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TITLE PAGE

Quantifying behavioural determinants relating to health professional reporting of medication errors: a cross-sectional survey using the Theoretical Domains Framework

Short title

Quantifying behavioural determinants relating to health professional reporting of medication errors

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Keywords - Medication errors; error reporting; cross-sectional survey; theoretical domains framework

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ABSTRACT

Purpose

The aims of this study were to quantify the behavioural determinants of health professional reporting of medication errors in the United Arab Emirates (UAE) and to explore any differences between respondents.

Methods

A cross-sectional survey of patient-facing doctors, nurses and pharmacists within three major hospitals of Abu Dhabi, the UAE. An online questionnaire was developed based on the theoretical domains framework (TDF, a framework of behaviour change theories). Principal component analysis (PCA) was used to identify components and internal reliability determined. Ethical approval was obtained from a United Kingdom (UK) university and all hospital ethics committees.

Results

Two hundred and ninety-four responses were received. Questionnaire items clustered into six components of: knowledge and skills; feedback and support; action and impact; motivation; effort; and emotions. Respondents generally gave positive responses for knowledge and skills, feedback and support, and action and impact components. Responses were more neutral for the motivation and effort components. In terms of emotions, the component with the most negative scores, there were significant differences in terms of: years registered as health professional (those registered longest most positive, $p=0.002$); and age (older most positive, $p<0.001$) with no differences for gender and health profession.

Conclusion

Emotional related issues are the dominant barrier to reporting and are common to all professions. There is a need to develop, test and implement an intervention to impact health professionals' emotions. Such an intervention should focus on evidence based behaviour change techniques of reducing negative emotions, focusing on emotional consequences and providing social support.

Key messages

- This research used the Theoretical Domains Framework to quantify the behavioural determinants of health professional reporting of medication errors.
- Questionnaire items relating to emotions surrounding reporting generated the most negative responses with significant differences in terms of years registered as health professional (those registered longest most positive) and age (older most positive) with no differences for gender and health profession.
- Interventions based on behaviour change techniques mapped to emotions should be prioritised for development.

Introduction

Publication of the seminal and groundbreaking report, 'To Err Is Human: Building a Safer Health System' in 1999 stimulated deeper examination of patient safety research and associated practices [1]. One key strategic recommendation was to identify and learn from medication errors by 'encouraging health care organisations and practitioners to develop and participate in voluntary reporting systems'. Effective medication reporting systems and processes are essential in promoting patient safety.

The National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) in the United States (US) leads national healthcare organisations collaborating and cooperating to address the interdisciplinary causes of errors and to promote the safe use of medication. One goal is to stimulate the 'development and use of reporting and evaluation systems by individual health care organizations' [2]. These systems should promote: staff engagement; quality, timely and consistent reporting; and feedback to impact organisations and practitioners.

A number of studies have employed a cross-sectional survey methodology to determine aspects of views, attitudes and experiences of health professionals around medication error reporting [3-10]. Most were conducted in the US [5,6,8] and Australia [4,7] with one each in the United Kingdom (UK) [9], Taiwan [10] and Iran [3]. All were based in hospital; five included nurses only [3-5,8,10], two were of doctors and nurses [6,7] and one of doctors, nurses and pharmacists [9]. The number of respondents varied from 43 (16% response rate) [8] to 1384 (no response rate stated) [4]. Findings focused largely on barriers towards reporting: fear of adverse consequences following reporting [3-5,8,10]; disagreement over error identification [4,5,8]; managerial factors [3,10]; aspects of knowledge and awareness [7,9]; lack of feedback [7]; and training [6]. One key limitation of all studies is the lack of attention to behavioural theory, which may diminish the value of the findings in the development of interventions to optimise medication error reporting.

The importance of theory as part of intervention development is articulated in the United Kingdom Medical Research Council (MRC) guidance on 'Developing and implementing complex interventions' [11]. Theory is a fundamental part of the development (intervention building) phase, '…you also need to be aware of the relevant theory, as this is more likely to result in an effective intervention, than is a purely empirical or pragmatic approach'. One theoretical framework being used increasingly in intervention based studies is the Theoretical Domains Framework (TDF). This framework was derived from 33 psychological theories and 128 theoretical constructs which are organised into 14 overarching domains of: knowledge; skills; social/professional role and identity; beliefs about capabilities;

optimism; beliefs about consequences; reinforcement; intentions; goals; memory, attention and decision processes; environmental context and resources; social influences; emotion; and behavioural regulation [12,13]. TDF can be used in research to characterise and quantify the domains of behaviour which need to be targeted in any intervention. TDF has been used in the development of interventions related to smoking cessation, physical activity, hand hygiene, acute low back pain and schizophrenia [14].

