Differences in Sociocognitive Beliefs between Involved and Noninvolved Employees during the Implementation of an Electronic Health Record System

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Abstract

Background: Electronic health records (EHRs) can improve quality and efficiency in patient care. However, the intention to work with such a new system is often relatively low among employees because the work processes of the healthcare organization may change. Involving employees in an EHR implementation may increase their beliefs and perceived capabilities concerning the new system. The current study aimed to assess the role of involvement and its effects on sociocognitive beliefs regarding the implementation of a new EHR system.

Methods: The study was performed in June 2015 among all eligible employees of a hospital in the Netherlands. Both involved and noninvolved employees were invited to complete a paper-based questionnaire concerning their sociocognitive beliefs (i.e., attitude, social influence, self-efficacy, and intention) related to the EHR implementation. Independent sample *t*-tests were used to assess potential differences in sociocognitive beliefs between employees who were involved in the implementation process and those who were not. Effect sizes (Cohen's *d*) were calculated to indicate the standardized difference between the means.

Results: A total of 359 participants completed the paper-based questionnaire and were included in the analyses. Involved employees ($n = 94$) reported significantly higher levels of attitude ($p < .001$, $d = .62$), perceived self-efficacy ($p = .01$, $d = .31$), social support ($p < .001$, $d = .68$), and a higher intention to work with the new EHR system ($p < .001$, $d = .60$), compared with the group of employees who were not involved in the implementation process ($n = 265$).

Conclusion: Involving employees during an EHR implementation appears to enhance employees' sociocognitive beliefs and increases their intention to work with the new system.

Keywords: electronic health record, sociocognitive beliefs, intention, implementation

Introduction

During the last decades, electronic health records (EHRs) have been implemented in healthcare settings in many countries.[1,2] EHRs are an important tool for data processing and information exchange.[3-5] They can facilitate the work of health professionals by means of improved communication, enhanced information exchange, and better access to patients' healthcare information.[6-8] Additionally, the implementation of an EHR has the potential to improve the quality of care because EHRs, for example, can check for drug-allergy interactions when a new medication is prescribed and alert the health professional to potential medical conflicts.[9-11]

Despite these potential benefits, the implementation of such a system is a major operation for healthcare organizations because the work processes of the organization may change.[12,13] Prior studies have shown that the intention to work with a new EHR is often relatively low among health professionals.[14,15] Especially in the hospital setting, difficulties in stimulating employees to accept the new EHR and to cooperate during the implementation process are experienced.[16,17] To optimize the implementation of EHRs, it is important to identify which factors may facilitate employees' intentions to work with the new system.

Past research has shown that employees who were more involved in the implementation process were more likely to cooperate during an organizational change process.[18] McKay et al. found that sharing information can be important to motivate employees to change their behavior and to increase the willingness to engage in an organizational change process.[19] Additionally, prior research has demonstrated that employees who received more information reported stronger intentions to change during an implementation process.[20] In addition, Graetz et al. revealed the importance of team-based work during the implementation of an EHR.[21] Team structure may stimulate an atmosphere of informal learning in which members feel comfortable working with the EHR and sharing knowledge on best practices with each other.[22,23] This reasoning proposes that a higher level of involvement (e.g., receiving more information about the new system, having the chance to discuss and change specific modules of the EHR with the software supplier, and having the opportunity to test and practice with the new EHR) may eventually lead to higher levels of intention among employees to work with the new system. However, to date, less is known about how involvement might affect employees' intention to work with an EHR.

According to several theoretical frameworks, such as the Reasoned Action Approach and the Attitude–Social influence–Self-efficacy framework, intention can be explained in terms of three socio-cognitive beliefs: individuals' attitude toward a specific behavior, subjective norms, and perceived self-efficacy.[24-28] Past research has suggested that a more positive attitude is likely to increase individuals' intention.[29,30] Receiving information about the benefits of the new system may improve employees' attitudes and is likely to influence people's intentions.[31] The intention to work with the new EHR may also be influenced by individuals' beliefs in their ability to work with the new EHR. Employees who get the possibility to practice with the new EHR may show a higher sense of self-efficacy related to the EHR. Therefore, socio-cognitive beliefs about the use of EHRs may vary among employees because of the amount of information they receive during the implementation process and may influence their intention to work with the new EHR.

