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Measuring knowledge, attitudes and behavior of nurses in medication management: cross-cultural comparisons in Italy and Malta

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Abstract. – OBJECTIVE: Medication errors are one of the most common causes of negative events affecting patient safety all over the world. Scientific literature divides the factors that contribute to the occurrence of harmful events into factors related to the characteristics of the healthcare workers and factors related to the organization of the drug management process. The aim of the study was to examine the knowledge, attitudes and behaviours related to medication errors among Italian and Maltese nurses.

SUBJECTS AND METHODS: Cross-sectional survey of nurses working in Intensive Care settings in Italian and Maltese hospitals was conducted. A valid and reliable questionnaire used in previous studies was adapted for online use. Despite improved reporting, The Strengthening the Reporting of Observational Studies in Epidemiology was used.

RESULTS: Findings showed good psychometric properties and reliability. MANOVA demonstrated significant differences in nurses' perception of the pharmacist presence during medication process and of the use of computerized provider order entry. MANOVA also demonstrated significant differences in the control of vital parameters and the application of the 8 right.

CONCLUSIONS: These findings support the contention that knowledge, attitude and behaviour of nurses is similar across different contexts in different countries wherein nurse training is harmonised and regulated through a transnational directive.

Key Words:
Cross-cultural comparison, Medication errors, Patient safety, Intensive care units, Cultural Competency.

Introduction

One of the most controversial aspects of medical care is the potential to cause unintended disability and distress. Wherever medical care is provided, the patient runs the risk of being injured as a result of involuntary consequences of treatment[1].

Often cited reports from the United States, such as *To Err is Human* or *Keeping Patients Safe*[2,3] and, more recently, in the English NHS inquiries by Keogh[4] and Francis[5], showed that medical errors were one the most common causes of negative events affecting patient safety[2]. Among adverse events, medication error is one of the most frequent causes of patient injury, disability or in-hospital death[2]. Institutions promoting error reporting were set up in all the world[6-8].

Medication error (MEs) is defined as "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. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labelling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use"[9,10].

It is estimated that any given patient is exposed to at least 1 medication error per day and that medication errors account for 100,000 hospitalizations each year[11]. Moreover, 6-7% of inpatients are exposed to MEs daily; the majority of such patients are in long-

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term care and/or admitted to intensive care unit (ICU), which is a high-complexity context where drug administration often requires a large number of interventions from healthcare personnel[12].

Scientific literature divides the factors that contribute to the occurrence of harmful or potentially harmful events into (i) factors related to the personal and professional characteristics, that are human factors, of the healthcare workers and (ii) factors related to the organization of the drug management process[13].

The latter organizational factors includes workplace conditions, risk management strategies, learning process, workload, overcrowding, lack of staff and shift works[14-17].

Human factors include personal and professional characteristic of registered nurses. Drug administration and management are integral part of the nurse's role: nurses spend up to 40% of their time administrating drugs[18]. So, medication errors are a persistent problem associated with nursing practice.

Knowledge and Medication Errors

The United States Food and Drug Administration (FDA) believes that lack of knowledge is one of the human factors most frequently associated with error[19]. Indeed, several studies that have evaluated the pharmacological knowledge of nurses and their calculation skills detect inadequate nursing knowledge[19-21].

The percentage of errors related to knowledge deficits is however not clear. Some studies[22,23] showed that about half of the therapeutic errors in ICU are the result of knowledge and/or performance deficits, while Rothschild et al[24] estimate a percentage of only 25% of these.

Attitude and Medication Errors

Primarily, negligence nursing care is related to error[25]. Medical science, as well as nursing care, cannot be considered as a profession that only requires technical and cognitive skills. It should be considered as the integration of this concrete ability with an "innate attitude of caring"[26]. The care provided by nurses with a good attitude is more frequently related to safe practice. Gastmans[26] believes that nurses with this attitude are constantly looking for the best nursing practice. Another study conducted by Lawton et al[27] showed that nurses that consider their role as "just a job" had a greater propensity to error. The occurrence of medication errors committed by a nurse is inversely related to job satisfaction and commitment of the nurse[28].

Behaviour and Medication Errors

Several studies showed behaviours that are directly related to a medication error, such as a failure to comply with guidelines, protocols or procedures or the ineffective controls or absence of double controls[29,30]. The literature showed most frequent medication errors involve missing or bypassing the administration, wrong-medication, wrong dose, wrong patient, wrong route, wrong rate, wrong timing[29,30].