A recent qualitative study of 29 health professionals in the United Arab Emirates incorporated TDF into data generation, analysis and interpretation of findings relating to behavioural determinants of medication error reporting. While it appeared that patient safety and organisational improvement goals and intentions were behavioural determinants which facilitated reporting, there were key determinants which deterred reporting. These included: the beliefs of the consequences of reporting (lack of any feedback following reporting, and impacting professional reputation, relationships and career progression); emotions (fear and worry) and issues related to the environmental context (time taken to report) [15].

The aims of this study were to extend the qualitative study findings by quantifying the behavioural determinants of health professional reporting of medication errors in the United Arab Emirates (UAE) and exploring any differences between respondents.

Methods

Research design

A cross-sectional survey of health professionals.

Setting

The research was conducted in the three major medical/ surgical hospitals (412, 451 and 461 beds) which provide care for 72.8 % of the Abu Dhabi population, the UAE [16].

All hospitals within the Health Authority of Abu Dhabi have adopted the NCCMERP definition of medication error, 'any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the health care professional, patient, or consumer' [2]. All health professionals are mandated to report all medication errors, including those which 'been detected and corrected through intervention by another health care professional or patient, before actual medication administration' [17].

Questionnaire development

A draft questionnaire was developed, informed by previous cross-sectional surveys and with reference to the TDF. The Determinants of Implementation Behavior Questionnaire, with items derived from the TDF was used as a basis for the development of the individual items, adapted as relevant to medication error reporting [18]. These items were presented as 5-point Likert scales (strongly agree to strongly disagree). In addition, demographic items were developed as appropriate to health professionals in the UAE. The draft questionnaire was reviewed for face and content validity by a panel of five experts in medication error reporting practice and related research in the UK and the UAE.

The pilot version of the questionnaire was formatted in Snap 10 Professional® (software for web and email questionnaire design, publication, data entry and analysis). A participant information leaflet was developed to provide information on study purpose, selection of participants, benefits of taking part, estimated duration to complete, and providing assurances of confidentiality and anonymity. The pilot was conducted in the three study hospitals in Abu Dhabi, with a convenience sample of 9 doctors, 10 nurses, and 10 pharmacists. Findings indicated that no amendments to the questionnaire were necessary as the questions were clear, not too difficult, taking around 20 minutes to answer. Pilot response were not included in the study dataset.

Recruitment

All patient facing-doctors, nurses and pharmacists working within the three study hospitals were included in the study, with no exclusions. While the hospitals were unable to provide specific numbers of those with patient facing roles, the total number of doctors, nurses and pharmacists was estimated to be around 5,000. A response from 370 was required to give a margin of error of 5% and confidence intervals of 95% [19]. Data collection took place from June to September 2014. Email invitations were sent by the human resources departments in each hospital to all doctors, nurses and pharmacists. The email contained a link to the participant information leaflet and questionnaire, with respondents submitting the questionnaire electronically.

Data analysis

The survey instrument generated anonymised emails of online submissions which were imported into Snap before direct export to SPSS version 21.0 and cleaned prior to analysis.

Descriptive statistics were used to describe respondent demographics and their responses. Questionnaire items were subjected to principal component analysis (PCA). PCA is a statistical procedure that uses varimax rotation to convert a set of observations of possibly correlated variables into a set of values of linearly interrelated variables termed components (or factors). The number of components to be retained was decided based on the Kaiser criterion (generally taken as eigenvalues greater than 1), visual inspection of the scree plot (first point that starts the flat line trend) and meaningfulness of the results according to the theoretical framework [20,21]. The analysis included items that were not freestanding, cross-loading or decreasing the scale's internal reliability, and that displayed acceptable communalities, with factor pattern/structure coefficients above 0.4 [20]. In performing PCA, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's Test of Sphericity were used to assess the suitability of the sample for PCA [20]. Following PCA, internal reliability analysis was performed by determining the Cronbach's coefficient alpha for each component identified. Nunnally suggests a minimum level of 0.7 for the component scale to be considered reliable [22]. Total component scores were obtained by assigning scores of 1 (strongly agree) to 5 (strongly disagree) to each of the Likert statement responses, with negatively worded items being reverse scored. Mann-Whitney U test was used to explore any relationship between demographic variables (health profession, gender, age and years of experience) and component scores. P-values ≤ 0.05 were considered statistically significant.

Governance

The study was approved by the ethical review panel of a university in the UK and the ethics committee of each participating hospital in the UAE.

Results

Two hundred and ninety-four responses were received over the study period. Respondent demographics are given in Table 1. Just over half were nurses (53.1%) and female (59.5%), almost two thirds were 35 years of age and above (63.7%), and had been registered as health professionals for over ten years (65.9%).

The appropriateness of PCA was confirmed by: the number of responses exceeded 150 and also five times the number of the questionnaire items; the Kaiser–Meyer–Olkin measure of sampling adequacy (0.884) and Bartlett's test of sphericity (significance <0.001) confirmed the factorability of the items; and the correlation matrix scores were all greater than 0.3. Figure 1 gives the Scree plot obtained.

