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Perception of Co-Assistent of Dentistry on Digital Radiography: an Extension of the Technology Acceptance Model (TAM2)

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Abstract. Conventional radiography has long been used since 1895. With the development of technology, the radiology department has also developed with the use of digital radiography to facilitating patient service. Digital radiography is profitable for new hospitals or dentists because the maintenance costs will be cheaper. Also has a low cost of film making because the hospital does not require a fee for solutions for processing. Digital Radiography also reducing the need for space, because the hospital does not need space to process the film. Furthermore, The staff needed to run the service are also fewer. However, the existence of digital radiography has not completely replaced conventional radiography. Due to the large cost needed in the procurement. Rumah Sakit Gigi dan Mulut (RSGM) Universitas Jenderal Soedirman (Unsoed) is one hospital that is developing digital radiographs in its services. The acceptance of this technology by the user needs to be known because the use of digital radiography users are less than conventional radiography. User acceptance is the desire of a group of users to utilize information technology designed to help their work. To predict user acceptance of information systems, researchers create models that can describe user acceptance. One model of technology acceptance is the Technology Acceptance Model 2 (TAM 2). The aim of this study was to find out the co-assistent acceptance of new technology, namely digital radiography. This study use an analytical cross sectional design with quantitative method. The survey was administered to a sample of 104 co-assistent randomly selected from RSGM Unsoed who have already used radiography digital. All data were analyzed using the Structural Equation Model (SEM). The result is only subjective norm that had significant effect to perceived of usefulness. Other variable are rejected. young dentists are still under the supervision of the DPJP [17]. Meanwhile, DPJP RSGM Unsoed is not familiar with digital radiography, and often uses conventional radiography.

Keywords: Digital Radiography, TAM 2, Co-Assistent, Acceptance, Technology

1. INTRODUCTION

Radiography was discovered by Wilhel, Roentgen of Germany in 1895 [1]. Along with the development of computer technology, computer-based radiography was developed. Digital radiography was first used in the mid 1980s [3,19]. The popularity of the use of digital radiography is currently still competitive with conventional radiography [16].

The existence of digital radiography seems to have not been fully approved of conventional radiography. Because of that large capital is needed in the procurement [5]. However, digital radiography is very beneficial for hospitals or dentists because the maintenance costs will be much cheaper. Digital radiogaphy has a low cost of film making because hospitals do not require a fee for film and solution for film processing [4]. In addition, it reduces the need for space, because the hospital does not need space to process films. And also need less staff for service [15].

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User acceptance is a method for knowing whether a technology is accepted by its users or not [20]. To predict user acceptance in the field of information systems, researchers create models that can accept user acceptance [11]. One model of technology acceptance is the Technology Acceptance Model (TAM 1) introduced by Davis [26]. However, because TAM 1 has several limitations in explaining the reasons for which a person will receive a given system is useful, then TAM 1 was developed by Venkatest and Davis [21] known as Technology Acceptance Model 2 (TAM2). TAM2 as a construction of additional social perspectives (subjective norms, volunteerism, and images) and cognitive perspectives (job relevance, output quality, demonstration results, and perceived ease of use) [21].

Rumah Sakit Gigi dan Mulut (RSGM) Universitas Jenderal Soedirman is a hospital that is developing digital radiography. In the last few months RSGM began using digital radiographs for the use of periapical, cephalometric or panoramic photographs. Previously, research on acceptance of this technology had been carried out in hospital were hospital information systems [13], on electronic medical records [14], and electronic prescriptions [7]. Research on acceptance of radiography was only carried out by Jeffrey [10] on the use of computed radiographs performed on radiographic staff [10]. Research on the perception of digital radiography used in the world of dentistry has never been done. Therefore the authors need to do research on digital radiography at RSGM UNSOED.

2. LITERATURE REVIEW

2.1 Digital Radiography

Wilhem C Rontgen is a professor from Germany who first introduced X-rays in 1895 [1]. The development of radiographic tools in the field of dentistry began in 1913, when William D. Coolidge perfected the discovery of Rontgen, by modifying the tubes by making an X-ray cathode tube containing filament [18]. Radiography then developed until 1966, which was characterized by the appearance of intraoral X-rays with a long beam. In 1987, Francis Mouyen introduced the first digital radiography and later developed into cone-beam computed tomography which can display radiographic images in two-dimensional (2D) or three-dimensional (3D) forms on a computer screen [1].

