



# MSI Patient Safety Culture Survey

## Technical Report of 2010 Survey Revisions

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August 2012

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## MSI Patient Safety Culture Survey Technical Report of 2010 Survey Revisions

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**Technical Report Purpose** ► This technical report describes validation work on the MSI 2010 Patient Safety Culture Survey. The analyses were carried out using data gathered from health settings across Canada by Accreditation Canada using the MSI 2010 Patient Safety Culture Survey. These analyses also considered the validity of the MSI across five different care settings: acute care medicine, long term care, homecare, community care, ambulatory care.

**Background** ► The MSI Patient Safety Culture Survey is designed to capture staff perceptions of patient safety culture in their healthcare organization. The first version of the MSI was developed as a Canadian adaptation of work by Singer and colleagues (Singer et al., 2003) at Stanford (MSI refers to the Modified Stanford Instrument). Since its initial development and use in 2002 to evaluate a patient safety educational intervention (Ginsburg, Norton, Casebeer, & Lewis, 2005), the MSI has undergone small scale revisions in 2006 and 2007. Accreditation Canada began using the MSI-2007 as part of its accreditation process in January 2008.

**2010 Revisions to the MSI** ► Analysis conducted of MSI-2006 and MSI-2007 data collected by members of the research team indicated that certain dimensions of the MSI had stronger statistical properties than others (Ginsburg et al., 2009). In addition, interpretation questions regarding some of survey items emerged fairly consistently between 2006 and 2009. Accordingly, during 2009-2010 researchers revised the MSI to produce the MSI-2010. The MSI-2010 was designed to focus on a small number of key dimensions of patient safety culture.

A key addition to the MSI-2010 reflected the area of **Talking about errors**. As early as 1980, Zohar identified “communication” as vital to safety culture. The ability to feel comfortable to talk about patient safety issues and errors is a fundamental aspect of safety culture. This area relates to aspects of a just culture, and staff perceptions of the value of reporting errors, but also to personal feelings of shame, as well as the degree of manager and co-worker support following errors. The revision process was guided by a review of the literature related to: repercussions of error, just culture, barriers to communication and talking about error and other related issues. In addition to the general themes of fear of repercussions and fear of blame our review of the literature and existing instruments that measure patient safety culture, several more specific recurring themes were identified including:

- Safer/better not to speak up
- Why talk about errors? Nothing gets done
- Worry about job/promotion loss
- Concern over damage to professional reputation
- Fear of social exclusion
- Shame/personal failure/not wanting to admit mistakes
- Fear of litigation (physicians only)

For each of these themes, three to four items were selected or modified from existing survey items and literature, or were newly created. A final group of 26 items underwent cognitive testing in a series of six group interviews with RNs and RPNs, allied health professionals and one healthcare aide in three organizations (one teaching hospital, one community hospital, one rehab/complex continuing care hospital). Based on clarity and importance ratings (Hyrkas et al., 2003) and variability of each item, as well as item feedback from interviewees and assessment by the researchers, 17 new items tested in the focus groups were retained for the MSI-2010.

In addition to new items reflecting the area of **Talking about errors**, the MSI-2010 continued to measure three dimensions of patient safety culture measured on earlier versions of the instrument: **Senior leadership support for safety**, **Supervisory leadership support for safety**, and **Patient safety learning culture**. Leadership support for safety at the organizational and supervisory level were among the most psychometrically sound dimensions of Patient Safety Culture (PSC) on the MSI-2007 and these two dimensions are also the most salient dimensions of PSC in the literature (Colla, Bracken, Kinney, & Weeks, 2005).

More details on the process used to create the MSI 2010 can be found at:

<http://www.yorku.ca/patientsafety/psculture/questionnaire/FINAL%20Report-Creating%20the%20MSI-2010.pdf>. The remainder of this technical report describes validation work done on the MSI 2010 Patient Safety Culture Survey.

## **METHODS**

**Sample** ► Accreditation Canada provided 16,410 cases of data collected from staff and managers in a variety of healthcare settings from across Canada between April and October 2011. All analyses described here are limited to the 13,126 cases where the job category is “Direct care to clients” (e.g. physicians, nurses, therapists, health care aides). A second sample of 7,889 cases collected in November – December 2011 was provided by Accreditation Canada for purposes of cross-validation (described below).

