented in Appendix 1.

For the quantitative part of the study, 164 survey interviews were conducted in different Armenian hospitals and polyclinics based

on a previously published and validated questionnaire (13). This questionnaire was adapted by incorporating the results of the qualitative survey and then pretested. Information was collected on both demographic characteristics and personal perceptions around a number of factors that could act as potential barriers for e-HIMS implementation using a five-point Likert scale (higher scores representing a more positive attitude). An electronic data questionnaire was developed using the web based platform SurveyToGo, and used during data collection in order to reduce bias (21). The main outcome variable of the study was considered to be the positive attitude towards e-HIMS implementation.

ANALYSIS AND STATISTICS:

For the qualitative data, a thematic content analysis approach was employed and reported in line with Consolidated criteria for reporting qualitative research (COREQ) (22). Interview notes were read and coded independently by the first three authors and discussed with a further person for consensus (the last author). Clusters of linked codes were grouped into categories, emergent themes and verbatim quotes. Data coding and analysis were done manually.

For the quantitative part, descriptive analysis (mean \pm standard deviation (SD) for continuous variables and frequencies and proportions for categorical variables) was conducted for the variables of interest. The differences between the with positive attitude group and the without positive attitude group, as well as those between the implemented and not implemented groups were evaluated using student's t-tests. Analyses were conducted using STATA 12 software and the EasySTAT online application (23, 24). The level of confidence was set at 5%.

ETHICS APPROVAL:

Ethics approval was received from the Institutional Review Board on Human Research within the Centre of Medical Genetics and Primary Health Care, in Yerevan Armenia (25).

RESULTS

QUALITATIVE RESULTS

BARRIERS FOR E-HIMS IMPLEMENTATION

The barriers preventing e-HIMS implementation are summarized in Table 1. These barriers could be categorized into four groups comprising: The inability to be prepared for changes, generally observed at all levels of e-HIMS implementation, from key-informant computer anxiety to lack of political will; uncertainty, which included concerns for the

future and fear that changes would lead to extra work; financial considerations and constraints; and attitude/ motivation, including unfavourable attitudes of health workers towards change and a lack of advocacy and trust.

ENABLING FACTORS ALLOWING PROGRESS IN E-HIMS IMPLEMENTATION

Overall, 20 interviews were conducted for the qualitative part of the study, as planned. The enabling factors for e-HIMS implementation in Armenia as determined from answers to interview questions (Appendix 1) from key-informants are summarized in Table 1. The determined enabling factors could be categorized into those related to strategic planning, resources, future orientation and vision. The decisions of hospital management in line with governmental enforcement, forward planning (including selection of the suppliers), continuous monitoring and evaluation of e-HIMS implementation were highlighted as important enablers. Time and financial resource allocation, including the use of savings expected from resource optimization due to effective e-HIMS implementation were also among important enabling factors. However, despite the progress made so far, interviewees expressed the need to ensure the sustainability of the current impetus. Areas requiring attention included monitoring and evaluation, training, strengthening of the IT network and other IT infrastructure, data flow optimization, and further integration of the e-HIMS into the health-care system of Armenia.

SUGGESTIONS FOR PROGRESS IN E-HIMS IMPLEMENTATION

Suggestions made by the key-informants on making progress towards e-HIMS implementation had a wide scope and included the need for enhancing political will, improving its monitoring and evaluation, insuring availability of IT infrastructure for implementation, the optimization of data flow, adequate allocation of financial resources, and the involvement of health-care data flow experts to present the long-term benefits as well as reduce uncertainty (Box 1).

QUANTITATIVE RESULTS

One survey per health-care facility was completed, by a relevant staff member, in a total of 106 facilities across all regions of Armenia that had not yet implemented e-HIMS. In the health-care facilities where e-HIMS was already implemented, 58 members of staff involved in its implementation completed the survey, taking the total to 164. The profiles of the key-informants shown in Table 2 were as follows: 111 physicians, 18 paramedics, 7 IT specialists and 28 managers. The health-care facility type where the key-informants were located were:

129 (78.6%) hospitals, 16 (9.8%) polyclinics and 19 (11.6%) rural outpatient clinics.