Thirteen components with eigenvalue of greater than 1.0 explained 72% of the variance. As many of the components had only a very small number of items loading, only those with more than six items loading were retained (eigenvalues ≥ 1.9), explaining 57% of the variance. Internal reliability values (Cronbach's alpha) were calculated for each of the six components, aiming for values over 0.7, with all negatively worded items reversed. Tables 2-7 give the item responses and Cronbach's alpha values for each component.

Component 1, knowledge and skills related item responses

The minimum possible value for the scale is 15 (representing most positive responses) and the maximum possible value for the scale is 75 (representing least positive responses) and midscale point of 45. With a median value of 28 and interquartile ratio (IQR) of 21-32, respondents generally gave positive responses. Slightly less positive responses were given in terms of the error reporting policy being straightforward to apply in practice. While responses were positive, there were significant differences in component scores in terms of gender (females most positive, $p<0.001$) and years registered as health professional (those registered longest most positive, $p=0.003$).

Component 2, feedback and support related item responses

The minimum possible value for the scale is 15 (representing most positive responses) and the maximum possible value for the scale is 75 (representing least positive responses) and a midscale point of 45. With a median value of 35 and IQR of 30-42, respondents generally gave positive responses. Less positive responses were given in terms of: being confident of receiving rapid feedback following reporting; that feedback would be constructive; that feedback would focus on the system and not the individual; that reporting will be appreciated by the multidisciplinary team; and that a no blame culture existed. While responses were positive, there were significant differences in component scores in terms

of: gender (females most positive, p=0.028); and years registered as health professional (those registered longest most positive, p=0.019).

Component 3, action and impact related item responses

The minimum possible value for the scale is 10 (representing most positive responses) and the maximum possible value for the scale is 50 (representing least positive responses) and a midscale point of 30. With a median value of 17 and IQR of 12-20, respondents generally gave positive responses. While responses were positive, there were significant differences in component scores in terms of: gender (females most positive, p=0.007); years registered as health professional (those registered longest most positive, p<0.001); and age (older most positive p<0.001).

Component 4, motivation related item responses

The minimum possible value for the scale is 8 (representing most positive responses) and the maximum possible value for the scale is 40 (representing least positive responses) and a midscale point of 24. With a median value of 21 and IQR of 18-23, respondents gave more neutral responses. Neutral responses were given particularly in terms of work colleagues thinking less of them for reporting errors committed either by themselves or others. While responses were neutral, there were significant differences in component scores in terms of: gender (females most positive, p=0.026); years registered as health professional (those registered longest most positive, p=0.002); and age (older most positive p=0.004). It should, however, be noted that the internal reliability of this component was relatively poor.

Component 5, effort related item responses

The minimum possible value for the scale is 5 (representing most positive responses) and the maximum possible value for the scale is 25 (representing least positive responses) and a midscale point of 15. With a median value of 11.5 and IQR of 10-14, respondents generally gave positive responses. Less positive responses were given in relation to error reporting taking little time and effort. While responses were positive, there were significant differences in component scores in terms of: gender (females most positive, p=0.017); years registered as health professional (those registered longest most positive, p<0.001); and age (youngest most positive, p=0.012).

Component 6, emotions item responses

All statements in component 6 were reversed in score therefore, the minimum score (6) represent the disagreement of participants to all statement and the maximum score (30)

present the agreement of all participant in the study for all statement in component 6. The minimum possible value for the scale is 6 (representing most positive responses) and the maximum possible value for the scale is 30 (representing least positive responses) and a midscale point of 18. With a median value of 20 and IQR of 16-23, respondents generally gave negative responses. The most negative responses were given in relation to the potential impact of error reporting on reprimand, career progression. Concerns were also expressed about naming the patient and health professional as part of the error report. While responses were general negative, there were significant differences in component scores in terms of: years registered as health professional (those registered longest most positive, $p=0.002$); and age (older most positive, $p<0.001$).

Discussion

Main findings

Questionnaire items clustered into six components of: knowledge and skills; feedback and support; action and impact; motivation; effort; and emotions. Respondents generally gave positive responses in terms of knowledge and skills, feedback and support, action and impact related components. Responses were more neutral for the motivation related component and the effort related component, while respondents generally gave negative responses for the emotions component. Comparison of component scores across professions, genders, years of professional experience and age identified that, in general, nurses, females, those with greater experience and being older were more likely to be positive in their responses. In terms of emotions, the component with the lower scores, those older respondents with greater experience gave more positive responses.