**Analysis** ► While the MSI 2010 included 17 new items designed to measure aspects of communication and talking about errors, the validation work described here involved all 38 items on the MSI 2010. The construct of Patient safety culture has been described as having the “Definitional precision of a cloud” (Reason, 1997). Given this definitional imprecision as well as the large scale nature of the changes to the MSI 2010 from the 2007 version (17/38 items were new in the 2010 version), we felt it was necessary to first carry out exploratory factor analysis (EFA). EFA was performed on a random sample of 3000 cases from the subset of 13,126 cases of direct care providers.

Based on the results of the EFA and consideration of dimensions of PSC that make theoretical sense, a seven-factor, 33-item measurement model was specified for testing using confirmatory factor analysis. Confirmatory factor analysis (CFA) represents a measurement model which depicts the links between latent variables (in this case the six PSC dimensions) and their

observed measures—the 38 items used to measure these six dimensions (Byrne, 2001). We used AMOS Version 7 (SPSS, Inc., Chicago, IL, USA) and performed a series of six CFAs. In **CFA-1**, a seven-factor, 33-item model of PSC was tested using 3000 cases of direct care providers from across a variety of care settings. Because the model did not demonstrate good fit, modified models with fewer items were tested in **CFA-2** and **CFA-4**. Model modifications were accomplished by removing items suggested by the modification indices and removal of items with large standardized residuals. A particularly high standardized residual for the covariance between two variables tells us that the relationship between those variables is not well accounted for by the model. It is however important to note that prior to removing any items, careful consideration was given to the content of the item. Ultimately, nearly all deleted items were felt to have a fairly high degree of redundancy with other items on the survey or were noted to have had ongoing interpretation problems.

When this kind of retrofitting of a model to the data is done (eg removing items that are not well accounted for by the model), it is important to validate the modified model in a separate (cross-validation) sample – this was done in **CFA-6** using an additional sample of 7,889 cases collected by Accrediation Canada between November and December 2011.

**CFA-3** and **CFA-5** used multiple group CFA techniques (Byrne, 2009) to test the validity of each of the modified models (CFA-2 and CFA-4) across five different care settings: acute care medicine, long term care, homecare, community care, ambulatory care.

### Chi-square values in CFA.

While a non-significant chi-square ( $P > 0.05$ ) is desirable and suggests the model adequately represents the data, it can be difficult to achieve with large samples. The relative / normed chi-square value, which is the chi-square to df ratio, has been suggested as an alternate index that is less dependent on sample size. Good fit is indicated for values less than two (Ullman, 2001) or three (Kline, 2010) .

**Assessing Model Fit.** The chi-square test, normed chi-square value, comparative fit index (CFI), and the root mean square error of approximation (RMSEA) were used to evaluate model fit in all CFA models. CFI takes sample size into account and RMSEA is a residual-based index that takes model complexity (e.g. number of parameters) into account (Byrne, 2009) and is scaled such that a lower value indicates better fit. Models with CFI values greater than 0.95 and RMSEA values less than .06 are indicative of good model fit. (Hu & Bentler, 1999) These criteria have been used in previous medical education research (Schmidt et al., 2005) and are used in the analyses reported here.

Slightly different metrics are required to evaluate multiple group CFA. Accordingly, CFA-3 and CFA-5 model fit would be supported by non-significant chi-square difference values and by changes in  $CFI < 0.01$ .

Finally, internal consistency reliability of the six dimensions of PSC (using the reduced CFA-4 model) was examined using Cronbach's alpha ( $\alpha$ ) coefficients for all care settings combined as well as for the five separate care settings (acute care medicine, long term care, homecare, community care, ambulatory care).

## RESULTS

**Exploratory Factor Analysis** ► In the exploratory factor analysis, a six-factor model emerged as the strongest model. There are a few points to note about this six-factor model: (1) the dimensions that were retained from the MSI 2007 and included in the MSI 2010 remained fairly robust (eg. The organization-level leadership for safety, supervisory leadership for safety, and the learning culture dimensions were supported as unique dimensions); (2) the 17 new items added to the MSI 2010 to reflect issues about communication and talking about errors seemed to factor into unique dimensions (factors 2 and 4 and the lowest four loadings on the organization-level leadership for safety). The items and their groupings in the six-factor model that emerged from the EFA are shown in the EFA column of the table in Appendix 1.

