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Chapter 6

Adoption of structured and standardised data recording among healthcare professionals: where to start?

Submitted



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Abstract

Introduction

To be reusable, patient data need to be stored as structured and standardised data (hereafter structured data). Recording structured data might cost healthcare professionals more time than recording free text, and might reduce freedom of expression. Changing current work processes to accommodate structured data recording is a challenging change process. Intentions of users are an important indication of behaviour and it is therefore important to determine factors that most influence the intentions of users to record structured patient data. These intentions might be different, based on the Electronic Health Record (EHR) of the healthcare organisation. In this study we aim to investigate the strongest predictors for the intention of healthcare providers to record structured patient data, and to what extent this set of predictors is influenced by EHR maturity.

Methods

Using a questionnaire built upon a previously validated model we gathered cross-sectional data from healthcare professionals in seven Dutch academic hospitals. For each of the factors in the model, one or more statements were presented with a 5-point ordinal answer option. For each factor a factor score was calculated. For both the cluster of low-mature centres and the cluster of high-mature centres we created a logistic model with the dichotomised intention to record structured patient data as outcome and all other factors as variables. Using stepwise model selection we determined the most predictive variables for both types of centre.

Results

We received 3,584 responses to our questionnaire. In all centres intention of healthcare providers to record structured and standardised patient data is best predicted with four process factors: Awareness, Attitude, Structural Assurance, and Perceived Risk. In low-mature centres this list is supplemented with eight factors, of which five are system-related: Accuracy, Format, Integration, Accessibility, System Satisfaction, Interpersonal Influence, Subjective Norm, and Institutional Trust. In high-mature centres the only additional factor is Perceived ease of use, also a process factor.

Discussion

We found four factors associated with the intention to perform structured data recording in both low- and high-mature centres. In the low-maturity centres additional system factors, related to the transition to high EHR maturity, are important. Low-mature centres should try to increase their EHR maturity as this is an important prerequisite for intention to record structured data. When high EHR maturity is reached the factors that remain are related to attitude and organisational culture. These factors should receive the main focus when trying to increase the intention to record structured patient data among the personnel of a healthcare organisation.

6.1 Introduction

Data reuse is becoming increasingly important for providing care to patients as well as for secondary purposes such as quality auditing, research, and management. To ensure reusability, data have to be structured and standardised (hereafter referred to as structured data) [96]. This means that data can be retrieved easily and are unambiguous. However, recording structured data might cost healthcare providers more time [74] and it might reduce the freedom of expression healthcare providers are used to [97]. Therefore, they might be reluctant to record structured data.

Increasing the recording of structured data requires a change in healthcare providers' behaviour. One important determinant of behaviour is the intention to act [95]. If the professionals do not have the intention to act (i.e. to record structured data) it will be difficult to influence their behaviour. An increase of this intention will ease the change in actual behaviour.

A number of factors can influence the intention of professionals to record structured data. In a previously published study [63] we developed and validated a theoretical model that shows factors that influence this intention. This model consists of 29 factors related to information systems, the documentation process, and personal beliefs. The factors can be divided into two groups: 'System' and 'Documentation process' factors. For hospitals aiming to increase both the number of professionals that record structured data and the extent to which they do this, it is essential to see which of these factors most influence the intention to act.

On the 'System' side of the model, an important distinction between different centres is the maturity or sophistication level of their recording practice (hereafter: maturity). This maturity is usually indicated on a predefined scale, for example the Electronic Medical Record Adoption Model (EMRAM) from the Healthcare Information and Management Systems Society (HIMSS) [98]. When a centre still records all data on paper, this is considered the lowest level of maturity. When more recording is done digitally, and more functionalities such as decision support or closed-loop medication ordering are added to the Electronic Health Record (EHR), the level of maturity rises. Centres with a high-mature EHR have one, fully integrated EHR that uses terminology systems and data forms, and no further paper-based records. Therefore the maturity of an EHR indicates the level of functionalities and integration that an EHR offers and the extent to which structured data can be recorded.

Important in this context is the trade-off between freedom of expression of the user and the reuse possibilities of the data [21]. Low-mature EHRs present much freedom of expression, usually through free text-data recording. This means that data recording is perceived as easy, but data is not easily reusable. High-mature EHRs (i.e. Gartner 3rd generation EHRs and up [99]) are designed to record structured data using terminology systems and structured data forms. This might decrease the freedom of expression of the user, but strongly increases the possibility of data reuse, e.g. enabling decision support.

