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Evaluation of a survey tool to measure safety climate in Australian hospital pharmacy staff

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ABSTRACT

Background: Safety climate evaluation is increasingly used by hospitals as part of quality improvement initiatives. Consequently, it is necessary to have validated tools to measure changes.
Objective: To evaluate the construct validity and internal consistency of a survey tool to measure Australian hospital pharmacy patient safety climate.
Methods: A 42 item cross-sectional survey was used to evaluate the patient safety climate of 607 Australian hospital pharmacy staff. Survey responses were initially mapped to the factor structure previously identified in European community pharmacy. However, as the data did not adequately fit the community pharmacy model, participants were randomly split into two groups with exploratory factor analysis performed on the first group ($n = 302$) and confirmatory factor analyses performed on the second group ($n = 305$).
Results: Following exploratory factor analysis (59.3% variance explained) and confirmatory factor analysis, a 6-factor model containing 28 items was obtained with satisfactory model fit (χ^2 (335) = 664.61 $p < 0.001$, RMSEA = 0.06, CFI = 0.93, TLI = 0.92), internal reliability ($\alpha > 0.643$) and model nesting between the groups ($\Delta\chi^2$ (22) = 30.87, $p = 0.10$). Three factors (blame culture, organisational learning and working conditions) were similar to those identified in European community pharmacy and labelled identically. Three additional factors (preoccupation with improvement; comfort to question authority; and safety issues being swept under the carpet) highlight hierarchical issues present in hospital settings.
Conclusions: This study has demonstrated the validity of a survey to evaluate patient safety climate of Australian hospital pharmacy staff. Importantly, this validated factor structure may be used to evaluate changes in safety climate over time.

1. Introduction

Since the publication of the seminal reports *To Err is Human: Building a Safer Health System*[1] in the United States of America and *An organisation with a memory*[2] in the United Kingdom, deficiencies in the delivery of healthcare have received greater attention globally. In Australia, the publication of the *Second National Report on Patient Safety: Improving Medication Safety* in 2002 raised a number of issues relating specifically to medication safety. Subsequently, there has been a considerable effort to improve both patient and medication safety by healthcare institutions globally. As a result, healthcare institutions have been identifying strategies to evaluate improvements to patient safety, both at the level of the patient and also the healthcare practitioner.

One of the greatest barriers to improving patient safety in hospitals is the safety culture of the organisation. Safety culture is a broad term that encompasses the norms, values, beliefs and assumptions of an organisation.[3,4] The literature shows that by understanding and improving safety culture, better patient outcomes and healthcare experiences can be achieved.[5] Whilst evaluating safety culture is ideal, using a multilevel ethnographic approach can be logistically challenging and time consuming to accurately

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perform.[3,6] Consequently, safety climate is often used to evaluate the safety culture of an organisation, and specifically refers to the employees' perceptions of the safety culture of an organisation at a particular point in time.[6,7]

As part of their role and responsibilities, many hospital pharmacists either drive or engage in medication safety initiatives. However, a number of factors, including working conditions and culture, can affect the safe delivery of care by hospital pharmacists. Currently there are numerous tools that measure safety climate in hospitals,[4] however, due to different perceptions of safety culture across disciplines and practice settings, it is important that any tool used is validated in the target population.[5] Although previous studies have validated safety climate assessment tools for use among community pharmacists in Europe[7] and more recently in hospital pharmacies in Asia,[8,9] no tool has been validated to measure the patient safety attitudes and values of Australian hospital pharmacists.[10] As the roles and responsibilities and remuneration structure of hospital pharmacies are somewhat different to that of community pharmacists and vary between countries, there is a need for a tool that is able to specifically assess the safety climate of Australian hospital pharmacists.[6,8] In the absence of a survey tool to measure safety culture in a target population, it is recommended that a survey tool that has been previously used in a population with similar characteristics be used as a basis for studying the target population.[11] Given that the most widely used survey tool to measure safety climate in pharmacists is the *Pharmacy Safety Climate Questionnaire* which has been previously validated in community pharmacy in the United Kingdom and Europe, this study aimed to evaluate the construct validity of the survey to assess patient safety climate among Australian hospital pharmacy staff.