Subjects and Methods

Aim

The goal of this study was to examine the knowledge, attitudes and behaviour of Italian and Maltese intensive care nurses in relation to medication errors. The objectives were to determine any similarities or differences between the Maltese and Italian nurses and to explore and understand the outcomes and implications of such comparisons. To this aim two studies were conducted: the first reported the exploratory factor analyses with an Italian sample of ICU nurses, whereas the second investigated the cross-cultural differences of KAB items between countries (Maltese and Italy).

Despite improved reporting, The Strengthening the Reporting of Observational Studies in Epidemiology (STROMBE) was used **(Supplementary File 1)**.

Design and Participants

This was a study with two samples in two different setting: Italian ICU and Maltese ICU. This study is a cross-sectional survey of nurses working in Intensive Care settings in Italy and Malta.

Sample 1 consisted of 53 nurses in Malta, aged between 24 and 54 years (M=37.04; SD±7.89). The Maltese participants worked in Malta and were involved in an ongoing longitudinal study, taking place at an acute general hospital in Malta. In terms of socio-demographic characteristics, 28.3% of participants were males and 71.7% females. They had an average of 13.13 years of working experience (SD ± 5.85).

Sample 2 was composed of 529 Italian nurses, the majority of whom were female (n=360; 68.1%). The participants from Italy were obtained from data collected in a previous study[31-33]. Their age ranged between 22 and 61 years (M=39.93

SD ± 9.12). A majority of the participants (56.9%) held at least a bachelor's degree".

Since the Maltese sample was smaller compared to the Italian dataset, a random sample of 55 nurses was selected from the 529 in the Italian sample (matched by age and sex). Socio-demographic characteristics for the whole sample in each country are presented in Table I.

Data Collection

Participation in this study was voluntary and participants were assured of anonymity. The participants were recruited from ICUs in Malta and Italy. The participants enrolled by a web survey. In the web survey, there is information about the study's purpose. To take part in this study, nurses had to work in an Intensive Care Unit. There were no exclusion criteria.

Ethical Consideration

Ethics approval was obtained through the appropriate Health Sciences Research Ethics Committee. Consent was implied by the return of a completed questionnaire or by the online completion of the web survey. The survey was anonymous.

Instruments

The Italian versions of the KAB related medication errors questionnaire[31-33] were used as a starting point in the translation process. First, two investigators translated the Italian versions of the instrument to English. To confirm if the English translations were reliable, an expert translated them back to Italian. Afterward, two judges (both fluent in English and Italian) evaluated and compared the retroversion with the original Italian versions and confirmed their accuracy[34].

The original version includes 33 items assessing knowledge, attitudes and behavior of nurses during the medication process (prescription, preparation, administration, documentation, monitoring for therapeutic and adverse effects). Participants were asked to express their degree of agreement with each item in the questionnaire, using a scale that ranged from 1 (Totally disagree) to 5 (Totally agree). However, the statements in the section on *attitude*s was instead provided with a three-level Likert scale (Agree, Uncertain and Disagree).

The questionnaire is made up of six sections: demographics and personal characteristics (section A); access to bibliography update (section B); knowledge about the use of IV drugs (section C); attitudes on to the use of IV drugs (section D); behaviour on the preparation and administration of IV drugs (section E); perceived training needs (section F).

Overview of the Statistical Analyses

Participants answered questions about socio-demographics and professional characteris-

Table I. Characteristics of the Maltese and Italian samples

	Maltese (n = 53)	Italian (n = 529)
Mean age (S.D.)	37.04 (7.89)	39.92 (9.12)
Sex (M/F)	15 (28.3)/38 (71.7)	169 (31.9)/360 (68.1)
Qualification (Bachelor's degree/not degree)	45 (84.9)/8 (15.1)	301 (56.9)/228 (43.1)
Postgraduated education (Master/Other)	13 (24.5)/23 (43.4)	144 (88.3)/19 (11.7)
Mean working experience in years (S.D.)	13.13 (5.86)	13.08 (9.33)
Knowledge in qualification (yes/no)	52 (98.1)/1 (1.9)	498 (94.1)/31 (5.9)
Knowledge about medication errors in postgraduated education (yes/no)	39 (73.6)/14 (26.4)	209 (62.4)/126 (37.6)
Self-assessed English Proficiency		
Very low	0 (0)	100 (18.9)
Low	1 (1.9)	164 (31.0)
Intermediate	3 (5.7)	152 (28.7)
Good	27 (50.9)	90 (17)
Excellent	22 (41.5)	23 (4.3)
Internet point (yes/no)	49 (92.5)/4 (7.5)	468 (94.2)/29 (5.8)
Library (yes/no)	28 (52.8)/25 (47.2)	382 (72.3)/146 (27.7)
Mean study time in hours/week		
< 1	35 (66)	332 (62.8)
1-5	11 (20.8)	164 (31.0)
1-10	4 (7.5)	24 (4.5)
> 10	3 (5.7)	9 (1.7)

