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Nurses' attitudes towards occupational transformation processes brought about by digital care technologies

Results from two cross-sectional studies

Abstract: *Background*. Digital technologies increasingly shape today's world of work. This not only affects sectors such as knowledge work and the automotive industry, but also the care sector. On the one hand, many nurses today use technologies supporting some selected and rather peripheral nursing tasks (e.g., electronic documentation). However, on the other hand, more comprehensive and additionally proximal care-related task devices (e.g., diagnostics via telecare) seem to be used less often. From a psychological perspective, attitudes towards technology are an important antecedent of user behaviour. Therefore, in two studies we aimed to examine if nurses' attitudes towards four digital technology fields (i.e., electronic documentation ED, ambient assisted living AAL, telecare application and robotics) are differing in relation to the type of task substitution, how technology appraisal and knowledge shape these attitudes, and how attitudes predict user behaviour.

Method. We conducted two cross-sectional survey studies with German nurses (Study 1: N = 148, Study 2: N = 252) with well-established scales (i.e., general and work-related positive and negative attitudes towards technologies, ease of use, usability, knowledge, and technology use).

Results. We found that it is important to consider positive and negative attitudes towards technology distinctively as intercorrelations were only moderately negative. As expected, we found in both studies that nurses reported stronger positive and less negative attitudes towards technologies assumed to be substituting more specific and peripheral (e.g., ED) than comprehensive and proximal care tasks (e.g., robotics). Moreover, we found that two types of technology appraisal (ease of use and usability) both positively correlated with positive attitudes towards all four technology fields, whereas patterns were more inconsistent and additionally influenced by technology knowledge when predicting negative attitudes. Although inconsistently across both studies and the considered technologies, in general, technology users reported more positive and less negative attitudes than non-users.

Conclusion. If technology developers and nursing facility managers want to help nurses successfully adopting new technologies in their work routines, nurses' technology appraisal and technology attitudes have to be considered already in the pre-development phase. Our study results show that nurses report different attitudes towards the four digital technology fields considered here in relation to the levels and types of task-substitution. More specifically, if core care-related work-tasks (e.g., direct care) are not substituted, nurses report stronger positive and less negative attitudes towards the supporting technologies and higher user behaviour.

Keywords: Digitised world of work, humane work, nursing, cross-sectional survey study

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1 Introduction

Digital technologies offer the opportunity to address recent challenges in professional nursing. Accordingly, many nursing facilities and nurses place high expectations on digital technologies, not only regarding an improvement of nursing care but, moreover, relating to a reduction of nurses' job-related stressors. Many nurses today use electronic patient records and increasingly telecare systems. Nevertheless, there is evidence for differing attitudes of employees in the healthcare sector regarding occupational transformation processes brought about by digital technologies [1, 2]. In

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extending this line of research, the aim of our two studies was twofold. First, in Study 1 we examined nurses' attitudes towards four emerging digital technology fields in this occupational context (i.e., electronic documentation, digital assistance systems, telecare and robotics). Referring to the technology acceptance model (TAM), we assume that perceived ease of use and perceived usefulness predict more positive and less negative attitudes towards nursing technologies. Second, in Study 2, we aimed to investigate how technology-related attitudes are associated with perceived processes of alienation (i.e., a reduction in nurses' job-related self-concept and job identification) and perceived risks for occupational health and safety. Finally, we investigated how attitudes examined in Study 1 and Study 2 relate to user behaviour.

1.1 Drivers of implementing digital technologies in nursing

Nursing includes the promotion of health, prevention of disease and care and the support for sick, disabled and dying people [3]. Currently about 1.9 million employees in Germany are working in this sector [4].

Nurses are frequently exposed to high psychological as well as physical demands. This is intensified, on the one hand, by increasingly ageing societies and correspondingly the rising need for care and, on the other hand, by many nurses retiring soon. The nursing sector faces a shortage of skilled workers as well the recruitment of new, highly qualified staff. Levels of strain, turnover rates and sick leave are often higher than in other professions [5, 6].

Several studies have shown that high physical and psychological stress can reduce nurses' job satisfaction, health and job performance [7, 8]. Without any doubt, there is a need for developing healthy and attractive working conditions to prevent absenteeism and early career exits of nurses by using work design principles according to ergonomic standards (e.g., DIN EN ISO 6385). In this line, digital nursing technologies represent one approach to reduce the load of nursing.

