2011
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FACULTY OF SCIENCES

Master of Statistics: Biostatistics

Masterproef

Psychometric validation of Dutch and French translations of the HSPSC questionnaire for belgian psychiaric hospitals

Promotor :
dr. An CREEMERS
Mevrouw Annemie VLAYEN

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Abdou Aissami

Master Thesis nominated to obtain the degree of Master of Statistics , specialization Biostatistics

Maastricht University

universiteit hasselt
KNOWLEDGE IN ACTION

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Certification

This is to certify that this report was written by *Abdou* AISSAMI under our supervision.

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Dr. An CREEMERS **Internal Supervisor**

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Cheers to all

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September 08, 2012

Abstract

Objective: *The objective of this study was to assess the psychometric properties of both Dutch and French translations of the Hospital Survey on Patient Safety Culture (HSPSC) applied in psychiatric hospitals in Belgium and investigate whether they are the same for acute hospitals. The aim was to perform an exploratory and confirmatory factor analysis, to prove construct validity and internal consistency to establish the reliability and validity of HSPSC.*

Research Design: *The Hospital Survey on Patient Safety Culture (HSPSC) was distributed organization-wide in 46 psychiatric Belgian hospitals participating in the federal program for safety. Data were collected in two periods, the first and second measurements from 2007 to 2011. The HSPSC measures safety culture on 12 dimensions, including 10 safety dimensions and 2 outcome dimensions, and is designed to measure staff perceptions on patient safety issues.*

Methodology: *In this report, item analysis, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), Cronbach's alpha and composite score intercorrelations techniques have been used to assess the psychometric properties of the HSPSC in order to prove construct validity and internal consistency of the Hospital Survey on Patient Safety Culture.*

Results:

Dutch speaking hospitals: *No evidence of problematic items is found in the Dutch translation of the original HSPSC when applied to psychiatric hospitals in Belgium. The exploratory factor analysis suggest a dimensional structure which is similar to the hypothesized one (original American HSPSC by Agency for Healthcare Research and Quality, AHRQ). Common factors exist, nevertheless combinations of certain dimensions are suggested as in previous investigations. Confirmatory factor analysis showed some evidence that the observed data had some fit to the hypothesized dimensional structure, even if there is still room for improvement. We will recommend a model with 10 dimensions where dimensions 'Teamwork across hospital units' and 'Hospital handoffs and transitions' on one side and dimensions 'Feedback & communication about error' and 'Communication openness' on the other side are combined as in findings by (Sarac et al. 2011) and (Bodur et al. 2010)) respectively about the Scottish and the Turkish validation of the HSPSC. The questionnaire is reliable and valid like the one of the Dutch translation for acute hospitals and the original HSPSC.*

French speaking hospital: *No evidence of problematic items is found in the French translation of the original HSPSC when applied to psychiatric hospitals in Belgium. The exploratory factor analysis suggest a dimensional structure which is similar to the hypothesized one (original American HSPSC by Agency for Healthcare Research and Quality, AHRQ). Common factors exist, nevertheless combinations of certain dimensions are suggested as in previous investigations. Confirmatory factor analysis showed some evidence that the observed data had some fit to the hypothesized dimensional structure, even if there is still room for improvement. We will recommend a model with 9 dimensions where dimensions 'Teamwork across hospital units' and 'Hospital handoffs and transitions', 'Feedback & communication about error' and 'Communication openness', 'Overall Perceptions of Safety' and 'Staffing' are combined in line with findings by (Waterson et al. 2010) reporting the English validation of the HSPSC. The questionnaire is reliable and valid like the one of the French translation for acute hospitals and the original HSPSC.*

Key words: *Agency for Healthcare Research and Quality, Exploratory Factor Analysis, Confirmatory Factor Analysis, Hospital Survey on Patient Safety Culture, Reliability, Validity.*

Table of Contents

List of tables:

D: Dutch (speaking hospitals)

F: French (Speaking hospitals)

Abbreviations

AFGI: Adjusted Goodness of Fit Index

AHRQ: Agency for Healthcare Research and Quality

CALIS: Covariance Analysis of Linear Structural equations

CFA: Confirmatory Factor Analysis

CFI: Comparative Fit Index

EFA: Exploratory Factor Analysis

GFI: Goodness of Fit Index

HSPSC: Hospital Survey on Patient Safety Culture

KMO-MSA: Kaiser-Meier-Olkin Measure of Sampling adequacy

NNFI: Non-normed Fit Index (Bentler-Bonett)

RMSR: Root Mean Square Residual

SRMSR: Standardized Root Mean Square Residual

Chapter one: Introduction

1.1 Background

Patient safety is a new healthcare discipline that emphasizes the reporting, analysis, and prevention of medical error that often leads to adverse healthcare events, (Wikipedia, 2012). Freedom from accidental injury, ensuring patient safety involves the establishment of operational systems and processes that minimize the likelihood of errors and maximize the likelihood of intercepting them when they occur (Kohn *et al.* 2000). Patient safety is an important component of healthcare quality. Several studies in various countries have shown that 2.9% to 16.6% of patients in acute care hospitals experience one or more adverse events and approximately 50% of the adverse events are judged to be preventable (Brennan *et al.* 1991).

"Safety culture refers to the beliefs, values and attitudes of patient safety shared by all members of the organization. These shared values are reflected in the day to day operations of the organization". (Linda *et al.* 2011) articulated an intellectual history and a definition, description, and model of patients' safety. They defined patients' safety as a discipline in the health care professions that applies safety science methods towards the goal of achieving a trustworthy system of health care delivery. They also define patient safety as an attribute of health care systems that minimizes the incidence and impact of adverse events and maximizes recovery from such events.

The Hospital Survey on Patient Safety Culture (HSPSC) is used to measure safety culture and research (Bodur and Filiz 2010; Li 2005; Sorra and Nieva 2002) has shown that the instrument is psychometrically sound for acute hospitals. The instrument has also been tested to determine the most appropriate individual, unit and hospital level for interventions aimed at improving the culture of patient safety. The unit level appears to be the dominating level for the clustering of responses to the dimensions, which would confirm that the HSPSC measures group values of culture and not just individual attitudes (Smits *et al.* 2009).

Patient safety is receiving growing attention in Belgium. A five year program (2007-2012) was launched to implement quality and patient safety initiatives in the acute, psychiatric and long term care hospitals. In 2007, the federal contract was signed by 80 % (n=164) of the hospitals, including 97 acute hospitals, 52 psychiatric hospitals and 15 long term care hospitals. The Belgian government provided a framework for implementing quality and safety strategies with attention to structure (*how care is organized*), processes (*what is done by health care providers*) and outcome measurement (*the health care results achieved*), according to Donabedian's trilogy. One of the main priorities in the federal program is developing a culture of safety. (Vlayen *et al*. 2011) reported that understanding safety culture is seen as a key component in improving patient safety in Belgian hospital settings. During the first program year (2007-2008), 158 hospitals completed a hospital-wide measurement of the safety culture using the Hospital Survey on Patients' Safety Culture (HSPSC). During the

second program year (2008-2009), 22 other hospitals additionally entering the federal patient safety program assessed the safety culture. In total, 88% of the Belgian hospitals (180 out of 205 hospitals) applied the HSPSC to measure the hospital-wide safety culture. A cluster analysis conducted by (Vlayen *et al*. 2012) revealed 2 main clusters, Cluster I: including the dimensions communication openness (dim 4), supervisor/manager expectations and actions promoting safety (dim 1), organizational learning continuous improvement (dim 2) and team work within units (dim 3). Within this cluster, the distance between these four dimensions was small, with the smallest distance between dimension 1 and 4. Cluster II includes the dimensions feedback and communication about error (dim 5), overall perceptions of patient safety (dim 11), non-punitive response to error (dim 6), frequency of events reported (dim 12), teamwork across units (dim 9), hand-off and transitions (dim 10), staffing (dim 7) and management support for patient safety (dim 8). Within this cluster, two sub-clusters can be distinguished: 1.Dimensions feedback and communication about error and overall perceptions of patient safety; 2. Dimensions non-punitive response to error, frequency of events reported, teamwork across units, handoffs and transitions and management support for patient safety and, at a lightly larger distance, the dimension staffing. For psychiatric hospitals, a similar structure was found except communication openness (dim4) clustered within cluster II.

Previous research (Hellings *et al.* 2010) also suggested differences between professional subgroups, although no representative conclusions could be made for the Belgian hospital sector. One dimension along which safety culture can vary within hospitals is by work area, such as the Pediatrics or Intensive Care Unit (ICU). (Pronovost *et al.* 2003) suggest that measuring safety culture of work areas can identify important opportunities for improvement. It has been also shown that safety culture of particular types of work areas varies across institutions and within institutions (Cooper *et al.* 2008). One question that arises when considering variations across work areas is the extent to which safety culture is related to the level of intrinsic hazard associated with work done in different areas. Previous literature supports the view that there could be variations in safety culture that are related to the place and complexity of work performed in different work areas. For example, greater effort to overcome safety hazards in more intrinsically hazardous work areas could result in better safety culture in these areas, as it has been demonstrated in anesthesiology (Huang *et al.* 2007)
Research has also examined safety culture perceptions among personnel by discipline, in general, physicians demonstrated more positive perceptions of safety culture than nurses and other clinical personnel. In one study, ICU physicians rated collaboration and communication with nurses more positively than did the nurses themselves, who reported difficulty in speaking up, disagreements not appropriately resolved and poor receptivity of their input into decision-making. However, other studies have found no difference between physicians and nurses (Makary *et al.* 2006) or more positive perceptions among nurses (Pronovost *et al.* 2003).

So far, we could not reach available published literature on patient safety culture and validation of HSPSC for psychiatric hospitals, thereof another point of relevance for this study.

1.2 Statement of the problem

The original HSPSC questionnaire was designed for acute hospitals. In Belgium the Dutch and French translations were validated only for acute hospitals. To date no validation has been done for psychiatric hospitals. The descriptive parts of the HSPSC of work environment and profession were adapted to the context of the psychiatric hospitals, the adaptations did not affect the content of the items but rather were applied to the work area and staff positions in psychiatric hospitals. There is therefore need to validate both the Dutch and French versions of the HSPSC for psychiatric hospitals. The main research question is then to investigate whether the Dutch and French translated versions of HSPSC for psychiatric hospitals have the same psychometric properties as the ones for acute hospitals.

1.3 Objectives

The objective of this report was to assess the psychometric properties of the HSPSC for psychiatric hospitals in Belgium, to perform a confirmatory factor analysis (CFA), to prove construct validity and internal consistency to establish the reliability and validity of the Hospital Survey on Patient Safety Culture.

Chapter two: Data and Methodology

2.1 Data description

2.1.1 Dutch speaking hospitals Data description

Data on Dutch speaking hospitals at the second measurement are composed of 5906 respondents coming from 35 hospitals collected in 2011. 96.6% of the respondents answered to have direct interactions with patients. Respondents profile were mainly composed of nurses (57.4%), and physicians (25.3%). The main working unit of the respondent (57.9%) was the specialized unit (mood or behavior disorders, psychosis care, addiction therapy) and Admission/observation or crisis unit (12.7%) with some (10.2%) working in many different hospital units/mobile team. It should be noted that 73.3% of the respondents has more than 5 year experience in their current profession. Overall response rate was 76.7% with physicians having a lower response rate of 41.8 %. The survey was conducted via a paper based and an electronic questionnaire, unlike the original American (AHRQ) which used as part of data collection "postage-paid envelope" on top of purposive sampling. It should be noted that first measurement is of 5096 respondents, the data collected in 2007, 2008 and 2011 were used to conduct validation of the results.