tics such as age, sex, the qualification obtained, post-graduate education, the extent of work experience.

The Statistical Package for the Social Sciences (SPSS®), version25 (SPSS Inc. Armonk, NY, USA), was used to analyse the data. The statistical significance level was set at 0.05. Descriptive statistics were used to analyse the distributions of responses on the questionnaire items and subscales; while inferential statistics were used to determine the presence of statistically significant differences.

To examine the dimensionality of the KAB questionnaire, exploratory factor analysis (EFA) was carried out on the Italian sample, using principal axis factoring as an extraction method, and Varimax as a rotation method. Multivariate analysis of variance was run to test the significant differences between countries on knowledge, attitude and behaviours items.

Results

Exploratory Factor Analysis

A factor analysis with varimax rotation was performed to determine the construct validity (KMO=0.931; gl=171; $p<0.01$). Three factors had eigenvalues higher than 1 and so these were revealed from the analytic procedure. The three factors explained together 83.51% of the common variance (Table II and Figure 1).

The items were summed into three factors and for each one, Cronbach's alpha coefficient was calculated to evaluate the internal consistency in the Italian and Maltese samples. The factors were called knowledge, attitude and behavior and their Cronbach's alpha are shown in Table III.

These values showed that the questionnaire possessed good reliability in both the samples[35,36].

Knowledge, Attitude and Behavior of Maltese Nurses

About 83% of the sample agreed that a good knowledge of drug calculation was useful to reduce medication administration errors such as a good knowledge of guidelines, protocols and procedures.

In a typical hospital environment, but mostly in Intensive Care Units, sounds of beepers and alarms are considered usual and at the same time, they have an important impact on patient safety. A majority of the Maltese nurses (67.9%) thought that noise and alarms could cause a medication error.

The hypothetic implementation of computerized provider order entry (CPOE) resulted in the reduction of medication error (66% of Maltese sample) such as the presence of pharmacist

Table II. Inverted components matrix.

		Factors	
	1	2	3
Knowledge_1	0.823	0.219	0.16
Knowledge_2	0.692	0.154	0.111
Knowledge_3	0.805	0.322	0.107
Knowledge_4	0.911	0.286	0.195
Knowledge_5	0.667	0.101	0.107
Knowledge_6	0.907	0.292	0.184
Knowledge_7	0.86	0.251	0.17
Attitude_1	0.412	0.76	0.347
Attitude_2	0.38	0.774	0.257
Attitude_3	0.257	0.779	0.393
Attitude_4	0.296	0.81	0.447
Attitude_5	0.25	0.804	0.316
Attitude_6	0.248	0.74	0.358
Attitude_7	0.223	0.756	0.352
Behaviour_1	0.198	0.432	0.839
Behaviour_2	0.183	0.349	0.916
Behaviour_3	0.185	0.349	0.916
Behaviour_4	0.184	0.349	0.916
Behaviour_5	0.181	0.349	0.916

Extraction method: Analysis of the main components. Rotation method: Varimax with Kaiser normalization. [a]Convergence for rotation performed in 6 iterations.