- Factor 1 (F1) – reflected seven organization-level leadership for safety items. Four items about receiving feedback about errors / management looking into errors also loaded on this dimension, though with very low loadings
- Factor 2 (F2) – included four items that reflect fear of job/promotion loss or disciplinary action for making a serious error
- Factor 3 (F3) – represents learning culture with five items
- Factor 4 (F4) – included 5 items about the impact of making errors on one’s reputation
- Factor 5 (F5) – supervisory leadership (three positively phrased items only)
- Factor 6 (F6) – supervisory leadership (five negatively phrased items only)
- From a total of 38 items, four items were deleted from the EFA given very low loadings or cross loadings (items 6,12,13,14) and one item (28) is a stand-alone item, not intended to be part of a PSC dimension.

Note: the question number notation in Appendix 1 indicates if an item was one of the 17 new items (@ precedes the question number) or an item retained from a previous MSI dimension (OL = organization leadership for safety item; LC = learning culture item; SL = supervisory leadership item)

**Confirmatory Factor Analysis** ► Based on the results of the EFA we examined potential PSC measurement models that made sense theoretically. It was decided to adhere to the above six factor model with one exception, the four items that ask about managerial feedback and follow-up on errors (which loaded on the organization leadership for safety dimension in the EFA but had low loadings) would be treated as a unique dimension of PSC. Accordingly, we proceeded with testing a seven-factor model in **CFA-1**. In addition, there was some uncertainty about proposing and testing two factors of supervisory leadership for safety (one with negatively phrased items and one with positively phrased items); however, at this stage it was felt that both groups of items needed to be retained (see the end of the Results section on page 8 for a discussion of the implications of using negatively phrased items in surveys).

**CFA-1** tested the seven-factor model of PSC and included all 33 items shown in the first column of appendix 1 that emerged from the EFA. This model did not fit the data well (**CFA-1**  $\chi^2 = 4095.45$ ,  $df = 474$ ,  $p = .000$ ,  $CFI = 0.926$ ,  $RMSEA = 0.050$ , relative  $\chi^2 = 8.64$ ). Ten items that

were not well accounted for by the model were eliminated. These items are shown with an asterisk in the **CFA-1** column of Appendix 1. From a theoretical standpoint the ten items that were removed were either redundant, were more distal to the remaining items in the latent construct, or they had been flagged previously by Accreditation Canada as being interpreted in multiple ways.

The retrofitted seven-factor, 23-item model produced good model fit in **CFA-2** ( $\chi^2 = 1134.97$ ,  $df = 209$ ,  $p = .000$ ,  $CFI = 0.971$ ,  $RMSEA = 0.038$ , relative  $\chi^2 = 5.43$ ). The scale alphas (not shown) were acceptable with the exception of the supervisory leadership dimension made up of negatively phrased items. Of the seven dimensions in **CFA-2**, three were preserved from previous versions of the MSI and the communication and talking about errors item set yielded 3 dimensions that reflect: (a) receiving follow up and feedback about reported incidents, (b) fear of job/promotion loss or disciplinary action for making a serious error, (c) the impact of making errors on one's reputation.

**Multiple Group CFA** ► Despite some question as to whether to proceed with two supervisory leadership dimensions, the CFA-2 model fit the data well. Accordingly, **CFA-3** used multiple group CFA techniques (Byrne, 2009) to examine whether the seven-factor 23-item model from **CFA-2** was invariant across five care settings of interest in our sample (acute care -medicine, long term care, homecare, community care, and ambulatory care). The results of **CFA-3** did not support invariance across the five care settings (baseline model<sup>1</sup>  $CFI = 0.944$ ,  $RMSEA = 0.023$ ), relative  $\chi^2 = 5.43$ ).