2.1.2 French speaking hospitals Data description

Data on French speaking hospitals at the second measurement is composed of 2384 respondents coming from 11 hospitals collected in 2011. 96.2% of the respondents answered to have direct interactions with patients. Respondents profile were mainly composed of nurses (45.7%), and physicians (24.4%). The main working unit of the respondent (50.3%) was the specialized unit (mood or behavior disorders, psychosis care, addiction therapy) and Admission/observation or crisis unit (16.4%) with some (15.4%) working in many different hospital units/mobile team. It should be noted that 78.2% of the respondents has more than 5 year experience in their current profession. Overall response rate was 61.8% with physicians having a lower response rate of 44.6 %. The survey was conducted via a paper based and an electronic questionnaire, unlike the original American (AHRQ) which used as part of data collection "postage-paid envelope" on top of purposive sampling. It should be noted that first measurement is of 1562 respondents, the data has been collected in 2008, 2009 and 2010 were used to conduct validation of the results.

For both Dutch and French translated versions of the HSPSC questionnaire, the factor model is composed of 42 variables (see table 1) below, negative worded variables are reversed before performing the statistical analyses.

Table 1: Safety dimensions, outcome and items related (including reversed items)

Safety dimensions		**items**	**Reversed items**
D1	Supervisor/manager expectations and actions	b1-b2-b3-b4	b3r-b4r
D2	Organizational learning–continuous improvement	a6-a9-a13	
D3	Teamwork within units	a1-a3-a4-a11	
D4	Communication openness	c2-c4c-c6	c6r
D5	Feedback and communication about error	c1-c3-c5	
D6	Nonpunitive response to error	a8-a12-a16	a8r-a12r-a16r
D7	Staffing	a2-a5-a7-a14	a5r-a7r- a14r
D8	Management support for patient safety	f1-f8-f9	f9r
D9	Teamwork across units	f2-f4-f6-f10	f2r-f6r
D10	Handoffs and transitions	f3-f5-f7-f11	f3r-f5r-f7r-f11r
Outcomes dimensions			
O1	Overall perceptions of patient safety	a10-a15-a17-a18	a10r-a17r
O2	Frequency of events reported	d1-d2-d3	

2.2 Methodology

2.2.1 Item Analysis

In psychometric literature (Nunnally and Bernstein 1994**,** Kline 1999), item analysis is conducted to investigate potential problematic items. High proportion of missingness (35%) and obvious level of skewness (85%) are used to identify problematic items (Glaros and Kline 1988). Usually low response rates indicate items referring to difficult question to which respondents do not want to answer or that shock people's apprehension. Highly skewed items refer to questions having little information. In this report, items having more than 35% proportion of missingness rate or more than 85% of their response on the same side of the response scale are considered to be problematic.

2.2.2 Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) could be described as orderly simplification of interrelated measures. EFA, traditionally, has been used to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome (Child, 1990). It is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. Mathematically, each variable is expressed as a linear combination of underlying factors. The covariance among the variables is described in terms of a small number of common factors plus a unique factor for each variable (Afifi, 2004). In this report, Exploratory factor analysis (EFA) has been used to investigate the number of latent constructs underlying the set of 42 items by analyzing the correlation pattern between these items. There are many rules to decide the number of factors to retain: The Kaiser-Guttmann rule (Guttman 1954 and Kaiser 1960) or "eigenvalues greater than one", The Cattell's (1966) scree rule, the proportion of variance accounted for, the average prior communalities to mention but a few. Here as the aim is to assess the psychometric properties of the questionnaire based on an *a*

priori hypothesis about the number of factors and compare with previous research, the problem of determining the number of factors is not of great concern. We therefore select 12 dimensions as proposed in the original instrument. Maximum likelihood extraction method has been used for factor extraction and orthogonal rotation method (Varimax) for factor rotation.

The Kaiser-Meier-Olkin (KMO) measure of sampling adequacy (MSA), a summary of how small partial correlations are relative to ordinary correlations was used to assess the appropriateness of factor analysis (Kaiser, 1970), high values (between 0.5 and 1.0) indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate and the overall KMO measures greater than 0.80 are referred to as excellent.

Bartlett's test of sphericity was used to examine the hypothesis that the variables are uncorrelated in the population (Bartlett, 1950). It tests the hypothesis that the population correlation matrix is an identity matrix, each variable correlates perfectly with itself ($r = 1$) but has no correlation with the other variables ($r = 0$). Rejection of this hypothesis indicate the appropriateness of the factor analysis.

2.2.3 Confirmatory factor analysis (CFA)

Ahead of exploratory factor analysis, confirmatory factor analysis is used to investigate if the number of factors and the loading of measured variables on them conform to what is expected on the basis of pre-established theory. A minimum requirement of confirmatory factor analysis is that one hypothesizes beforehand the number of factors in the model, but usually also the researcher will posit expectations about which variables will load on which factors (Kim and Mueller, 1978). Several measures of Goodness of fit were used to assess the fit of the data to the model. The Comparative Fit Index (CFI) is equal to the discrepancy function adjusted for sample size. CFI ranges from 0 to 1 with a larger value indicating better model fit. Acceptable model fit is indicated by a CFI value of 0.90 or greater (Hu and Bentler, 1999). Root Mean Square Error of Approximation (RMSEA) is related to residual in the model. RMSEA values range from 0 to 1 with a smaller RMSEA value indicating better model fit. Acceptable model fit is indicated by an RMSEA value of 0.06 or less (Hu & Bentler, 1999). Finally ratio of the Chi-square statistic and its corresponding degree of freedom close to 1 is an indication of an acceptable fit (Shkedy, 2004). The CALIS (covariance analysis of linear structural equations) procedure in SAS has been used to fit the model.

2.2.4 Reliability analysis

Cronbach's alpha has been used to investigate the internal consistency for the 12 dimensions. Usually, the higher alpha, the more reliable the test. Cut-off equal to 0.7 and above is acceptable (Nunnally, 1978). It is a common misconception that if the alpha is low, it must be a bad test. Actually the test may measure several latent dimensions rather than one and thus the Cronbach Alpha is deflated. It should be noticed that alpha is a lower bound on the true reliability of a test under general conditions, and that it is only equal the true reliability if the items satisfy a property known as essential τ–equivalence (Lord and Novick 1968), which

requires that items must be measuring the same thing. Reliability being the reproducibility of an empirical measure has several dimensions, in this report focus will be given on internal consistency.

2.2.5 Validity analysis

Validity determines the degree of confidence we can place on inferences based on the score. Construct validity refers to relation with theoretical concepts (Laenen, 2008). Validity assessment has been conducted through Intercorrelations between dimensions. Composite scores for the 12 dimensions were obtained as the mean of the scores on the different items within each dimension after reversing the score of the negatively worded items. Summary statistics (mean, median and standard errors) for the composite scores of each dimension and the intercorrelations have been computed. Extreme absolute values for intercorrelations between 2 dimensions may be an indication that these dimensions need to be combine as they seem to provide similar information. These correlations could also be used to investigate the a priori hypothesis that the dimensions are independent.

Chapter three: Results

3.1 Dutch speaking hospitals Results

3.1.1 Item Analysis

Out of the 42 items of the factor model, none rings bell as for missingness. The greatest proportion of missingness is 4.3% observed on item d3 (*when a mistake is made that could harm the patient, but does not, how often is this reported?*), this item is part of the "*frequency of events reported*" dimension. The lowest proportion of missingness is observed on item a2 (*we have enough staff to handle the workload*) which is part of '*staffing"* dimension. Table A3 (appendices) is giving a list of variables each with its corresponding proportion of missingness, value of skewedness and percentage on each of the five likert scale.

Furthermore, within the 42 items of the factor model, there is no item with extreme levels of skewedness, no item has 85% of the responses on one of the 5 point likert scale (1-5). Item h5 which is binary, has 96.6% of its response on one side. Not only it is not an item of the factor model but also it confirms that almost all respondents have direct interaction with patients which may add credibility to their perception on patient safety.

In summary, item analysis results both from proportion of missingness (35%) and skewedness (85%) investigation did not point out any problematic item in the HSPSC questionnaire.

3.1.2 Exploratory factor analysis (EFA)

Exploratory factor analysis (EFA) has been used to investigate the number of latent constructs underlying the set of 42 items based on an *a priori* hypothesis of the factor model. 12 dimensions were selected as proposed in the original instrument. Nevertheless eigenvalue criteria selected 9 factors and the average prior communality (the variance in each item explained by the extracted factors) of 0.40 selected 12 factors. These dimensions only explain about 59.35% of the original variance but account for 44% of the common variance. The null hypothesis of "*No Common Factors*" was rejected (p-value < 0.0001), supporting that there is at least 1 common factor. Moreover the null hypothesis of *"12 Factors are sufficient"* was rejected (p-value < 0.0001), meaning there is eventually room for selection of more factors if needed. The Bartlett's Test of Sphericity is significant (p-value<0.0001 and the Kaiser-Meyer-Olkin (KMO) measure of Sampling Adequacy is 0.921 which strongly supports the adequacy of the sample for factor analysis.

33 items out of the 42 loaded high (>0.40) on only one factor, no item loaded high on 2 or more factors. There are similarities between this dimensional structure and the proposed one by the AHRQ (*Table A7: rotated factor matrix-ML extraction method).* Dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'* are treated as one dimension. So also the dimensions '*Feedback & communication about error'* and *'Communication openness'* are treated as one dimension. These fusions remain logical since

both combined dimensions have strongly related content. A kind of sensitivity analysis has been conducted changing the extraction method from Maximun Likelihood to principal component, obtained results showed similar trends (*Table A8: rotated factor matrix - Principal component extraction method*). The items of *"Overall perceptions of patient safety*" dimension did not load high (up to 0.40) on factors, nevertheless items a17 and a18 loaded 0.33 and 0.32 respectively. Table 2 below shows the 12 factors extracted, the eigen values and the amount of variability explained.

Table 2: The extracted 12 factors based on Maximum Likelihood method- D

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.06	21.58	21.58	8.34	19.87	19.87	2.68	6.40	6.40
2	2.53	6.03	27.62	2.00	4.76	24.64	2.25	5.35	11.76
3	2.14	5.10	32.72	1.79	4.26	28.90	2.10	5.00	16.76
4	1.70	4.06	36.79	1.18	2.81	31.71	1.92	4.57	21.33
5	1.61	3.84	40.63	1.22	2.91	34.63	1.90	4.52	25.86
6	1.39	3.32	43.96	0.95	2.27	36.90	1.53	3.66	29.52
7	1.34	3.19	47.15	0.76	1.81	38.71	1.51	3.60	33.12
8	1.20	2.87	50.02	0.63	1.52	40.23	1.43	3.40	36.53
9	1.08	2.58	52.61	0.43	1.03	41.27	1.17	2.80	39.33
10	0.98	2.34	54.95	0.41	0.99	42.27	0.80	1.91	41.24
11	0.94	2.24	57.20	0.40	0.95	43.22	0.76	1.82	43.07
12	0.90	2.15	59.35	0.28	0.68	43.90	0.35	0.83	43.90

3.1.3 Confirmatory factor analysis (CFA)

The confirmatory factor analysis has been performed to decide whether the data fit to the hypothesized dimensional structure. Results are displayed in Table 3 below. On one hand Chi square p value and it's ratio to the corresponding degree of freedom indicate no evidence of fit. It has been reported (Bentler and Bonnet, 1980) that Chi-Square statistic is in essence a statistical significance test it is sensitive to sample size and that the Chi-Square statistic nearly always rejects the model when large samples are used (Jöreskog and Sörbom, 1993). On the other hand, the RMR (0.0229) and the SRMSR (0.0315) are found to be less than 0.05 suggesting an acceptable fit. Moreover GFI, AFGI, CFI, and NNFI are close to 1 also suggesting an acceptable model. Generally, we can therefore conclude that the hypothesized dimensional structure is acceptable even though areas for improvement are perceptible.