Previous research has demonstrated a likely relationship between the level of involvement and the intention to use the new system.[32,33] However, up to now, little research has been conducted concerning the role of involvement and its effects on socio-cognitive beliefs. Insight into those beliefs could be used to improve future EHR implementations by targeting these beliefs more specifically. The ASE model is used as a theoretical framework in this study.[34] The aim of this study is to explore whether there are differences in socio-cognitive beliefs between employees who are involved and employees who are not involved in the implementation of an EHR. It is expected that employees who are more involved in the implementation process of the EHR will have a more positive attitude toward the system, higher perceived social influences, a higher perceived ability to work with the EHR, and higher intentions to work with the EHR, compared with employees who are not involved in the implementation process.

Methods

Study Design and Procedure

Participants in the current quasi-experimental study were employees of a hospital in the Netherlands. The hospital is a medium-sized hospital (approximately 2,500 employees) in the middle of the Netherlands that focuses on both emergency and acute care and cure. Ethical approval was not necessary, according to Dutch law, because the questionnaire did not have a deep psychological impact and participation was optional and anonymous. Moreover, the questionnaire was not distributed among patients.[35]

Data Collection

In June and July of 2015, all employees of the hospital (nurses, managers, physicians, surgeons, administrative personnel, etc.) who would need to work with the new EHR (approximately 864 employees according to the headcount of the hospital) were invited to complete a paper-based questionnaire. To make sure that all eligible employees were invited to participate, the paper-based questionnaire was given to the manager of each department with the request to distribute the questionnaire to the employees within their department. The paper-based questionnaire required about 10 to 15 minutes to complete. The first page of the questionnaire briefly explained the purpose of this study and instructed employees how to complete the questionnaire. Furthermore, it was emphasized that answers were accessible only to the researchers. Employees were asked to return the questionnaire to the researchers in a sealed envelope after completion. If the distributed questionnaires were not returned, the manager was instructed by e-mail or telephone to remind the personnel in the department to complete and return the questionnaire.

Involvement of Employees during the Implementation Process—Task Groups

The EHR was implemented in November 2015. Before the EHR could be implemented, it reviewed from February to July by 52 task groups to adapt the EHR to the demands of the employees or health professionals who had to work with each specific part of the EHR. In the majority of cases, multiple stakeholders (e.g., nurses, surgeons, physicians, administrative personnel) in the department were signed up by their manager to participate in a task group. Employees who participated in a task group received information about the EHR through informative sheets, workshops, and meetings. Members of each task group attended several meetings in which they had the opportunity to evaluate a so-called best-practice approach to the use of the EHR and were able to define changes according to their needs and wishes on behalf of their department. Additionally, task group members had the opportunity to test the entire EHR during two test days. During these days, the complete system and task group–specific modules of the EHR were verified by task group members. The revisions that were made to the modules resulted in the final version of the EHR that was used by all employees of the hospital. Therefore, task group members were more involved in the organizational change and the implementation of the EHR. Employees who were not involved in the task group did not receive this specific information concerning the EHR implementation (such as workshops, informative sheets, meetings, etc.) and were also not able to review specific modules of the EHR. Both employees who took part in the task groups and those who did not participate were invited to complete the paper-based questionnaire.

Measurements

A draft version of the questionnaire was piloted by several employees ($N = 5$) of the hospital to ensure that the questions could be understood by all participants. Based on their feedback, a final version of the questionnaire was developed. The questionnaire measured the following concepts: demographics, sociocognitive variables, and intention to work with the new EHR system. These concepts are explained in detail below.

Demographics

The following demographic variables were measured: gender (1 = female; 2 = male), age (in years), educational level (3 = high [higher vocational school or university level], 2 = medium [higher general secondary education, preparatory academic education, medium vocational school], 1 = low [primary, basic vocational, lower general school]), years of experience working in the organization (ranging from 1, meaning less than one year, to 6, meaning more than 20 years), job description (open question regarding the participant's function at the hospital, which was used to define the variable "giving patient care"), years of total work experience (ranging from 1, representing less than five years, to 5, representing more than 20 years), working hours according to the employee's contract (1 = 0 to 10 hours, 2 = 11 to 20 hours, 3 = 21 to 30 hours, 4 = 31 to 36 hours), and hours of weekly use of a computer, laptop, or tablet (1 = 0 to 10 hours, 2 = 10 to 20 hours, 3 = 20 to 30 hours, 4 = 30 to 40 hours, 5 = more than 40 hours).