Based on the maturity of the EHR in a centre, the factors that influence the personnel's intention to record structured data might be different. Low-mature centres might need to work on other aspects than high-mature centres. Therefore, our aim is to determine the factors that belong to the best predictive model for the intention of healthcare providers to record structured patient data and the extent to which the set of predictive factors is modified by EHR maturity.

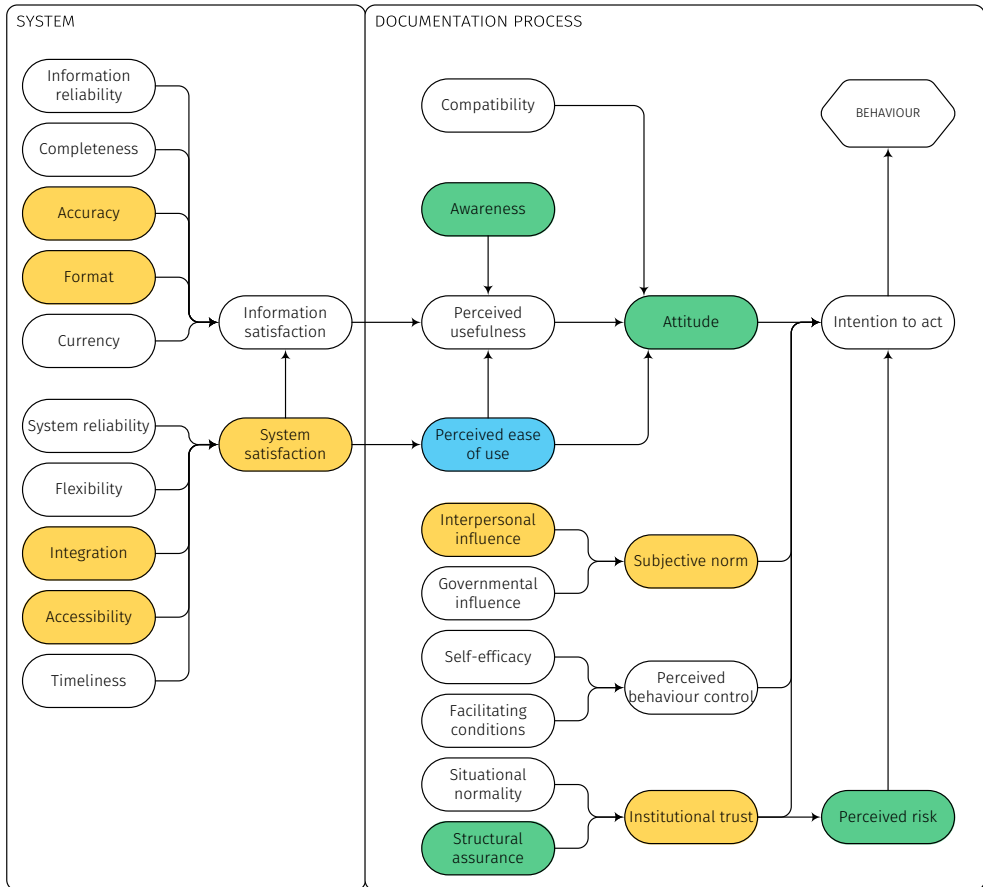


Figure 6.1: Model as described in [63]. Outcomes of this study indicated with colours. Factors that were selected in centres of both maturity levels or only in those centres with low or high maturity with intention to act as outcome variable. Green variables selected in both types of centre, yellow variables only in low-mature centres, blue variables only in high-mature centres.

6.2 Methods

To measure the intention of healthcare professionals we created an online questionnaire with 58 questions corresponding with the 29 factors from our previously validated model [63] (Figure 6.1). Each question was a statement with a five-point ordinal rating scale (strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5)). The factor Behaviour is left out of the analysis in the current study as intention influences behaviour and not vice versa. This results in one outcome factor (Intention to Act) and 27 factors possibly influencing this outcome.