There were a number of factors found to be significantly associated with a positive attitude towards e-HIMS implementation (defined as having a higher than average score for the study population) including related knowledge, perceived usefulness, perceived ease of use, patient-provider relationship, professional relationships, organizational support, group usefulness, organizational change, and vision and future benefits, with computer anxiety found to be negatively associated (Table 3/ Fig. 1.)

We also compared the scores of each factor between those that had been working with the implemented e-HIMS and those that continued to use the paper-based system. Table 4/ Fig. 2 summarizes the factors and their association with the e-HIMS implementation status of the health-care facilities. According to the data, the study participants from medical centres using e-HIMS have a statistically significantly more positive attitude towards e-HIMS implementation in general, as well as more positive attitude for the following factors: Vision and future benefits, personal innovativeness, related knowledge, perceived usefulness, perceived ease of use. They also had significantly lower levels of computer anxiety, fewer concerns about physician autonomy, patient-provider relationship and professional relationships.

DISCUSSION

This is the first study in Armenia to identify not only the barriers, but also the enabling factors in transitioning from paper-based data management to e-HIMS. The mixed-method approach employed involving different specialists, but with a focus on the primary users of the e-HIMS (physicians), from a range of health-care facilities allowed for a broader overview of factors effecting e-HIMS implementation (26).

Overall, the identified enablers, allowing positive progress in e-HIMS implementation, were primarily related to strategic planning, future-based orientation of hospital management and sufficient resources, with the main barriers relating to the inability to prepare for changes, feelings of uncertainty and a rejecting attitude of medical staff, which were generally consistent with previous studies (3, 13, 27). The identification of these enablers and barriers can have a number of policy-related and practical implications, notably, allowing for issues to be prioritized and addressed by policy-makers in a more systematic way, contributing to a more efficient e-HIMS

implementation. It also appears that hospitals themselves and not only the government, should make e-HIMS a strategic plan, as was the case in the hospitals that have successfully implemented the systems, and the plan should be linked to time-bound milestones and targets for a successful and efficient implementation. This would also reduce the influence of staff-turnover within the service providers, which had been mentioned as another barrier. Interviewees also expressed concern on sustaining gains made, which could be supported by making priorities in this area, for example, by providing clear guidance, documentation and training at a national level. Further important practical suggestions made by various decision-makers indicate the need for greater country-level technical assistance, the ability to exchange experiences and the need for continuous monitoring and evaluation of the e-HIMS implementation activities.

In addition to identifying barriers and enablers, we compared the opinions of staff in health-care facilities with and without e-HIMS implementation. This allowed for more clear understanding of the underlying mechanisms of e-HIMS implementation and the critical factors driving the change. The data obtained showed that staff working in health-care facilities where the e-HIMS had already been implemented had a significantly more positive attitude towards e-HIMS implementation in general, perceived it as more useful and easier to use, and had a greater related knowledge than those not using it. So, if potential users are aware of the benefits of e-HIMS they might have more positive attitude towards its implementation and thereby support and ensure its success. Therefore, on a practical level, experience sharing, training workshops and collaboration, particularly between those actively using e-HIMS and potential users, to improve knowledge and spread encouragement could be highly useful.

Finally, we assessed which factors were associated with having an overall positive attitude towards e-HIMS implementation, based on positive attitude being a primary determinant. The data indicate that related knowledge, perceptions on usefulness, ease of use and future benefits, as well as professional relationships determine the positive attitude towards change. These factors should therefore be in focus during experience sharing and training programmes in order to improve their impact and efficacy. However, current negative attitudes and a lack of motivation could be also explained by the failure to provide proper strategic planning and directions for the future, meaning that even with experience sharing and training, the most optimistic and future-oriented staff could lose enthusiasm, especially if it is resulting in an increased workload. We therefore hope that policy-makers will pay

attention to well plan, and to well prepare potential users for, upcoming changes, so that the new requirements for the e-HIMS implementation will be expected and welcomed.