Strengths and weaknesses

The theoretical underpinning is a key strength of this study. There are, however, a number of weaknesses hence the results should be interpreted with caution. While the total number of patient-facing doctors, nurses and pharmacists in the study hospitals was unknown hence a precise response rate could not be calculated, the number of responses was low. Several factors may have contributed to the low response. The email invitation was not sent by the research team hence may not have been received by all doctors, nurses and pharmacists. Medication error reporting is a sensitive area hence the nature of the study may have deterred participation. This may be reflected in the survey results which identified emotional issues being barriers to reporting. Biases around recruitment and response may therefore have impacted the findings. Ideally the demographics of the respondents and non-respondents would have been compared but this was not possible due to the absence of any information on the non-respondents. There may have been social desirability bias, particularly in relation to specific components (e.g. knowledge and skills related). A further weakness is that the results are all based on self-reported data which could not be validated. Then internal reliability of component 4 was poor impacting the interpretation of the findings. Additionally, the study was carried out in three tertiary hospitals in Abu Dhabi hence the findings may not be generalisable to the UAE, the Middle East or beyond.

Interpretation of findings

This study was the quantitative element of a mixed methods (qualitative, quantitative) study and as such extends the knowledge base beyond the qualitative findings of themes of beliefs of the consequences of reporting, emotional issues and social influences being barriers to reporting [15]. The survey results have allowed quantification of the behavioural

determinants and comparison amongst respondents, which when considered alongside the qualitative findings will facilitate the development of a theoretically informed intervention to enhance reporting.

The most negative responses were given in relation to the items within the emotions component, with particularly negative responses were given in relation to the potential impact of error reporting on reprimand, career progression. While several others have also noted fear of reporting for various reasons [3-5,8], this is the first study which has used behaviour theories and also quantified scores. Interestingly, the only significant differences in scores were in terms of years of registration (greater experience most positive) and age (older most positive) but with no differences in terms of gender or profession. Interventions to modify emotions should be prioritised in an effort to enhance reporting and be targeted at all professions, particularly the younger and less experienced.

While component scores within the components of motivation and effort were generally neutral, there were negative responses to items relating to colleagues and peers thinking less of those reporting errors and also the time and effort to complete and submit a report. These findings are similar to previously reported cross-sectional surveys [4,8,10]. In this study, there were significant differences scores in terms of gender (females most positive) and years of experience (greater experience most positive).

The responses for the three remaining components of knowledge and skills, feedback and support, and action and impact were generally positive. While there were significant differences in component scores, largely between gender and years of experience, these are less important given the overall positive responses.

It therefore appears that the key barrier to medication error reporting identified in this study relates to the behavioural determinant of emotions. Multimodal interventions may be required to promote behavioural change, particularly in areas such as emotions, a complex process that takes place over time at individual, population and organisational levels. Evans et al reported the evaluation of an intervention aimed at improving voluntary incident reporting in hospitals [23]. The intervention comprised providing intense education, a range of reporting options, changes in report management and enhanced feedback. While results demonstrated significant improvement in reporting rates in certain hospital areas there was considerable variation.

Any intervention developed and implemented with the aim of enhancing medication error reporting would be classed as a ‘complex intervention’. These are defined by the UK MRC as

'interventions with several interacting components' [11]. Behaviour change interventions, can be defined as 'coordinated sets of activities designed to change specified behaviour patterns'. These are often complex, consisting of many interacting components known as 'behaviour change techniques' (BCTs), 'observable and replicable components designed to change behaviour' [24].

Michie et al reported recently a Delphi type consensus exercise aiming to develop a cross-disciplinary taxonomy of evidence based BCTs [25], which were then mapped to specific TDF domains [26]. There are three BCTs which could form part of an intervention to impact emotions:

1. Reducing negative emotions, advising on ways of reducing negative emotions to facilitate performance of the behaviour
2. Focusing on emotional consequences, providing information (e.g. written, verbal, visual) about emotional consequences of performing the behaviour
3. Providing social support (emotional), advising or arranging to provide emotional social support (e.g. colleagues, 'buddies' or staff) for performance of the behaviour.

Development of such an intervention will require commitment at all levels throughout the organisation. This is consistent with operating within a positive safety culture. Such organisations are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measure' [27]. Mutual trust and confidence are key within this definition and the findings of this study demonstrate that much work is required to promote a safety culture in relation to medication error reporting.

Further research

There is need for further research in terms of developing and evaluating an intervention to tackle the emotional issues around medication error reporting. This should follow the phases of the MRC guidance in terms of intervention development, feasibility and pilot testing, implementation and evaluation.

Conclusion

This research has extended the knowledge base around the specific behavioural determinants which appear to impact medication error reporting. Emotional aspects are the dominant barrier to reporting and are common to all professions. There is a need to develop, test and implement an intervention to impact health professionals' emotions. Such

an intervention should focus on evidence based BCTs of reducing negative emotions, focusing on emotional consequences and providing social support.