In this study we focussed on university hospitals in the Netherlands. We only included university hospitals since these are comparable in type of care they provide, their size, and the composition of their workforce. Additionally, the Dutch university hospitals participate

in a national project on structured data recording. The questionnaire was distributed among personnel of seven out of the eight Dutch university hospitals. In five hospitals, all personnel was invited to participate, in two hospitals a random selection of 1000 employees that worked with patient data was invited to participate. Data were collected between May and November 2015. Only responses from personnel actually working with patient data (i.e. reading data from or writing data in the patient record) were used in this study, since the outcome was intention to perform structured recording of patient data.

Multiple classification systems to describe the maturity of an EHR have been suggested [98–100] all with different numbers of levels and different functionalities that are required to reach a higher level. Based on these models, in this study we distinguish two levels of maturity, low-mature and high-mature centres. Centres that still work with paper-based records and those with basic (previous generation, separate subsystem) EHRs are included in the group of low-mature centres. In the group of high-mature centres, we include those with, sometimes recently implemented, EHRs that are integrated systems that use terminology systems, and offer advanced additional functionalities such as decision support and alerting systems.

We created a factor score for the outcome and each of the 27 factors by taking the mean of all answers on the questions that correspond to that specific factor. We used Mann-Whitney-U tests to compare factor scores between the low-mature and high-mature centres. P-values of < 0.05 were regarded significant (corrected for the number of tests with Bonferroni correction).

To analyse which factors are associated with the providers' intention to record structured data we performed logistic regression analysis. We dichotomised the outcome into positive intention (answer 4 and 5 on the factor Intention to Act) and no intention (answer 1 through 3). To assess whether maturity modifies the association between factors and the intention to act, we repeated the analyses in the subgroups of low-mature and high-mature centres. For each of these two datasets we created 27 univariate logistic models, one for each factor of our model. Based on p-values in the univariate analyses, we initially selected those factors that showed some association ($p < 0.2$) with our outcome intention to act. These subsequently formed the input variables for the Akaike Information Criterion (AIC) bidirectional stepwise variable selection procedure. To account for clustering of our data within centres, we included organisation as a random effect in all our models.

To adjust for missing values we used stochastic multiple imputation methods from the mice package [101] to create one hundred datasets without missing values. To minimise the influence on our end results of the imputation we performed all analyses on these one hundred sets, pooling the results to find the final outcomes. We performed the stepwise variable selection separately on the datasets and for our final model selected those variables that were present in at least half of the models (i.e. in 50 or more separate models). Finally, this resulted in two lists of factors associated with intention to record structured data, one for low-mature and one for high-mature centres. All analyses were performed using the statistical environment R (version 3.5.1) [71].

6.3 Results

We received 5,011 responses to our questionnaire of which 3,584 were from users working with patient data and the EHR. All further analyses are based on the answers of these 3,584 respondents. The demographics of our respondents are summarised in Table 6.1. Of our seven centres, two had already implemented a new structured and standardised, completely

integrated, centre-wide EHR enabling structured data recording. Based on the characteristics of these systems and the absence of paper records these two centres are categorised as high-mature centres. The other five centres were working with systems less advanced based on not fully integrated subsystems, sometimes supplemented with paper-based records. Therefore, these five were categorised as low-mature centres.

For each centre, and both the combination of low-mature and high-mature centres, the mean factor score on our factors and outcome is depicted in Table 6.2. The table also shows whether there are significant differences in factor scores between the low-mature and high-mature centres. The largest differences (up to 0.81 points) were in the 'System' factors of our model where high-mature centres score higher on eight out of twelve factors. These factors include Accessibility, Integration, and System Satisfaction. In the 'Documentation process' factors there are five out of fifteen factors with a significant difference. On three factors low-mature centres score higher (i.e. on Self-Efficacy, Facilitating Conditions, and Perceived Behavioural Control), on the other two factors the high-mature centres score higher (i.e. Structural Assurance and Institutional Trust).

Table 6.3 shows the results of the univariate models. For each variable the odds ratio (OR) and confidence interval (CI) are reported. These results are reported for low-mature and high-mature clusters separately. In our univariate models, twenty variables were selected for the low-mature centres, and eighteen variables for the high-mature centres.

In the stepwise variable selection twelve variables were selected for the low-mature centres, and five for the high-mature centres. The OR and CI of these variables are also shown in Table 6.3. These variables are highlighted in the original model (Figure 6.1). Factors selected in both clusters are highlighted in green, those only selected in the low-mature cluster in yellow, those only selected in the high-mature cluster in blue.