Further examination of items not well accounted for by the model suggested that item OL\_22 be removed as well as at least two of the three items in the negatively phrased supervisory leadership dimension (F6)<sup>2</sup>. Given scale alphas  $< 0.70$  for the negatively phrased supervisory leadership dimension and the need for a parsimonious model of PSC measurement (e.g. that ideally *does not* have two separate dimensions measuring supervisory leadership) a decision was made to remove the negatively phrased supervisory leadership items. This further retrofitted six-factor 19-item model was examined and produced good model fit in **CFA-4** ( $\chi^2 = 641.63$ ,  $df = 137$ ,  $p = .000$ ,  $CFI = 0.981$ ,  $RMSEA = 0.035$ , relative  $\chi^2 = 4.68$ ).

This model was also found to be invariant across the five care settings of interest in **CFA-5**. The results of the *invariance testing* in **CFA-5** shows that the measurement model (e.g. the factor loading parameters) is invariant across the five care settings we examined (model 1  $\Delta CFI = .001$ ). Given the highly significant chi-square difference in model 2, structural invariance (e.g. factor covariances) of the model remains equivocal despite the acceptable  $\Delta CFI$  (model 2  $\Delta CFI = .007$ ).

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<sup>1</sup> In multi-group CFA the first stage of testing yields a baseline (configural) model which reflects the extent to which the number of factors and patterns of their structure is similar (not equivalent) across the different groups of interest. Further testing looks at (a) the items in a measurement instrument and (b) the factor structure are equivalent (e.g. invariant) across particular groups—in this case care settings.

<sup>2</sup> the 7 factor 23 item model had 24 standardized residuals  $> 2.58$  (the recommended cutoff). Removal of item OL\_22 as well as the three negatively phrased supervisory leadership items led to model with 5 standardized residuals  $> 2.58$

**RESULTS HIGHLIGHT:** Results support a six-factor 19-item measurement model of PSC. The results further indicate that the number of factors and their items (e.g the meaning of the six PS Culture factors) holds across 5 unique care settings. There may, however, be real world differences in how the six factors in the model relate to one another in the eyes of staff working in the different care settings.

These results, which provide full support for measurement invariance and partial support for structural invariance, indicate that the number of factors and their items (e.g the meaning of the six PS Culture factors) is consistent across these different care settings. The partial support for structural invariance in CFA-5 may reflect real world differences in how the six factors in the model *relate to one another* in the eyes of staff working in the different care settings (Brown, 2011; L. Ginsburg, Tregunno, Norton, & Casebeer, 2006)

**Cross-Validation** ► Results of **CFA-6** support good model fit for the cross-validation sample ( $\chi^2 = 906.07$ ,  $df = 137$ ,  $p = .000$ , CFI = 0.983, RMSEA = 0.033, relative  $\chi^2 = 6.61$ ). In order to avoid fitting the model to trivial artefacts of the data further improvements in model fit were not carried out (Byrne, 2009). Summary results of all six confirmatory models are provided in table 1. The final path diagram is shown in Appendix 2. The reductions that were made at each stage of the analyses described above are summarized in Appendix 1. The items shown in red text in Appendix 1 are the 19 items that were retained and are recommended for the final measurement model of patient safety culture.

Table 1 – Confirmatory Factor Analysis Summary Results

CFA Model	Comparative Fit Index (CFI)	RMSEA	Fit assessment(Hu & Bentler, 1999)
CFA-1	0.926	0.050	Unacceptable
CFA-2	0.971	0.038	Good
CFA-3	0.944	0.021	Borderline
	* $\Delta CFI = .001$ * $\Delta\chi^2 p=.000$		
CFA-4	0.981	0.035	Good
CFA-5	0.960	0.028	Good
	* $\Delta CFI = .001$ * $\Delta\chi^2 p=.01$		
CFA-6 <sup>†</sup>	0.983	0.033	Good

\* Indices for measurement invariance (the meaning of the six PS culture factors that is reflected in the number of factors and their items is equivalent across the groups)

<sup>†</sup> Cross-validation sample



**Methods effects in scaling with positive and negatively phrased items** ► The use of positively and negatively worded items in questionnaires has been suggested in order to reduce response bias, such as the tendency to agree with items independent of item content (American Educational Research Association, 1999). Negatively worded items are intended to act as “cognitive speed bumps that require respondents to engage in more controlled, as opposed to automatic, cognitive processing” (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). However, analyses have also shown that using positively and negatively worded items is likely to introduce systematic measurement errors such that when two factors contain only positive or negative items the importance of each factor is confounded with potential measurement effects (Schmitt & Stults, 1985; Wood, Taylor, & Joseph, 2010). There is some evidence showing that constructs conceptualized as unidimensional may appear multidimensional and positively and negatively worded items may look as though they form two separate factors (DiStefano & Motl, 2006; Samuelstuen, 2003). These kinds of methods effects represent systematic variation that is the result of the method used to measure a particular trait (Campbell & Fiske, 1959).