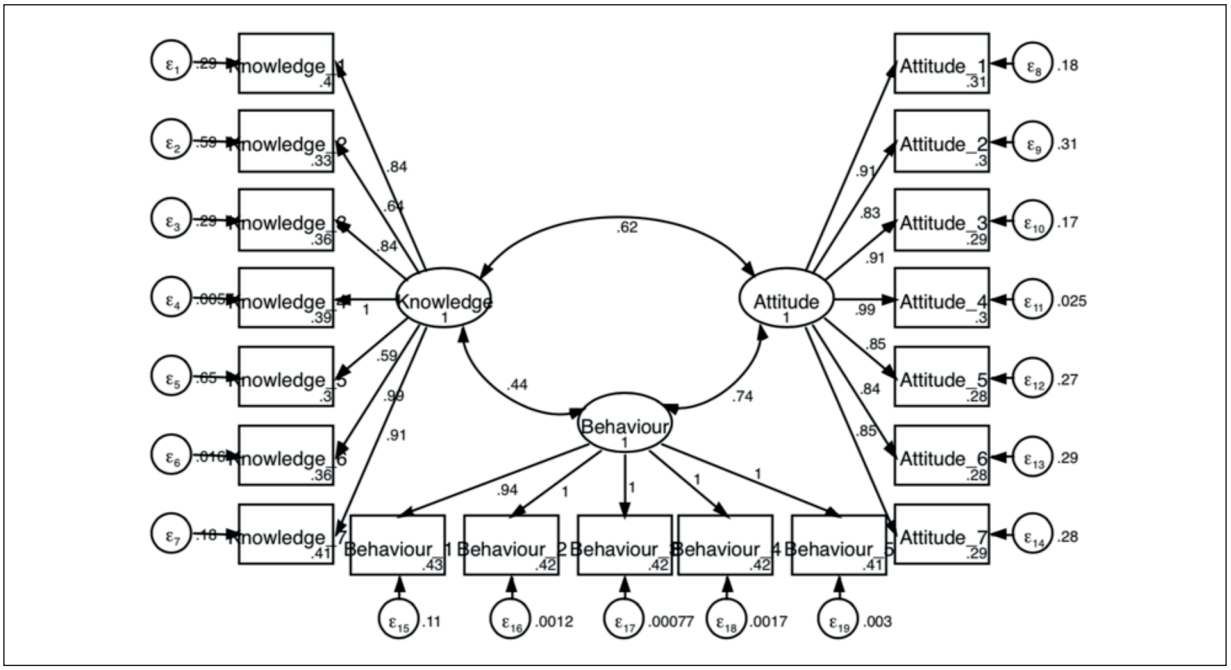

Figure 1. Original KAB structure in the Italian sample.

during medication administration (79.2 of Maltese sample). There were no statistically significant differences between knowledge items and socio-demographics and professional characteristic of the sample.

In response to the items of Attitude sub-scale, Maltese nurses showed a positive attitude to nursing education (79.2 of Maltese sample), motivation (83% of Maltese sample), clinical skills (86.8 of Maltese sample) and error reporting (84.9% of Maltese sample).

The third and final section showed how the correct behavior can reduce medication errors. The Maltese samples reportedly use the correct procedures before drug management such as correct handwashing (94.4% of Maltese sample), correct control of vital parameters (100% of Maltese sample), application of double-checking (92.4%) and 8 rules (98.1% of Maltese sample). Moreover, 88.7% of the nurses in the Maltese sample agreed with complying with IV drugs infusion rate.

Univariate analysis showed statistical significance ($p < 0.01$) between nurses who spent more time in education and training and the use of checking of vital parameters during vasoactive drugs administration ($p<0.05$). Furthermore, nurses who believe in a useful ME reporting showed greater inclination to checking vital parameters during vasoactive drugs administration ($p<0.01$) and compliance to drug infusion rate ($p<0.01$).

Comparison of Countries on KAB Items

Multivariate analysis of variance (MANOVA) was run to test the significant differences between countries on knowledge, attitude and behaviours items.

Table III. Cronbach's alpha co-efficient for three factors into Italian and Maltese samples.

	Cronbach alpha	
	Maltese (n = 53)	Italian (n = 529)
Knowledge	0.447	0.920
Attitude	0.551	0.959
Behaviour	0.544	0.995
Total Cronbach alpha	0.626	0.959

