Nurses' participation in the implementation of innovations: emergent versus planned change implementation on the ICU

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Chapter 4

Intensive insulin therapy implementation by means of planned versus emergent change approach.

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Abstract

Aim

To compare a planned change and an emergent change implementation approach to introduce an intensive insulin therapy to an intensive care unit (ICU)

Background

Nurses' participation in decisions about new care procedures and protocols is potentially of benefit for patient outcomes. Whether nurses' participation in decisions is allowed in the implementation of innovations depends on the implementation approach used for the introduction. A planned change implementation approach does not allow it, an emergent change implementation does.

Design

A prospective comparative study in an ICU in the Netherlands comparing two teams of nurses using either implementation approach.

Methods

Pre-introduction the comparability of the two teams was assessed. The nurse compliance to the protocol was assessed as being nurses' behaviour according to the protocol and leading to acceptable glucose values. The effectiveness of the implementation was assessed by measuring the percentage of patients' glucose values within the target range, the occurrence of hypoglycaemic events and the time to glucose value normalization. Data were collected from December 2007 till January 2009.

Results

In the emergent change approach team there were better nurse compliance measurements than in the planned change approach team, a better percentage of glucose values in the target range and a shorter time to glucose value normalization.

Conclusions

The implementation approach allowing nurse participation was associated with better nurse compliance and patient outcome measurements. The implementation approach did not conflict with introducing an evidence-based innovation. It was also associated with more effective adaptation of the protocol to changing circumstances.

Relevance to clinical practice

When a new treatment requires adaptability to changing circumstances to be most effective, nurses' participation in decisions about implementation of the treatment should be considered.

INTRODUCTION

Evidence based practice requires that nurses frequently change their working methods to bring the latest results of medical and nursing research into practice. These changes in nursing working methods can either be implemented with or without the nurses participating in the decisions of how the new working methods are applied. In a planned change implementation (PC-implementation) the new working method is provided by management in a centrally directed manner. (Burnes 1996). In an emergent change implementation (EC-implementation) the new working method is provided as a start off protocol and the nurses are invited to change and improve on it. The purpose of this prospective comparative study was to examine the influence of nurses' level of decision making on their compliance with a new intensive insulin therapy (ITT) protocol and to determine the effects on patients' outcomes.

Background

Nursing participation in the decisions of how a new working method is applied has been associated with better patient outcomes (DuBose et al. 2009, Laschinger & Havens 1997, Page et al. 2008). However, it is usually advised by implementation experts (e.g., Burnes 2004) that a change agent directs the way a new working method is applied. When change agents direct the new working method, nurses might be consulted but they do not participate in the decisions of how a new working method is applied.

When nursing management wants to introduce new nursing innovations, their views upon nurses' participation are important for the choice of introduction method or implementation approach. With its choice of implementation, management determines whether the nurses are involved in what care looks like and whether the nurses are invited to participate in the implementation process (hereafter participation) and the construction of the final innovation. When implementations are considered for the degree they allow this participation a distinction can be made in PC-implementation and EC-implementation (Burnes 1996, Bamford & Forrester 2003). Burnes (1996) argues that there are many organizational change theories, but they can all be positioned on a continuum by the degree the theories consider an implementation can be preplanned. PC- and EC-implementation represent the two sides of this continuum and the crucial factor in this representation is participation in the implementation process and in the construction of the final innovation.

In PC-implementation, there is no such participation; it is a pre-planned and centrally directed process (Burnes 1996). The management alone decides on the introduction process and the exact content of the innovation. In this way management 'owns' the innovation. PC-implementation dates back to the 1940ies (Lewin 1947). In the years thereafter it became the more traditional managerial approach (Lippit et al. 1958, Chin & Benne 1969)

In EC-implementation, the goal to aim for is put forward by management to the staff members. The staff members are invited to participate in finding ways to achieve the goal. Burnes (1996, p14) describes it as follows: "the role of the managers is not to plan or implement change, but to create or foster an organizational structure and climate which encourages and sustains experimentation …. and to develop a workforce that will take responsibility for identifying the need for change and implementing it". In this way managers are expected to become facilitators rather than doers. Proposals on how to do things, come from management and staff members. Pettigrew & Whipp (1993) typify the manager's new role in leading change as linking action by people at all levels of the business. Although management does not let go of their own responsibility, the aim is to make the staff members the owner of the innovation itself. This ownership consists of the staff members' responsibility to find ways to come to the desired end result.