In the validation work reported here, the bank of items previously used to measure supervisory leadership for patient safety seemed to demonstrate these kinds of systematic methods effects when they loaded on two different factors. Accordingly, and given the need for parsimony as well as other characteristics of these items such as the lower alpha for the negatively phrased supervisory leadership items, a decision was made to remove the negatively phrased supervisory leadership items from the instrument.

## **DISCUSSION / RECOMMENDATIONS**

The results of the validation work presented here suggests the six factor, 19-item model tested in **CFA-4**, found invariant to care setting in **CFA-5** and cross validated in **CFA-6** reflects distinct and theoretically important aspects of PSC. This model was considered optimal in representing the observed data from the two samples provided. See Table 2 for proposed MSI 2012 items.



Table 2 – Proposed Dimensions & Items in the MSI 2012

<p><b>F1 – Senior leadership support for safety (valuing safety)</b> 4 items (alpha = 0.84)</p> <ul style="list-style-type: none"><li>• Senior management provides a climate that promotes patient safety</li><li>• Senior management has a clear picture of the risk associated with patient care</li><li>• Patient safety decisions are made at the proper level by the most qualified people</li><li>• Senior management considers patient safety when program changes are discussed</li></ul>
<p><b>F2 – Fear of disciplinary action, job or promotion loss</b> 3 items (alpha = 0.77)</p> <ul style="list-style-type: none"><li>• If I make a serious error I worry that I will face disciplinary action from management</li><li>• Making a serious error would limit my career opportunities around here</li><li>• Making a serious error may cause a staff member to lose his/her job.</li></ul>
<p><b>F3 – Unit learning culture</b> 4 items (alpha = 0.89)</p> <ul style="list-style-type: none"><li>• On this unit, when a serious error occurs, we think about it carefully</li><li>• On this unit, after a serious error has occurred, we think about how it came about and how to prevent the same mistake in the future</li><li>• On this unit, when a serious error occurs, we analyze it thoroughly</li><li>• On this unit, after a serious error has occurred, we think long and hard about how to correct it</li></ul>
<p><b>F4 – Impact of errors on one’s reputation</b> 3 items (alpha = 0.77)</p> <ul style="list-style-type: none"><li>• If I make a serious error my manager will think I am incompetent</li><li>• My co-workers will lose respect for me if they know I’ve made a serious error</li><li>• Others make you feel like a bit of a failure when you make an error</li></ul>
<p><b>F5 – Supervisory leadership for safety</b> 2 items (alpha = 0.82)</p> <ul style="list-style-type: none"><li>• My supervisor/manager seriously considers staff suggestions for improving patient safety</li><li>• My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures</li></ul>
<p><b>F6 – Management follow up and feedback about incidents</b> 3 items (alpha = 0.73)</p> <ul style="list-style-type: none"><li>• If I point out a potentially serious patient safety incident, management will look into it</li><li>• Staff are usually given feedback about changes put into place based on incident reports</li><li>• If I report a patient safety incident, someone usually follows up to get more information from me</li></ul>
<p><b>Stand-alone item</b></p> <ul style="list-style-type: none"><li>• Individuals involved in patient safety incidents have a quick and easy way to report what happened</li></ul>

**MSI 2012 compared to previous versions** ► The reduced version of the MSI-2010 shown in Table 2 above that emerged from the validation work reported here leads to a dramatically shorter Patient Safety Culture Survey. It is recommended that the proposed survey retain the item “Individuals involved in patient safety incidents have a quick and easy way to report what happened” as a stand-alone item designed to reflect the ease of reporting. Accordingly the proposed **MSI-2012** will have 20 core items plus the two overall items that ask respondents to give their unit and their organization a grade for patient safety. Organizations using the MSI 2012 who are wishing to compare their results with those collected using previous versions of the survey can do so on an item by item basis or by calculating reduced scale scores on previous and new data sets using the smaller item sets in the proposed 6 dimensions that emerged from this work (and shown in table 2). Note that no new items are proposed for the MSI 2012. The proposed changes solely reflect item reductions from the 2010 version based on factor analyses presented in this report. Table 3 summarizes how the dimensions have changed from the MSI 2010 to the proposed new 2012 version.