In order to provide additional support to those involved in e-HIMS and to complement our current results, future research would aim at determining both the perspectives of patients and relevant governmental policy-makers towards e-HIMS.

CONCLUSION

The current study identified important enabling factors, barriers and ways forward in e-HIMS implementation from the perspective of the health-care staff involved. The data highlight existing gaps in financial and human resources but propose solutions, including better collaboration and exchange of experience within the field and improved training, as well as better strategic planning, to motivate the implementation of e-HIMS. These findings support and supplement previous recommendations and are not only relevant to Armenian policy-makers and health-care workers but to other countries considering e-HIMS implementation. Further research is recommended to understand the details behind the successful planning of e-HIMS implementation.

Acknowledgements: We are grateful for the support of IJRGP. We are also grateful to all who participated in the interviews without which this work would not have been a reality. We would like also to express special thanks to Katie Chapman for providing outstanding editorial support.

Sources of funding: This research was conducted with financial support of Innovative Solutions and Technologies Center (ISTC) Joint Research Grant Program (IJRGP). The ISTC is joint program of IBM, USAID, Government of Armenia and Enterprise Incubator Foundation (EIF). The main purpose of ISTC Joint Research Grant Program (IJRGP) is to encourage collaboration between academy and industry, R&D promotion and commercialization.

Conflicts of interest: None declared.

Disclaimer: The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the decisions or policies of the World Health Organization.

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TABLE 1. SUMMARY OF THE ENABLING FACTORS AND BARRIERS BEHIND E-HIMS IMPLEMENTATION

| Category | Enablers |
|----------------------------------|---|
| Strategic planning | <p>Decision made by hospital management</p> <p>Proper selection of experienced suppliers</p> <p>Discussions on the "pros" and "cons" of various implementation strategies and needs for the e-HIMS implementation with staff and suppliers</p> <p>Continuous monitoring and evaluation</p> <p>Governmental enforcement</p> |
| Resources | <p>Savings that could be made on resource optimization were reinvested within other areas of e-HIMS implantation, e.g. training</p> <p>Grant opportunities received and utilized for training of Tuberculosis doctors and nurses to implement the e-HIMS</p> <p>Allocation of enough funds to reach to the targeted milestones</p> <p>Motivational incentives for users upon the successful implementation and utilization of the e-HIMS</p> <p>User friendly e-HIMS</p> <p>Allocation of enough time</p> |
| Future orientation and vision | <p>Long-term planning and the seeking of future benefits not only for improved administration but health-care services in general</p> <p>Business opportunities by improving efficiency in patient search and identification, which can also increasing effectiveness in clinical research</p> <p>Research opportunities for doctors if they have electronic data</p> |
| Category | Barriers |
| Inability to prepare for changes | <p>Lack of proper documentation and understanding by hospital management of the current data flow procedures required for the e-HIMS</p> <p>No capacity-building/training of policy and decision-makers on e-HIMS management</p> <p>No competent health-care data flow specialist available</p> <p>Lack of collaborative partnerships to catalyse positive change</p> <p>Specialists do not feel mandated, or lack political will</p> <p>Computer anxiety</p> <p>Frequent turn-over among the service providers</p> |
| Uncertainty | <p>Requirements are not clear</p> <p>Fear of not being capable</p> <p>Not being able to identify future expectations concerning e-HIMS</p> <p>Apathy in changing the current situation since future benefits are not understood</p> |
| Financial considerations | <p>There are no financial resources for procurement, supply and maintenance of IT infrastructure</p> <p>Insufficient knowledge of cost-benefit ratio evaluation</p> <p>Resistance in changing existing budgeting and management structure</p> |
| Attitude /motivation | <p>Doctors do not get any incentives while having to spend extra time to learn and adapt to changes and thus are less motivated.</p> <p>Lack of advocacy and lack of colleague advocacy</p> <p>Lack of trust</p> |