Conventional radiography is still often used but the intensity of use in the hospital has begun to decrease. This is because the dosage is fixed, the dose cannot be reduced, thus limiting the information captured by the film. In addition, the image cannot be changed with contrast after processing. Moreover, radiograph conventional using hazardous materials for processing, storage and taking of film in the long term is difficult. X-rays are produced by targeting metals with high electron energy. X-rays pass through the patient's body and are absorbed, which causes the incoming light to be received by the film to be weaker. So that on conventional radiographs the dosage and contrast are fixed and cannot be adjusted [12].

Digital radiography has developed further. In digital radiography, image results can be stored in software for a long time. The results can also be modified in contrast to 6000 times without increasing the radiation dose. In addition, radiographers do not need hazardous fluids for film processing, because the results of the film can be directly printed using a printer [1]. In addition, the dose of digital radiography is also lower and the exposure time is also shorter. Its use is also more environmentally friendly because processing does not require chemicals [2].

2.1 Digital Radiography

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The use of information technology is a major concern of research from technological developments. Significant progress in explaining and predicting technology user acceptance. In particular, substantial theoretical and empirical support has been accumulated in the Technology Acceptance Model [6]. A number of empirical studies state that TAM consistently explains the proportion of around 40% in intensity of use and TAM better than other alternative models such as Theory of Reasoned Action (TRA), and Theory of Planned Behavior (TPB) [6].

TAM theory developed by Davis [6], explains that a person's behavioral intension has two perspectives, namely perceived usefulness, which is defined as perceived benefits and the degree to which someone believes that using systems will improve work performance and perceived ease of use [6]. And Perceived ease of use, defined as the degree to which someone believes that using a system will facilitate his work [11].

TAM theorizes that the effects of external variables such as training and development on the intention to use are mediated by perceived usefulness and perceived easy of use. Perceived usefulness has consistently become a strong determinant of useage intention because perceived usefulness is a fundamental driver of usage intention, it is important to understand this construct. TAM designed organizational interventions that would increase user acceptance and use of new systems. Davis and Venkantest [21] develop TAM 2 by adding external factors. TAM2 combines additional theoretical constructs that include social perspectives (subjective norms, voluntariness, and images) and cognitive perspectives (job relevance, output quality, demonstrability results, and perceived ease of use).

1. Subjective norm
   A person's perception that most people are important to him think he must or does not do this behavior. People can choose to do behavior, even if they themselves do not like behavior or consequently, if they believe in one or more important references, who think they are motivated enough to comply with references.
2. Image
   It is a perception to increase a status into a social system
3. Job relevance
   That is the individual's perception of the extent to which the target system can be applied to his work.
4. Output quality
   Degrees in which a person believes that using a system improves the completion of his task properly.
5. Result demonstrability
   An effective system can fail to gather user acceptance if people have difficulty connecting profits in their work performance specifically with the use of the system.
6. Perceived Usefulness
7. The extent to which people believe that using a technology is useful and improves its performance.
8. Perceived Ease of Use
   The extent to which people believe that using a technology is easy.
9. Intention to Use
   That is the interest (desire) of someone to do certain behavior.
10. Usage Behavior

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Measured by the amount of time used to interact with technology and the frequency of using the technology.

3. MATERIAL AND METHOD

The study began by distributing the TAM2 questionnaire on young dentists who used digital radiography. Research on the acceptance of young dentists on the use of digital radiography is analytical research using quantitative analysis. The research subjects taken were young dentists at RSGM Unsoed who had used digital radiography. The sample used was using total sampling, that were 104 young dentists. The location of the study was conducted at the Rumah Sakit Gigi dan Mulut (RSGM) at Jenderal Sudirman University. The instruments used were adopted from Davis and Venkantest [21]. Data were analyzed using Structural Equation Modeling (SEM) and tested using AMOS 20 software. The questionnaire contained 9 constructs with 27 indicators, including Subjective norm variables, Image, Job relevance, Output quality, Result Demonability, Perceived Usefulness, Perceived Ease of Use, Intention to Use, Usage Behavior.