Involvement during the EHR Implementation

Involvement was measured by one item asking employees whether they were involved in the implementation process. The question that measured whether employees took part in a task group was "Are you a member of a task group during the EHR implementation?" (1 = yes, 0 = no).

Sociocognitive Variables

The sociocognitive variables were based on the Attitude–Social Influence–Self-efficacy model,[36-38] which has shown to be a valid and reliable model in previous studies.[39-41] Because no prior questionnaire was available to measure sociocognitive factors concerning an EHR implementation, the variables were based on previous questionnaires concerning sociocognitive beliefs about computer use.[42-44]

Attitude was measured by eight items assessing the positive and negative consequences of the EHR (e.g., increases patient safety, reduces the number of medical mistakes, increases the working pressure among medical specialists, or is too expensive), resulting in a five-point Likert scale (ranging from 1 for "totally disagree" to 5 for "totally agree"). An example of a positive attitude question is "I believe that the EHR can increase patient safety."

Social influence was measured by seven items assessing the social norm and social support employees may perceive. Questions were asked concerning the perceived support or norms of colleagues, supervisors, and the organization, resulting in a five-point Likert scale (ranging from 1 for "totally disagree" to 5 for "totally agree"). An example of a social support question is "I feel supported by the colleagues in my department to work with the new EHR'. An example of a question to measure employees' social norm is "I believe colleagues in my department are motivated to work with the new EHR."

Self-efficacy was measured by five items assessing employees' ability to work with the EHR in different situations, resulting in a five-point Likert scale (ranging from 1 for "very easy" to 5 for "very difficult"). An example of a self-efficacy question is "I think it is…for me to work with the new EHR when I am stressed."

Intention to work with the EHR was measured by one item assessing the intention of employees to work with the EHR, resulting in a five-point Likert scale (ranging from 1 for "totally disagree" to 5 for "totally agree"). The question that measured employees' intention was "At this point in time I am motivated to work with the new EHR."

Full Disclosure

Materials used in this study as well as nonidentifiable data and the syntax used for the analyses have been made available at https://osf.io/2v6da/.[45] These efforts were taken to acknowledge recent pleas for full disclosure to maximize scrutiny, foster accurate replication, and facilitate future data syntheses (e.g., meta-analyses).[46,47]

Data Analyses

Before conducting the analyses, we decided that the data from a participant would be excluded if the individual had greater than 10 percent missing data. Data on a specific measurement (i.e., attitude, social support, social norm, or self-efficacy) would be excluded if two or more items per measurement were missing.

Second, to assess the scale quality of measurements, we began by assessing dimensionality using exploratory factor analyses. Eigenvalues were used to estimate the explained variance. Subsequently, we used the R function scaleStructure within the package userfriendlyscience[48] to assess the internal structure of the measurements. This function presents McDonald's omega as a less-biased alternative to Cronbach's alpha.[49] More specifically, the omega hierarchical provides an estimate of factor saturation based on the sum of the squared loadings of items on the general factor.[50]

Third, descriptive analyses were conducted to check for differences in demographic characteristics between participants who took part in a task group and those who did not. Chi-square tests were used for categorical variables, whereas *t*-tests were used for continuous variables. Additionally, independent-sample *t*-tests were used to assess the differences in intention, attitude, social support, social norm, and self-efficacy between participants who took part in a task group and those who did not. Pearson correlation coefficients were used to assess the correlation between intention to use the EHR and attitude, social support, social norm, and self-efficacy. Bootstrapping was performed (1,000 samples) to calculate 95 percent confidence intervals. In order to look at differences in these associations, these analyses were run separately for participants who took part in a task group and those who did not. Effect sizes (Cohen's *d*) were calculated to indicate the standardized difference between the means.[51]

Results

Sample Characteristics

A total of 432 participants (50 percent of all 864 eligible employees) returned the questionnaire. According to the predetermined cutoff values described above, data from a participant were excluded if the individual had more than 10 percent missing data (i.e., five or more items). This criterion resulted in data from 359 participants (83.1 percent) being used in the analyses. Only very few participants had two or more items per measurement missing (i.e., attitude, $n = 6$; social support, $n = 2$; social norm, $n = 3$; self-efficacy, $n = 3$). Exploratory factor analysis revealed one factor underlying each of the measurements except for attitude. Two items (i.e., regarding work pressure and costs) had very low factor loadings (.27 and .28 respectively) and were excluded from further analyses. The eigenvalues and omega hierarchical were deemed appropriate for all measurements: attitude (eigenvalue, 3.07; O = .65), social support (eigenvalue, 2.97; O = .84), social norm (eigenvalue,

2.13; O = .73), and self-efficacy (eigenvalue, 3.74; O = .88). Hence, the mean scores of the items were calculated per measurement.