The impact of using EC models in clinical settings has been described by a few authors e.g., Dubose et al (2009). However, no published reports are available which directly compare EC and PC. Therefore, in a study conducted on an intensive care unit (ICU) we sought to do this using a newly developed intensive insulin therapy (IIT) for managing hyperglycaemia on an ICU. This paper reports the results for nurse compliance and levels of glycaemic control.

METHODS

Hypothesis

The hypothesis for this study was that the EC-implementation would result in better glucose regulation for the ICU patients and better nurse compliance to the innovation (indicated by the nurse-initiated insulin infusion rates) as compared to the PC-implementation.

Design.

A prospective comparative study design was used, in which two geographically separated groups of nurses (teams) on one ICU were compared. In one team PC-implementation was

used, in the other EC-implementation. The two teams implemented the same innovation at the same time. The outcome measurements were the nurses' compliance, and the patient glucose values. These outcome measurements were considered to indicate the value of the implementations to introduce an innovation which is effective and safe for the patients.

Ethical considerations

The local medical ethics committee considered the risks for the patients and the demands upon the nursing staff. The committee approved the study and waived the need for written informed consent. As stipulated by the committee the ICU-nurses were informed before the study began about the purpose and measurements in this study.

Setting and participants,

The ICU is part of a general hospital in the Netherlands. At the time of the study, it had 24 ICU beds. The ICU consisted of two relatively independent functioning wings at different ends of the hospital building. Wing 1 with nursing team 1 had 16 ICU-beds. Wing 2, nursing team 2 had 8 ICU-beds.

The study was done from December 2007 till January 2009.

Participating nurses

All nurses working on the ICU participated in the study. The nurses were working in two teams (72 nurses in team 1 and 47 in team 2 at the start of the study). These teams already existed before the start of the study, the basis for these two teams was the two geographically separated sets of rooms. The teams were used as the experimental and control group, because randomisation of the nurses over the groups was not possible. During the study, the nurses remained working in the same team.

Participating patients

The ICU provided care for surgical and medical adult patients. The majority of these were cardiothoracic surgery patients. Any patient being admitted to the ICU could be admitted to either unit. Admission was decided upon by the vacancy of a bed not by any medical or nursing criterion.

On admission the ICU-nurses started IIT in all ICU-patients unless the medical staff specifically prescribed not to do so. The reasons for exclusion were admission diagnosis of a diabetic hyperglycaemic crisis or a moribund patient.

The innovation: IIT

At the start of this study IIT had become the evidence-based treatment for hyperglycaemia in critically ill patients. The effects on mortality, morbidity and duration of hospital stay had been extensively researched (Van den Berghe et al. 2001, Brown & Dodek 2001, Furnary et al. 2003, Krinsley 2004, Van den Berghe et al. 2006). Based on the evidence reported in the literature, a practical format for IIT and a protocol for use by ICU-nurses was newly developed by the intensive care medical staff and the researcher.

For this study the following targets for the glucose values were set and communicated to the nurses. 1) The mean glucose should preferably be below 6.5 mmol/l. 2) Glucose values should be kept between 4.0 and 6,5 mmol/l ("target range") and especially hypoglycaemia (glucose values below 2.5 mmol/l) should be avoided. 3) The time interval from admission of the patient to normalization of the patient's glucose value (glucose < 6.5 mmol/l) should be 6 hours or less. The IIT was discontinued when the patient started to eat solid food, or the patient was discharged from the ICU.