However, the potential of digital technologies for a human-centered job design in nursing is still largely unknown. In principle, digital nursing technologies have the potential to facilitate nurses' work. Digital documentation systems and nursing robots can take over time-consuming routine tasks. Telecare applications as well as digital assistance systems can help enlarging healthcare in rural areas and reducing work-related stressors such as travelling demands in outpatient care. At the same time, attention should be paid to possible negative consequences: The substitution of core nursing tasks brought by digital technologies might lead to alienation and a simplification of tasks. In addition, an increase in work intensity through a concentration of remaining cognitively demanding tasks seems possible.

However, digital systems can only be beneficial given a high level of acceptance. For instance, despite their widespread availability, some technologies such as ergonomic lifters are hardly used by the nursing staff. Against this backdrop, a clear understanding of factors influencing technology acceptance and thus technology usage appears necessary.

Especially with regard to technologies that have not yet been implemented, successful adoption of new technologies appears to depend on whether they are perceived as beneficial for daily work. An integrated consideration of research on technology acceptance and healthy and motivational work design might help to shed light on the question, how technologies' benefits can be ensured. To the best of our knowledge this combination was not examined yet, especially not in the nursing sector.

1.2 Hypothesis

Based on the theoretical assumptions and empirical findings outlined above, we conducted two questionnaire studies with German nurses. We investigated how technology appraisal and knowledge about technology relate to positive and negative attitudes towards technology and, in turn, user behavior. Moreover, we considered the four nursing technology fields differing in the way they appear to substitute direct care tasks and reduce the variety of tasks in relation to nurses' positive and negative attitudes towards the technologies.

Based on research related to the job characteristics model we propose:

Hypothesis H1. Positive attitudes (H1a) towards digital technologies will decrease and negative attitudes (H1b) increase towards technologies assumed to be reducing direct-care tasks and task variety in increasing order (i.e., electronic documentation < ambient assistant livings < telecare < robotics).

Based on the TAM and related research we propose:

Hypothesis H2. Perceived ease of use positively relates to positive attitudes (H2a) and negatively relates to negative attitudes (H2b) towards digital technologies.

Hypothesis H3. Perceived usability positively relates to positive attitudes (H3a) and negatively relates to negative attitudes (H3b) towards digital technologies.

Research shows that the perceived knowledge about a topic in question could moderate the impact attitudes have on evaluative judgements [18]. Moreover, according to information processing research [19], persons who have a strong cognition-based attitude towards a given object might have difficulties in mapping their belief structure to an evaluative judgement such as good or bad. Therefore, we assume:

Hypothesis H4. The negative relationship between perceived usability and negative attitudes is stronger for nurses with lower than higher knowledge about the respective technology.

In line with the TAM – predicting that attitudes shape behavioral intentions and, in turn, actual use behavior – we further propose:

Hypothesis H5. Technology users report higher positive attitudes (H5a) and lower negative attitudes (H5b) towards technology than non-users.

2 Methods

We conducted two cross-sectional survey studies with professional German nurses between March and December 2017. A cooperation between the Institution for Statutory Accident Insurance and Prevention in the Health and Welfare Services (BGW) and the German Network "Offensive Gesund Pflegen" supported data collection. In both studies, we tested Hypotheses 1 and 5, in Study 1 further Hypotheses 2-4.

2.1 Study 1

1.1.2 Data collection

We collected data from a convenience sample of nurses with paper-pencil questionnaires at nursing fairs in Germany, and during workshops and trainings of the BGW. In total, 576 subjects participated but only N = 148 nurses reported full data. Most of these were female (75%) and worked in hospitals (49%) or inpatient elderly care (30%). The majority was between 20 and 39 years old (53%; 42% were older).

1.1.2 Measures

The respondents answered the following scales or items for each of the four technology fields (ED, AAL, telecare, robotics).

Perceived ease of use. Participants rated three items from the Technology Usage Inventory (TUI) [20] on a 5-point Likert scale (1 = 'strongly disagree', 5 = 'strongly agree'). Internal consistency α ranged from .67 to .76.

Usability. Participants rated four items from the TUI on a 5-point Likert scale (1 = 'strongly disagree', 5 = 'strongly agree'). Internal consistency α ranged from .85 to .90.