TABLE 2. KEY-INFORMANT CHARACTERISTICS

| Characteristic | Number (%) |
|----------------------------------|------------|
| Profiles | |
| Doctors | 111 (68) |
| Paramedics | 18 (11) |
| IT Specialists | 7 (4) |
| Management | 28 (17) |
| Regions | |
| Aragatsotn | 10 (6) |
| Ararat | 5 (3) |
| Armavir | 6 (4) |
| Gegharkunik | 7 (4) |
| Kotayq | 9 (5) |
| Lori | 9 (5) |
| Shirak | 9 (5) |
| Syunik | 7 (4) |
| Tavush | 5 (3) |
| Vayots Dzor | 3 (2) |
| Yerevan (Capital City) | 94 (57) |
| Health-care facility type | |
| Hospital | 129 (79) |
| Polyclinic | 16 (10) |
| Rural outpatient clinic | 19 (11) |

BOX 1. SUGGESTIONS BY KEY-INFORMANTS FOR PROGRESS IN E-HIMS IMPLEMENTATION

- Regular training is needed to implement the e-HIMS
- There should be continuous monitoring and evaluation of the activities to reduce the inefficiency of the project activities
- IT infrastructure including Internet, networks and computers, needs to be put in place prior to e-HIMS implementation
- Data flow needs to be optimized and the e-HIMS adjusted according to the actual data flow requirements
- Allocation of financial resources need to be ensured before each phase of implementation
- Involving health-care data flow experts will reduce uncertainty and will be useful for clear need evaluation

TABLE 3. FACTORS ASSOCIATED WITH A POSITIVE ATTITUDE TOWARDS E-HIMS IMPLEMENTATION

| Factors for e-HIMS implementation | Overall, mean (+/-SD) | Positive Attitude towards e-HIMS implementation | | p value* |
|-----------------------------------|-----------------------|---|-------------|----------|
| | | No N=80 | Yes N=75 | |
| Personal innovativeness | 3.18 (0.7) | 3.09 (0.69) | 3.28 (0.69) | 0.11 |
| Related knowledge | 3.73 (0.71) | 3.62 (0.72) | 3.85 (0.69) | 0.05 |
| Computer anxiety | 2.64 (0.83) | 2.86 (0.89) | 2.4 (0.68) | <0.01 |
| Perceived usefulness | 3 (0.94) | 2.54 (0.89) | 3.53 (0.69) | <0.01 |
| Perceived ease of use | 3.45 (0.78) | 3.2 (0.81) | 3.71 (0.66) | <0.01 |
| Physician autonomy | 3.35 (0.51) | 3.36 (0.55) | 3.33 (0.45) | 0.72 |
| Resistance to change | 2.99 (0.7) | 3.04 (0.7) | 2.93 (0.71) | 0.34 |
| Patient-provider relationship | 2.77 (0.84) | 3.04 (0.9) | 2.48 (0.65) | <0.01 |
| Professional relationships | 2.85 (0.72) | 3.13 (0.59) | 2.53 (0.72) | <0.01 |
| Organizational support | 3.67 (0.55) | 3.46 (0.57) | 3.9 (0.42) | <0.01 |
| Group usefulness | 3.21 (0.86) | 2.8 (0.81) | 3.66 (0.67) | <0.01 |
| Organizational change | 3.18 (0.73) | 3.01 (0.71) | 3.36 (0.71) | <0.01 |
| Physical access | 3.32 (0.66) | 3.36 (0.71) | 3.27 (0.6) | 0.36 |
| Vision and future benefits | 2.59 (0.94) | 2.11 (0.87) | 3.12 (0.69) | <0.01 |