The experimental conditions: the implementation processes in the teams

An otherwise not involved with the ICU, hospital employee flipped a coin and in this manner team 2 was randomly assigned to the PC -implementation and team 1 to the EC-implementation. The two team leaders were in charge of the implementation process and they received instructions in accordance with the assigned condition. The names or any further information about the implementations were not revealed either to the team leader nor to the team members. Both teams received identical lectures explaining the background of IIT, and the proposed protocol. The information in these lectures was as factual as possible. In each team there were scheduled and impromptu meetings of the team members, team leaders and the researcher about IIT. The researcher was present to provide factual information on request, and to check whether the implementation proceeded according to the assigned condition. The latter was done with the help of a checklist stating the characteristics of the assigned implementation and a diary of the meetings kept by the researcher. In collaboration with team members and team leaders a monthly IIT update newsletter per group

was sent to the team members of that team. The researcher provided factual data and checked that the style of the newsletter was in accordance with the experimental condition (see below).
The operational differences of the implementations are displayed in table 1. It shows that in the EC-team the members were invited to propose changes to the protocol and the team leader checked that the suggestions were in line with the aims of the protocol. In the planned change team (PC-team) the members were not given the opportunity to change the protocol. The team leader decided on solutions to problems.

In case a patient needed to be transferred from one team to the other, the care of the patient was taken over by the recipient team. The outcome results of that patient from the time of transfer onwards were assigned to the recipient team. This ensured that the results of the IIT treatment by the nurses was always assigned to the appropriate team. Glucose value changes follow changes in intravenous insulin administration very quickly and therefore differences between the teams in IIT insulin administration will be reflected in the glucose values immediately after a transfer. Also nurse compliance to the IIT innovation was in a similar way assigned to the team in which the compliance decision was made.

Data collection

Team characteristics considered important for the success of an implementation.
At the start of the study the nursing teams were compared for age, level of nursing education, length of general and ICU experience. Furthermore, three assessments considered important for the success of an implementation were done in both teams: 1: level of professional clinical autonomy, 2: perceived innovation characteristics 3:and team characteristics. The two teams were compared for the level of professional clinical autonomy of the nurses by means of the Dutch translation of the Nursing Activity Scale (NAS) (Kelly 2001). The Dutch translation of the NAS, Cronbach's alpha 0.82 (Luiking et al 2012) delivers a score per nurse-respondent ranging from 54 (indicating very low professional clinical autonomy) to 216 (indicating very high professional clinical autonomy).
According to the innovation contingency model of van Linge (2006) pre-implementation configuration differences between the teams would indicate a pre-existing difference in the chance of success of the implementation. Contingency theory was originally developed for

organizational analysis by Burns and Stalker (1961), Woodward(1965) and Lawrence and Lorch (1967) and has been used frequently in the context of organizational development. The model of van Linge distinguishes 4 basic types of sets of characteristics or configurations (group configuration, developmental configuration, hierarchical configuration and rational configuration). Every actual workplace makeup can be described as a specific combination of these 4 basic types of configurations. To measure pre-implementation configuration differences between the teams two instruments were used based on the model of van Linge, measuring respectively perceived innovation characteristics (alpha 0.7-0.8) and team characteristics (alpha 0.7-0.8). (van Linge 2006).

Both instruments are in the form of a questionnaire and measure the presence of the 4 configurations on three different levels (operational practices, expressed values and basic values). This results in 12 scores per questionnaire.

Assessment of fidelity to the experimental conditions

To assess the degree to which the experimental conditions were realized as intended, the newsletters written in both teams were analysed and 8 nurses out of each team were interviewed. All newsletters were blindly (M.G.) identified as coming from either the PC- or the EC-team. Classification was based on the ownership of the innovation manifested in the newsletters, the role of the researcher and the role of the team as apparent in the newsletter.

Furthermore, all interviews were blindly (L.B.) identified as coming from either the PC- or the EC-team. Classification was based on ownership of the innovation manifested made in the statements in the interviews.

nurse compliance

Nurse compliance was determined by:

1 The number and percentage of insulin infusions which conformed to the IIT protocol.
2 The number and percentage of insulin infusions appropriate for the glucose value (‘Safe insulin compliance’)

An insulin infusion was considered appropriate for the glucose value when it fully conforming to the IIT protocol or when it accommodated adequate adaptations to the IIT regime due to unforeseen circumstances.