4. MODEL

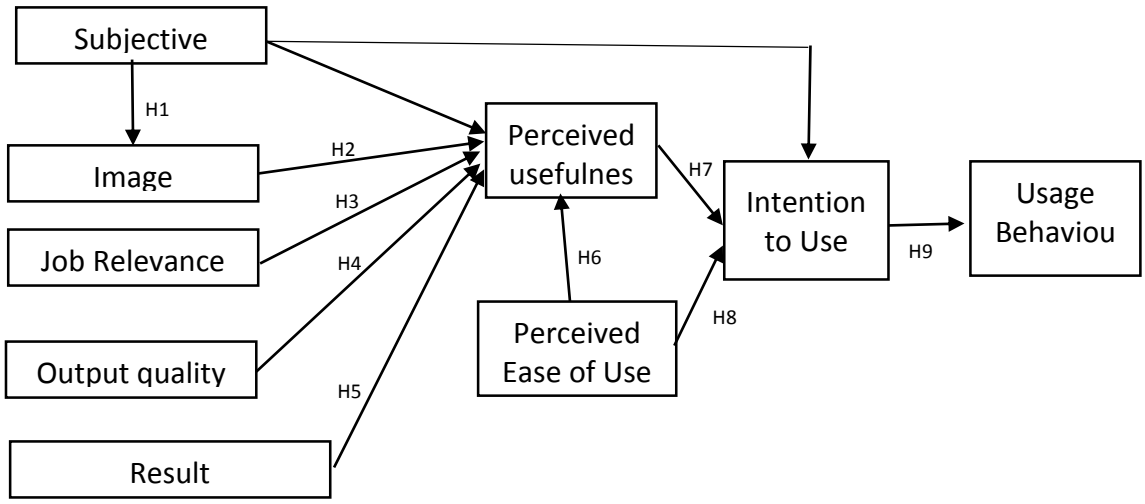

Fig. 1 Model research

Hypothesis 1: subjective norms have a positive effect on perceived usefulness of using digital radiography

Hypothesis 2: image have a positive effect on perceived usefulness of the use of digital radiography

Hypothesis 3: job relevance has a positive effect on perceived usefulness of the use of digital radiography

Hypothesis 4: quality of results has a positive effect on perceived usefulness of the use of digital radiography

Hypothesis 5: results demonstrability have a positive effect on perceived usefulness of the use of digital radiography

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Hypothesis 6: perceived ease has a positive effect on the perceived usefulness of using digital radiography

Hypothesis 7: perceived usefulness has a positive effect on intention to use from the use of digital radiography

Hypothesis 8: perceived ease of use has a positive effect on intention to use from the use of digital radiography

Hypothesis 9: intention to use has a positive effect on the usage behaviour of digital radiography

5. RESULT

There are 104 questinnaires that were returned and analyzed. This amaount is enough to be able to use the AMOS software in its analysis.

5.1 Conformity test and statistical test

Some conformity indices and cut-off values used to test whether a model is accepted or rejected are as follows [8];

a. The Chi-Square statistic, the small value of Chi-Square is better, and it is accepted based on probability with a cut-off value of p> 0.05

b. RMSEA (The Root Mean Square Error of Approximation), is an index used to compensate chi-square in a large sample. A RMSEA value that is small or equal to 0.08 is an index for the model can be accepted based on the degree of freedom.

c. CMIN / DF (The Minimum Sample Discrepancy Function Devided with Integrity of Freedom), is a chi-square X2 statistic divided by its degree of freedom so that it is called X2 relative. The value of X2 relative to less than 2.0 or 3.0 is an acceptable fit indication between the model and data.

d. TLI (Tucker Lewis Indeex), is an incremental index that compares a model tested against a baseline model, where the value recommended as a reference for a model is ≥ 0.95

e. CFI (Comparative Fit Index), the range of values is 0 -1, which is closer to 1, indicating the highest level of fit.