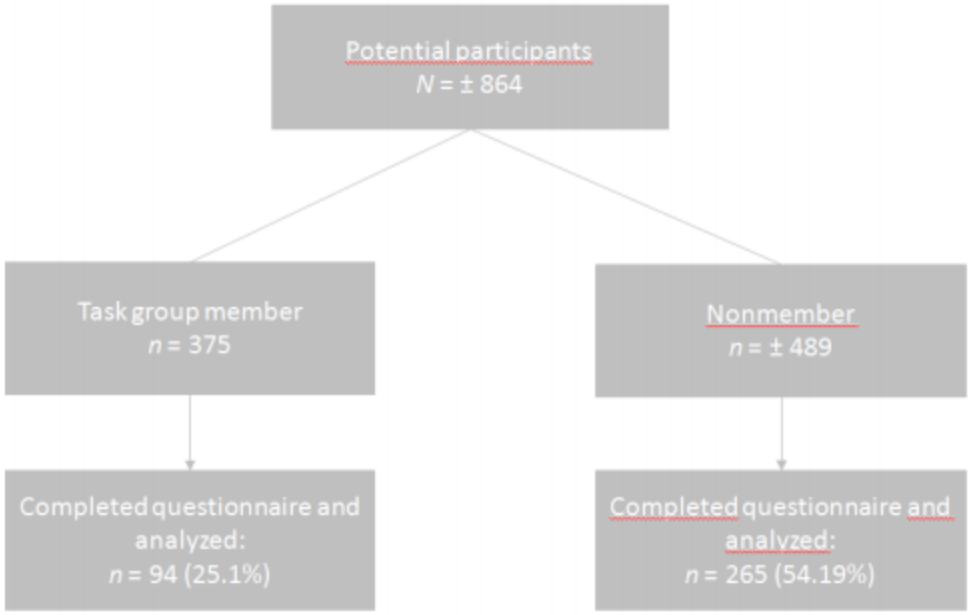
Table 1: Demographic Characteristics of Participants Who Were Involved in the Task Group and Those Who Were Not

Characteristics	All	In Task Group	Not in Task Group	t or χ^2	df	p
Number	359	94	265			
Gender (female); % (n)	83.9 (303)	71.3 (67)	89.4 (236)	$\chi^2 = 17.5$	1, $N = 303$	**<.001****
Educational level; % (n)				$\chi^2 = 20.8$	2, $N = 358$	**<.001****
Low	17.0 (61)	10.6 (10)	19.3 (51)			
Medium	42.2 (151)	28.7 (27)	47.0 (124)			
High	40.8 (146)	60.6 (57)	33.7 (89)			
Age; mean (SD)	44.5 (10.6)	45.4 (8.8)	44.27 (11.0)	$t = 0.9$	354	0.37
Employment duration; % (n)				$\chi^2 = 6.2$	5, $N = 359$	0.29
Less than 1 year	3.9 (14)	3.2 (3)	4.2 (11)			
1–5 years	12.3 (44)	18.1 (17)	10.2 (27)			
5–10 years	23.4 (84)	17.0 (16)	25.7 (68)			
10–15 years	15.6 (56)	17.0 (16)	15.1 (40)			
15–20 years	12.5 (45)	11.7 (11)	12.8 (34)			
More than 20 years	32.3 (116)	33.0 (31)	32.1 (85)			
Direct patient care; % (n)	62.8 (201)	63.4 (53)	62.4 (148)	$\chi^2 = 0.05$	1, $N = 201$	0.82
Total working experience; % (n)				$\chi^2 = 3.4$	4, $N = 359$	0.49
Less than 5 years	5.6 (21)	4.3 (4)	6.4 (17)			
5–10 years	8.9 (32)	8.5 (8)	9.1 (24)			
10–15 years	11.7 (42)	7.4 (7)	13.2 (35)			
15–20 years	13.9 (50)	13.8 (13)	14.0 (37)			
More than 20 years	59.6 (214)	66.0 (62)	57.4 (152)			
Use of computer; % (n)				$\chi^2 = 30.6$	3, $N = 356$	**<.001****
0–20 hours	27.8 (99)	8.5 (8)	34.7 (91)			
20–30 hours	30.1 (107)	28.7 (27)	30.5 (80)			
30–40 hours	25.0 (89)	35.1 (33)	21.4 (56)			
40 hours or more	17.1 (61)	27.7 (26)	13.4 (35)			

Note: Significant p-values at the $p < .05$ level are shown in bold. Asterisks indicate chi-square or t values significant at the $p < .01$ level.