Nurse compliance was assessed with the help of a computer program, which assessed, evaluated following every glucose measurement, whether the insulin infusion after the

measurement was conforming to the IIT protocol, not conforming to the protocol but still appropriate for the glucose value or neither. The criteria for an insulin infusion to be not conforming to the protocol but still appropriate for the glucose value were: 1. the glucose value of the next measurement was within target range, or 2. the correct insulin infusion was commenced before the next glucose measurement is due, or 3. the next glucose measurement was earlier than the protocol requires, but the protocol was adhered to otherwise.

Patient glucose measurements

The glucose values were measured on the ICU using point of care (POC) glucose meters (Accu-check Inform System 2008, Roche). Arterial blood was used for the measurements. All data were entered into the patient data management system, which provided the following information for every glucose measurement: the glucose value, time of measurement, time-interval since admission of the patient, team responsible for measurement, subsequent insulin administration infusion rate and time-interval between insulin administration and preceding glucose measurement.

The number of glucose measurements per patient during the patient's IIT treatment was variable. Some patients contributed a low number of measurements to the team results, others contributed a large number. To assess the variability of the patients' contribution to the team results, distribution characteristics of the number of glucose measurement per patient were calculated.

The incidence of low glucose values (below 2.5 mmol/l) was used to assess the occurrence of hypoglycaemic events, the percentage of glucose values between 4 and 6.5 mmol/l was used to assess normalization of the glucose, the time interval from admission to a glucose value of 6.5 mmol/l was used to establish the time to normalization of the glucose.

Patients characteristics

Further data acquired from the patient data management system were age of the patient, gender, duration of stay on the ICU, referring department, Acute Physiology and Chronic Health Evaluation II (APACHE II) score and Therapeutic Intervention Scoring System (TISS) score at admission. The APACHE II score indicates the severity of the illness for ICU patients and the TISS score the extent of ICU nursing care required (Knaus et al 1985, & Kottler 1997).) The availability of nursing care for each patient is indicated by the number of beds an ICU-nurse was in charge of during her shift.

Statistical analysis

The characteristics of the nurses and patients at baseline were compared between the teams by means of chi-square tests, and t-tests for independent samples. The distribution characteristics of the glucose measurement and the time interval from admission to a glucose value of 6.5 mmol/l were compared by means of t-tests for independent samples. The differences in percentage of glucose values between 4 and 6.5 mmol/l and the occurrence of hypoglycaemic events were compared by means of chi-square tests. The differences between the teams in nurse compliance and data from newsletters and interviews were analysed using chi square. All analysis were based on two-sided tests (significance level $p < 0.05$) using the Statistical Package for the Social Sciences (SPSS for Windows, version 16 [SPSS Inc., Chicago, IL, USA]).

RESULTS

Table 2 shows that there were no statistical differences between the nursing teams for age, level of nursing education or length of general and ICU experience. The number of nurses in the teams differed due to the difference in size of the two wings. In the EC-team relatively more new nurses (n=19) were employed than in the PC-team (n=5), (Chi-square=5.483, p=0.019).

There was no significant difference in the NAS score or the measurement instruments of the innovation contingency model between the nursing teams at the start of the study (table 3).

In the PC-team where the team leader initiated the meetings, there were 11 meetings about the IIT during the implementation period. The checklist and diary kept by the researcher showed there were no incidences in which the team members introduced changes to the protocol. This indicated that PC-implementation was well adhered to.

In the EC-team, where team members could initiate meetings, there were 19 meetings. The EC-team members decided to make no changes to the insulin infusion rates or time intervals between measurements of the original protocol proposal. They made changes in the infusion materials (pumps and IV-lines etc) to be used. Furthermore, the EC-team members made new guidelines on which infusions could be combined with insulin using the same intravenous pathway and new guidelines on how to discontinue IIT when the patient started to eat solid

food or was discharged from the ICU. Other decisions made by the EC-team pertained to which patients and situations needed extra vigilance.
In this team there were no incidences in which the team leader enforced a particular solution. This indicated that EC-implementation was well adhered to.
When the newsletters were analysed, three newsletters could not be assigned to either team. Their style was compatible with both teams. All other newsletters (n=18) were assigned correctly. Hence it can be concluded that the newsletters fitted the experimental condition (Chi-square=88.364, p=0.0001).
The blind judge analysed the interviews and correctly assigned 14 out of the 16 interviews to the right team. Hence it can be concluded that the perception of ownership of the innovation by the nurses fitted the experimental condition (Chi-square=41.143, p=0.001)