In both models for high-mature and low-mature centres the factors that were selected are Awareness, Attitude, Structural Assurance, and Perceived Risk. The model for high-mature centres included one additional factor: Perceived ease of use. The model for low-mature centres included eight additional factors: Accuracy, Format, Integration, Accessibility, System Satisfaction, Interpersonal Influence, Subjective Norm, and Institutional Trust.

6.4 Discussion

High-mature centres are more satisfied on system factors such as Accessibility, Integration, and System Satisfaction, low-mature centres on Self-Efficacy, Facilitating Conditions, and Perceived Behavioural Control. In all centres intention of healthcare providers to record structured and standardised patient data is best predicted with four process factors: Awareness, Attitude, Structural Assurance, and Perceived Risk. In low-mature centres this list is supplemented with eight factors, of which five are system-related: Accuracy, Format, Integration, Accessibility, System Satisfaction, Interpersonal Influence, Subjective Norm, and Institutional Trust. In high-mature centres the only additional factor is Perceived ease of use, also a process factor.

Table 6.1: Demographics of our respondents.

	C1		C2		C3		C4		C5		C6		C7	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Total respondents	898	(100)	131	(100)	620	(100)	869	(100)	659	(100)	256	(100)	151	(100)
Gender														
Male	229	(25.5)	34	(26)	160	(25.8)	263	(30.3)	146	(22.2)	100	(39.1)	33	(21.9)
Female	669	(74.5)	97	(74)	460	(74.2)	606	(69.7)	513	(77.8)	156	(60.9)	118	(78.1)
Function														
Analytical staff	14	(1.5)	1	(0.7)	16	(2.6)	17	(1.9)	12	(1.8)	0	(0)	1	(0.7)
Clinical (co-)care provider	84	(9.2)	16	(11.7)	60	(9.8)	115	(12.6)	67	(10)	8	(2.9)	18	(12.7)
Medical support staff	1	(0.1)	0	(0)	4	(0.7)	3	(0.3)	1	(0.1)	0	(0)	0	0
Management	23	(2.5)	5	(3.6)	19	(3.1)	23	(2.5)	16	(2.4)	9	(3.3)	2	(1.4)
Medical specialists	186	(20.4)	32	(23.4)	144	(23.5)	224	(24.6)	129	(19.2)	162	(59.6)	30	(21.1)
Administrative staff	62	(6.8)	18	(13.1)	56	(9.1)	72	(7.9)	39	(5.8)	10	(3.7)	9	(6.3)
Nurses	396	(43.4)	39	(28.5)	231	(37.6)	330	(36.3)	310	(46.1)	57	(21)	62	(43.7)
Scientific research	80	(8.8)	14	(10.2)	32	(5.2)	71	(7.8)	47	(7)	18	(6.6)	9	(6.3)
Other	67	(7.3)	12	(8.8)	52	(8.5)	55	(6)	51	(7.6)	8	(2.9)	11	(7.7)
Age														
<30	124	(13.8)	19	(14.5)	102	(16.5)	106	(12.2)	93	(14.1)	29	(11.3)	25	(16.6)
30-39	246	(27.4)	35	(26.7)	144	(23.2)	223	(25.7)	192	(29.1)	82	(32)	51	(33.8)
40-49	194	(21.6)	29	(22.1)	148	(23.9)	222	(25.5)	145	(22)	57	(22.3)	31	(20.5)
50-59	243	(27.1)	35	(26.7)	178	(28.7)	241	(27.7)	175	(26.6)	74	(28.9)	37	(24.5)
≥60	91	(10.1)	13	(9.9)	48	(7.7)	77	(8.9)	54	(8.2)	14	(5.5)	7	(4.6)

Table 6.2: Scores on outcome (intention to act) and factors per centre, and combined per maturity level. Scores on a five-point rating scale (strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5)). Mann-Whitney-U (MWU) p-values for difference between high-mature and low-mature centres (* = significant).