Knowledge. Participants answered on a 5-point Likert scale (1 = 'do not know this technology, 5 = 'know this technology very well) the question 'How well do you know… (ED, AAL, telecare, robotics)?'

Attitudes towards using technology. Participants rated seven items for positive attitudes and five items for negative attitudes from the TA-EG Questionnaire [21] on a 5-point Likert scale (1 = 'strongly disagree', 5 = 'strongly agree'). Internal consistency α for positive attitudes ranged from .86 to .90 and for negative attitudes from .73 to .77. We found that positive and negative attitudes for each technology correlated only slightly negative, supporting that they represent different constructs (ED: r = -.31, p < .001; AAL: r = -.22, p < .01; telecare: r = -.35, p < .001; robotics: r = -.25, p < .01).

Technology use*. We asked the nurses if they already use the specific* technology at work (0 = 'no', 1 = 'yes').

2.2 Study 2

2.2.1 Data collection

Study 2 also consists of a convenience sample, but was conducted as an online-survey. In total, 495 subjects participated of whom N = 252 reported full data. Most of these nurses were female (62%) and worked in hospitals (63%). 21 percent worked in inpatient elderly care. The majority of the nurses was older than 40 years (59%; 41% were younger).

2.2.2 Measures

In contrast to Study 1, were we assessed attitudes towards technology use more generally, we assessed specific job-related attitudes in Study 2. Since digitalization is still a new topic, we could not refer to a standardized questionnaire. Therefore, we developed the following items in an expert-consensus procedure. Again, the respondents answered all items for each of the four technology fields (ED, AAL, telecare, robotics).

Positive attitudes towards using technology. Participants rated one item asking 'How does this digital technology relates to a facilitation of your own work?' on a 4-point Likert scale (1 = 'little, 4 = 'strongly').

Negative attitudes towards using technology. Participants rated two items asking 'How does this digital technology relates to an alienation of your work?' and 'How does this digital technology relates to a hazard for your work?' on a 4-point Likert scale (1 = 'little, 4 = 'strongly').

Correlations between positive and negative attitudes. We found that positive (i.e., facilitation) and negative attitudes (i.e., alienation, hazard) for each technology correlated only moderately negative, supporting that they represent different constructs (all *p*s < .01; ED: *r* = -.45, -.44; AAL: *r* = -.64, -.44; telecare: *r* = -.53, -.48; robotics: *r* = -.60, -.56).

Technology use. As conducted in Study 1, we asked the nurses if they already use the specific technology at work (0 = 'no', 1 = 'yes').

2.3 Data Analysis

In both studies, we calculated descriptive statistics (mean, standard deviation) for all variables and tested technology-related differences in variables with repeated measures ANOVAs and, post-hoc, with t-Tests for dependent measures. In Study 1, we conducted moderated regression analyses to examine how attitudes towards technologies are predicted by perceived ease of use, usability and knowledge about technologies as moderating variable. Attitudinal differences between technology users and non-users in attitudes were examined in both studies with t-tests for independent samples.

3 Results

3.1 Study 1

3.1.1 Appraisal and attitudes towards digital technologies

Table 1 shows differences in positive and negative attitudes, technology appraisal and knowledge for the four digital technology fields under investigation. Considering attitudes, we found that nurses perceived all four technology fields as rather positive (on average high positive and low negative attitudes). Hypotheses 1a and 1b were widely confirmed with strong differences in positive and negative attitudes between ED and robotics. Differences in attitudes between AAL and telecare were not significant. Considering technology appraisal, we found similar patterns for ease of use and usability. Moreover, knowledge about ED was higher than for the three other technologies, for which, on average, knowledge was on a rather moderate level.