If presented in the table the Goodness of Fit Index is as follows:

Tabel1. Fit indices for the measurement model

Goodness of Fit Index	Cut off Value	Output	Keterangan
X2-Chi Square	Expected Small	1,394	Goodness of fit
CMIN/DF	≤ 3,00	0,697	Goodness of fit
Significance Probability	≥ 0,05	0,498	Goodness of fit

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TLI	≥ 0,95	1,003	Goodness of fit
CFI	≥ 0,95	1,000	Goodness of fit
RMSEA	≤ 0,08	0,000	Goodness of fit

After going through some testing, the last step is to conclude testing of hypotheses developed in this study. From all the variables above, it can be concluded that only the Subjective Norm which influences Perceived Usefulness is p <0.05 and estimate is 0.182 (Positive effect). Perceived Usefulness and Intension Use cannot be an intervening variable because p value is not significant, ie 0.992 and 0.773

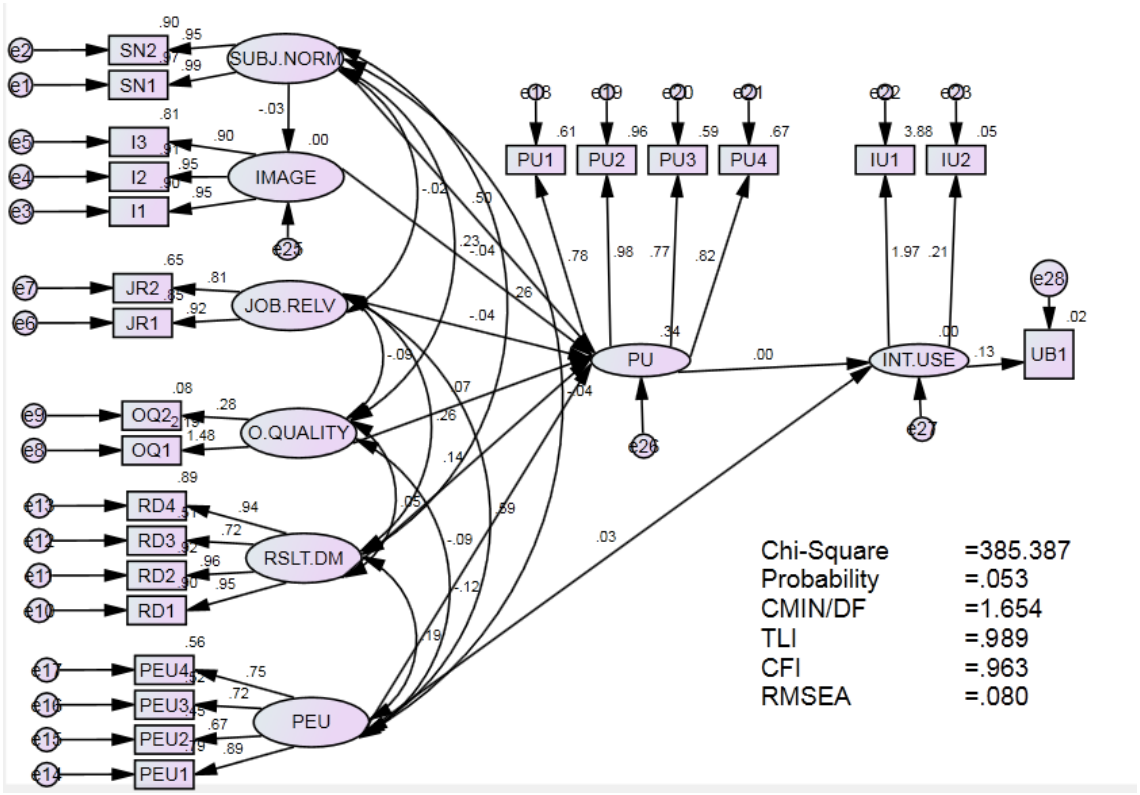

Fig2. Model of fit

Tabel2. Hypothesis testing

			Estimate	S.E.	C.R.	P	Label
IMAGE	<---	SUBJ.NORM	-.029	.087	-.330	.741	
PU	<---	SUBJ.NORM	.182	.037	4.929	***	
PU	<---	IMAGE	-.015	.036	-.419	.676	
PU	<---	JOB.RELV	-.022	.067	-.335	.738	
PU	<---	O.QUALITY	.051	.081	.632	.527	
PU	<---	RSLT.DM	.063	.041	1.555	.120	
PU	<---	PEU	-.086	.114	-.754	.451	
INT.USE	<---	PEU	.078	.123	.633	.527	