A more parsimonious model with 10 dimensions where dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'* on one side and dimensions '*Feedback & communication about error'* and *'Communication openness'* on the other side are combined, could be adopted. This is in line with findings by (Sarac *et al.* 2011) and (Bodur *et al.* 2010) respectively about the Scottish and the Turkish validation of the HSPSC. Both of

them suggested a 10 factor model factor structure, the Scottish validation combined dimensions '*Feedback and communication about error*' and '*Communication openness*' as one factor, and '*Staffing*' and '*Overall perceptions of Safety*' as another one. Items a11 (Teamwork within units), a10 (Overall Perceptions of Safety), a9 (Organizational learning-improvement) load relatively low on the factors and could be reconsidered in the model. Items of the combined dimensions could as well be reviewed to avoid redundancy

Table 3: Confirmatory factor analysis goodness of fit summary-D

Goodness of fit statistics	**Estimates**
Chi-Square	3583.0824
Chi-Square DF	440
Pr > Chi-Square	<.0001
Chi-Square/ Chi-Square DF	8.14
Root Mean Square Residual (RMSR)	0.0241
Standardized RMSR (SRMSR)	0.0335
Goodness of Fit Index (GFI)	0.9490
Adjusted GFI (AGFI)	0.9349
Bentler Comparative Fit Index	0.9364
Bentler-Bonett Non-normed Index	0.9237

3.1.4 Reliability analysis

Cronbach's alpha has been used to investigate the internal consistency for the 12 dimensions, results are shown in Table 4. Estimates for the reliability of the 12 dimensions range between 0.54 and 0.85. It should be noted that "*Frequency of Event Reporting*" and "*Overall Perceptions of Safety"* showed the highest and lowest internal consistency respectively. Six of the dimensions have reliability coefficient greater than or equal to 0.7, all others have reliability estimate above 0.5 though exhibiting a lower level of reliability. Overall internal consistency of the items is good and comparable both to the original questionnaire and it's Dutch translation. Table 4 below gives estimates of alpha's value by dimension and the corresponding Dutch translated and original (AHRQ) questionnaire values.

Table 4: Reliability coefficients (Cronbach's alpha) of the 12 safety culture dimensions-D

Dimensions	***Items***	***Alpha PH***	***Alpha AH***	***Alpha AHRQ***
D1: Supervisor/manager expectations	b1-b2-b3-b4	0.76	0.77	0.75
D2: Organizational learning	a6-a9-a13	0.50	0.59	0.76
D3: Teamwork within units	a1-a3-a4-a11	0.65	0.66	0.83
D4: Communication Openness	c2-c4c-c6	0.66	0.65	0.72
D5: Feedback & Communication	c1-c3-c5	0.76	0.78	0.78
D6: Non punitive response to error	a8-a12-a16	0.70	0.68	0.79
D7: Staffing	a2-a5-a7-a14	0.56	**0.57**	**0.63**
D8: Management support for patient safety	f1-f8-f9	0.72	0.72	0.83
D9: Team work across hospital units	f2-f4-f6-f10	0.69	0.66	0.80
D10 Hospital handoffs and transitions	f3-f5-f7-f11	0.70	0.71	0.80
D11: Overall Perceptions of Safety	a10-a15-a17-a18	**0.54**	0.58	0.74
D12: Frequency of event reporting	d1-d2-d3	**0.85**	**0.85**	**0.84**

(**PH**= Psychiatric hospital, **AH**=Acute Hospital)

3.1.5 Validity analysis

Composites scores intercorrelations and summary statistics are shown in Table 5 and Table A1 (appendices). The means of the composite scores range between 3.14 and 3.73 while the corresponding standard errors ranges between 0.52 and 0.88. All pair-wise correlations for the composite score of the dimensions are significant and positive, the corresponding values range from 0.04 to 0.57.

Correlations between '*Communication Openness'* and *'Feedback & Communication' (0.57)* on one hand and '*Hospital handoffs and transitions'* and '*Team work across hospital units' (0.56)* on the other hand are relatively high. This is in line with the exploratory factor analysis findings since these dimensions have been combined. In fact, '*Communication Openness'* and '*Feedback & Communication'* all deal with communication. *'Hospital handoffs and transitions'* and '*Team work across hospital units*' deal with cooperation across units in the hospital. It should be pointed out that none of the correlations were extremely high suggesting the need to combine some dimensions. Also, most of the correlations are less than 0.5 implying that the a priori hypothesized independence between the dimensions may be plausible.

Table 5: Pair-wise correlations between the 12 safety culture dimensions - D

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
D1: Supervisor/manager expectations	1											
D2: Organizational learning	0.39	1										
D3: Teamwork within units	0.35	0.34	1									
D4: Communication Openness	0.46	0.36	0.42	1								
D5: Feedback & Communication	0.45	0.43	0.35	**0.57**	1							
D6: Non punitive response to error	0.34	0.26	0.31	0.47	0.3	1						
D7: Staffing	0.23	0.12	0.19	0.25	0.17	0.32	1					
D8: Management support for patient	0.33	0.35	0.24	0.35	0.36	0.33	0.26	1				
D9: Team work across hospital units	0.31	0.31	0.33	0.34	0.32	0.29	0.25	0.44	1			
D10 Hospital handoffs and transitions	0.28	0.23	0.27	0.30	0.27	0.3	0.27	0.36	**0.57**	1		
D11: Overall Perceptions of Safety	0.38	0.36	0.31	0.38	0.33	0.38	0.37	0.41	0.34	0.36	1	
D12: Frequency of event reported	0.24	0.26	0.18	0.27	0.39	0.16	**0.04**	0.19	0.2	0.18	0.2	1

3.2 French speaking hospitals Results

3.2.1 Item Analysis

From the 42 items of the factor model, none has alarming rate of missingness. The greatest proportion of missingness is 17.2% observed on item a7 *(*we use more agency/temporary staff than is best for patient care), this item is part of the "*Staffing*" dimension. The lowest proportion of missingness (0.4%) is observed on items a14 (we work in "crisis mode" trying to do too much, too quickly) which is also part of '*Staffing"* dimension, both items are negatively worded. Table A6 (appendices) is giving a list of variables each with its corresponding proportion of missingness, skewedness value and percentage for each likert scale.

Within the 42 items of the factor model, there is no item with extreme levels of skewedness, no item has 85% of the responses on one of the 5 point likert scale (1-5). Item h5 which is binary has 96.2% of its response on one side. Not only it is not an item of the factor model but also it confirms that almost all respondents have direct interaction with patients which may add credibility to their perception on patient safety.

In summary, item analysis results both from proportion of missingness (35%) and skewedness (85%) investigation did not point out any problematic item in the HSPSC questionnaire.

3.2.2 Exploratory factor analysis (EFA)

Exploratory factor analysis (EFA) has been used to investigate the number of latent constructs underlying the set of 42 items based on an *a priori* hypothesis of the factor model. Twelve dimensions were selected as proposed in the original instrument. Nevertheless eigenvalue criteria selected 10 factors and the average prior communality (the variance in each item explained by the extracted factors) of 0.40 selected 12 factors. These dimensions only explain about 61.57% of the original variance but account for 46.61% of the common variance. The null hypothesis of "*No Common Factors*" was rejected (p-value < 0.0001), supporting that there is at least 1 common factor. Moreover the null hypothesis of *"12 Factors are sufficient"* was rejected (p-value < 0.0001), meaning there is eventually room for selection of more factors if needed. The Bartlett's Test of Sphericity is significant (p-value<0.0001) and the Kaiser-Meyer-Olkin (KMO) measure of Sampling Adequacy is 0.915 which strongly support the adequacy of the sample for factor analysis.

33 items out of the 42 loaded high (>0.40) on only one factor, no item loaded high on 2 or more factors. There are similarities between this dimensional structure and the proposed one by the AHRQ (*table a4: rotated factor matrix*-ML extraction method*).* Dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'* are treated as one dimension. Also the dimensions '*Feedback & communication about error'* and *'Communication openness'* are treated as one. Moreover the dimensions '*Overall Perceptions of Safety*' and '*Staffing*' are combined in one dimension. A kind of sensitivity analysis has been conducted changing the extraction method, the results showed similar trends unless for the last two dimensions '*Overall Perceptions of Safety*' and '*Staffing*' which are not combined

now (Table A9: Rotated factor matrix - Principal component extraction method). Table 6 below shows the 12 factors extracted, the eigen values and the amount of variability explained.

Table 6: The extracted 12 factors based on Maximum Likelihood method-F

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.63	22.94	22.94	9.07	21.60	21.60	2.64	6.22	6.22
2	2.36	5.62	28.56	1.85	4.41	26.02	2.43	5.81	12.13
3	2.14	5.11	33.68	1.73	4.11	30.14	2.05	4.98	17.11
4	1.96	4.66	38.35	1.51	3.60	33.74	2.01	4.86	21.91
5	1.69	4.02	42.38	1.11	2.65	36.40	1.86	4.45	26.36
6	1.55	3.71	46.09	1.16	2.78	39.13	1.81	4.46	30.83
7	1.26	3.00	49.09	0.73	1.74	40.97	1.76	4.19	34.92
8	1.17	2.78	51.88	0.64	1.53	42.43	1.64	3.86	38.88
9	1.09	2.61	54.50	0.50	1.20	43.65	1.23	2.93	41.81
10	1.04	2.49	56.99	0.43	1.03	44.67	0.94	2.24	44.05
11	0.98	2.34	59.33	0.47	1.11	45.83	0.72	1.76	45.81
12	0.941	2.24	61.57	0.33	0.80	46.66	0.33	0.75	46.66

3.2.3 Confirmatory factor analysis (CFA)

Confirmatory factor analysis has been performed to decide whether the data fit to the hypothesized dimensional structure. Results are displayed on table 7 below. On one hand Chi square p value and it's ratio to the corresponding degree of freedom indicate no evidence of fit. It has been reported (Bentler and Bonnet, 1980) that Chi-Square statistic is in essence a statistical significance test it is sensitive to sample size and that the Chi-Square statistic nearly always rejects the model when large samples are used (Jöreskog and Sörbom, 1993).. On the other hand, the RMR (0.0369) and the SRMSR (0.0383) are found to be less than 0.05 suggesting an acceptable fit. Moreover GFI, AFGI, CFI, and NNFI are close to 1 also suggesting an acceptable model. Generally, we can therefore conclude that the hypothesized dimensional structure is acceptable even though areas for improvement are perceptible.

A model with 9 dimensions where dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'*, '*Feedback & communication about error'* and *'Communication openness'*, '*Overall Perceptions of Safety*' and '*Staffing*' are combined could be adopted rather than the original 12 model. This is in line with findings by (Waterson et al. 2010) which reported in the English validation of the HSPSC a nine-factor model with 40 items.

Items f11 (Hospital Handoffs and Transitions), a11 (Teamwork within units), a10 (Overall Perceptions of Safety), a9 (Organizational learning-improvement), a7 (Staffing) loaded

relatively low on the factors and could be reconsidered in the model. Items of the combined dimensions could as well be reviewed to avoid redundancy.

Table 7: Confirmatory factor analysis goodness of fit summary - F

Goodness of fit statistics	**Estimates**
Chi-Square	1648.2444
Chi-Square DF	505
Pr > Chi-Square	<.0001
Chi-Square/ Chi-Square DF	3.26
Root Mean Square Residual (RMSR)	0.0381
Standardized RMSR (SRMSR)	0.0387
Goodness of Fit Index (GFI)	0.9257
Adjusted GFI (AGFI)	0.9073
Bentler Comparative Fit Index	0.9241
Bentler-Bonett Non-normed Index	0.9105

3.2.4 Reliability analysis

Cronbach's alpha has been used to investigate the internal consistency for the 12 dimensions, results are shown in Table 8. Estimates for the reliability of the 12 dimensions range between 0.49 and 0.84. Dimensions "*Frequency of Event Reporting*" and "*Staffing"* showed the highest and lowest internal consistency respectively. Six of the dimensions have reliability coefficient greater than or equal to 0.7, others have reliability estimate above 0.5 exhibiting therefore a lower level of reliability except '*Staffing'* that has 0.49 reliability coefficient which can be considered as very poor. Overall internal consistency of the items is good and comparable both to the original questionnaire and it's French translation. Table 8 below gives estimates of alpha's value by dimension and the corresponding Dutch translated questionnaire values. Highest and lowest internal consistency are exactly observed on the same items for both psychiatric and acute hospitals, '*Frequency of event reporting*' and '*Staffing*' respectively.