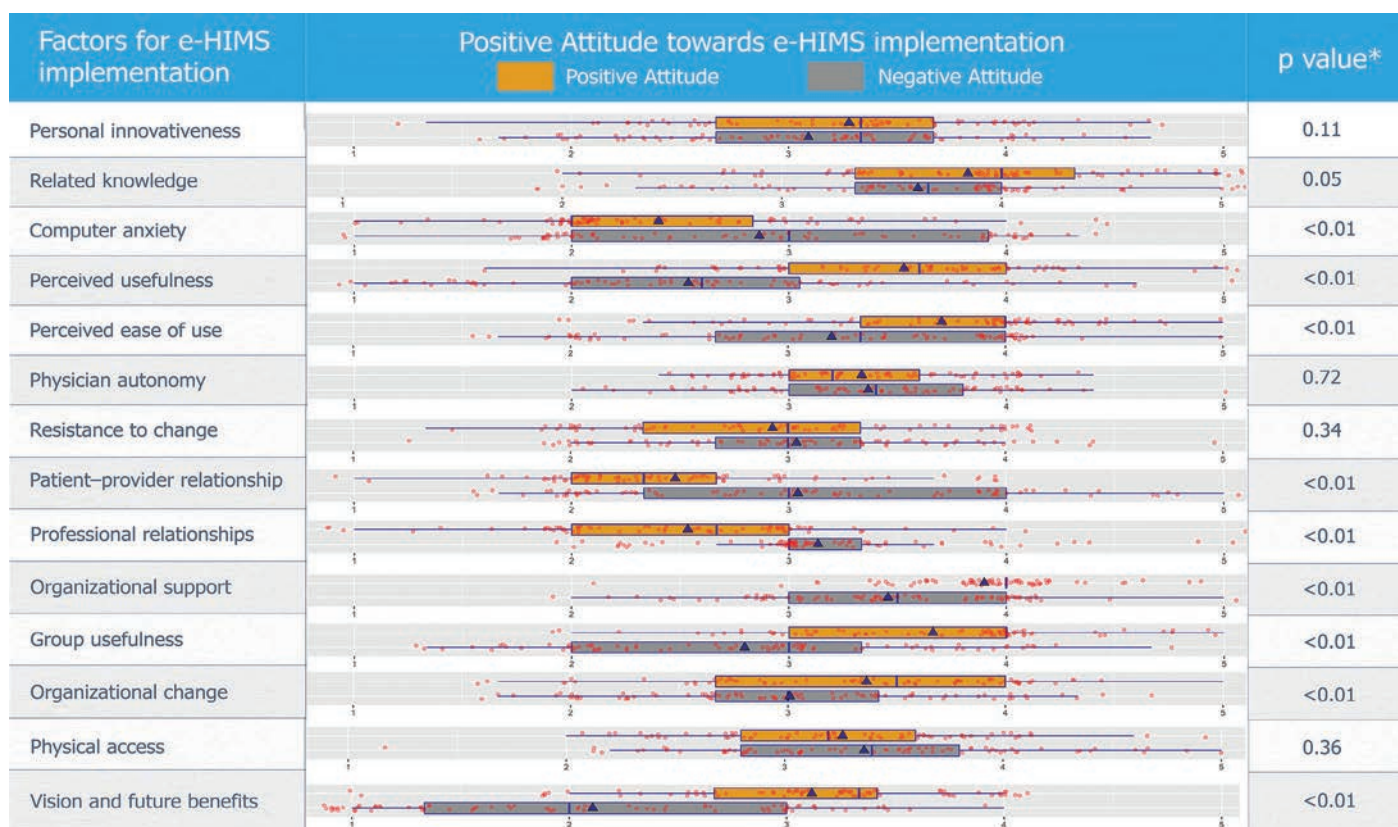
* Student's t-test. The p value is for the comparison between the mean score of positive and negative attitude groups for each factor. Positive attitude is defined as having a higher than average score overall.

