



## Research Article

# Modified Research Utilization Questionnaire: Development and Validation Study among Italian Nurses



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## ABSTRACT

**Purpose:** The purpose of this study was to develop the modified research utilization questionnaire (M-RUQ) and to establish its content and face validity, construct validity, and reliability.

**Methods:** This study has a multiphase (three phases), methodological, and cross-sectional design. First, research utilization questionnaire (RUQ) was translated into Italian, which is the target language to develop the M-RUQ. Second, the RUQ psychometric properties were assessed using exploratory factorial analysis to identify ambiguous or problematic items (e.g., cross-loadings) (cross-sectional sampling A). The RUQ modification (i.e., item deleting, wording modification, and scoring procedure) represented the development of the M-RUQ among Italian nurses. The third phase was aimed to confirm the construct validity of the M-RUQ and to test its stability and internal consistency (cross-sectional sampling B).

**Results:** This study's findings show that M-RUQ has a three-dimensional structure and a total of 22 items. The M-RUQ shows evidence of validity and reliability. Precisely, the factorial structure coming from an exploratory factorial analysis on the first sample ( $n = 504$ ) was confirmed by a final model of confirmatory factorial analysis (CFA) on a second sample ( $n = 362$ ). The final CFA model showed adequate goodness of fit, where all the factor loadings showed values higher than .40. Cronbach's  $\alpha$  was satisfactory for each domain and for the overall scale. Furthermore, the M-RUQ showed good stability described by the test–retest.

**Conclusion:** The M-RUQ should be used to assess research utilization among nurses for educational or research purposes to address the practice. Further research about its validity and reliability is suggested.

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## Introduction

Research utilization aims to integrate the best available evidence with the experiences of nurses, patient preferences, and various contextual circumstances [1]. This approach is better

known as evidence-based practice (EBP) [2]. More specifically, research utilization, as a subset of EBP, is the process by which specific research-based knowledge is implemented in practice. Research utilization is also positively associated with individual attitudes toward research [1]. So far, research utilization among nurses is commonly measurable using the research utilization questionnaire (RUQ) [2,3]. However, it presents some limits mainly related to its unexplored psychometric structure. Those limits should undermine the RUQ usefulness in those research studies that contemplate the multivariate analysis approach, such as multilevel structural equation modeling, due to the models fit

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being highly related to the psychometric features of the instruments used for data collection.

The literature indicates that there is considerable debate as to whether nurses actually make use the best available research evidence [4]. Nonetheless, consensus holds that despite the benefits of research utilization—including improved and updated clinical practice, enhanced quality of care, and improved patient outcomes and safety—there exists a wide research–practice gap [2]. According to many authors, this gap is not to be intended as a real theory–practice gap [5], but it is mainly related to the relation between individual variables, contextual issues, and research findings utilization as a standard in clinical practice [6–8]. For this reason, the description of this gap is most commonly referred to be a “research finding to routinely practice gap” and not to be a theory practice one.

Different instruments have been used to measure nurses' research utilization in clinical practice [1,3]; however, the validity of these instruments is often questionable, unknown, or with weak psychometric proprieties [9]. The RUQ is one of the most used tools to measure research utilization among nurses [1]. The RUQ construct validity was tested using multiple regression modeling to test the relationships between research utilization (dependent variable) and availability and attitude and support (independent variables). The RUQ can be used in a variety of clinical and educational settings to describe research utilization [1,3].

Nonetheless, the RUQ's psychometric properties remain unexplored. The literature provides a wealth of information on the internal consistency of each domain but provides no details with respect to a factorial analysis [9]. This gap could undermine its potential usefulness in research, especially when study findings are to be compared. As alpha is an index of internal consistency, it provides no information regarding the number of factors explaining item correlations. Such information could be obtained only after an examination of the items' latent structure, using factor analysis [10]. The only validated translations for the RUQ are for Swedish [11] and Norwegian [12]. Also considering the RUQ validation studies, there is no availability of information regarding the items' latent structure.

Hence, the RUQ is not available for Italian-speaking nurses, with there being no validation studies having been performed among Italian nurses. Measuring research utilization is pivotal in this period for nursing in Italy because most of the Italian facilities take up challenging quality projects aimed at improving the standards of care within a strongly regulated accreditation process supervised by foreign agencies [8]. Moreover, the possibility to measure research utilization—using brief self-reporting questionnaires—could be strategic for raising awareness among nurses or students because it could drive educational intervention aimed to avoid the frustration given by the belief that research findings are not usable in practice, while nurses have the duty to design better standards of care using limited resources [13].