Table 8: Reliability coefficients (Cronbach's alpha) of the 12 safety culture dimensions- F

Dimensions	***Items***	***Alpha PH***	***Alpha AH***	***Alpha AHRQ***
D1: Supervisor/manager expectations	b1-b2-b3-b4	0.7371	0.7489	0.75
D2: Organizational learning	a6-a9-a13	0.5842	0.5870	0.76
D3: Teamwork within units	a1-a3-a4-a11	0.8360	0.8206	0.83
D4: Communication Openness	c2-c4c-c6	0.7096	0.7208	0.72
D5: Feedback & Communication	c1-c3-c5	0.7005	0.7554	0.78
D6: Non punitive response to error	a8-a12-a16	0.6789	0.6447	0.79
D7: Staffing	a2-a5-a7-a14	***0.4990***	***0.5219***	**0.63**
D8: Management support for patient safety	f1-f8-f9	0.7886	0.7743	0.83
D9: Team work across hospital units	f2-f4-f6-f10	0.6630	0.6776	0.80
D10 Hospital handoffs and transitions	f3-f5-f7-f11	0.6958	0.7247	0.80
D11: Overall Perceptions of Safety	a10-a15-a17-a18	0.5843	0.6299	0.74
D12:Frequency of event reporting	d1-d2-d3	***0.8439***	***0.8725***	**0.84**

PH= Psychiatric Hospital, **AH**=Acute Hospital

3.2.5 Validity analysis

Composite scores intercorrelations and summary statistics are shown in Table 9 and Table A4 (appendices). The means of the composite scores range between 2.97 and 3.68 while the corresponding standard errors range between 0.58 and 0.86. All pair-wise correlations for the composite score of the dimensions are significant and positive, the corresponding values range from 0.08 to 0.56.

Correlations between '*Communication Openness'* and *'Feedback & Communication' (0.56)* on one hand and '*Hospital handoffs and transitions'* and '*Team work across hospital units' (0.56)* on the other hand are relatively high. This is in line with the exploratory factor analysis findings since these dimensions have been combined. In fact, '*Communication Openness'* and '*Feedback & Communication'* all deal with communication. *'Hospital handoffs and transitions'* and '*Team work across hospital units*' deal with cooperation across units in the hospital. The correlation between *'Overall Perceptions of Safety'* and *'Staffing''* dimensions is 0.39. It should be pointed out that none of the correlations were extremely high suggesting the need to combine some dimensions. Also, most of the correlations are less than 0.5 implying that the a priori hypothesized independence between the dimensions may be plausible.

Table 9: Pair-wise correlations between the 12 safety culture dimensions - D

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
D1: Supervisor expectations	1											
D2: Organizational learning	0.44	1										
D3: Teamwork within units	0.36	0.35	1									
D4: Communication Openness	**0.52**	0.32	0.38	1								
D5: Feedback & Communication	0.48	0.43	0.34	**0.56**	1							
D6: Non punitive response to error	0.36	0.26	0.35	0.48	0.30	1						
D7: Staffing	0.29	0.16	0.22	0.32	0.26	0.36	1					
D8: Management support for patient	0.38	0.37	0.23	0.35	0.36	0.35	0.27	1				
D9: Team work across units	0.31	0.26	0.28	0.34	0.31	0.32	0.26	0.45	1			
D10 Hospital handoffs and transitions	0.30	0.18	0.27	0.35	0.32	0.29	0.25	0.32	**0.56**	1		
D11: Overall Perceptions of Safety	0.37	0.35	0.30	0.38	0.35	0.41	0.39	0.48	0.34	0.33	1	
D12: Frequency of event reported	0.21	0.22	0.16	0.22	0.33	0.12	**0.08**	0.15	0.17	0.15	0.17	1

Chapter four: Discussions and Conclusion

4.1 Discussions and Conclusion Dutch speaking hospitals

In view of the above results from item analysis, exploratory and confirmatory factor analysis, reliability and validity analysis, no evidence of problematic items is found in the Dutch translated version of the original Hospital Survey on Patient Safety Culture when applied to psychiatric hospitals in Belgium. No item is equivocal, shocks staff apprehension or provoke refusal to answer. The Exploratory factor analysis suggested a dimensional structure which is similar to the hypothesized one (original AHRQ), we found evidence that common factors exist nevertheless combinations of certain dimensions are suggested as in previous investigations. Confirmatory factor analysis showed some evidence that the observed data had some fit to the hypothesized dimensional structure, even if there is still room for improvement. Reliability analysis pointed out reasonable internal consistency of the dimensions like the one of the translate Dutch version of the acute hospital and the original AHRQ. Moreover validity analysis showed low to moderate intercorrelations between the different dimensions. All correlations were positive ranging from 0.04 to 0.57.

To summarize, based on the results above, evidence is found that the Dutch translated version of the questionnaire (HSPSC) is reliable and valid. Nevertheless, we can see room for improvement on the original a priori hypothesis. We recommend a 10 factors model where dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'* on one side and dimensions '*Feedback & communication about error'* and *Communication openness'* on another side are combined.

4.2 Discussions and Conclusion French hospitals

Finally, in view of the results from item analysis, exploratory and confirmatory factor analysis, reliability and validity analysis, no evidence of problematic items is found in the French translated version of the original Hospital Survey on Patient Safety Culture when applied to psychiatric hospitals in Belgium. No item is equivocal, shocks staff apprehension or provoke refusal to answer. The Exploratory factor analysis suggested a dimensional structure which is similar to the hypothesized one (original AHRQ), we found evidence that common factors exist nevertheless combinations of certain dimensions are suggested as in previous investigations. Reliability analysis pointed out reasonable internal consistency of the dimensions like the one of the translate French version of the acute hospital and the original AHRQ. Moreover validity analysis showed low to moderate intercorrelations between the different dimensions. All correlations were positive ranging 0.08 to 0.56. Confirmatory factor analysis showed some evidence that the observed data had some fit to the hypothesized dimensional structure, even if there is still room for improvement.

To summarize, based on the results above, evidence is found that the French translated version of the questionnaire (HSPSC) is reliable and valid. Nevertheless, we can see room for

improvement on the original a priori hypothesis. We recommend a 9 factor model where dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'*, '*Feedback & communication about error'* and *'communication openness',* '*Overall Perceptions of Safety*' and '*staffing*' are combined could be adopted.

To contrast in view of the above, we can see that the factor structure for Dutch and French psychiatric hospitals despites some similarities with the original HSPSC and the acute hospitals are somehow different. For Dutch speaking hospitals, we will recommend a model with 10 dimensions where dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'* on one side and dimensions '*Feedback & communication about error'* and *'communication openness'* on another side are combined in line with findings by (Sarac *et al.* 2011) and (Bodur *et al.* 2010) respectively about the Scottish and the Turkish validation of the HSPSC. Whereas for French speaking hospitals, a model with 9 dimensions where dimensions '*Teamwork across hospital units'* and '*Hospital handoffs and transitions'*, '*Feedback & communication about error'* and *'communication openness',* '*Overall Perceptions of Safety*' and '*staffing*' are combined could be adopted in line with findings by (Waterson et al. 2010) reporting validation the English validation of the HSPSC.

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Appendices:

Appendix Table A1**:** Mean and standard deviation of the 12 safety culture dimensions - D

Dimensions	N	Mean	Median	Std error
D1: Supervisor/manager expectations	4	3.73	3.75	0.56
D2: Organizational learning	3	3.52	3.67	0.52
D3: Teamwork within units	4	3.72	3.75	0.57
D4: Communication Openness	3	3.61	3.67	0.65
D5: Feedback & Communication	3	3.46	3.67	0.74
D6: Non punitive response to error	3	3.32	3.33	0.70
D7: Staffing	4	3.19	3.25	0.64
D8: Management support for patient safety	3	3.31	3.33	0.64
D9: Team work across hospital units	4	3.36	3.50	0.55
D10 Hospital handoffs and transitions	4	3.14	3.00	0.61
D11: Overall Perceptions of Safety	4	3.44	3.50	0.57
D12: Frequency of event reported	3	3.32	3.33	0.88

Appendix Table A 2: The extracted 12 factors based on Principal factor analysis method - D

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.06	21.58	21.58	8.53	20.32	20.32	2.39	5.68	5.68
2	2.53	6.03	27.62	2.06	4.91	25.24	2.26	5.39	11.08
3	2.14	5.10	32.72	1.68	4.00	29.24	2.10	5.00	16.09
4	1.70	4.06	36.79	1.17	2.78	32.02	1.92	4.57	20.66
5	1.61	3.84	40.63	1.15	2.75	34.78	1.91	4.55	25.21
6	1.39	3.32	43.96	0.90	2.14	36.92	1.70	4.04	29.25
7	1.34	3.19	47.15	0.77	1.83	38.76	1.52	3.63	32.89
8	1.20	2.87	50.02	0.63	1.51	40.27	1.38	3.30	36.19
9	1.08	2.58	52.61	0.46	1.10	41.38	1.12	2.67	38.86
10	0.98	2.34	54.95	0.37	0.90	42.28	0.99	2.37	41.23
11	0.94	2.24	57.20	0.32	0.78	43.06	0.56	1.35	42.58
12	0.90	2.15	59.35	0.26	0.63	43.70	0.46	1.11	43.70

Appendix Table A3: Item variables with corresponding % of missingness, skewness and scales - D

Variables	*% of missingness*	*Skewness*	*Likert scale (% of responses in each scale)*				
			1	*2*	*3*	*4*	*5*
a1	0.4	-0.79	0.3	3.7	12.4	59.9	23.7
a2	0.4	-0.12	6.5	28.5	27.5	33	4.5
a3	0.5	-0.75	0.5	4.6	18.4	61.7	15
a4	0.7	-.077	0.6	4.4	16.5	58.2	20.3
a5	1.6	0.36	6.5	40.1	37.2	13.9	2.3
a6	0.8	-0.68	0.4	4.2	25.7	**61.4**	8.2
a7	0.9	0.36	7.5	38	31.5	18	4.9
a8	0.7	0.48	8.7	45.9	31.2	12.2	1.9
a9	0.7	-0.55	1.2	8.3	42.7	45.2	2.6
a10	0.8	0.45	13.2	42.8	28.8	12.7	2.5
a11	0.7	-0.22	5.9	27.1	27.1	36.3	3.6
a12	0.6	0.40	6.1	43.6	33.8	14.8	1.8
a13	1.1	-0.49	0.9	12.3	34.5	48	4.4
a14	0.6	0.37	3.5	39.9	29.8	22.6	4.2
a15	1.1	-0.51	1.6	15.7	27.3	48.5	6.8
a16	0.9	0.08	4.6	29.3	41.5	21.6	3
a17	0.7	0.66	6.5	51	27.1	13.2	2.1
a18	0.7	-0.47	1.4	11.2	42.6	42.2	2.6
b1	1.3	-0.64	0.7	4.5	28.3	57.6	8.8
b2	1.2	-0.73	0.7	4.8	22.2	60.3	12.1
b3	0.6	0.58	8.7	56.3	28.8	5.6	0.6
b4	1.4	0.65	13	58.1	24	4.1	0.7
c1	2	-0.18	4	19.7	36.8	32.6	6.9
c2	1.4	-0.63	0.5	5	19.3	50.7	24.5
c3	1.1	-0.35	2	13.5	32.1	41.7	10.7
c4	1.9	-0.27	2.9	16.5	37.3	36.6	6.7
c5	1	-0.59	0.8	6.4	24.8	53.3	14.7
c6	1.2	0.29	10.2	48.5	34.5	6.3	0.5
d1	3.9	-0.16	3.9	21.8	30.8	34	9.6
d2	4	-0.09	3.8	22	34	31.4	8.8
d3	**4.3**	-0.37	2.2	13.7	28.2	39.3	16.6
f1	0.9	-0.69	1.1	7.9	32.8	53.3	4.8
f2	1.4	0.06	1.1	22.4	43.5	28.8	4.1
f3	1.7	0.05	0.9	24.3	41	30	3.6
f4	1.3	-0.57	0.6	8.8	36.9	50.5	3.2
f5	1.6	0.33	2.9	39.2	34.3	21.1	2.4
f6	1.3	0.64	6.8	55	30.9	6.5	0.8
f7	1.5	0.19	1.5	32.2	41.9	22.6	1.7
f8	1.3	-0.27	2	13.1	48.4	33.4	3.2
f9	1.3	0.29	3.1	34.2	41.4	18.4	2.8
f10	1.3	-0.52	0.7	8.1	36.8	50.1	4.3
f11	1.8	0.43	5.6	42	39.9	10.6	2