Table 1 shows the demographic characteristics of participants who were involved in a task group ($n = 94$) and those who were not ($n = 265$) (see Figure 1). The mean age of the participants was 44.5 years (SD = 10.6). Of the total sample, 303 participants (83.9 percent) were female and 61 participants (17 percent) had a low level of education. Furthermore, participants in the two groups differed significantly in terms of gender ($p < .001$), educational level ($p < .001$), and computer experience ($p < .001$). Those who took part in a task group had a lower proportion of females, had a higher educational level, and made more use of the computer, compared with participants who did not take part in a task group.

Figure 1: Number of Participants Invited to Participate in the Study



Note: The "±" symbol before a number indicates that it represents the approximate number of employees who were invited to participate in the study, according to the head count of the hospital.

Differences between Involved and Noninvolved Employees

As shown in Table 2, task group participants had a higher intention to use the EHR system compared to those who were not involved, $t(354) = 5.00$, $p < .001$, $d = .60$. Participants who took part in a task group reported significantly higher levels of attitude, $t(351) = 5.16$, $p < .001$, $d = .62$; perceived self-efficacy, $t(354) = 2.59$, $p = .01$, $d = .31$; and social support, $t(355) = 5.70$, $p < .001$, $d = .68$, compared with the employees who did not take part in a task group. Additionally, social norm did not significantly differ between the two groups, $t(354) = 1.73$, $p = .08$, $d = .21$.

Table 2: Differences between Participants Who Were Involved in the Task Group and Those Who Were Not

Item	In Task Group (*n*=94), Mean (SD)	Not in Task Group (n=265), Mean (SD)	*t*	*p*	Mean-difference (95% CI)	*d*
Intention	4.23 (0.65)	3.79 (0.75)	$t(354) = 5.00$	**<.001**	.44 (.26, .61)	.60
Attitude	3.83 (0.54)	3.50 (0.50)	$t(351) = 5.16$	**<.001**	.32 (.20, .45)	.62
Social support	3.75 (0.60)	3.29 (0.68)	$t(355) = 5.70$	**<.001**	.45 (.30, .61)	.68
Social norm	3.71 (0.53)	3.59 (0.58)	$t(354) = 1.73$	.08	.12 (-.02, .25)	.21
Self-efficacy	3.36 (0.65)	3.17 (0.61)	$t(354) = 2.59$	**.01**	.19 (.05, .34)	.31

Note: Significant *p*-values at the $p < 0.05$ level are shown in bold.

All correlations with the intention to use the EHR system were moderate, except for self-efficacy among those who did not take part in a task group. For attitude (r = .50) and social norm (r = .42), correlations were stronger for those who did not take part in a task group but were always within the confidence interval of the correlations for those who did take part in a task group (see Table 3).

Table 3: Correlations with Intention to Use Electronic Health Records (R Values and 95% Confidence Intervals)

Item	In Task Group (n=94)	Not in Task Group (n=265)
Attitude	.36 (.14, .55)	.50 (.40, .61)
Social support	.48 (.30, .63)	.43 (.30, .56)
Social norm	.33 (.15, .49)	.42 (.28, .55)
Self-efficacy	.33 (.13, .51)	.16 (-.02, 32)

Discussion

Main Results

Until now, little research has been conducted concerning the role of employees' involvement during the implementation of an EHR and its effects on sociocognitive beliefs. Therefore, the aim of this study was to explore the differences in sociocognitive factors of employees according to the level of involvement during an EHR implementation.