References

1. Kohn LT, Corrigan JM, Donaldson MS. To Err is Human: Building a Safer Health System. National Academies Press; 2000.
2. National Coordinating Council for Medication Error Reporting and Prevention. Available at http://www.nccmerp.org [accessed July 2016].
3. Bahadori M, Ravangard R, Aghili A, Sadeghifar J, Gharsi Manshadi M, Smaeilnejad J. The Factors Affecting the Refusal of Reporting on Medication Errors from the Nurses' Viewpoints: A Case Study in a Hospital in Iran. ISRN Nursing 2013: 876563.
4. Wakefield DS, Wakefield BJ, Uden-Holman T, Borders T, Blegen M, Vaughn T. Understanding why medication administration errors may not be reported. AJMQ. 1999;14(2):81-88.
5. Stratton KM, Nlegen MA, Peppper G, Vaughn T. Reporting of medication errors by pediatric nurses. J Pediatr Nurs 2004;19:385-392.
6. Wild D, Bradley E. The gap between nurses and residents in a community hospital's error-reporting system. JQPS 2005;31(1):13-20.
7. Evans SM, Berry JG, Smith BJ, Esterman A, Selim P, O'Shaughnessy J, et al. Attitudes and barriers to incident reporting: a collaborative hospital study. Qual Saf Health Care 2006;15(1):39-43.
8. Patrician PA, Brosch LR. Medication error reporting and the work environment in a military setting. JNCQ 2009;24(4):277-286
9. Sarvadikar A, Prescott G, Williams D. Attitudes to reporting medication error among differing healthcare professionals. Eur J Clin Pharmacol 2010;66:843-853.
10. Chiang H, Lin S, Hsu S, Ma S. Factors determining hospital nurses' failures in reporting medication errors in Taiwan. Nursing Outlook 2010;58(1):17-25.
11. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. Brit Med J 2008;337:a1665.
12. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. Implement Sci 2012:7:37.
13. Francis JJ, O'Connor D, Curran J. Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. Implement Sci 2012:7:35.
14. Francis JJ, O'Connor D, Curran J. Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. Implement Sci 2012:7:35.
15. Alqubaisi M, Tonna A, Strath A, Stewart D. Exploring behavioural determinants relating to health professional reporting of medication errors: a qualitative study using the Theoretical Domains Framework. Eur J Clin Pharmacol 2016;72:887-895.

16. SEHA Annual Report 2. The Changing Face of HealthCare. Abu Dhabi Health Services Co. Available at http://docplayer.net/2810751-Abu-dhabi-health-services-company-pjsc-seha-annual-report-2012-annual-report-2012-the-changing-face-of-healthcare.html
17. Health Authority Abu Dhabi Medication Error Reporting Policy version 1, 2009. Available at http://www.haad.ae/haad/tabid/58/Mid/417/ItemID/225/ctl/Details/Default.aspx [Accessed July 2016]
18. Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJ, et al. Measuring determinants of implementation behavior: psychometric properties of a questionnaire based on the theoretical domains framework. Implement Sci 2014;9.
19. Krejcie RV, Morgan DW. Determining sample size for research activities. Educ psychol meas 1970;30(3):607-10.
20. Osborne JW, Costello AB. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. Pan-Pacific Management Review 2009;12(2):131-46.
21. Hayton JC, Allen DG, Scarpello V. Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. ORM 2004;7(2):191
22. Nunnally JC. Psychometric theory. Tata McGraw-Hill Education, 2010
23. Evans SM, Smith BJ, Esterman A, Runciman WB, Maddern G, Stead K, et al. Evaluation of an intervention aimed at improving voluntary incident reporting in hospitals. Qual Saf Health Care 2007 Jun 1;16(3):169-75.
24. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci. 2011;6:42.
25. Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W, et al. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. Ann Behav Med 2013;46(1):81-95.
26. Michie S, Wood CE, Johnston M, Abraham C, Francis JJ, Hardeman W. Behaviour change techniques: the development and evaluation of a taxonomic method for reporting and describing behaviour change interventions (a suite of five studies involving consensus methods, randomised controlled trials and analysis of qualitative data). Health Technol Assess 2015;19(99).
27. Halligan, M, Zecevic A. Safety culture in healthcare: a review of concepts, dimensions, measures and progress. BMJ Qual Saf 2011;20(4);338-343.

Table 1: Respondent demographics (N=294)

Characteristic	Percentage	Frequency, n
Profession		
Doctor	27.6	81
Nurse	53.1	156
Pharmacist	15.6	46
Missing	3.7	11
Gender		
Male	37.4	110
Female	59.5	175
Missing	3.1	9
Age, years		
<25	1.0	3
25-34	33.0	97
35-44	36.1	106
45-54	18.4	54
>54	9.2	27
Missing	2.4	8
Years registered as health professional		
< 6 years	10.5	31
6-10 years	22.1	65
11-15 years	24.8	73
16-20 years	17.3	51
> 20 years	23.8	70
Missing	1.4	4