1265 patients in the pre-introduction period and 1220 patients in the post-introduction period were included in the study. There were no significant differences between the two teams for patients gender, age, duration of stay on the ICU, referring department, APACHE II score, TISS score or the availability of nursing care for each patient in the pre- or post-introduction period (table 4).
The results of the glucose measurement outcomes of the pre-introduction period are displayed in table 5. There were no significant differences.
In table 5 the glucose measurement outcomes of the post-introduction period are also displayed. There was a small but significant difference for the percentage of glucose values in the target range. This was for the EC-team 53.5% and for the PC-team 52.8% (Chi-square = 5.483, p=0.02). The time to normalization was very significantly different and was 6-7 hours in the EC-team and 10-11 hours in the PC-team (t-test = 90.284, p<0.0001). There were no significant differences between the incidences of hypoglycaemic values.
The nurse compliance measurements show significant differences between the two teams. The percentage of insulin infusions conform the IIT protocol was 83.5% in the EC-team and 66.8 % in the PC-team (Chi-square = 3278.4, p<0.0001). The percentage of insulin infusions appropriate for the glucose value was in the EC-team 91.3% and 79.0% in the PC-team, (Chi-square =23774, p<0.001).

DISCUSSION

In the EC-team there were more glucose values in the target range, the time to normalization of the glucose was shorter and the two nurse compliance measurements were higher than in the PC-team. These outcome measurements represent on patient and on provider level the difference in implementation success.

On patient level, the EC-team had a slightly better percentage of glucose values in the target range of 4 mmol/l to 6,5 mmol/l than the PC-team. It is unclear whether this slightly better percentage is clinically important to the patients (Finfer et al 2009). However, a better glucose regulation in the EC-team was mainly found in the form of a shorter time to normalization of the glucose value. This shorter time to normalization was thought by van den Berghe et al (2006) to be important to the patients and was one of the targets. A shorter time to normalization was also found by Dubose et al (2009) when ICU-nurses were invited to participate in improving an IIT protocol.

On provider level the success of the implementation was assessed by means of the compliance of the nurses, i.e., the providers of the care. Both types of compliance measures were higher in the EC-team.

The percentage of insulin infusions conforming to the IIT protocol can be regarded as an indicator of the importance the nurses ascribed to executing the IIT protocol. The ascribed importance seemed to be higher in the EC-team than the PC-team.

The percentage of insulin infusions appropriate for the glucose value denotes appropriate actions by the nurses which might or might not be according to the exact prescriptions of the IIT protocol. It therefore denotes effective flexible application of the protocol. This compliance measure was higher in the EC-team than the PC-team and this seems to indicate that the EC-implementation method helped to use the protocol more flexibly. This is in line with the statement by Weick & Quinn (1999) indicating that the participation of the work floor in emergent change makes new developments more adaptable to changing circumstances.

Although the EC-team had the opportunity to change the protocol, this team decided not to change the core of the protocol. This freedom of the EC-team to make (as a team) changes to the core of the protocol did not lead to less but to more adherence by the team members to the exact prescriptions of the IIT protocol. It seems to indicate that, for the EC-team the prescriptions of the IIT protocol had become more of their own choice, since they had the opportunity to change them. They seemed to perceive themselves the owners of the

innovation. The perception of ownership of the innovation might be the explanation of the higher compliance in the EC-team.

The results of this study indicate that participation can lead to even better results for the patients. They show that participation of the nurses in the implementation process and in the construction of the final innovation can help to adapt an evidence-based treatment method to the actual workplace. They also show that participation can lead to a flexible application of an innovation. A flexible but still effective application can be very helpful in nursing situations where a lot of unpredicted events might have to be accommodated: e.g., emergency departments.