1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree

Appendix Table A 4: Mean and standard deviation of the 12 safety culture dimensions - F

Dimensions	N	Mean	Median	Std error
D1: Supervisor/manager expectations	4	3.54	3.75	0.71
D2: Organizational learning	3	3.59	3.67	0.62
D3: Teamwork within units	4	3.68	4.00	0.77
D4: Communication Openness	3	3.47	3.67	0.82
D5: Feedback & Communication	3	3.32	3.33	0.80
D6: Non punitive response to error	3	3.05	3.42	0.81
D7: Staffing	4	3.41	3.75	0.68
D8: Management support for patient safety	3	3.20	3.67	0.78
D9: Team work across hospital units	4	3.17	3.25	0.58
D10 Hospital handoffs and transitions	4	2.97	3.00	0.71
D11: Overall Perceptions of Safety	4	3.06	3.25	0.68
D12: Frequency of event reported	3	3.12	3.17	0.86

Appendix Table A 5 : The extracted 12 factors based on Principal factor analysis method – F

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.63	22.94	22.94	9.13	21.73	21.73	2.65	6.32	6.32
2	2.36	5.62	28.56	1.92	4.57	26.31	2.52	6.00	12.33
3	2.14	5.11	33.68	1.71	4.07	30.39	2.26	5.39	17.73
4	1.96	4.67	38.35	1.48	3.52	33.91	2.03	4.83	22.56
5	1.69	4.03	42.38	1.16	2.77	36.69	1.90	4.53	27.10
6	1.56	3.71	46.09	1.07	2.55	39.24	1.87	4.45	31.55
7	1.26	3.00	49.09	0.73	1.75	41.00	1.64	3.91	35.47
8	1.17	2.79	51.88	0.63	1.50	42.50	1.39	3.32	38.79
9	1.09	2.61	54.50	0.53	1.26	43.77	1.08	2.59	41.38
10	1.04	2.49	56.99	0.45	1.08	44.86	0.99	2.35	43.73
11	0.98	2.35	59.34	0.40	0.96	45.82	0.68	1.63	45.37
12	0.94	2.24	61.58	0.32	0.79	46.58	0.51	1.215	46.58

Appendix Table A 6: Item variables with corresponding % of missingness, skewness and scales- F

Variables	*% of missingness*	*Skewness*	*Likert scale (% of responses in each scale)*				
			1	*2*	*3*	*4*	*5*
a1	0.8	-0.75	2.6	10.3	19	48.9	19.2
a2	0.7	0.15	11	34.1	22.5	25.8	6.5
a3	0.8	-0.89	1.6	8.8	15.5	**56.3**	17.8
a4	1.1	-0.57	2.5	10.9	25	45.1	16.5
a5	1.6	0.75	30	41.2	20.1	7	1.8
a6	1.0	-0.75	1.2	4.8	20.7	53.4	19.8
a7	**17.2**	0.31	31.4	25	35.7	6.1	1.8
a8	0.9	0.13	9.1	28.8	37.1	19.3	5.7
a9	0.8	-0.61	3.2	12	35.4	44.5	4.9
a10	1.2	-0.35	6.9	14.3	29.3	31.1	18.4
a11	0.9	-0.69	2.8	11.8	22.3	50	13.2
a12	0.7	0.16	11.5	31.2	28.8	21.8	6.7
a13	1.4	-0.62	1.4	7.5	32.6	51.4	7.1
a14	**0.4**	0.37	7.8	40.6	23.6	21.5	6.6
a15	0.9	-0.52	1.3	13.5	22.3	48.3	14.6
a16	1.1	-0.12	4.5	19	37.1	29.8	9.5
a17	1.0	-0.10	5.2	24.3	30.1	31.8	8.7
a18	0.6	-0.42	4.7	16.8	40.2	35.1	3.3
b1	0.8	-0.20	8.3	20.1	39.7	26.9	4.9
b2	0.9	-0.59	3.9	10.6	29.7	44.4	11.4
b3	0.7	0.61	21	47.8	24.5	5.3	1.3
b4	0.8	0.63	24.7	44.3	23.8	5.8	1.5
c1	1.8	-0.03	7.2	21.6	36.2	24.9	10.1
c2	2.2	-0.56	2.3	8.4	25.8	39.6	23.9
c3	1.2	-0.12	4.4	17.6	37.1	29.2	11.7
c4	2.0	-0.10	10.1	21.7	32.3	26.9	9
c5	1.6	-0.64	3	9	26.5	46.1	15.3
c6	1.3	0.33	20.2	37.5	30.2	10.7	1.5
d1	9.1	-0.22	5.6	16	40.1	29.8	8.5
d2	10	-0.59	7.8	22.4	41.3	23	5.5
d3	10.5	-0.20	5.2	15.8	40.7	29.7	8.5
f1	1.0	-0.40	2.9	15.3	38	39.1	4.6
f2	1.8	-0.10	1.3	17	39.2	35.2	7.2
f3	2.1	-0.04	4.5	28.7	27.2	32.8	6.8
f4	1.5	-0.38	2.6	16.9	41.7	36.5	2.4
f5	2.2	0.04	5.1	29.1	32.7	27.5	5.5
f6	1.7	0.43	7.3	44.8	38	8.4	1.6
f7	1.6	-0.15	1.9	19.5	38	35.1	5.5
f8	1.0	-0.22	3.6	16.4	41.5	32.2	6.3
f9	1.1	0.15	6.6	31.4	33.8	22.6	5.6
f10	3.9	-0.32	1.9	11	45.7	37.1	4.3
f11	4.4	0.20	7.4	32.2	36.5	19.3	4.7

1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree

Figure 1: Confirmatory factor model-Safety culture dimensions from the Hospital survey on Patient Safety Culture – Dutch speaking hospitals

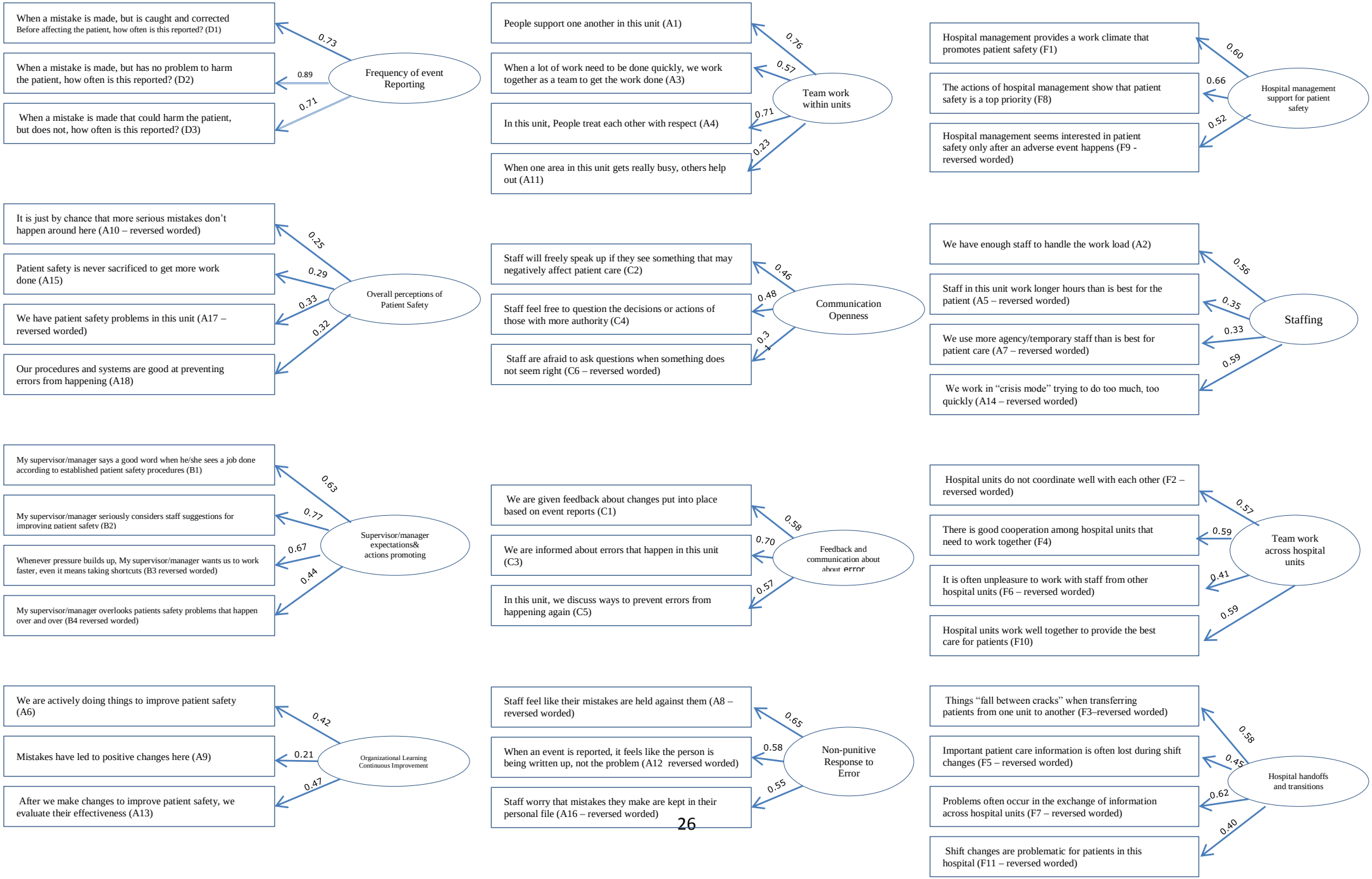
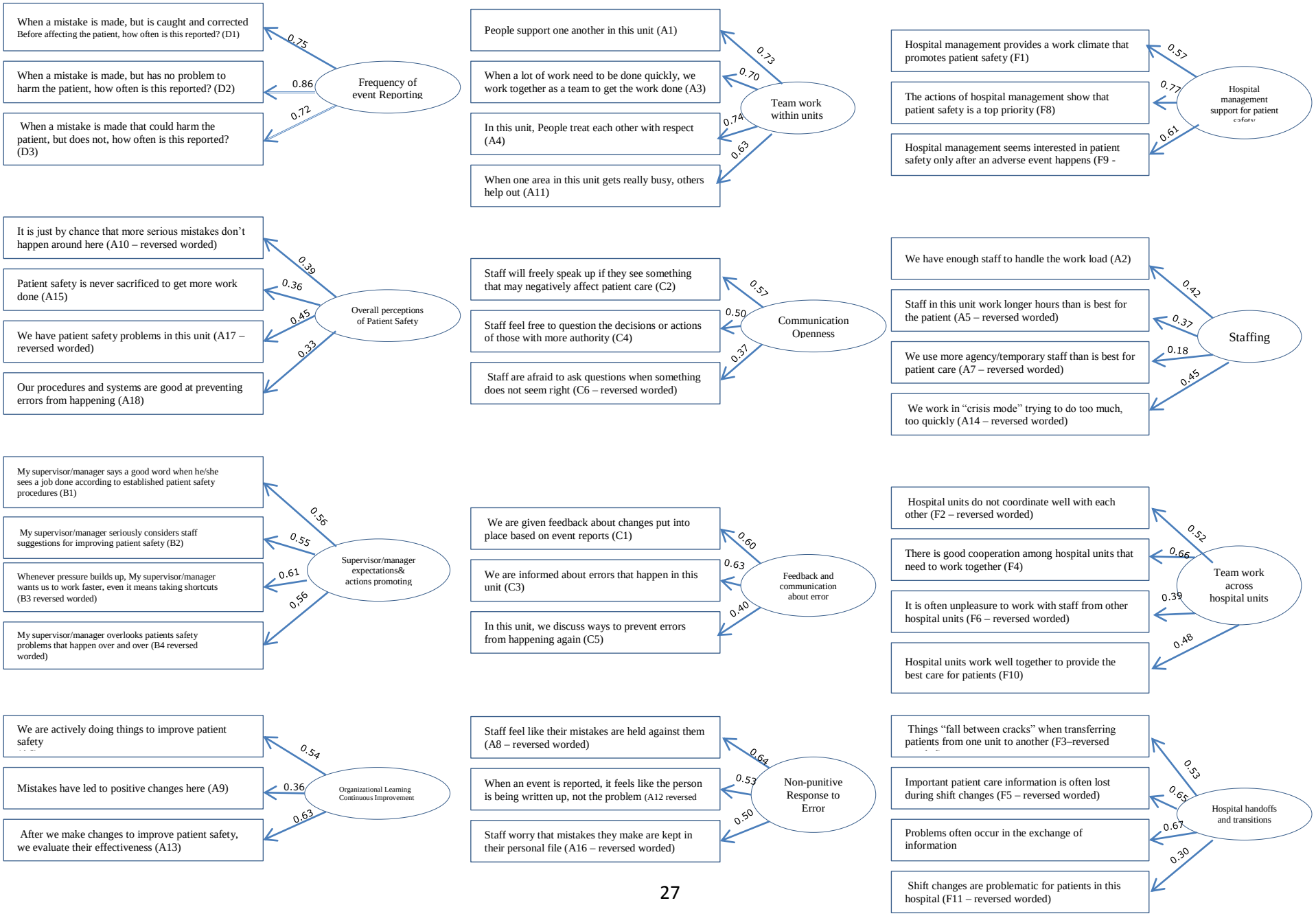