TABLE 4. FACTORS ASSOCIATED WITH THE IMPLEMENTATION STATUS OF THE HEALTH-CARE FACILITY

| Factors for e-HIMS implementation | Overall, mean (+/-SD) | e-HIMS implementation status | | p value* |
|---|-----------------------|------------------------------|--------------|----------|
| | | Not Implemented | Implemented | |
| | | N=106 | N=58 | |
| Personal innovativeness | 3.17 (0.7) | 3.03 (0.64) | 3.51 (0.71) | <0.01 |
| Related knowledge | 3.74 (0.71) | 3.63 (0.72) | 3.97 (0.64) | <0.01 |
| Computer anxiety | 2.62 (0.83) | 2.76 (0.87) | 2.34 (0.69) | <0.01 |
| Perceived usefulness | 3 (0.94) | 2.86 (1.01) | 3.3 (0.68) | <0.01 |
| Perceived ease of use | 3.46 (0.78) | 3.35 (0.76) | 3.67 (0.78) | 0.01 |
| Physician autonomy | 3.35 (0.52) | 3.43 (0.51) | 3.17 (0.5) | <0.01 |
| Resistance to change | 2.98 (0.7) | 3.03 (0.7) | 2.87 (0.71) | 0.22 |
| Patient-provider relationship | 2.76 (0.82) | 2.97 (0.88) | 2.36 (0.5) | <0.01 |
| Professional relationships | 2.85 (0.71) | 3 (0.68) | 2.55 (0.66) | <0.01 |
| Organizational support | 3.66 (0.56) | 3.68 (0.55) | 3.61 (0.57) | 0.43 |
| Group usefulness | 3.18 (0.87) | 3.13 (0.93) | 3.3 (0.74) | 0.21 |
| Organizational change | 3.16 (0.73) | 3.13 (0.79) | 3.25 (0.6) | 0.29 |
| Physical access | 3.31 (0.66) | 3.35 (0.72) | 3.24 (0.47) | 0.29 |
| Positive attitude towards e-HIMS implementation | 3.49 (0.81) | 3.33 (0.88) | 3.84 (0.5) | <0.01 |
| Vision and future benefits | 2.58 (0.93) | 2.36 (0.99) | 3.06 (z0.53) | <0.01 |