Table 3 – Dimension Changes between 2010 and 2010 versions of the survey

<p><b>F1 - Senior leadership support for safety (valuing safety)</b></p> <ul style="list-style-type: none"><li>• 4/7 items are retained in the MSI 2012</li></ul> <p><b>F2 - Fear of disciplinary action, job or promotion loss</b></p> <ul style="list-style-type: none"><li>• These 3 items were not yet part of a talking about errors sub-dimensions on the MSI 2010</li></ul> <p><b>F3 – Unit learning culture</b></p> <ul style="list-style-type: none"><li>• 4/6 items are retained in the MSI 2012</li></ul> <p><b>F4 - Impact of errors on one’s reputation</b></p> <ul style="list-style-type: none"><li>• These 3 items were not yet part of a talking about errors sub-dimensions on the MSI 2010</li></ul> <p><b>F5 – Supervisory leadership for safety</b></p> <ul style="list-style-type: none"><li>• 2/5 items are retained in the MSI 2012</li></ul> <p><b>F6 - Management follow up and feedback about incidents</b></p> <ul style="list-style-type: none"><li>• These 3 items were not yet part of a talking about errors sub-dimensions on the MSI 2010</li></ul>
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**Other issues that should continue to be explored** ► The revision process and the feedback Accreditation Canada receives about the instruments it uses continues to highlight issues for consideration. The following three issues continue to require exploration:

- **Demographic Section** ► For the initial phase of implementation of the MSI-2010, it was felt it would be extremely valuable to add a question that asks whether English is a respondent's mother tongue (1<sup>st</sup> language learned). These data would provide important insight into our understanding of how well the items in the MSI work in an ESL population (in some parts of Canada, the proportion of the health professional population for whom English is a second language may be as high as 50%). There are indications in the literature that negatively worded items may not work well in cross cultural populations. This question was excluded in error from the initial testing of the MSI-2010 and it is strongly suggested that it be included in the next version of the instrument. It can be removed within a few months, after an initial set of cases of data have been collected.
- The mother tongue question should also ask whether French is the "1<sup>st</sup> language learned" in order to further explore how the MSI works in the French language. In particular, questions have been raised regarding a few items that use idioms. It remains unclear what happens to these items when they are translated into French and when the items are completed by respondents for whom English is not their first language. Data from an additional question about 1<sup>st</sup> language learned (English, French, or other) would be very valuable for indicating whether further item wording revisions are required.
- More detailed questions about primary work area and occupation were added to the MSI-2010 to help understand how these factors may influence perceptions of patient safety culture. It is recommended that these items be retained.
- **Unit vs. Team** ► Use of the word "unit" and "department" have been included in the present and previous versions of the MSI. Currently the language is "unit" with a definition provided to indicate this may refer to one's work team or department, depending on the setting in which they work. It has been suggested that the term "team" might be used instead of "unit" as it has clearer meaning in non-institutional settings. Further discussion is recommended given that "team" and "unit" are not synonymous (eg. "team" is often conceived of as the micro system (Batalden et al., 2003) which is a smaller than the more structured "unit"). Ultimately, one term will not work equally well in all settings so caution and careful consideration of both intended and unintended consequences of any language change is suggested.
- **Defining "senior management"** ► The distinction between senior management and manager/supervisor is unclear in settings such as home care. Any proposed changes to this terminology require the same consideration noted in the previous bullet. One suggestion is to change "senior management" to "the organization". This requires further exploration as a potential solution.

The authors of this report are pleased to continue to engage with Accreditation Canada in order to continue to explore and attempt to resolve the above issues.

**Appendix 1 – Factors Analysis Models**

Items shown in **red text** are the 19 retained items that are recommended for the final measurement model of patient safety culture.