Figure 1: Confirmatory factor model-Safety culture dimensions from the Hospital survey on Patient Safety Culture-French speaking hospitals



Appendix Table A 7**:** Rotated factor matrix - ML extraction method - **D**

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12
Hospital Handoffs and Transitions (f7)	0.62973	0.03536	0.05331	0.03278	0.12863	0.02984	0.09575	0.08737	0.03455	0.29274	0.03512	0.20678
Team work across hospital units (f10)	0.59630	0.09233	0.07637	0.10817	0.04670	0.06444	0.18367	0.07161	0.15129	0.02685	0.02818	-0.18806
Team work across hospital units (f4)	0.59196	0.09507	0.03341	0.11059	0.05261	0.04695	0.07140	0.03114	0.15890	0.01223	0.02190	-0.21536
Hospital Handoffs and Transitions (f3)	0.58020	0.07485	0.06424	0.02087	0.09663	0.06449	0.07419	0.11101	0.06362	0.12349	0.01035	0.27821
Teamwork Across Hospital Units (f2)	0.57100	0.12710	0.07184	0.02062	0.09632	0.03130	0.18184	0.13697	0.06610	-0.01680	0.01738	0.05832
Teamwork Across Hospital Units (f6)	0.41120	0.05104	0.03678	0.10528	0.14524	0.07888	0.07353	0.06892	0.00353	0.21900	0.08362	-0.12354
Teamwork within units (a11)	*0.23019*	*0.10789*	*0.04204*	*0.16699*	*-0.00774*	*0.06737*	*0.08915*	*0.09016*	*0.04124*	*-0.11332*	*0.00607*	*0.00664*
Feedback and communication about error (c3)	0.11015	0.70073	0.18229	0.09889	0.07378	0.08961	0.10084	0.02095	0.09981	0.03431	0.04361	0.04436
Feedback and communication about error (c1)	0.13827	0.58368	0.17736	0.02418	0.05629	0.13679	0.14488	0.04864	0.16311	-0.03333	0.03599	0.10242
Feedback and communication about error (c5)	0.11982	0.57567	0.18320	0.22191	0.15624	0.17292	0.08665	0.04949	0.24430	0.10484	0.06972	-0.05222
Communication openness (c4)	0.11972	0.48241	0.07296	0.15430	0.26185	0.14501	0.16078	0.09712	0.01906	0.06024	0.03606	-0.07410
Communication openness (c2)	0.08984	0.46881	0.09219	0.25894	0.29205	0.18344	0.05314	0.09458	0.10737	0.10768	0.05650	-0.11694
Frequency of event Reporting (d2)	0.08221	0.12004	0.89807	0.04720	0.05988	0.05451	0.03822	-0.00046	0.06546	0.02238	0.00787	0.00316
Frequency of event Reporting (d1)	0.06739	0.16657	0.73464	0.03071	0.06183	0.04562	0.05985	-0.01619	0.10154	-0.02082	0.02566	0.02865
Frequency of event Reporting (d3)	0.09810	0.17292	0.71299	0.06970	0.04071	0.06384	0.03142	-0.00599	0.10816	0.07258	0.07430	-0.02931
Teamwork Within Units (a1)	0.08728	0.13695	0.03677	0.76018	0.13678	0.08544	0.04590	0.04260	0.08772	0.08584	0.01895	0.00284
Teamwork Within Units (a4)	0.10243	0.09375	0.02897	0.71314	0.19550	0.08730	0.04399	0.01357	0.08144	0.09460	0.02765	-0.02638
Teamwork Within Units (a3)	0.11867	0.15567	0.07292	0.57865	0.07577	0.10353	0.01555	0.11018	0.18117	0.02665	0.02814	0.02049
Non punitive response to error (a8)	0.09646	0.09681	0.05195	0.16827	0.65907	0.05534	0.09785	0.17294	0.09062	0.02531	0.04376	0.04707
Non punitive response to error (a12)	0.12481	0.15069	0.06034	0.12102	0.58952	0.10859	0.08968	0.12836	0.11577	0.07430	0.05644	-0.04934
Non punitive response to error (a16)	0.09227	0.09787	0.02566	0.04734	0.55912	0.02918	0.09674	0.13820	-0.02434	0.04210	0.04842	0.03663
Communication openness (c6)	0.11703	0.25359	0.09234	0.19346	0.31446	0.08832	0.02928	0.11758	0.07852	0.12658	0.11334	-0.06517
Supervisor/manager expectations (b2)	0.08511	0.22004	0.06734	0.14559	0.13458	0.77149	0.08956	0.06538	0.14337	0.03120	0.12479	-0.04963

Supervisor/manager expectations (b1)	0.12328	0.24010	0.08882	0.13951	0.06330	0.63586	0.09799	0.01872	0.16090	0.00983	0.11442	0.05261
Supervisor/manager expectations (b4)	0.10209	0.16489	0.09215	0.12598	0.17284	0.44126	0.10710	0.12309	0.16060	0.10217	0.40993	0.00750
Hospital management support (f8)	0.18361	0.13748	0.06577	0.02624	0.05714	0.06728	0.66104	0.04934	0.19744	-0.01707	0.04397	0.01864
Hospital management support (f1)	0.22525	0.15656	0.03567	0.08340	0.13209	0.11968	0.60578	0.20540	0.16037	0.07977	0.00811	-0.04754
Hospital management support (f9)	0.23563	0.11862	0.03795	0.01947	0.22422	0.04614	0.52167	0.09496	0.06090	0.12146	0.05885	0.01220
Staffing (a14)	0.10935	0.03685	0.02669	0.03747	0.13690	0.01389	0.01687	0.59850	0.08717	0.04529	0.10422	0.02846
Staffing (a2)	0.12628	0.06236	-0.01095	0.12289	-0.00656	0.02287	0.16779	0.56167	-0.01015	-0.07300	-0.02141	0.03254
Staffing (a5r	*0.05004*	*-0.00187*	*-0.03049*	*-0.04109*	*0.10365*	*0.01229*	*0.00172*	*0.35768*	*-0.00137*	*0.06420*	*0.05044*	*-0.04888*
Overall Perceptions of Safety (a17)	*0.07920*	*0.04216*	*0.03294*	*0.09985*	*0.21502*	*0.05750*	*0.18352*	*0.33604*	*0.25002*	*0.22604*	*0.05165*	*0.01846*
Staffing (a7)	*0.04676*	*0.06955*	*-0.00688*	*0.05524*	*0.20890*	*0.04673*	*0.04555*	*0.33072*	*0.03775*	*0.14350*	*0.02391*	*0.03468*
Organizational learning-improvement (a13)	0.14236	0.23158	0.14942	0.09886	0.04489	0.13288	0.06742	0.02222	0.47115	0.01005	0.03597	0.05373
Organizational learning-improvement (a6)	0.11815	0.12323	0.08952	0.15033	0.04900	0.11907	0.18366	-0.02215	0.42855	0.01197	0.02349	-0.03152
Overall Perceptions of Safety (a18)	*0.19015*	*0.14990*	*0.07954*	*0.08373*	*0.13187*	*0.12905*	*0.25465*	*0.16821*	*0.32460*	*0.13210*	*-0.03954*	*0.02195*
Overall Perceptions of Safety (a15)	*0.06626*	*0.05302*	*0.08203*	*0.09350*	*0.04315*	*0.04611*	*0.09990*	*0.17530*	*0.29588*	*0.06555*	*0.15721*	*0.00170*
Organizational learning-improvement (a9)	*0.09388*	*0.16871*	*0.02722*	*0.13776*	*0.16233*	*0.15397*	*0.10110*	*0.00697*	*0.21383*	*0.01307*	*0.00531*	*-0.11572*
Hospital Handoffs and Transitions (f5)	0.40078	0.10905	0.07748	0.10198	0.07346	0.03697	0.02718	0.10369	0.09444	0.45008	0.05657	0.21748
Hospital Handoffs and Transitions (f11)	0.23391	0.05722	0.01290	0.10039	0.10056	0.01716	0.08596	0.13750	0.02435	0.40969	0.05736	-0.04831
Overall Perceptions of Safety (a10)	*0.04766*	*0.04559*	*0.04348*	*0.10040*	*0.25341*	*0.05988*	*0.06618*	*0.19336*	*0.18848*	*0.25853*	*0.06760*	*-0.06301*
Supervisor/manager expectations (b3)	0.07401	0.08975	0.06995	0.02174	0.13226	0.20895	0.03920	0.17248	0.07685	0.07150	0.67495	-0.00170

Appendix Table A 8: Rotated factor matrix - Principal component extraction method **-D**