Table 1 Nurses' appraisal and attitudes towards digital technologies

	ED (A)		AAL (B)		Telecare (C)		Robotics (D)		Test for Differences	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*ns.*
Ease of Use	3.6	1.0	3.1	0.9	3.2	0.8	2.9	0.8	33.4	B vs. C
Usability	4.1	1.0	3.5	1.0	3.4	1.0	3.2	1.1	41.3	B vs. C
Knowledge	3.9	1.1	2.6	1.5	2.4	1.3	2.5	1.2	73.2	B vs. C, D; C vs. D
Positive Attitudes	3.7	0.9	3.5	0.9	3.5	0.9	3.1	1.0	31.3	B vs. C
Negative Attitudes	2.4	0.9	2.5	0.8	2.5	0.9	2.6	0.9	7.2	B vs. A, C

Note. N = 148, ED = electronic documentation, AAL = ambient assistant living, M = mean, SD = standard deviation. F-values for repeated measures ANOVA are all significant with p <.001. All post-hoc mean differences between technologies are significant if not reported as not significant (ns).

3.1.2 Technology appraisal and knowledge as predictors of attitudes towards digital technologies

We further assumed perceived ease of use and usability as predictors of attitudes (H2 and H3). Moreover, we suggested technology knowledge as a moderator variable for relationships between usability and negative attitudes towards digital technologies (H4). Results are displayed in Table 2. Variables under investigation explained between 32 % to 46 % of variance for positive attitudes and between 16 % to 22 % of variance in negative attitudes.

Our results fully confirmed H2a and H3a as ease of use and usability positively predicted nurses' positive attitudes. More specifically, our results showed stronger relationships for usability than for ease of use. However, H2b, suggesting negative relationships between ease of use and negative attitudes, could be confirmed only for ED but not for the other three technologies. Moreover, H3b, suggesting negative relationships between usability and negative attitudes, could be confirmed only for AAL and telecare. In addition, we found partial support for H4 as knowledge moderated the negative relationships between usability and negative attitudes when considering ED and robotics. Interaction plots are displayed in Figure 1a and 1b supporting our assumption of stronger negative relationships between usability and negative attitudes for nurses with lower than higher knowledge about the respective technology.

Table 2 Results of moderated regression analysis for nurses' technology appraisal and technology knowledge as predictors of attitudes towards digital technologies

	ED		AAL		Telecare		Robotics	
	PA	NA	PA	NA	PA	NA	PA	NA
	β	β	β	β	β	β	β	β
Ease of Use E	**.23**	**-.33**	**.30**	-.12	**.24**	-.10	**.18**	-.14
Usability U	**.50**	-.12	**.49**	**-.35**	**.46**	**-.35**	**.63**	**-.37**
Knowledge K	.01	-.03	**-.21**	**-.19**	-.07	-.08	-.06	-.06
E x K	.10	-.05	.06	-.08	.11	-.04	.05	-.06
U x K	.01	**.25**	-.06	-.03	-.03	.08	-.08	**.16**
F	**18.1**	**9.45**	**18.64**	**9.30**	**15.04**	**6.40**	**25.92**	**7.98**
R^2	.37	.22	.38	.22	.32	.16	.46	.19

Note. N = 148, ED = electronic documentation, AAL = ambient assistant living, PA = positive attitudes, NA = negative attitudes, β = standardized regression weight. We used z-standardized variables for regression analysis and creating the interaction-(product)-term. Parameter estimates in boldface are significant with p <.05.