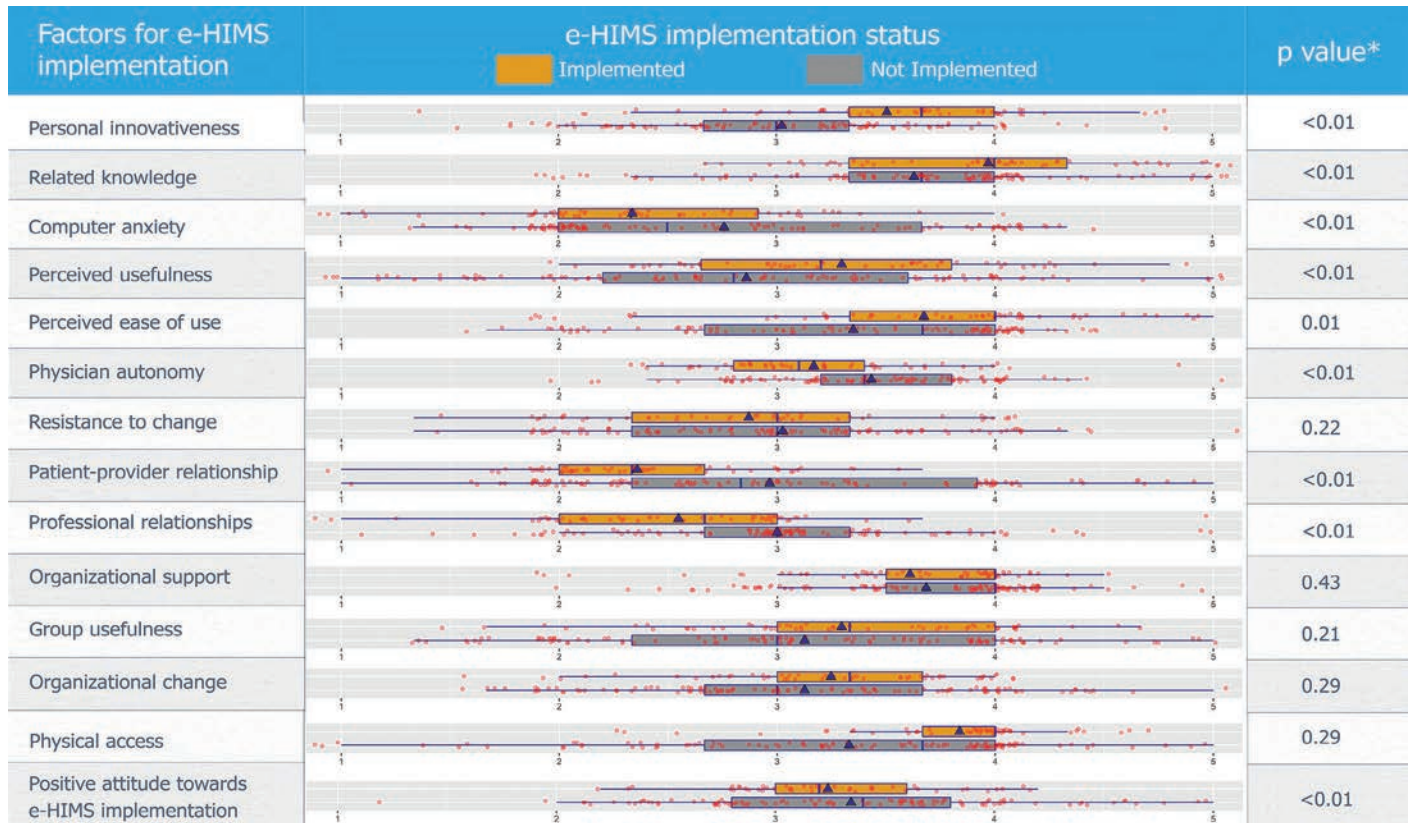
* Student's t-test. The p value is for the comparison between the mean score of not implemented and implemented groups for each factor.

FIG. 1. FACTORS ASSOCIATED WITH A POSITIVE ATTITUDE TOWARDS E-HIMS IMPLEMENTATION



* Student's t-test. The p value is for the comparison between the mean score of positive and negative attitude groups for each factor. Positive attitude is defined as having a higher than average score overall.

FIG. 2. FACTORS ASSOCIATED WITH THE IMPLEMENTATION STATUS OF THE HEALTH-CARE FACILITY



* Student's t-test. The p value is for the comparison between the mean score of not implemented and implemented groups for each factor.

APPENDIX 1. QUALITATIVE SURVEY INTERVIEW QUESTIONS

| General questions to describe the study population: | |
|---|--|
| 1. Position: | |
| 2. Profession: | |
| 3. Health-care Facility: | |
| In-depth interview questions | |
| 4. Are you familiar with e-HIMS? | |
| 5. Has your health-care facility decided to implement e-HIMS before the government introduce it nationally? | |
| 6. How satisfied are you with the current data management system? | |
| 7. What is the most preferable data management for your health-care facility? | |
| 8. How do the current data management system affect the quality of the provided services? | |
| 9. Do you think that e-HIMS can contribute to a "patient centred" treatment? | |
| 10. What is your opinion about the current e-HIMS presented by the government? | |
| 11. What are your suggestions for further improvement of data management in health care in general? | |
| 12. What are the factors preventing the shift from paper-based to e-HIMS for data management? | |
| 13. What could be done to improve the implementation process of e-HIMS in your centre? | |
| 14. Is there enough capacity/knowledge/experts that can implement the e-HIMS in your health-care facility? | |
| 15. Is there enough willingness to implement the e-HIMS? | |
| 16. Did your centre have additional requirements from the e-HIMS system to address local needs? | |