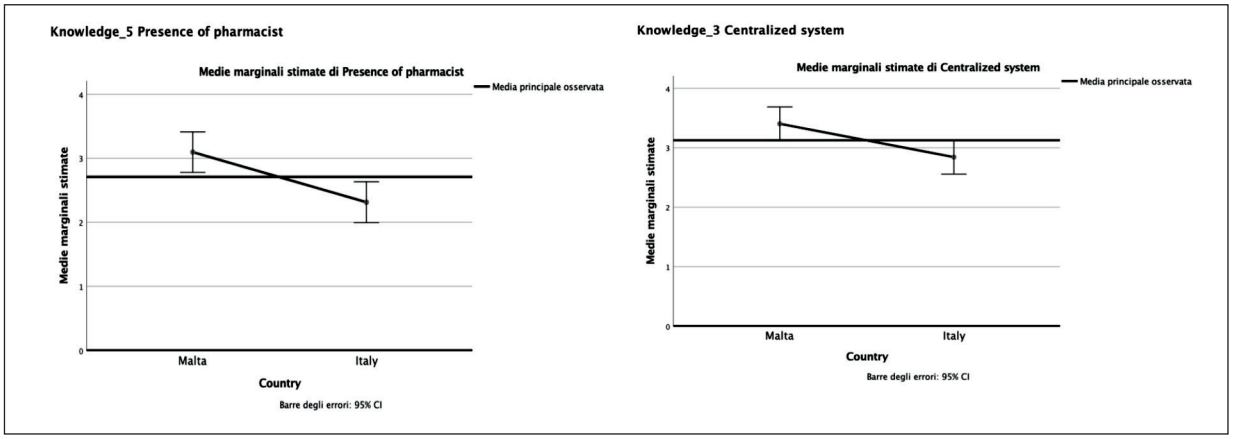

Figure 2. Differences between countries on Knowledge items.

MANOVA demonstrated significant differences between Italian and Maltese nurses' perception of the presence of a pharmacist during medication process [F(1,101)=11.92, $p<0.05$] and of the use of CPOE [F(1,101)=7.622, $p<0.05$]. Maltese nurses were significantly more likely to consider the presence of a pharmacist (M=0.772; $p=0.001$) and the use of a CPOE (M=0.561; $p=0.007$) as effective in reducing medication errors (Figure 2).

Another significant difference between Italian and Maltese samples was shown in behaviour scores. MANOVA demonstrated significant differences in the reported frequency of controlling of vital parameters before medication administration [F(1,105)=7.154, $p=0.009$] and the application of the "8 right of medication administration" [F(1,105)=9.64, $p=0.002$] among samples (Figure 3). No statistically significant differences were revealed in attitude items.

Since the Maltese sample was smaller compared to the Italian dataset, a total number of 55 registered nurses (matched by age and sex) randomly sampled from Italy. Table IV shows the mean scores for each item of Knowledge, Attitude and Behaviour sub-scales by countries.

Discussion

This publication reports the comparison of measures of KAB questionnaire used among a cohort of nurses in Malta and another in Italy. EFA findings showed good psychometric properties and a good reliability. There are only a few statistically significant differences between the two samples. These findings therefore support the contention that knowledge, attitude and behaviour are similar across cohorts of nurses whose training and education is similar. Nurses working in both countries satisfy the training and education criteria for registration and practice as a nurse stipulated for European Union. Their training is therefore very similar

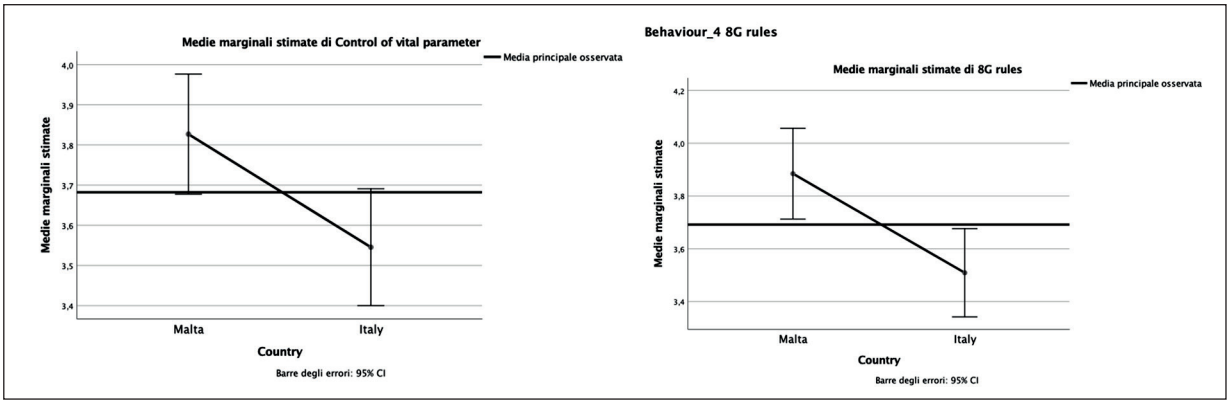

Figure 3. Differences between countries on Behaviors items.