In line with prior research, the results demonstrated that sociocognitive factors were strongly related to the level of the employees' involvement.[52-54] It was shown that employees who were involved in decisions related to the implementation process had also higher intentions to work with the new EHR. The findings are in line with previous studies that have already shown that involvement and participation are predictive of positive responses among employees undergoing an organizational change process.[55,56] Compared with noninvolved employees, involved employees also hold more positive attitudes toward the EHR. Consistent with the findings from other studies,[57,58] it is likely that employees who have received more information about the EHR were more aware of the advantages of the system, which in turn may have led to more positive attitudes.[59] Nevertheless, it is also possible that external variables such as educational level influenced whether employees participated in the task group or not. However, it is less likely that education was the deciding factor whether employees accepted the new EHR.[60,61] The results also showed that employees who were involved during the EHR implementation had higher self-efficacy expectations than employees who were not involved. Being a member of a task group may have contributed to a sense of familiarity with the system. During the several task group meetings, employees had the opportunity to evaluate the system and define changes to their needs and wishes. Because of their proactive contribution within the task group, these employees may have been more confident in their use of the new EHR. Previous research has already shown that training sessions are able to increase employees' self-efficacy.[62] It is therefore important to ensure that employees have the opportunity to practice the use of a new EHR system to get acquainted with the various functionalities of the system.

For social support, a clear difference was observed between involved and noninvolved employees. Involved employees felt more supported by their colleagues and managers to work with the EHR. This finding may be explained by the different task group meetings in which task group members had the opportunity to exchange opinions about the EHR. Previous studies have already identified insufficient social support to be one of the greatest barriers to EHR success.[63-65] Mobilizing social support (e.g., by giving information about others approval of the system) may be therefore used as a strategy to increase perceived social support during EHR implementations. Overall, the results of the present study indicate that targeting employees' personal attitudes, their support from others to work with the EHR, and their perceived self-efficacy may be useful to encourage employees to work with a new EHR system. Addressing these factors during training sessions therefore may be helpful to optimize future EHR implementations.

Strengths and Limitations

A strength of the present study was the relatively large sample of respondents who completed the paper-based questionnaires. Overall, 50 percent of the employees who had to work with the EHR took part in the study.

However, our findings should also be considered in view of several limitations. First, the findings of this study reflect the opinion of respondents, and results were based on employees' self-reports. Because of the design of the study, it was not possible to verify the answers of participants. We measured employees' intention to work with the EHR instead of their actual behavior. Although the assessment of employees' intention to engage in a certain behavior serves as a reliable indicator, objective assessments of employees' behavior (e.g., the amount of time using the system, observation visits) might be also collected in future studies to improve the methodological strength of this research.[66] Second, even though employees participated voluntarily, they were asked by their supervisor to complete the questionnaire, which may have placed pressure on them and may have caused them to give socially desirable answers. However, before employees began the questionnaire, it was emphasized that the answers were accessible only to the researchers and that the questionnaires should be returned in a sealed envelope. Furthermore, it would have been better to categorize the "years of total working experience" and "years of working experience in the organization" variables in a different way to exclude overlap in the answer options. However, this issue is unlikely to have had a substantial impact on our results. Finally, it is possible that more highly motivated employees were selected by their managers to participate in the task group. This possibility increases the chance that participants in the task group may have differed at the start of the study from those who did not take part. The results of the basic demographic characteristics demonstrated that differences between the groups were minor and participants differed only in terms of gender, educational level, and computer experiences. Hence, these differences may have had very little impact on our results.

Conclusions

Involving employees during an EHR implementation seems to enhance employees' sociocognitive beliefs and increases their intention to work with the new system. The results indicate that targeting employees' attitudes, self-efficacy, and social support can help optimize future EHR implementations. This study can be seen as an important first step to assess the role of involvement and its effects on sociocognitive beliefs regarding the implementation of a new EHR. However, more research is needed to develop specific strategies that can target employees' sociocognitive beliefs during EHR implementations. Furthermore, future studies should include larger sample sizes of employees involved in the design, development, and deployment of EHRs.

Notes

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Acknowledgments

N.E.S., H.P.C., N.S., and E. S. conceived and designed the study. R.C. and N.E.S. analyzed the data. N.S., E. S., R.C., H.P.C., and N.E.S. contributed to data cleaning. N.S., E. S., R.C., H.P.C., and N.E.S. wrote the paper.

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Article citation:
Stanczyk, Nicola Esther; Crutzen, Rik; Sewuster, Nikki; Schotanus, Elwin; Mulders, Merijn; Cremers, Henricus Paul. "Differences in Sociocognitive Beliefs between Involved and Noninvolved Employees during the Implementation of an Electronic Health Record System" *Perspectives in Health Information Management* (Spring, April 2017).