Limitations

This study is not a randomized controlled study. Such a design was not considered possible for ethical reasons, e.g. randomization of the nurses was considered to endanger the continuous 24 hour care of the ICU-patients. That the ICU consisted of two separate units with their own staff allowed a design that minimized confounding and contamination. Before the start of the study the teams of nurses were extensively compared. The absence of significant differences between the teams was an important argument that the two existing teams although unequal in size, could be used.

The two teams had their own relatively independent functioning wings but were part of one ICU. A mutual influence on the implementations due to communication between the teams can not be excluded. However, it was observed by the principal investigator that IIT was not a regular topic of discussion in the common room mutual to both teams. Cross team conversations were not mentioned in the team meetings nor were events or results of the other team discussed in the team newsletters. If this type of contamination did take place, it would weaken the differences.

CONCLUSION

The EC-implementation with a central position to participation of the nursing staff was followed by better compliance by the nursing staff and better patient glucose values than the PC-implementation without this central position to participation. More opportunities were given to the nurses in the EC-team to change the innovation, thereby making it more their own innovation. This freedom leads to more compliance to the prescriptions of the protocol, and it resulted furthermore in more actions appropriate to the situation, showing more effective adaptation to changing circumstances.

What is known about this topic?

- Planned change implementation is the more traditional implementation approach and often used in the implementation of evidence-based innovations but doesn't allow nurses' participation in decisions.
- Emergent change approach allows nurses' participation in the decision process and is considered to make new developments more adaptable to changing circumstances.

What this paper adds

- Provides evidence that emergent change implementation can be ensued by better compliance and more adaptability to changing circumstances.
- Patient outcome results can improve following nurses' participation in decisions about an implementation.

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Table 1. Operational differences of planned and emergent change implementation approaches

Emergent Change	Planned Change
● Initial Protocol was presented as evidence-based basis for treatment	● Protocol was presented as final
● Nurses are asked to participate to improve treatment further	● Nurses are expected to adhere to protocol exactly
● Focus in meetings on normalization of patient glucose values	● Focus in meetings on proper protocol application
● Meetings initiated by team members	● Meetings initiated by teamleader
● Problems are defined by team members	● Problems are defined by teamleader
● Solutions to problems provided by team members	● Solutions to problems provided by teamleader
● Newsletter is report on IIT by team members	● Newsletter is notification from management
● Newsletter reports proposals by team members	● Newsletter explains proper application of protocol

Table 2. Characteristics of the nursing teams

	Emergent Change team (n=)		Planned Change team (n=)		P-value	
▪ ICU beds assigned to team	16		8			
▪ Nurses at begin of study	72		47			
▪ Nurses present at both begin and end of study (% of begin of study)	63 (87.5%)		38 (80.9%)		0,18	1
▪ Newly employed since begin of study (% of begin of study)	19 (26.4%)		5 (10.6%)		0,019	1
Demographic characteristics at the start of the study						
Male	7		6		0,481	1
Female	65		41			
	Mean	**SD**	**Mean**	**SD**		
Age (Y)	41,24	8,122	39,1	8,399	0,182	2
Nursing experience (Y)	20,84	8,375	18,96	8,32	0,248	2
ICU experience (Y)	13,09	7,683	12,51	7,854	0,703	2
Higher Grade training	8 (11%)		4 (8.5%)		0,394	1
Lower Grade training	64 (89%)		43 (91.5%)			

1 Chi square test, 2 Student t-test

Table 3: Pre- introduction Nursing Activity Scale score and measurements of the innovation contingency model instruments