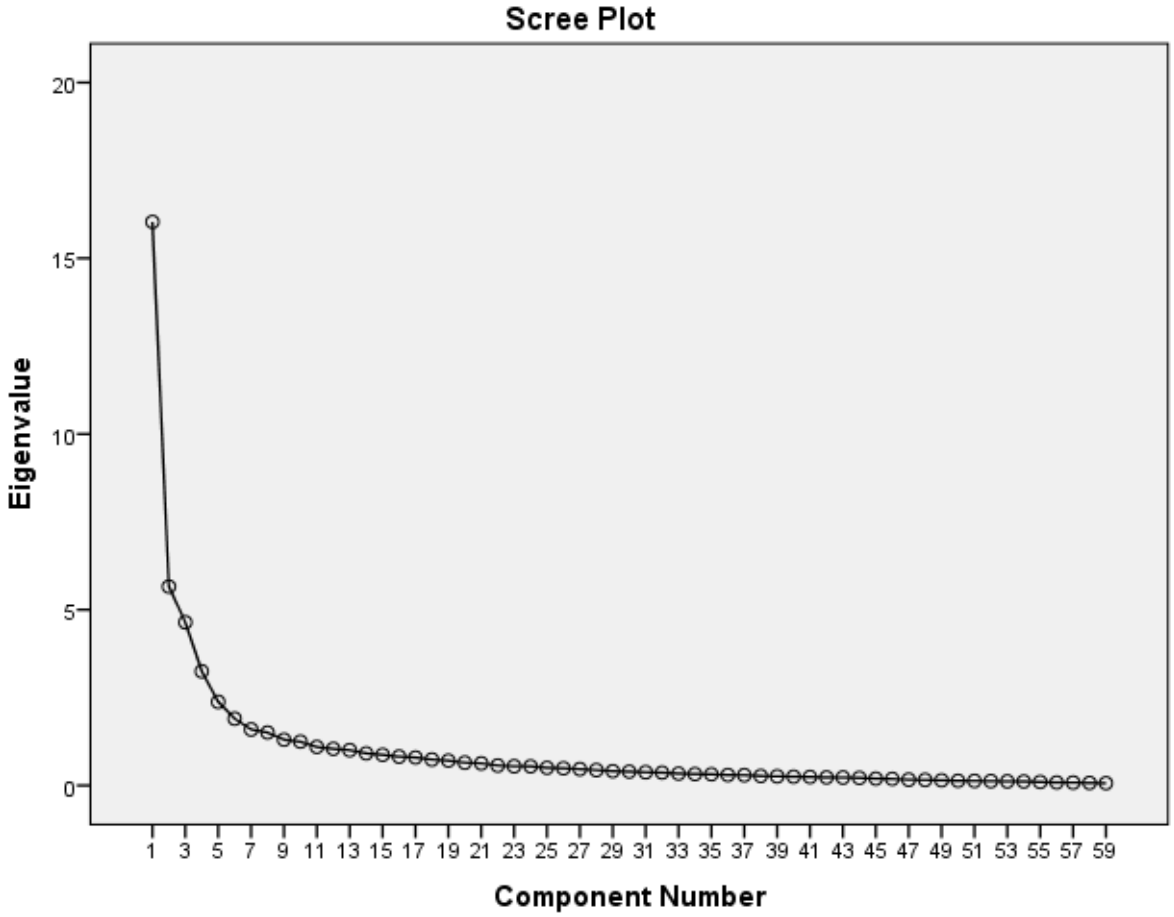

Figure 1: Scree plot of eigenvalues associated with each component

Table 2: Component 1, knowledge and skills related item responses (N=294)

Component 1, knowledge and skills related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
I am aware of the policy relating to medication error reporting in Abu Dhabi hospitals	33.7 (99)	43.5 (128)	17.7 (52)	3.1 (9)	0.7 (2)	1.4 (4)
I have a clear plan of how to submit a medication error report	32.7 (96)	49.3 (145)	12.9 (38)	2.4 (7)	1.0 (3)	1.7 (5)
I have a clear plan of under what circumstances I should submit a medication error report	31.6 (93)	50.3 (148)	12.9 (38)	2.0 (6)	0.7 (2)	2.4 (7)
I find the policy straightforward to interpret	26.5 (78)	50.7 (149)	17.7 (52)	2.4 (7)	0.7 (2)	2.0 (6)
I have the ability to report medication errors	36.1 (106)	50.7 (149)	7.5 (22)	2.7 (8)	0.7 (2)	2.4 (7)
I am confident in my ability to recognise all medication errors	42.2 (124)	48.3 (142)	8.2 (24)	0.3 (1)	0	1.0 (3)
I have received sufficient training in medication error reporting	22.1 (65)	43.9 (129)	13.6 (40)	16.3 (48)	1.4 (4)	2.7 (8)
I find the policy straightforward to apply in practice	27.9 (82)	45.9 (135)	22.1 (65)	2.4 (7)	0.3 (1)	1.4 (4)
I have the necessary experience to report medication errors	29.6 (87)	50.7 (149)	10.5 (31)	5.4 (16)	0.3 (1)	3.4 (10)
I am aware of what is expected of me in relation to medication error reporting	38.4 (113)	47.6 (140)	10.2 (30)	0.7 (2)	0.7 (2)	2.4 (7)