Table IV. Mean, Standard deviation and Standard error from Knowledge, attitudes and behavior (KAB) scales in Italian and Maltese samples.

	A3 Country	N	Mean	Standard deviation	Mean ES
Knowledge_1 Drug dosage	1 Malta	53	3.29	0.915	0.127
	2 Italy	54	3.15	0.96	0.131
Knowledge_2 Computerized prescription	1 Malta	53	2.87	0.95	0.132
	2 Italy	54	2.89	1.11	0.151
Knowledge_3 Centralized system	1 Malta	53	3.4	0.891	0.124
	2 Italy	54	2.89	1.144	0.156
Knowledge_4 Protocols, poster	1 Malta	53	3.31	0.755	0.105
	2 Italy	55	2.87	1.072	0.145
Knowledge_5 Presence of pharmacist	1 Malta	53	3.1	1.015	0.141
	2 Italy	53	2.34	1.255	0.172
Knowledge_6 Allarms	1 Malta	53	2.87	1.048	0.145
	2 Italy	55	3	1.155	0.156
Knowledge_7 Workload	1 Malta	53	3.33	0.964	0.134
	2 Italy	55	3.11	0.994	0.134
Attitude_1 Education	1 Malta	53	1.79	0.412	0.057
	2 Italy	55	1.89	0.369	0.05
Attitude_2 Awareness	1 Malta	53	1.75	0.437	0.061
	2 Italy	55	1.85	0.356	0.048
Attitude_3 Motivation	1 Malta	53	1.83	0.382	0.053
	2 Italy	55	1.93	0.262	0.035
Attitude_4 Guidelines	1 Malta	53	1.75	0.437	0.061
	2 Italy	55	1.87	0.388	0.052
Attitude_5 Protocols and procedures	1 Malta	53	1.83	0.43	0.06
	2 Italy	55	1.87	0.388	0.052
Attitude_6 Clinical skills	1 Malta	53	1.87	0.345	0.048
	2 Italy	55	1.91	0.348	0.047
Attitude_7 Error reporting	1 Malta	53	1.81	0.487	0.067
	2 Italy	55	1.93	0.262	0.035
Behaviour_1 Hand washing	1 Malta	53	3.65	0.738	0.102
	2 Italy	55	3.53	0.69	0.093
Behaviour_2 Control of vital parameter	1 Malta	53	3.83	0.382	0.053
	2 Italy	55	3.55	0.662	0.089
Behaviour_3 Infusion rate	1 Malta	53	3.67	0.678	0.094
	2 Italy	55	3.55	0.662	0.089
Behaviour_4 8G rules	1 Malta	53	3.88	0.379	0.052
	2 Italy	55	3.51	0.791	0.107
Behaviour_5 Double check	1 Malta	53	3.62	0.631	0.088
	2 Italy	55	3.42	0.854	0.115

and variance in the training of the nurse seems to be a significant cause of medication errors. Hence, the similarities in the knowledge, attitude and behaviour amongst the two cohorts were expected. In turn, these findings suggest that (1) organisational factors may be the cause of medication errors by a cohort of nurses and that (2) in view of the seriousness of the outcomes of medication errors, the need to determine such organisational factors is of paramount importance, and is the need to address such factors promptly and correctly.

With reference to organisational factors, the Maltese nurses who participated in this research study see the presence of the pharmacist as a solution to reduce medication errors, as well as the use of CPOE. There is a significant difference between the Italian and Maltese sample in Behavior's sub-scale. The Maltese sample reportedly checked vital parameters before medication administration and routinely use the "8 right of medication administration" more consistently than their Italian counterparts.

Future studies should further explore the organizational factors among the two samples. The present study has some methodological limitations. First, the samples of the study did not represent the countries' population, and the sample sizes were small. It is necessary to

increase the Maltese sample size. These can also give us greater power to detect differences among countries. Secondly, the data were based only on self-reports of knowledge, attitude and behaviour.

Conclusions

The similarities between the two nurse cohorts which were revealed in the findings suggest that variances in the nurses' practice across different contexts and countries may be associated with varying organizational factors in which different nurse cohorts practice, rather than with the personal and professional characteristics of the nurse. To our knowledge, this study is the first that compares an Italian and Maltese sample in terms of knowledge, attitude and behavior about medication error. KAB scores were tested also in a Spanish context[37]. The findings of this study support a strong positive relationship between knowledge, attitude and behavior in medication administration and management.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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