	Low-mature centres							High-mature centres			Combined		MWU
	C1	C2	C3	C4	C5	C6	C7	LOW	HIGH				
System factors	Information Reliability	4.04	3.64	3.73	3.59	3.97	3.80	3.75	3.80	3.78	0.347		
	Completeness	3.62	3.62	3.61	3.26	3.43	4.03	3.86	3.48	3.96	0.000*		
	Accuracy	3.45	3.46	3.49	3.36	3.43	3.65	3.67	3.43	3.65	0.000*		
	Format	3.26	2.99	3.04	2.84	3.28	2.87	3.30	3.07	3.02	0.509		
	Currency	3.51	3.43	3.56	3.44	3.50	3.88	3.70	3.50	3.81	0.000*		
	System Reliability	3.43	3.20	3.52	3.23	3.50	3.81	3.65	3.40	3.75	0.000*		
	Flexibility	3.28	3.20	3.14	3.18	3.36	3.35	3.16	3.22	3.28	0.305		
	Integration	3.04	3.14	3.01	2.58	3.06	3.77	3.17	2.90	3.56	0.000*		
	Accessibility	3.64	3.88	3.81	3.26	3.53	4.57	4.01	3.56	4.37	0.000*		
	Timeliness	3.06	3.21	2.85	3.02	3.38	3.73	3.15	3.05	3.52	0.000*		
Information Satisfaction	3.40	3.17	3.19	3.00	3.36	3.31	3.50	3.22	3.37	0.002			
System Satisfaction	3.04	2.90	2.96	2.21	3.10	3.54	3.37	2.80	3.48	0.000*			
Documentation process factors	Compatibility	3.53	3.78	3.72	3.74	3.45	3.52	4.02	3.64	3.69	0.091		
	Awareness	3.62	3.45	3.64	3.56	3.63	3.55	3.59	3.60	3.56	0.365		
	Perceived Usefulness	3.52	3.36	3.39	3.34	3.59	3.34	3.49	3.44	3.39	0.255		
	Perceived Ease Of Use	3.12	2.93	3.02	2.79	3.14	2.93	3.23	2.99	3.04	0.444		
	Interpersonal Influence	3.53	3.31	3.51	3.32	3.49	3.32	3.46	3.44	3.37	0.170		
	Governmental Influence	3.00	3.11	3.21	3.28	NA†	3.14	3.13	3.24	3.13	0.105		
	Self-Efficacy	3.93	3.93	3.90	3.87	3.65	3.58	3.81	3.87	3.66	0.001*		
	Facilitating Conditions	2.76	2.83	2.82	2.77	3.04	2.52	2.80	2.82	2.61	0.001*		
	Situational Normality	3.49	3.55	3.56	3.39	3.52	3.53	3.69	3.48	3.58	0.099		
	Structural Assurance	3.52	3.26	3.53	3.26	3.47	3.75	3.67	3.42	3.72	0.000*		
Attitude	3.97	3.84	3.89	3.84	3.97	3.89	3.90	3.90	3.89	0.650			
Subjective Norm	3.56	3.61	3.70	3.59	3.61	3.69	3.64	3.61	3.68	0.238			
Perceived Behavioural Control	3.73	3.60	3.65	3.60	3.74	3.36	3.67	3.66	3.47	0.001*			
Institutional Trust	3.95	4.09	4.07	3.91	3.88	4.17	4.08	3.96	4.14	0.000*			
Perceived Risk	2.81	2.80	2.87	2.79	2.85	3.00	2.87	2.83	2.95	0.020			
Intention To Act	3.96	3.93	4.08	4.10	3.94	4.15	3.99	4.03	4.09	0.123			

† Question category not shown in this centre

Table 6.3: Outcomes of both univariate and final models. For all included variables are reported the unadjusted Odds Ratio (OR) and Confidence Interval (CI). Bold variables were selected for stepwise regression ($p < 0.2$).