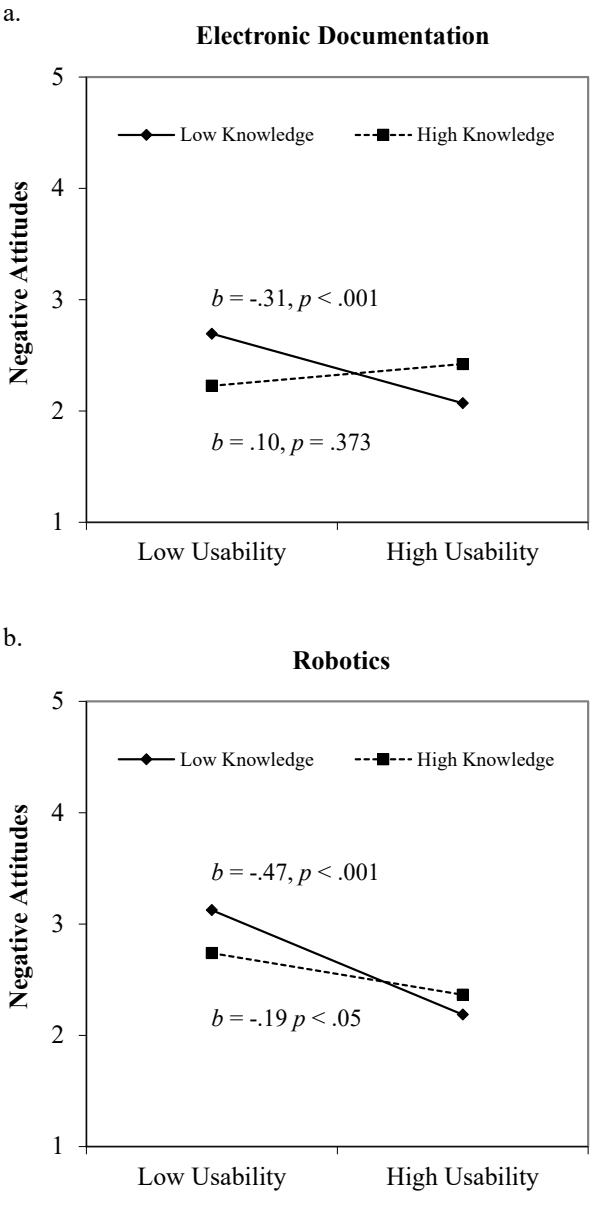

Figure 1 Interaction effects of usability and knowledge for predicting negative attitudes towards digital technologies (a. documentation, b. robotics)

3.2 Study 2

In extension to Study 1, we now considered stronger work-related positive (i.e. facilitation) and negative (i.e., alienation, hazard) attitudinal aspects in relation to the four digital technology fields. As shown in Table 3, and in partial support to H1a and H1b, we found a decrease in positive attitudes and an increase of negative attitudes towards digital technologies with a potential reduction in the variety of tasks and a substitution of direct care tasks (i.e., ED < AAL < telecare < robotics). While the suggested stepwise pattern was fully confirmed for perceived alienation brought by digital technologies, other differences were only significant for more extreme levels of low and high technology-induced task substitution (e.g., ED vs. robotics).

Table 3 Nurses' work-related attitudes towards digital technologies in Study 2

	ED (A)		AAL (B)		Telecare (C)		Robotics (D)		Test for Differences	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	ns
Positive Work Attitudes										
Facilitation	3.0	0.9	2.9	0.9	2.4	0.9	2.4	1.0	47.3	A vs. B, C vs. D
Negative Work Attitudes										
Alienation	2.1	1.0	2.5	1.2	2.9	1.1	3.2	1.0	75.9	
Hazard	1.6	0.7	1.6	0.8	2.1	1.0	2.4	1.1	57.9	A vs. B

Note. $N = 252$, ED = electronic documentation, AAL = ambient assistant living, *M* = mean, *SD* = standard deviation. *F*-values for repeated measures ANOVA are all significant with $p < .001$. All post-hoc mean differences between technologies are significant if not reported as not significant (ns).

3.3 Attitudes and user behaviour

Finally, we suggested that technology users report higher positive attitudes (H5a) and lower negative attitudes (H5b) towards technology than non-users. Results for Study 1 and 2 are displayed in Table 4. Note that prevalence estimates of technology use differed between the two study samples (i.e., lower rates in Study 2). Differences in positive attitudes between technology users and non-users were confirmed for ED and robotics in Study 1 and for AAL in Study 2. Differences in negative attitudes between technology users and non-users were confirmed for AAL and telecare Study 2 but not for ED and robotics. Therefore, results supported H5a and H5b only partially.

Table 4 Attitudes towards technologies and technology use in Study 1 and Study 2

	ED			AAL			Telecare			Robotics		
	NU	U		NU	U		NU	U		NU	U	
	M	*M*		*M*	*M*		*M*	*M*		*M*	*M*	
Study 1 (N = 148)												
Prevalence		69%			37%			29%			23%	
Positive Attitudes	3.4	3.8	*	3.4	3.5		3.5	3.6		2.9	3.4	**
Negative Attitudes	2.5	2.4		2.5	2.3		2.5	2.4		2.7	2.6	
Study 2 (N = 252)												
Prevalence		92%			18%			4%			1%	
Positive Attitudes												
Facilitation	3.0	3.1		2.9	3.2	*	2.4	2.8		2.3	3.5	
Negative Attitudes												
Alienation	2.1	2.1		2.6	2.0	**	3.0	2.6		3.2	2.0	
Hazard	1.7	1.5		1.6	1.8		2.1	1.5	*	2.4	1.0	

Note. NU = non-users, U = users; mean (M) differences tested with t-Tests. ED = electronic documentation; AAL = ambient assistant living. * $p < .05$, ** $p < .01$.