Item # <sup>¥</sup>	Item	Measurement models tested				
		EFA	CFA-1	CFA-2 CFA-3 <sup>†</sup>	CFA-4 CFA-5 <sup>†</sup>	CFA-6
OL_5	Senior management provides a climate that promotes patient safety	F1	F1	F1	F1	F1
OL_1	Senior management has a clear picture of the risk associated with patient care	F1	F1	F1	F1	F1
OL_4	Patient safety decisions are made at the proper level by the most qualified people	F1	F1	F1	F1	F1
OL_9	Senior management considers patient safety when program changes are discussed	F1	F1	F1	F1	F1
OL_22	My organization effectively balances the need for patient safety and the need for productivity	F1	F1	F1	*	n/a
OL_2	Good communication flow exists up the chain of command regarding patient safety issues	F1	F1	*	n/a	n/a
OL_23	I work in an environment where patient safety is a high priority	F1	F1	*	n/a	n/a
@20	If I point out a potentially serious patient safety incident, management will look into it	F1	F7	F7	F6	F6
@24	Staff are usually given feedback about changes put into place based on incident reports	F1	F7	F7	F6	F6
@17	If I report a patient safety incident, someone usually follows up to get more information from me	F1	F7	F7	F6	F6
@8	There is no point in talking about a patient safety problem because nothing usually gets done about it	F1	F7	*	n/a	n/a
@25rev	If I make a serious error I worry that I will face disciplinary action from management	F2	F2	F2	F2	F2
@26rev	Making a serious error would limit my career opportunities around here	F2	F2	F2	F2	F2
@18rev	Making a serious error may cause a staff member to lose his/her job.	F2	F2	F2	F2	F2
@3	If I make a serious error I worry that I will face disciplinary action from the college	F2	F2	*	n/a	n/a
LC_33	On this unit, when a serious error occurs, we think about it carefully	F3	F3	F3	F3	F3
LC_35	On this unit, after a serious error has occurred, we think about how it came about and how to prevent the same mistake in the future	F3	F3	F3	F3	F3
LC_36	On this unit, when a serious error occurs, we analyze it thoroughly	F3	F3	F3	F3	F3
LC_38	On this unit, after a serious error has occurred, we think long and hard about how to correct it	F3	F3	F3	F3	F3
LC_34	On this unit, when people make a serious error, they ask others about how they could have prevented it	F3	F3	*	n/a	n/a
@11rev	If I make a serious error my manager will think I am incompetent	F4	F4	F4	F4	F4
@16rev	My co-workers will lose respect for me if they know I've made a serious error	F4	F4	F4	F4	F4
@21rev	Others make you feel like a bit of a failure when you make an error	F4	F4	F4	F4	F4
@7	I would feel ashamed if I made a serious error and my co-workers heard about it	F4	F4	*	n/a	n/a
@10	My co-workers will think I am incompetent if they know I've made a serious error	F4	F4	*	n/a	n/a
SL_30	My supervisor/manager seriously considers staff suggestions for improving patient safety	F5	F5	F5	F5	F5
SL_29	My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	F5	F5	F5	F5	F5

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Item # <sup>¥</sup>	Item	Measurement models tested				
		EFA	CFA-1	CFA-2 CFA-3 <sup>†</sup>	CFA-4 CFA-5 <sup>†</sup>	CFA-6
@27	If I made a serious error my manager would be supportive	F5	F5	*	n/a	n/a
SL_13	13. I am rewarded for taking quick action to identify a serious error	C/LL	*	n/a	n/a	n/a
SL_31	Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	F6	F6	F6	*	n/a
SL_32	My supervisor/manager overlooks patient safety problems that happen over and over	F6	F6	F6	*	n/a
LC_37	On this unit, it is difficult to discuss errors	F6	F6	F6	*	n/a
@15	On this unit it is difficult to speak up if you feel there is a problem related to patient safety	F6	F6	*	n/a	n/a
@19	On this unit it is difficult to question the decisions or actions of those with more authority	F6	F6	*	n/a	n/a
@6	When an incident is reported, it seems like the person is being written up, not the problem	C/LL	*	n/a	n/a	n/a
@12	On my unit, staff who report a <i>co-worker's</i> error are labelled as 'not being a team player'	C/LL	*	n/a	n/a	n/a
@14	My co-workers would support me if they learned of a serious error I made	C/LL	*	n/a	n/a	n/a
@28	Individuals involved in patient safety incidents have a quick and easy way to report what happened	n/a	n/a	n/a	n/a	n/a