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12
Hospital Handoffs and Transitions (f7)	0.66167	0.03851	0.05426	0.04075	0.05767	0.12424	0.08933	0.09942	0.02765	0.17090	-0.09866	-0.00796
Hospital Handoffs and Transitions (f3)	0.59641	0.08350	0.06593	0.02500	0.06595	0.09093	0.07778	0.10637	0.04973	0.02362	-0.21078	0.00547
Teamwork Across Hospital Units (f2)	0.55907	0.12564	0.07481	0.02420	0.03871	0.08872	0.19263	0.13180	0.05611	-0.08977	-0.03001	0.01325
Team work across hospital units (f10)	0.55595	0.09462	0.07585	0.11925	0.07834	0.04193	0.19890	0.06757	0.14168	-0.04693	0.15876	0.06446
Team work across hospital units (f4)	0.53546	0.09722	0.03856	0.12124	0.06390	0.04625	0.09616	0.03627	0.14990	-0.05228	0.19285	0.03290
Hospital Handoffs and Transitions (f5)	0.47421	0.10716	0.07978	0.11306	0.08245	0.07876	0.01894	0.12218	0.06564	0.32436	-0.13146	-0.00338
Teamwork Across Hospital Units (f6)	0.42301	0.04203	0.03796	0.10946	0.11996	0.14414	0.06870	0.08955	0.00795	0.15269	0.19141	-0.01100
Teamwork within units (a11)	0.21052	0.10577	0.04389	0.17963	0.06193	-0.01941	0.09654	0.08623	0.03983	-0.15250	0.05542	-0.08139
Feedback and communication about error (c3)	0.11600	0.64135	0.19999	0.10426	0.12673	0.07697	0.10598	0.03218	0.08852	0.03854	-0.00962	-0.02451
Feedback and communication about error (c5)	0.13073	0.56330	0.19105	0.23747	0.21085	0.15248	0.09856	0.04557	0.20814	0.06430	0.02252	0.08800
Feedback and communication about error (c1)	0.13573	0.55913	0.19231	0.02800	0.15860	0.04721	0.15132	0.05676	0.13921	-0.01393	-0.04956	-0.07270
Communication openness (c4	0.12275	0.47628	0.07161	0.16634	0.15409	0.26360	0.16343	0.08951	0.01739	-0.00178	0.05751	0.02900
Communication openness (c2)	0.09474	0.47211	0.08971	0.27261	0.20117	0.29422	0.05767	0.08040	0.09350	0.03945	0.06404	0.12105
Frequency of event Reporting (d2)	0.08986	0.13439	0.81771	0.05081	0.06355	0.05760	0.03995	-0.00721	0.06292	0.00603	-0.00585	0.00413
Frequency of event Reporting (d1)	0.06651	0.15989	0.73524	0.03355	0.06598	0.05934	0.06358	-0.01465	0.07641	-0.02581	-0.02142	0.00399
Frequency of event Reporting (d3)	0.10580	0.16227	0.71566	0.07183	0.10620	0.04117	0.02989	0.00424	0.08444	0.05512	0.03650	0.02592
Teamwork Within Units (a1)	0.09861	0.13910	0.03784	0.69951	0.10002	0.14351	0.04246	0.04617	0.08242	0.06186	0.00780	0.00656
Teamwork Within Units (a4)	0.11058	0.09572	0.03091	0.67532	0.10101	0.19411	0.04248	0.02073	0.07382	0.06683	0.02147	0.03403
Teamwork Within Units (a3)	0.11853	0.15260	0.07993	0.58367	0.11424	0.06893	0.02869	0.10904	0.14804	0.00543	-0.01654	0.00024
Supervisor/manager expectations (b2)	0.08350	0.24333	0.05815	0.17216	0.65619	0.12525	0.10171	0.04091	0.15598	-0.02560	0.02257	-0.08510
Supervisor/manager expectations (b4)	0.11561	0.14382	0.10329	0.11943	0.60581	0.16017	0.10857	0.14045	0.10306	0.08335	0.00280	0.09748
Supervisor/manager expectations (b1)	0.12300	0.25022	0.08040	0.15500	0.60422	0.05493	0.10166	-0.00067	0.15462	-0.03537	-0.03056	-0.13526
Supervisor/manager expectations (b3)	0.08784	0.06615	0.08158	0.00857	0.45794	0.12998	0.03345	0.20676	0.02604	0.08838	0.03498	0.18115

Non punitive response to error (a8)	0.10770	0.10603	0.05544	0.17472	0.09354	0.59346	0.10212	0.19222	0.06672	0.01926	-0.03184	0.02230
Non punitive response to error (a12)	0.13169	0.14939	0.06345	0.13286	0.14129	0.56336	0.09216	0.14620	0.11329	0.04725	0.06944	-0.03033
Non punitive response to error (a16)	0.10316	0.09291	0.02585	0.05161	0.06674	0.53100	0.09342	0.15073	-0.02224	0.02834	-0.01506	-0.00723
Communication openness (c6r)	0.13589	0.25345	0.08903	0.20492	0.15383	0.31720	0.03430	0.10623	0.03491	0.05851	0.00945	0.21055
Overall Perceptions of Safety (a10)	0.08416	0.04035	0.04728	0.11078	0.10456	0.25439	0.07077	0.20792	0.17016	0.22301	0.02187	0.06866
Hospital management support (f8)	0.18765	0.14532	0.07275	0.02466	0.09465	0.05707	0.60049	0.06301	0.16668	-0.02352	-0.00830	0.03128
Hospital management support (f1)	0.23584	0.16257	0.03517	0.09091	0.12041	0.13652	0.57654	0.19432	0.15243	0.02775	0.02855	-0.00839
Hospital management support (f9)	0.25623	0.11897	0.03791	0.01943	0.08142	0.22217	0.50091	0.10294	0.04635	0.09344	0.02360	0.00744
Staffing (a14)	0.12007	0.03561	0.02622	0.04207	0.08157	0.13337	0.04064	0.54963	0.05097	0.01244	-0.03566	0.07728
Staffing (a2)	0.12044	0.06394	-0.02133	0.12367	0.01652	0.00633	0.16780	0.48785	-0.00110	-0.08874	-0.00783	-0.04470
Staffing a5r	0.05591	-0.00377	-0.02566	-0.04297	0.03963	0.09923	-0.00551	*0.37348*	-0.00351	0.03946	0.06198	0.00508
Staffing a7r	0.07083	0.07010	-0.00303	0.06015	0.06129	0.20212	0.04294	*0.34553*	0.02418	0.14159	-0.03278	-0.04509
Overall Perceptions of Safety (a17)	0.11724	0.03832	0.03502	0.11289	0.10358	0.21153	0.19699	0.33660	0.21847	0.17752	-0.08770	0.09732
Organizational learning-improvement (a6)	0.11617	0.12924	0.09900	0.16383	0.13256	0.04222	0.19537	-0.01810	0.39942	0.00905	0.05101	-0.02224
Organizational learning-improvement (a13)	0.14773	0.24049	0.16181	0.11383	0.16277	0.02734	0.09065	0.03361	0.39546	-0.00191	-0.03950	0.04866
Overall Perceptions of Safety (a18)	0.20890	0.15657	0.08174	0.10060	0.11216	0.13350	0.26437	0.16407	0.31701	0.08281	-0.05700	-0.04153
Overall Perceptions of Safety (a15)	0.07817	0.04968	0.08610	0.09624	0.13860	0.03023	0.11142	0.18819	0.24574	0.04561	-0.03321	0.18785
Organizational learning-improvement (a9)	0.07992	0.17015	0.03053	0.14586	0.14235	0.16519	0.10220	0.01340	0.24419	-0.00992	0.15551	-0.10586
Hospital Handoffs and Transitions (f11r)	0.29170	0.05056	0.00871	0.11288	0.05649	0.11035	0.07626	0.15198	0.01607	0.34035	0.05363	0.00396

Appendix Table A 9: Rotated factor matrix - ML extraction method – F

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12
Hospital Handoffs and Transitions (f7)	0.67967	0.03856	0.09270	0.04815	0.06948	0.06686	0.00566	0.12480	0.04102	0.11372	0.18901	-0.01436
Team work across hospital units (f4)	0.66522	0.14741	0.07654	0.04927	0.06219	0.13520	0.11138	0.03201	0.07293	-0.04324	-0.01282	0.02949
Hospital Handoffs and Transitions (f3)	0.53933	0.02831	0.11343	0.01284	0.00493	0.05152	0.05435	0.04938	-0.00729	0.04585	0.25779	0.08254
Teamwork Across Hospital Units (f2)	0.52335	-0.00631	0.04084	0.05478	0.12695	0.14078	0.03186	0.16605	-0.00090	0.04277	-0.02134	-0.00877
Team work across hospital units (f10)	0.48565	0.13652	0.07419	0.04684	0.04449	0.26247	0.18061	0.05292	0.07289	0.02052	-0.00671	-0.00502
Teamwork Across Hospital Units (f6)	0.39698	0.12208	0.06225	0.06300	0.13672	0.03405	0.03112	0.08991	0.12021	0.08332	0.00959	-0.06061
Teamwork Within Units (a4)	0.10601	0.74547	0.05072	0.07400	0.13828	0.04520	0.13328	0.06686	0.02455	0.03959	0.03182	-0.23624
Teamwork Within Units (a1)	0.09898	0.73883	0.12331	0.06196	0.16874	0.08104	0.10717	0.03549	0.02072	0.08627	0.02049	-0.12331
Teamwork Within Units (a3)	0.12015	0.70764	0.11530	0.04673	0.07874	0.04902	0.12027	0.09860	0.09633	0.02934	0.10261	0.20214
Teamwork within units (a11)	0.13638	0.63558	0.10104	0.03023	0.11436	0.01518	0.22526	0.14965	0.07216	0.08199	0.01679	0.33646
Feedback and communication about error (c3)	0.13527	0.07133	0.62851	0.13941	0.06135	0.09838	0.14985	0.15366	0.04587	0.11200	0.07521	0.01399
Feedback and communication about error (c1)	0.13384	0.05449	0.60050	0.18943	-0.01527	0.10280	0.19019	0.20496	-0.03262	0.12979	0.07645	-0.01026
Communication openness (c2)	0.09852	0.16043	0.57183	0.07019	0.33364	0.08719	0.13893	0.02843	0.30991	0.05287	0.05832	0.01049
Communication openness (c4)	0.14941	0.15466	0.50423	0.08039	0.39227	0.14286	0.08507	0.05383	0.15452	0.10299	-0.03772	0.00556
Feedback and communication about error (c5)	0.12116	0.22016	0.40366	0.13286	0.15148	0.10201	0.35350	-0.00079	0.16464	0.11559	0.03811	0.01139
Frequency of event Reporting (d2)	0.06684	0.04659	0.08906	0.86175	0.03879	0.00570	0.03294	0.03045	-0.05119	0.05445	0.01694	0.04607
Frequency of event Reporting (d1)	0.07807	0.05648	0.10617	0.75804	0.01827	0.03834	0.14775	0.03446	0.06197	0.03554	0.00222	0.01285
Frequency of event Reporting (d3)	0.06822	0.06097	0.12770	0.72716	0.03923	0.06460	0.09731	0.03836	0.07231	0.01149	0.06544	-0.05655
Non punitive response to error (a8)	0.12614	0.14678	0.07208	0.01771	0.64346	0.10330	0.10187	0.22850	0.06580	0.09226	0.04667	-0.00483
Non punitive response to error (a12)	0.15109	0.12906	0.11978	0.02214	0.53793	0.10775	0.18200	0.23674	0.07781	0.08191	0.05394	-0.02002
Non punitive response to error (a16)	0.05195	0.08047	0.05280	0.01847	0.50892	0.07666	0.00027	0.18363	0.08474	-0.01182	-0.00202	0.02568
Communication openness (c6)	0.17332	0.16415	0.21118	0.05502	0.37636	0.08212	0.11758	0.05627	0.23451	0.04818	0.09541	-0.01282
Hospital management support (f8)	0.18824	0.04245	0.10665	0.05204	0.07670	0.77321	0.21291	0.06565	0.02629	0.06187	-0.00302	0.08536