4 Discussion

Aiming to improve our understanding on how a successful adoption of new nursing technologies depends on technology attitudes, we integrated research on technology attitude and healthy and motivational work design. More specifically, we extended the well-established TAM by differentiating between positive and negative attitudes towards technology use as well as by adding users' knowledge about the technologies as a moderating variable. To explain how work-related effects of digital technologies might shape attitudes towards new technologies and their use, we tested how the assumed substitution of direct-care tasks and/or a reduction of the variety of leaving tasks is associated with attitudes towards technologies.

Results from Study 1 show that positive attitudes allow a stronger and more robust model prediction than negative attitudes. Negative attitudes regarding the four considered technology fields were more inconsistent, i.e. depending on the technologies as well as prior technology knowledge as a moderating variable. Results from both studies confirm that a human-centered job design (in nursing) asks for a better understanding of positive and negative components of nurses' attitudes towards work systems. We could show that nurses' attitudes are associated with the expected influence of technologies on direct-care tasks and the variety of tasks left. To ensure a human-centred design of work systems, we suggest to integrate psychological criteria such as work-related motivators like significance, task identity and task variety into technology development and implementation processes. Undoubtedly, a key challenge for the development of such an integrative model is a task analysis before implementing new technologies into work systems. A viable approach could be the use scenario analysis or established tools for prospective task and work system analysis, for instance, the software tool REBA [22, 23].

Our study is not without limitations. First, a large proportion of nurses did not fully report data limiting the statistical power and representativity of the samples. This may be explained by the sampling strategy (e.g., fairs and workshops) and, in addition, by the long questionnaire which was more comprehensive in variables than considered here. Second, our cross-sectional data does not allow to draw causals interferences. For instance, it is possible that attitudes affect technology appraisals or that user behaviour influences reported attitudes. Third, we assessed some of the variables under investigation with one-item measure limiting reliability of results. Therefore, future studies might consider a stronger study design with more comprehensive assessments of variables, a representative sampling, and a longitudinal study approach. Furthermore, there is a need to explore relationships between the motivational job characteristics and the considered digital technologies in more detail.

5 Conclusion

Our study results show that nurses report diverse attitudes towards the four digital technology fields considered in relation to their task-substitution potential. Likewise, nurses indicate stronger positive and less negative attitudes towards technology fields that are assumed to have a lower potential of substituting care-related tasks (e.g., direct care). This finding strongly suggests the need of a consideration of the form of the assumed substitution of nursing tasks in the design of human-centered socio-technical work systems. Moreover, to ensure the technologies' benefits, nurses' technology appraisal and technology attitudes have to be considered already in the pre-development phase.

Digital technologies might, vice versa, affect employees' mental models and in turn their attitudes towards and the acceptance of work systems, e.g. by restricting the scope for employee's decision-making or also by reducing the time spent with social interaction [24]. Therefore, designing socio-technical work systems also requires considering possible influences of the interplay of work-tasks and technologies on employee's mental models of their work.

Author Statement

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References

[1] Hebesberger D, Koertner T, Gisinger C, Pripfl J. A Long-Term Autonomous Robot at a Care Hospital: A Mixed Methods Study on Social Acceptance and Experiences Of Staff and Older Adults. International Journal of Social Robotics 2017; 9: 417–429.

[2] Huryk LA. Factors influencing nurses' attitudes towards healthcare information technology. Journal of Nursing Management 2010; 18(5): 606–612.

[3] International Council of Nurses. Position statements. Geneva: ICN, 2002.

[4] Bundesagentur für Arbeit. Statistik der Bundesagentur für Arbeit (2019). Tabellen, Beschäftigte nach Berufen (KldB 2010) (Quartalszahlen) 2019.