Variable	Univariate models		Final model			
	Low-mature centres OR (CI)	High-mature centres OR (CI)	Low-mature centres OR (CI)	High-mature centres OR (CI)		
System factors	Information Reliability	1.639 (1.366-1.967)	1.707 (1.045-2.790)			
	Completeness	0.960 (0.871-1.058)	1.174 (0.891-1.547)			
	Accuracy	1.179 (1.031-1.349)	1.426 (0.987-2.060)	1.135 (0.948-1.359)		
	Format	0.931 (0.844-1.026)	1.194 (0.922-1.546)	0.819 (0.711-0.943)		
	Currency	1.095 (0.985-1.216)	1.050 (0.768-1.434)			
	System Reliability	1.106 (0.997-1.228)	1.337 (0.997-1.792)			
	Flexibility	1.032 (0.932-1.142)	1.127 (0.881-1.441)			
	Integration	0.898 (0.806-1.000)	1.203 (0.893-1.619)	0.905 (0.789-1.038)		
	Accessibility	1.125 (1.027-1.232)	1.285 (0.932-1.771)	1.072 (0.957-1.201)		
	Timeliness	0.997 (0.908-1.094)	1.309 (1.039-1.650)			
	Information Satisfaction	0.977 (0.872-1.094)	1.274 (0.946-1.716)			
	System Satisfaction	0.900 (0.817-0.992)	1.311 (1.003-1.714)	0.731 (0.629-0.849)		
	Documentation process factors	Compatibility	1.148 (1.033-1.275)	1.073 (0.803-1.432)		
		Awareness	2.744 (2.294-3.282)	3.164 (1.942-5.154)	1.943 (1.572-2.402)	2.414 (1.365-4.270)
Perceived Usefulness		1.303 (1.112-1.526)	1.878 (1.175-3.002)			
Perceived Ease Of Use		0.956 (0.857-1.065)	1.236 (0.901-1.695)		0.725 (0.485-1.083)	
Interpersonal Influence		1.345 (1.210-1.495)	1.451 (1.097-1.919)	1.150 (1.008-1.313)		
Governmental Influence		1.181 (1.033-1.350)	1.187 (0.881-1.600)			
Self-Efficacy		1.379 (1.223-1.557)	1.134 (0.849-1.514)			
Facilitating Conditions		0.987 (0.896-1.088)	1.115 (0.849-1.464)			
Situational Normality		1.015 (0.911-1.130)	1.313 (0.978-1.763)			
Structural Assurance		1.402 (1.229-1.598)	2.495 (1.653-3.766)	1.193 (0.986-1.442)	2.007 (1.252-3.220)	
Attitude		4.994 (3.989-6.251)	5.372 (2.616-11.031)	3.557 (2.771-4.565)	3.625 (1.654-7.944)	
Subjective Norm		1.401 (1.255-1.563)	1.442 (1.079-1.927)	1.152 (1.001-1.325)		
Perceived Behavioural Control		1.155 (1.035-1.289)	1.166 (0.885-1.536)			
Institutional Trust		1.542 (1.345-1.768)	1.716 (1.199-2.456)	1.135 (0.949-1.359)		
Perceived Risk	1.270 (1.110-1.452)	1.481 (1.035-2.119)	1.281 (1.100-1.490)	1.281 (0.855-1.918)		

Our previously published model [63] defines 27 factors that influence the intention of healthcare professionals to record structured and standardised patient data. When attempting to optimise this intention, focussing on all 27 factors would not be an efficient way to allocate the usually limited resources of healthcare organisations. The current study indicates that there are at least four factors that are always important to address: Awareness, Attitude, Structural Assurance, and Perceived Risk. For high-mature centres these factors are the top four factors to focus all attention on supplemented with Perceived ease of use. In low-mature centres additional resources should be directed to improve on the eight additional factors that we found. It is important to note that in these centres the documentation system itself requires specific attention (e.g. Accuracy and Integration).

Awareness and Attitude indicate whether healthcare professionals are aware what structured data recording is, and whether they think that its benefits outweigh its negative aspects, respectively. This means that regardless of maturity, it is important to make sure the personnel of a hospital knows what structured data recording is and why they should care, i.e. what the benefits of this recording practice are. Structural Assurance indicates whether the organisation makes sure that the EHR is always available and data are stored securely. Perceived Risk means that the healthcare professionals assess that structured data recording does not pose a risk to patient safety or the safety of themselves as healthcare providers. The personnel wants to be able to trust their employer that all data are stored safely so that nothing gets lost, or accessed by unauthorised individuals, and that they do not potentially harm the patients or themselves with structured data.