Hospital management support (f9)	0.22467	0.03804	0.08818	0.03363	0.17619	0.61250	0.11193	0.21912	0.10629	0.07988	0.10681	-0.04121
Hospital management support (f1)	0.23457	0.07741	0.15669	0.05165	0.15522	0.57177	0.13700	0.24528	0.10918	0.03299	-0.00048	-0.04126
Organizational learning-improvement (a13)	0.06057	0.06798	0.14150	0.11897	0.08930	0.03971	0.63338	0.11474	0.04807	0.10960	0.06024	0.01961
Organizational learning-improvement (a6)	0.06530	0.20942	0.13294	0.10111	0.02388	0.18947	0.54168	0.07775	0.08273	0.02157	0.00187	-0.03278
Overall Perceptions of Safety (a15)	0.09189	0.11371	0.04183	0.11076	0.07956	0.17086	*0.36561*	0.20220	0.15500	-0.01261	0.13209	0.01801
Organizational learning-improvement (a9)	0.09524	0.11676	0.13424	0.02098	0.11234	0.12457	*0.36347*	0.02876	0.03753	0.13955	-0.03303	0.02564
Overall Perceptions of Safety (a17)	0.07255	0.03748	0.00032	0.03545	0.13512	0.17672	0.09169	0.45937	0.04632	0.11637	0.07528	-0.03807
Staffing (a14)	0.11982	0.00175	0.07483	0.04907	0.20927	0.01529	0.11827	0.45173	0.19274	0.00002	0.07527	0.15997
Staffing (a2)	0.13208	0.10630	0.17117	-0.02461	0.03221	0.15332	-0.02654	0.42276	0.07453	0.00927	-0.02575	0.10219
Overall Perceptions of Safety (a10)	0.09908	0.03352	0.03347	0.06269	0.22898	0.08584	0.09955	0.39599	0.02927	0.07453	0.09520	-0.02675
Staffing (a5)	0.06896	0.07276	0.05688	0.01148	0.13930	0.01390	0.06639	*0.37143*	0.17746	-0.08139	-0.02468	-0.08984
Overall Perceptions of Safety (a18)	0.15621	0.13976	0.20858	0.03151	0.07840	0.32000	0.27199	*0.33405*	0.00532	0.00825	0.03796	-0.13436
Supervisor/manager expectations (b3)	0.10079	0.03839	0.05051	0.03828	0.16872	0.06784	0.09837	0.21936	0.61061	0.12050	0.04875	0.05088
Supervisor/manager expectations (b4)	0.11362	0.10470	0.15855	0.04341	0.10367	0.20344	0.22387	0.19178	0.56442	0.27718	0.08299	-0.06457
Staffing (a7)	*0.03749*	*0.02631*	*0.08156*	*0.00847*	*0.07570*	*-0.00400*	*0.00718*	*0.15013*	*0.18633*	*-0.10842*	*-0.00234*	*0.00160*
Supervisor/manager expectations (b1)	0.16858	0.15031	0.28103	0.10537	0.12305	0.06507	0.18767	0.04443	0.05944	0.56990	0.03012	0.00301
Supervisor/manager expectations (b2)	0.13805	0.14592	0.31297	0.05705	0.12434	0.14884	0.24995	0.06217	0.29726	0.55977	-0.00864	0.02149
Hospital Handoffs and Transitions (f5)	0.38560	0.14228	0.09987	0.09150	0.04823	0.07002	0.09169	0.11342	0.04913	0.04053	0.65446	-0.01757
Hospital Handoffs and Transitions (f11)	*0.29116*	*0.04891*	*0.09025*	*0.03389*	*0.20818*	*0.01799*	*0.03229*	*0.10147*	*0.14143*	*-0.03592*	*0.30697*	*0.02201*

Appendix Table A 10 : Rotated factor matrix - Principal component method – F

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12
Hospital Handoffs and Transitions (f7)	0.68901	0.05012	0.11201	0.04785	0.07438	0.07529	0.00411	0.09651	0.02727	0.11521	0.05474	0.00968
Team work across hospital units (f4)	0.61315	0.15559	0.06345	0.05026	0.17127	0.06048	0.10846	0.01046	0.10753	-0.04748	-0.05511	-0.03149
Hospital Handoffs and Transitions (f3)	0.57243	0.04209	0.12450	0.00805	0.05117	-0.00241	0.06350	0.00910	0.00549	0.03789	0.16247	0.07453
Teamwork Across Hospital Units (f2)	0.50390	0.00133	0.05136	0.05449	0.17555	0.14008	0.02544	0.02005	0.05613	0.09696	-0.08577	0.04380
Hospital Handoffs and Transitions (f5)	0.47503	0.15417	0.11823	0.09479	0.05172	0.05051	0.08443	0.06115	0.03120	0.14909	0.35813	0.02800
Team work across hospital units (f10)	0.45853	0.14512	0.06993	0.04990	0.29646	0.04541	0.17104	0.06008	0.05608	-0.00119	-0.05019	-0.03243
Teamwork Across Hospital Units (f6)	0.39317	0.12652	0.06489	0.07327	0.03798	0.14124	0.02396	0.13332	0.10520	0.03771	-0.06737	-0.05645
Hospital Handoffs and Transitions (f11)	0.34329	0.05970	0.08052	0.04084	0.01637	0.20050	0.02041	0.06257	0.14870	0.03934	0.29322	-0.00811
Teamwork Within Units (a1)	0.09980	0.72410	0.13835	0.06206	0.07213	0.14918	0.09145	0.05555	0.01780	0.04459	-0.01669	-0.07809
Teamwork Within Units (a4)	0.10555	0.70576	0.06358	0.07697	0.05566	0.13420	0.10996	0.03515	0.01964	0.08315	-0.01244	-0.12086
Teamwork Within Units (a3)	0.13398	0.70184	0.11160	0.04592	0.05738	0.07949	0.11205	0.07195	0.09889	0.01615	0.09548	0.08797
Teamwork within units (a11)	0.13540	0.62534	0.11475	0.03269	0.03565	0.12067	0.20961	0.09205	0.11078	0.02627	0.02057	0.17862
Feedback and communication about error (c3)	0.14929	0.08064	0.61894	0.14837	0.11211	0.07417	0.13329	0.06806	0.08354	0.07541	0.05100	0.04309
Feedback and communication about error (c1)	0.15370	0.06555	0.59034	0.19516	0.12013	0.01545	0.17517	0.02566	0.06832	0.11425	0.02235	0.10640
Communication openness (c2)	0.10272	0.17335	0.54016	0.07104	0.10176	0.29212	0.12131	0.21046	0.21672	-0.05219	0.09552	-0.12000
Communication openness (c4)	0.13200	0.16937	0.50647	0.07557	0.14956	0.35108	0.07539	0.13652	0.13958	0.00426	-0.02633	-0.10745
Feedback and communication about error (c5)	0.11944	0.23435	0.41530	0.14133	0.10291	0.12933	0.33364	0.17194	0.08064	-0.03688	0.05200	-0.04166
Supervisor/manager expectations (b1)	0.18689	0.17404	0.37389	0.10341	0.04434	0.11738	0.17899	0.37058	-0.12316	0.10579	-0.09431	0.09503
Frequency of event Reporting (d2)	0.07069	0.05452	0.10983	0.79804	0.00604	0.02865	0.03949	-0.00841	-0.02300	0.04133	0.00216	0.03621
Frequency of event Reporting (d1)	0.07596	0.06247	0.11146	0.74810	0.04416	0.02115	0.13270	0.06149	0.04799	0.00910	0.00031	-0.00229
Frequency of event Reporting (d3)	0.07983	0.06410	0.13150	0.71735	0.06356	0.03847	0.08828	0.04760	0.04497	0.03332	0.04161	-0.03447
Hospital management support (f8)	0.18364	0.05392	0.12558	0.05274	0.68001	0.08462	0.20951	0.08319	-0.00761	0.06164	0.00795	0.02781
Hospital management support (f9)	0.24126	0.04195	0.10220	0.03955	0.60456	0.20198	0.10104	0.13962	0.06901	0.15440	0.07317	0.02870

Hospital management support (f1)	0.22317	0.08369	0.15963	0.05123	0.59784	0.15987	0.12654	0.08892	0.15873	0.14059	-0.01604	-0.00534
Overall Perceptions of Safety (a18)	0.15544	0.15252	0.22196	0.02816	0.34725	0.07177	0.25553	-0.02360	0.14221	0.33817	-0.00725	-0.08977
Non punitive response to error (a8)	0.13732	0.17002	0.11304	0.01416	0.11613	0.60338	0.09251	0.09113	0.13103	0.14452	-0.00320	0.00591
Non punitive response to error (a12)	0.16477	0.14380	0.14686	0.02548	0.11573	0.54493	0.17228	0.09398	0.12406	0.13986	0.01977	0.04930
Non punitive response to error (a16)	0.05029	0.08988	0.05766	0.01920	0.08935	0.51141	0.00119	0.03973	0.14111	0.07329	0.01208	0.01895
Communication openness (c6)	0.18078	0.17726	0.21726	0.05237	0.08321	0.35329	0.10098	0.17790	0.15479	0.00928	0.12560	-0.11786
Organizational learning-improvement (a13)	0.07120	0.10177	0.18281	0.12745	0.06606	0.09168	0.54587	0.11601	0.03588	0.10123	0.02927	0.03788
Organizational learning-improvement (a6)	0.05867	0.21968	0.14084	0.10420	0.19622	0.02000	0.51672	0.07217	0.07235	0.06048	0.02873	-0.05210
Organizational learning-improvement (a9)	0.08532	0.13178	0.16325	0.02812	0.13762	0.12294	0.36519	0.10906	-0.01184	-0.01924	-0.09858	0.06313
Overall Perceptions of Safety (a15)	0.10813	0.12815	0.04549	0.10496	0.17096	0.07060	0.35965	0.09781	0.17215	0.17945	0.16803	-0.04168
Supervisor/manager expectations (b4)	0.12678	0.11354	0.19103	0.04419	0.21375	0.12613	0.20717	0.54717	0.22767	0.11069	0.08304	-0.05680
Supervisor/manager expectations (b2)	0.14237	0.16896	0.39184	0.05703	0.13047	0.12222	0.23621	0.52547	-0.01315	0.10025	-0.06875	0.03647
Supervisor/manager expectations (b3)	0.10163	0.04447	0.05816	0.03866	0.08734	0.18796	0.10022	0.47598	0.35584	0.03577	0.09130	0.02604
Staffing (a14)	0.13278	0.01765	0.07519	0.04731	0.05310	0.22874	0.12399	0.10177	0.40000	0.19640	0.08785	0.24427
Staffing (a5r	0.06557	0.07361	0.03564	0.01676	0.05400	0.13606	0.05910	0.04021	0.39778	0.19394	-0.03397	-0.04010
Staffing (a2)	0.12848	0.11322	0.16639	-0.02939	0.19722	0.04557	-0.01703	0.01392	0.32656	0.19478	-0.05252	0.21202
Staffing (a7)	0.03441	0.02249	0.04537	0.01391	0.01169	0.07678	0.01226	0.03807	0.29562	-0.00626	0.02762	-0.02200
Overall Perceptions of Safety (a17)	0.09262	0.04887	0.03528	0.03206	0.17929	0.15800	0.07626	0.09638	0.14061	0.48114	0.01812	0.01344
Overall Perceptions of Safety (a10)	0.12525	0.04276	0.05468	0.06477	0.09077	0.25713	0.08612	0.05643	0.14908	0.36185	0.06510	0.05387

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Richting: **Master of Statistics-Biostatistics**
Jaar: **2012**

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Voor akkoord,

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Datum: **14/09/2012**