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			Estimate	S.E.	C.R.	P	Label
INT.USE	<---	PU	.001	.120	.010	.992	
UB1	<---	INT.USE	.092	.320	.289	.773	

P value <0.05

6. DISCUSSION

The results of hypothesis testing show one hypothesis that is accepted, that is hypothesis 1, namely the technology receiver digital radiography is influenced by subjective norms. User acceptance research examining the direct effect of subjective norm on intention has yielded mixed results. Teo [23]did find a significant effect of subjective norm. This result is in accordance with Moghbell's [13], Vankatesh and Davis [21], Helia [9] study which states that acceptance of a technology is influenced by subjective norms. But this result contrary with Ifinedo [22] found no significant effect of subjective norm on intention, whereas In their empirical comparison of TAM and TRA, Davis et al. [6] found that subjective norm had no significant effect on intentions over and above perceived usefulness and ease of use [6].

While other hypotheses from this study were rejected. That is, the acceptance of digital radiography at RSGM is not influenced by image, quality, result demonstability, job relevance, eprceived ease of use, perceived of usefulness. This result linear with Chismar [24] research that perceivrd ease of use and image did not had a significant effect to intention to use, while perceived usefulness, output quality, job relevance had significant effect. This result is contrary to the research of Vankatesgh and Davis [21] that tell image, quality, result demonstability, job relevance, eprceived ease of use, perceived of usefulness had significant effect. Chang [25] output quality had no significant, to intention to use.
Image, perceived ease of use had no significan effect [26].

The results prove that only the subjective norm variable influences the perceived usefulness. This is because in their work, young dentists are still under the supervision of the responsible dentist [17]. Patients who want an examination and action must go through permission and approval from DPJP. Meanwhile, DPJP RSGM Unsoed is not familiar with digital radiography, and often uses conventional radiography. The young dentist will only use digital radiographs when receiving an order from DPJP. In addition, there is actually no obligation for young dentists to use digital radiography or conventional radiography. However, because this digital radiography tool is still new, so the price is indeed more expensive than conventional radiography. Conventional periapical radiography costs 35 rb, while digital radiography costs 50 rb. Because these young dentists are mostly not yet independent, most of them will prefer cheaper radiogradi. Therefore it is necessary to do new rules, support from all hospital stakeholders, so users can be encouraged to use them.

7. LIMITATION

This study uses young dentist research subjects, so that in the use of digital radiography, the intensity and frequency of the use of digital radiography is still under the responsibility or request of the supervisor. This research was conducted using a cross sectional method. So that

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measurements are only made when technology has been implemented. Subsequent research should be carried out longitudinally, so that researchers can use experience variables in their research.

8. CONCLUSION

Based on the data analysis that has been done, the factors that apply subjective norms to perceived usefulness. Because this research was conducted on young dentist who are still awaiting DPJP doctor supervision. Choosing a young dentist does not have the freedom to choose what radiographs they choose.

References

Bansal, G., J., 2006, Digital radiography, A comparison with modern conventional imaging, Postgrad Med J, 82: 425-8.

Berkhout, W., E., R., Sanderink, G., C., H., Van der Stel, P., F., 2002, A Comparison of Digital and Film Radiography in Dutch Dental Practice Assessed by Questionnaire, Dentomaxillofacial Radiology, 31: 93-99.

Brennan J., 2002, An introduction to digital radiography in dentistry, J Orthod, 29: 66-9.

Brian, J., N., Williamson, G., F., 2007, Digital Radiography in Dentistry: A Survey of Indiana Dentist, Dentomaxilofacial Radiology, 36: 18-23.

Carlos, Flores-Mir, Neal, G.P., Herbert, C., N., Fareeza K., Paul, W., M., 2006, Perceptions adn Attitudes of Cadanian Dentist toward Digital and Electronic Technologies, J. Can Dent Assoc, 72(3): 243a-e.