		Emergent Change n= 47 *		Planned change n= 32 *		
		Mean	**SD**	**Mean**	**SD**	**p-value #**
Nursing Activity Scale		166,30	14,20	168,00	14,82	0,607
Organizational configuration of the team						
		Mean	SD	Mean	SD	
Hierarchical score	**O**	3,32	0,45	3,19	0,47	0,226
	E	3,62	0,64	3,56	0,61	0,707
	B	2,98	0,91	3,22	0,78	0,220
Group score	**O**	3,13	0,47	3,02	0,50	0,336
	E	3,55	0,65	3,56	0,66	0,951
	B	3,23	0,72	3,13	0,82	0,890
Developmental score	**O**	3,12	0,50	3,05	0,38	0,488
	E	3,09	0,77	2,91	0,63	0,267
	B	3,02	0,73	2,91	0,72	0,497
Rational score	**O**	3,25	0,46	3,04	0,48	0,062
	E	3,66	0,66	3,59	0,55	0,637
	B	3,21	0,77	3,13	0,78	0,628
Organizational configuration of the innovation						
Hierarchical score	**O**	3,71	0,46	3,74	0,49	0,755
	E	3,57	0,71	3,50	0,61	0,625
	B	3,04	0,87	2,97	0,77	0,697
Group score	**O**	3,19	0,44	3,24	0,43	0,627
	E	3,94	0,48	3,97	0,47	0,767
	B	2,83	0,81	2,78	0,82	0,798
Developmental score	**O**	3,20	0,51	3,27	0,49	0,511
	E	3,51	0,74	3,44	0,93	0,716
	B	2,85	0,87	2,63	0,78	0,239
Rational score	**O**	3,70	0,40	3,94	1,37	0,347
	E	3,98	0,44	3,78	0,48	0,073
	B	2,87	0,98	2,72	0,80	0,454

O = operational value, E= Expressed value, B= Basal value, #=Student t-test

* To answer the questions of the innovation contingency model instruments, it is necessary to be a fully qualified regular employee. Only the fully qualified, non agency nurses who had been working without interuption in the same team in the 2 month before the study participated.

Table 4. Characteristic of patients admitted to both teams

	Emergent change team	Planned change team	P-value	
Pre-introduction				
Number of ICU beds in team	16	8		
Number of beds an ICU nurse was in charge of	1.74 (0.13)	1.78 (0.10)	0,1867	2
Number of patients	898	367		
Male (%)	63	61	0,218	1
Female (%)	37	39		
Age (SD), yr	66.8 (13.4)	66.3 (14.4)	0,593	2
Duration of stay (SD), hr	91.4 (180.3)	98.9 (159.3)	0,483	2
APACHE II Score	19.7 (7.44)	19.1 (6.67)	0,297	2
TISS Score	37.2 (11.33)	36.4 (11.14)	0,357	2
Refering department (%)				
Cardiothoracic surgery	73	75	0,143	1
Other department	27	25		
Post-intoduction				
Number of ICU beds in team	16	8		
Number of beds an ICU nurse was in charge of	1.82 (0.10)	1.78 (0.12)	0,166	2
Number of patients	834	386		
Male (%)	62	60	0,23	1
Female (%)	38	40		
Age (SD), yr	66,2 (13,6)	66,0 (13,7)	0,732	2
Duration of stay (SD), hr	95,4 (187,7)	89,5 (139,2)	0,148	2
APACHE II Score	21,2 (7,95)	20,9 (7,76)	0,668	2
TISS Score	37,3 (12,16)	37,3 (12,35)	0,974	2
Refering department (%)				
Cardiothoracic surgery	71	69	0,2	1
Other department	29	31		

1 Chi square test, 2 Student t-test

Table 5 Glucose measurement outcomes,

		Emergent change team	Planned change team	P-value	
Pre-introduction					
Number of glucose measurements		26554	11158		
Mean of glucose measurements per patient (SD)		29,6 (20,45)	30,4 (18,87)	0,49	2
Incidence of Hypoglycaemic values, <2,5 mmol/l	%	0,274	0,246	0,32	1
Percentage of glucose values in the target range	%	40,36	40,79	0,16	1
Time to normalization of glucose value after admission	hr	12-13	12-13	0,53	2
Post-introduction					
Number of glucose measurements		26076	11858		
Mean of glucose measurements per patient (SD)		31,3 (20.30)	30,7 (20.24)	0,66	2
Incidence of Hypoglycaemic values, <2,5 mmol/l	%	0,28	0,24	0,21	1
Percentage of glucose values in the target range	%	53,5	52,8	0,02	1#
Time to normalization of glucose value after admission	hr	6-7	10-11	<0.0001	2##

1 Chi square test, 2 Student t-test

Significant at 0.05 level, ## Significant at 0.005 level