[5] Estryn-Behar M, van der Heijden BIJM, Fry C, Hasselhorn HM. Longitudinal Analysis of Personal and Work-Related Factors Associated With Turnover Among Nurses. Nursing Research 2010; 59(3); 166-177.
[6] Drupp M, Meyer M. Belastungen und Arbeitsbedingungen bei Pflegeberufen – Arbeitsunfähigkeitsdaten und ihre Nutzung im Rahmen eines Betrieblichen Gesundheitsmanagements. In: Jacobs K, Kuhlmey A, Greß S, Klauber J, Schwinger A, editors, Pflege-Report 2019. Berlin, Heidelberg: Springer; 2020.
[7] Zhang Y, Punnett L, Mawn B, Gore R. Working Conditions and Mental Health of Nursing Staff in Nursing Homes. Issues in mental health nursing 2006; 37(7): 485–492.
[8] Melzer M. Arbeitssituation und Gesundheit beruflich Pflegender. In: Bundesanstalt für Arbeitsschutz und Arbeitsmedizin. Stressreport Deutschland 2019; Dortmund/Berlin/Dresden; 2020.
[9] Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 1989: 319-340.
[10] Venkatesh V, Davis FD. A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science 2000; 46(2): 186-204.
[11] Fishbein M & Ajzen I. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Addison-Wesley, California, 1975.
[12] King WR, He J. A meta-analysis of the technology acceptance model. Information & Management 2006; 43(6): 740-755..
[13] Tubaishat A. Perceived usefulness and perceived ease of use of electronic health records among nurses: application of technology acceptance model. Informatics for Health and Social Care 2018; 43(4): 379-389.
[14] IChen I.J, Yang KF, Tang FI, Huang CH, Yu S. Applying the technology acceptance model to explore public health nurses' intentions towards web-based learning: A cross-sectional questionnaire survey. International Journal of Nursing Studies 2008; 45(6): 869-878.
[15] Fazio RH, Pietri ES, Rocklage MD & Shook NJ. Positive versus negative valence: Asymmetries in attitude formation and generalization as fundamental individual differences. Advances in Experimental Social Psychology, Academic Press 2015; 51: 97-146.
[16] Hackman JR, Oldham GR. Development of the job diagnostic survey. Journal of Applied Psychology 1975; 60(2): 159–170.
[17] Humphrey SE, Nahrgang JD, Morgeson FP. Integrating motivational, social, and contextual work design features: a meta-analytic summary and theoretical extension of the work design literature. Journal of Applied Psychology 2007; 92(5).
[18] Wallace LE, Patton KM, Luttrell A, Sawicki V, Fabrigar LR, Teeny J, MacDonald TK, et al. Perceived Knowledge Moderates the Relation Between Subjective Ambivalence and the ‚Impact' of Attitudes: An Attitude Strength Perspective. Personality and Social Psychology Bulletin 2020; 46(5): 709-722.
[19] Giner-Sorolla R. Affective attitudes are not always faster: The moderating role of extremity. Personality and Social Psychology Bulletin 2001; 27(6): 666-677.
[20] Kothgassner OD, Felnhofer A, Hauk N, Kastenhofer E, Gomm J, Kryspin-Exner I. TUI - Technology Usage Inventory, Manual. https://www.ffg.at/sites/default/files/allgemeine_downloads/thematische%20programme/programmdokumente/tui_manual.pdf (11.09.2020).
[21] Karrer K, Glaser C, Clemens C, Bruder C. Technikaffinität erfassen – der Fragebogen TA-EG. In: Lichtenstein A, Stößel C & Clemen C, editors. Der Mensch im Mittelpunkt technischer Systeme. 8. Berliner Werkstatt Mensch-Maschine-Systeme: Düsseldorf, Germany: VDI; 2009: 196-201.
[22] Jordan P, Pohlandt A, Hacker W, Richter P. REBA-Rechnergestütztes Verfahren zur psychologischen Tätigkeitsbewertung. Softwarewerkzeuge zur Arbeitsgestaltung in Konstruktion und Fertigung. Darmstadt: Institut für Arbeitswissenschaft; 1997.
[23] Schlick CM. Industrial Engineering and Ergonomics. Visions, Concepts, Methods and Tools. Berlin: Springer; 2009: 321-333.
[24] Claßen K, Oswald F, Wahl HW, Heusel C, Antfang P, Becker C. Bewertung neuerer Technologien durch Bewohner und Pflegemitarbeiter im institutionellen Kontext. Zeitschrift für Gerontologie und Geriatrie 2010; 43(4): 210-218.