2. Methods

A cross-sectional survey was conducted among 2347 hospital pharmacy staff members who were registered as currently practising members of The Society of Hospital Pharmacists of Australia (SHPA), the national professional organisation representing pharmacy staff that work in hospital settings. Data were collected between May and July 2010 with approval to conduct this study granted by the Human Research Ethics Committee at The University of Sydney (Project Number: 12615).

2.1. Survey instrument

A survey tool was developed to evaluate the safety climate attitudes of Australian hospital pharmacy staff. The tool was based on the *Pharmacy Safety Climate Questionnaire*, originally developed to evaluate safety climate in community pharmacy in the United Kingdom, and subsequently validated across a number of other European countries. The tool was modified slightly for use in this study: specifically, three items that referred to similar issues were split into separate items in order to avoid any potential ambiguity in the interpretation of the items by survey respondents. The modified survey tool was reviewed by a small group of practicing hospital pharmacists for face validity. The final survey tool consisted of four sections: (A) a single question assessing overall grade of patient safety in the respondent's hospital pharmacy; (B) 42 Likert-type scale items adapted from the original *Pharmacy Safety Climate Questionnaire*[12]; (C) participant and hospital demographics and (D) a free text comment field to provide comments on patient safety, error management and incident reporting. This study relates to the quantitative data collected in sections B and C of the survey. Analysis of the qualitative responses in section D has also been performed,[13] however is not reported here.

2.2. Data collection

The federal secretariat of the SHPA granted permission to use the contact details of its members for the purpose of recruitment, in accordance with the SHPA privacy policy. An external data management company was employed to administer the survey on behalf of the research team. All 2347 currently practising SHPA members were sent a letter inviting them to complete the survey. Reply paid envelopes were provided and coded for the members' identities by the data management company, which enabled follow-up of non-responders after 3 weeks. After a total of 10 weeks, the survey was closed and the compiled, de-identified data were provided to the research team.

2.3. Data analysis

All data analyses were completed using IBM SPSS Statistics version 21 (SPSS Inc., Chicago, IL) and Amos Version 21 (Amos Development Corporation, Meadville, PA). Expectation maximisation imputation of missing values was conducted as there were a limited number of cases with missing data ($n = 10$, 1.55%) and the data were considered to be missing at random (Little's MCAR = 2059.71, df = 2064, $p = 0.52$). Due to the limitations of Amos programming, Mahalanobis distance was calculated to remove multivariate outliers from the cohort. The four factor structure to measure European community pharmacists' safety climate suggested by Phipps et al.[7] was applied to the data. As the goodness of fit statistics were not deemed to be acceptable ($\chi^2(318) = 2022.02$, $p < 0.001$, CFI = 0.79, TLI = 0.77, RMSEA = 0.09), it was concluded that the European community pharmacist model was not appropriate to be applied in the Australian hospital pharmacy setting. Therefore, a two-step process consisting of exploratory and confirmatory factor analyses was undertaken to evaluate the construct validity and internal consistency of the survey tool.

Participant responses were randomly split into two groups using the "select cases" function in SPSS with approximately 50% of participants in each group ($n = 302$ and $n = 305$). Participant characteristics were compared across the two groups using the independent samples Mann Whitney *U* test for categorical variables and independent sample *t*-tests for continuous variables.

An exploratory factor analysis (EFA) was performed on survey responses from the first group of participants to understand the latent structure underpinning their responses to the survey using maximum likelihood estimation and varimax rotation. As adequate sample sizes across both groups were obtained, Kaisers criterion for factor retention was adopted with individual factors loading greater than 0.32 considered significant for retention.[14] The factor structure was assessed for a theoretical basis, using the Scree plot to verify the number of factors retained.

The construct validity of the survey was evaluated using a confirmatory factor analysis (CFA) on the second group's survey responses. Each item was considered to have a latent construct and a measurement error, with both causal effects depicted by unidirectional arrows. Correlations between variables within the model were depicted using bi-directional arrows. Maximum likelihood estimation was performed to calculate item loading. Items were removed from the model where modification indices suggested multiple correlations with other items. Using Bentler's method of estimating a minimum sample size to conduct a CFA, which is based on the number of included items to number of factors ratio, it was estimated that 150 survey responses would be adequate.[15] The goodness of fit of the model was evaluated using: Chi square to measure model parsimony, root mean-square error of approximation (RMSEA) to measure absolute fit, and both the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) to