I am aware of which medication errors should be reported	34.4 (101)	45.9 (135)	11.9 (35)	3.7 (11)	2.4 (7)	1.7 (5)
I am aware of my responsibilities for medication error reporting	43.9 (129)	48.3 (142)	3.7 (11)	0.3 (1)	0.7 (2)	3.4 (9)
I am aware of the definition of a medication error	63.6 (187)	33.0 (97)	2.0 (6)	0	0	1.4 (4)
I am aware of the distinction between a medication error and an adverse drug reaction	66.0 (194)	30.6 (90)	2.0 (6)	0	0	1.4 (4)
For me, submitting a medication error report is something I do automatically	31.3 (92)	45.6 (134)	11.9 (35)	8.8 (26)	0.3 (1)	2.0 (6)
Cronbach's alpha score		0.934				
Median		28				
Interquartile range		21-32				

Table 3: Component 2, feedback and support related item responses (N=294)

Component 2, feedback and support related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
When I submit a medication error report, I am confident that that I will receive feedback from the medication error reporting organisation	10.5 (30)	53.1 (152)	23.8 (68)	8.4 (24	4.2 12	2.7 (8)
When I submit a medication error report, I am confident that I will receive rapid feedback from the medication error reporting organisation	9.4 (27)	43.7 (125)	30.1 (86)	12.6 (36)	4.2 (12)	2.7 (8)
When I submit a medication error report I am confident that I will receive constructive feedback from the medication error reporting organisation	7.7 (22)	46.1 (131)	31.3 (89)	10.9 (31)	3.9 (11)	2.7 (8)
When I submit a medication error report I am confident that I will feedback from the medication error reporting organisation which is appropriate to the severity of the error	8.5 (24)	55.6 (158)	28.5 (81)	4.9 (14)	2.5 (7)	3.4 (10)

When I submit a medication error report I am confident that I will feedback from the medication error reporting organisation which focuses on the system and not the individual	11.2 (32)	43.4 (124)	31.5 (90)	9.1 (26)	4.9 (14)	3.4 (10)
I feel that there is a positive safety culture in my organisation in relation to medication errors	18.9 (54)	47.0 (134)	23.2 (66)	6.0 (17)	4.9 (14)	3.1 (9)
I receive sufficient encouragement and support from my multidisciplinary team to report medication errors	10.6 (30)	45.4 (129)	30.6 (87)	9.2 (26)	4.2 (12)	3.4 (10)
I believe that each medication error report I submit will be appreciated by my multidisciplinary team	19.0 (56)	35.7 (105)	29.3 (86)	11.2 (33)	2.0 (6)	2.4 (7)
I feel that there is a 'no blame' culture in my organisation in relation to medication errors	11.1 (32)	32.8 (94)	30.7 (88)	18.5 (53)	7.0 (20)	2.4 (7)
I receive sufficient encouragement and support from my peers to report medication errors	20.0 (57)	60.7 (173)	15.1 (43)	3.9 (11)	0.4 (1)	3.1 (9)
I get professional reassurance from each medication error report that I submit	16.3 (48)	36.1 (106)	34.4 (101)	8.2 (24)	2.0 (6)	2.4 (7)
I believe that each medication error report I submit will be appreciated by my seniors	22.4 (66)	40.8 (120)	26.5 (78)	5.1 (15)	2.7 (8)	2.7 (8)

I believe that each medication error report I submit will be appreciated by my peers	47.3 (139)	43.9 (129)	6.1 (18)	0.3 (1)	0	2.7 (8)
I receive sufficient encouragement and support from my seniors to report medication errors	15.1 (43)	51.6 (147)	19.6 (56)	9.8 (28)	3.9 (11)	3.1 (9)
I receive sufficient encouragement and support from my organisation to report medication errors	14.3 (41)	48.1 (138)	25.8 (74)	9.4 (27)	2.4 (7)	2.4 (7)
Cronbach's Alpha	0.934					
Median	35					
Inter-quartile rate	30-42					

Table 4: Component 3, action and impact related item responses (N=294)

Component 3, actions and impact related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
I believe that each medication error report I submit can make a significant contribution to my professional practice	56.1 (165)	38.8 (114)	3.1 (9)	0	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to patient care	47.3 (139)	43.9 (129)	6.1 (18)	0.3 (1)	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to patient safety	55.4 (163)	37.8 (111)	3.7 (11)	0.7 (2)	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to the professional practice of others	48.3 (142)	40.5 (119)	7.5 (22)	1.0 (3)	0	2.0 (6)
I believe that each medication error report I submit can make a significant contribution to my organisation	48.3 (142)	41.2 (121)	7.1 (21)	0.7 (2)	0	2.7 (8)
I believe that it is my professional duty to report medication errors which I have made	47.6 (140)	46.6 (137)	2.7 (8)	0.3 (1)	0	2.7 (8)