High-mature centres only have associated factors on the 'Documentation Process' side of the model. Low-mature centres additionally have factors on the underlying 'System' side of the model. This indicates that upon the transition from low-maturity to high-maturity the healthcare providers' focus shifts away from basic system factors to process factors. This could imply that the systems in high-mature centres are good enough to be less of an influence on peoples intention to record structured patient data. This corresponds with the largest differences on factor scores (Table 6.2) being factors from the 'System' part of our model, where high-mature centres score significantly higher than low-mature centres. Therefore, low-mature centres should, before focussing on process measures of awareness and attitude, especially focus on making sure their personnel is satisfied with their EHR and on increasing its maturity. Part of this process could consist of upgrading or replacing the current EHR with an integrated system of a higher maturity level. High-mature centres on the other hand, where the basic system aspects are considered satisfactory, should focus on maintaining and increasing the usability of the system and on the factors from the 'Documentation process' part of our model.

The factors that apply to both types of hospitals are process factors. This indicates that at the core, the intention to record structured patient data is more associated with the human interaction aspects of EHR use than the technical and system related aspects. In low-mature centres the opinion of colleagues plays a role (Interpersonal Influence and Subjective Norm) whereas in high-mature centres the main factors are whether the personnel personally knows why they should record data a certain way and considers this generally beneficial to their work (Attitude and Awareness).

In high-mature EHRs failure to record structured data can have more serious consequences than in low-mature centres. A large number of additional functionalities of modern EHRs (e.g. alerts based on allergies) rely on structured data to function correctly. Data that is recorded in the wrong way might lead to errors in care processes based on these records. This might

explain why in low-mature centres the opinion of colleagues still plays a role (“I do this because others expect me to”) whereas in high-mature centres the intention is based more on personal opinion and knowledge (“I do this because I know/experience that it is important”). Additionally, recording structured data often requires more work and a different work process reflected in the inclusion of Perceived ease of use in the high-mature centres. If data has to be recorded more structured, than the system’s usability becomes more important.

The change process leading to structured data recording is challenging. Especially, since implementing or changing recording systems in healthcare is a socio-technical process [33]. Focussing on technical aspects alone while neglecting changes in work processes might decrease the potential benefits of a new system or recording practice [35]. Our study attempts to bring focus in this change process by showing which factors are most important to increase the intention to record structured data.

The main strength of our study is our inclusion of a large number of healthcare professionals from seven out of the eight Dutch academic hospitals, providing us with a large number of respondents to build our models. Unfortunately, not all centres responded in equally high numbers. We corrected for this in our models by including the organisation of the respondent as a random effect in our model. An important limitation is that the number of hospitals in both groups (low-mature and high-mature) and the number of respondents in the high-mature group are low. This can influence the outcomes of our study and the generalisability of our results. Follow-up studies should include more centres in both groups.

Our results can be generalised to non-university hospitals. However, in these hospitals research usually plays a smaller role, decreasing the need of data reuse for research. This might influence the intention of the personnel although most reasons for reuse remain important for any type of hospital, such as direct support in providing care and calculating quality indicators. Furthermore, our four main factors Awareness, Attitude, Structural Assurance, and Perceived risk seem independent of the goal of the data reuse. Generalisability to hospitals abroad might depend on similarities in legal requirements on medical data collection and processing. In countries with a stronger legal requirement of structured data recording, the governmental influence might play a larger role, for example.

Other studies have found that strategic and organisational aspects of the introduction of technology are as important to the introduction of electronic systems as the technological aspects [33,35,102]. Deutsch et al. [102] state, based on research into national EHR programs, that as the technological aspects are considered as the core tasks of the implementing program, these system-related aspects might be focussed on too heavily. They conclude that among others, the areas of acceptance, change management, and demonstration of benefits should be given at least as much importance [102]. We found in our study that the focus lies on process factors. In line with the research of Deutsch et al. [102] this could be the result of the centres focussing on the system factors already, but neglecting the process factors.

6.5 Conclusion

Our study shows that process factors Awareness, Attitude, Structural Assurance, and Perceived risk are the most important factors associated with the intention of healthcare providers to record structured patient data in academic hospitals. In low-mature centres this list is supplemented with eight more factors, including five system factors focussing on the EHR itself. Low-mature centres should try to increase their EHR maturity as this is an important prerequisite for intention to record structured data. When high EHR maturity is reached the

factors that remain are related to attitude and organisational culture. These factors should receive the main focus when trying to increase the intention to record structured patient data among the personnel of a healthcare organisation.

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