Davis, F., 1989, Perceived usefullness, perceived ease of use and user acceptance of information technology,MIS Quarterly, 13(3):319-339.

Escobar-Rodriguez, T., Monge, P., Romero-Aloso, M., M., 2012, Acceptance of E-Prescriptions and Automated Medication-Managemen Systems in Hospital: An Extension of the Technology Acceptance Model, Journal of Information Systems, 26(1):77-96

Ferdinand. 2005. Metode Penelitian Manajemen. Edisi 2. BP Universitas Diponogoro : Semarang

Helia, V., N., Asri, V., I., Kusrini, E., Miranda, S., 2018, Modified technology acceptance model for hospital information system evaluation – a case study, MATEC Web Conference, 154: 1-5

Jeffrey, B., C., 2009, The Influence of Perceived Usefulness, Perceived Ease of Use, and Sub jective Norm ont the Use of Computed Radiography Systems: A Pilot Study, Radiologic Science and Therapy Division, The Ohio State University.

Lai, P., C., 2017, The Literature Review of Tchnology Adoption Models and Theories for the Novelty Technology, Journal of International Systems and Tchnology Management, 14(1): 21-38

Longo, D., L., dkk., 2017, Comparison of Digital and Conventional Radigraphic Techniques, RSBO, 14(2):74-79

ISBN: 978-623-7144-28-1

Mogghbeli, F., Langarizadeh, M., Kouhestani, A., Orooji, A., 2018, Modeling the Acceptance of Hospital Information Systems among Nurses an Extended Technology Acceptance Model, Iranian Journal of Medical Informatics, 7(1):1-6.

Mohammad, A., Yunus, A., M., 2017, Technology Acceptance in Healthcare Service: A Case of Electronic Medical Records (ERM), International Journal of Academic Research in Business and Social Sciences, 7(11):863-877.

Ozcete, E., Boydak, B., Ersel, M., dkk., 2015, Comparison of Conventional Radiorgaphy and Digital Computerized Radiography in Patients Presenting to Emergency Department, Turki Journal Emergency Medical, 15(1): 8-12.

Paul, F., 2008, Better imaging. The advantages of digital radiography, J Am Dent Assoc, 139 (3): 7-1.

Peraturan Konsil Kedokteran Indonesia tentang standar pendidikan profesi dokter gigi Indonesia , 2012

Petrikowski C., G., 2009, Introducing digital radiography in the dental office: an overview, J Can Dent Assoc, 71: 651(1-6).

Rovaris, K., Vasconcelos, K., F., do Nascimento, E., H., L., Oliveira, M., L., Freitas, D., Q., Haiter-Neto, F., 2016, Brazilian Young Dental Practitioners Use and Acceptance of Digital Radiographic Examintations, Imaging Science in Dentistry, 46 (239-244).

Taherdoost, H., 2018, A Review of Technology Acceptance and Adoption Models and Theoris, Procedia Manufacturing, 22:960-967.

Venkatesh, V., Davis, F., D., 2000, A Theoretical Extension ofthe Technology Acceptance Model: Four Longitunidal Field Studies, Management Science, 46(2): 186-204.

Ifinedo, P., 2017, Using an Extended Theory of Planned Behavior to Study Nurses' Adoption of Healthcare Information Systems in Nova Scotia, International Journal of Technology Diffusion, 8, 1, 1-17.

Teo, T., 2010, Examining the influence of subjective norm and facilitating conditions on the intention to use technology among pre-service teachers: a structural equation modeling of an extended technology acceptance model, Asia Pacific Educ. Rev. (2010) 11:253–262

Chismar, W.G., Wiley-Patton, S., Does the Extended Technology Acceptance Model Apply to Physicians Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03) 0-7695-1874-5/03 $17.00 © 2002 IEEE

Chang, Mong-Yuan, Pang, Chuan, dkk., 2015, Exploring User Acceptance of an e-Hospital Service: An Empirical Study in Taiwan, Computer Standards &Interfaces, 38: 35-43

Sedlmayr, B., dkk, 2013, Comparative evaluation of different medication safety measures for the emergency department: physicians' usage and acceptance of training, poster, checklist and computerized decision support, Medical Informatics & Decision Making, 13-79:2-15