I believe that it is my professional duty to report medication errors which others have made, irrespective of their professional background	38.4 (113)	48.6 (143)	8.5 (25)	2. 0 (6)	0	2.4 (7)
I am confident that I will report medication errors even if others I work with do not	35.8 (102)	50.5 (144)	11.6 (33)	2.1 (6)	0	3.1 (9)
I report medication errors even if there is very little time available	32.3 (95)	48.0 (141)	12.2 (36)	3.4 (10)	1.4 (4)	2.7 (8)
I intend to report all medication errors	42.5 (125)	43.5 (128)	9.5 (28)	2.7 (8)	0	1.7 (5)
Cronbach's Alpha	0.910					
Median	17					
Interquartile rate	12-20					

Table 5: Component 4, motivation related item responses (N=294)

Component 4, motivation related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
*I need to be constantly reminded by others to submit a medication error report	5.4 (16)	15.3 (45)	10.9 (32)	46.6 (137)	18.0 (53)	3.7 (11)
*I am too busy to report medication errors	3.7 (11)	13.9 (41)	9.9 (29)	51.4 (151)	18.4 (54)	2.7 (8)
*For me, reporting medication errors is low priority compared to other professional duties	1.4 (4)	11.2 (32)	8.4 (24)	61.8 (176)	17.2 (49)	3.1 (9)
*Others I work with will think less of me if I submit a report for a medication error I have made	7.6 (22)	34.0 (98)	29.9 (86)	22.9 (66)	5.6 (16)	2.4 (7)
*It is sometimes difficult for me to accept that I have made a medication error	10.9 (32)	31.0 (91)	9.5 (28)	35.4 (104)	11.6 (34)	1.7 (5)
*Others I work with will think less of me if I submit a report for a medication error they have made	7.6 (22)	34.0 (98)	29.9 (86)	22.9 (66)	5.6 (16)	2.0 (6)
Reporting medication errors is something I seldom forget	12.6 (37)	35.7 (105)	14.3 (42)	24.1 (71)	8.5 (25)	4.8 (14)
I prioritise reporting those medication errors which I consider to be more serious	25.9 (76)	51.4 (151)	6.5 (19)	9.9 (29)	3.1 (9)	3.4 (10)
Cronbach's Alpha	0.560 (<0.7 hence scale may lack reliability)					
Median	21 (6 items reverse scored*)					

Table 6: Component 5, effort related item responses (N=294)

Component 5, effort related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
Reporting medication errors is compatible with my daily practice	13.0 (37)	61.8 (176)	17.5 (50)	7.4 (21)	0.4 (1)	3.1 (9)
For me, reporting medication errors takes very little time	9.5 (28)	44.2 (130)	21.4 (63)	20.4 (60)	1.7 (5)	2.7 (8)
For me, reporting medication errors takes very little effort	8.8 (26)	44.2 (130)	21.8 (64)	21.1 (62)	1.4 (4)	2.7 (8)
I am likely to report medication errors even if my peers do not	20.0 (57)	60.7 (173)	15.1 (43)	3.9 (11)	0.4 (1)	3.1 (9)
I am likely to report medication errors even if my seniors do not	18.8 (54)	61.3 (176)	15.0 (43)	4.2 (12)	0.7 (2)	2.4 (7)
Cronbach's Alpha	0.751					
Median	11.5					
Interquartile rate	10-14					

Table 7: Component 6, emotions item responses (N=294)

Component 6, emotions						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
*I am concerned about any potential reprimand following submission of a medication error report	11.2 (32)	44.4 (127)	15.4 (44)	26.2 (75)	2. 8 (8)	3.4 (10)
*I am concerned about the potential impact on my career following submission of a medication error report	10.5 (30)	39.2 (112)	16.1 (46)	29.0 (83)	5.2 (15)	2.7 (8)
*I am concerned about patient confidentiality by having to include the patient name on a medication error report	15.5 (44)	43.5 (123)	17.0 (48)	21.2 (60)	2.8 (8)	3.7 (11)
*I am concerned about the potential consequences of having to include the name of the professional on a medication error report	10.9 (31)	44.0 (125)	23.2 (66)	19.0 (54)	2.8 (8)	3.4 (10)
*I feel uncomfortable about submitting a medication error report for an error I have made	6.3 (18)	29.1 (83)	13.3 (38)	40.7 (116)	10.5 (30)	2.0 (6)
*I feel uncomfortable about submitting a medication error report for an error others have made	7.3 (21)	30.9 (89)	20.1 (58)	32.6 (94)	9.0 (26)	3.1 (9)
Cronbach's Alpha	0.820					

Median	20	(All items reverse scored*)
Interquartile rate	16-23	