\* Item not well accounted for by previous model and was removed in the current model

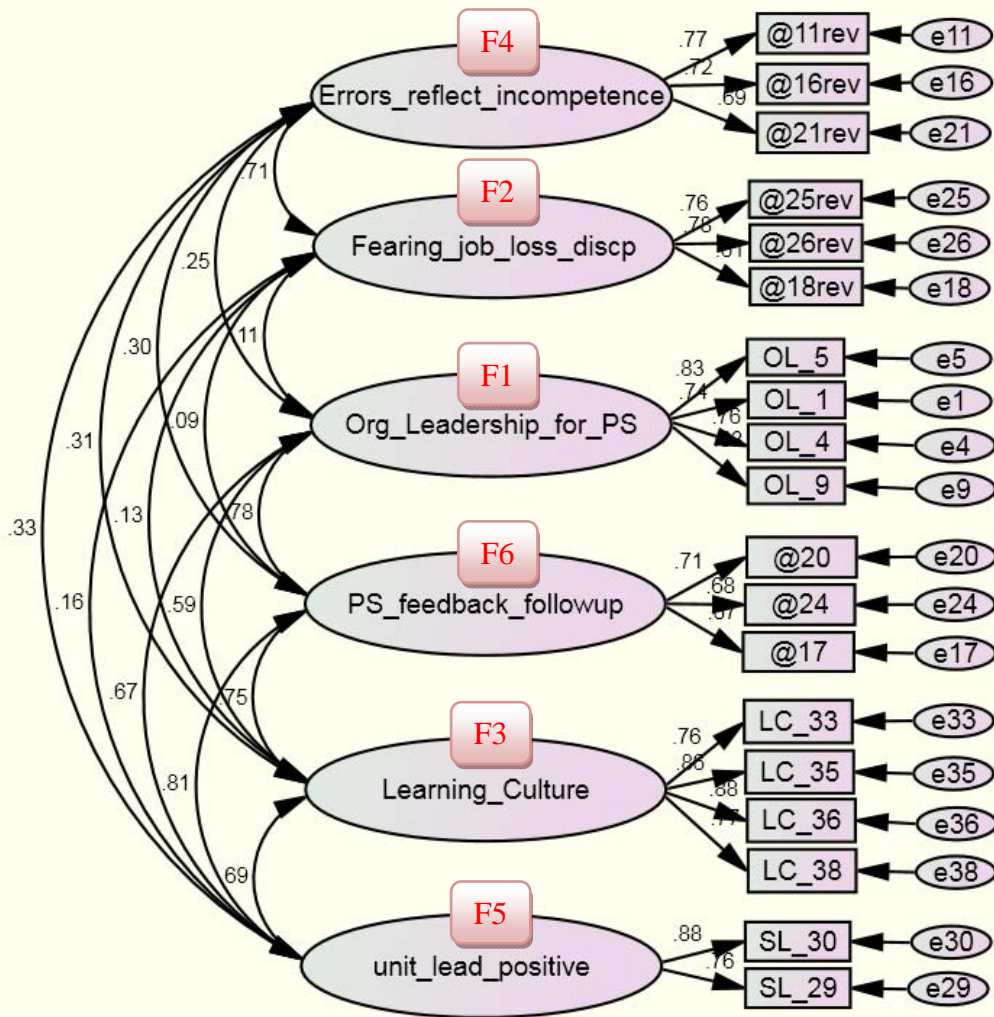
<sup>†</sup> Multiple-group CFA

<sup>¥</sup> Number notation indicates item dimension in the MSI 2010: item #s preceded by the @ sign were new in the MSI 2010, OL = Organizational leadership for safety, SL = supervisory leadership for safety, LC = unit learning culture

<sup>C/LL</sup> Cross loading or low loading

<sup>n/a</sup> not included in the model

Appendix 2 - Final Path Diagram



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