While the RUQ consists of 46 items, a shorter form is not yet available either for Italian nurses or international nurses, and it might be useful to facilitate data collection, especially in studies that require more than a questionnaire. In fact, nurses need approximately 20 minutes to fill the RUQ, and their time commitment could become important when they have to fill more than a questionnaire [1,3]. A modified version of the RUQ could be easily usable by educators and researchers whenever it will be shorter and with well-known psychometric properties. For this reason, the aim of this study is to develop a modified research utilization questionnaire (M-RUQ) and to establish its content and face validity, construct validity, and reliability among a population of Italian nurses.

## Methods

### Study design

This study has a multiphase (three phases), methodological, and cross-sectional design. Phase 1 referred to the cultural–linguistic validation of the RUQ into Italian developed by the research team of this study. The initial RUQ translations have to be supported by content and face validity. Phase 2 involved the collection of data from a cross section of Italian nurses to assess the psychometric proprieties of the RUQ and to identify which items could be modified or deleted for the purposes of developing the M-RUQ. Phase 3 involved a second round of data collection to confirm the construct validity of the M-RUQ and to test its reliability (i.e., internal consistency). This study was also approved by the original authors of the RUQ.

### Setting and sample

As will be discussed in the following paragraphs, the major involvement of participants was related to Phase 2 (psychometric analysis to address M-RUQ development) and 3 (construct validity phase), whereas the first phase encompassed the involvement of experts for cultural–linguistic validation and content validity. Phase 2 was conducted in four major hospitals in the greater Milan area (Italy). The final sample (i.e., Sample A) was composed of 504 nurses enrolled between December 2015 and February 2016, based on a sample of nurses who had correctly completed the questionnaire (504 out of 620 nurses who were invited to participate, 81.3% rate of return). The RUQ version used in this phase was modified according to the findings in relation to content validity (i.e., some items had been removed based on the input of the panelists). Phase 3 was handled in two major hospitals in the greater Milan area (Italy) and used a sample composed of 362 nurses (i.e., Sample B) enrolled between April and August 2016. The sample was selected based on nurses who had correctly completed the questionnaire (i.e., 362 nurses out of 400 nurses invited to participate, 90.5% return rate). Convenience sampling was used for both the samplings.

### Ethical consideration

The authors obtained ethical approval from the director of research unit of each participating hospital and from the Research Direction of the University Hospital Policlinico San Donato, Italy (Approval no. 728/psd). The study was conducted in full accordance with International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use guidelines and European legal and ethical requirements for noninterventional research studies. All participants voluntarily participated, fully were informed about the study purpose, and provided a written informed consent.

### Measurements

The RUQ was originally developed by Champion and Leach [3]. It has four subscales, including support (8 items), attitude (21 items), research availability (7 items), and research utilization (10 items). These subscales include both positive and negative statements. Items are rated using a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The RUQ total score is computed by adding the scores for each domain and dividing the result by the number of items within the respective domain. Negative items are reversed. Any missing data should be substituted with a mean value [12]. In addition, the RUQ collects demographic data on the respondent. These demographic data include the respondent's

gender, age, education, length of service, and working setting. This demographic information is used to describe the sample population.

#### Data collection

The Phase 1 of the study was aimed to achieve the Italian cultural–linguistic validation and content and face validity of the original tool (RUQ) as it was unavailable in Italian. RUQ translation was strategic to explore the dimensionality of tool and address the modifications needed to propose a shorter version (M-RUQ). Translating the RUQ into Italian use has required considerable effort by researchers to maintain the quality of the translation. Consequently, the methodology used throughout this phase strictly followed an adaptation of Brislin's classic translation model [14], according to some recent Italian cultural–linguistic validations [15,16]. This phase was performed with a combined translation and bilingual techniques. Translation involved a group of four translators to ensure appropriate back-translation. Specifically, a project manager (R.C.) was identified by the research team at the beginning of the translation process to control the rigor of the overall translation. Then, two bilingual translators prepared two Italian versions of the RUQ. Each Italian version was blindly back translated into English by two other translators. Finally, the four translators had a meeting to forward translate the two different versions and find consensus on the optimal translation (forward translation). This first phase took place in an Italian teaching hospital, from August to October 2015. The Italian-translated RUQ was tested for content validity [17] using a panel of experts to rate the pertinence of each item in relation to the objective of its measurement. Conversely, face validity was determined based on panelists' understanding of the items and their views about the overall concept that they purported to measure [18]. The panel consisted in 20 expert panelists (i.e., 20 research nurses), who evaluated the instrument on a 3-point Likert scale (1 = *not necessary*; 2 = *useful but not essential*; 3 = *essential*).

To obtain face validity, the authors asked the same panel of experts ( $n = 20$ ) to answer to three open-ended questions, with their responses transcribed verbatim. The questions sought to explore the clarity of the wording used for each item and to identify areas of ambiguity or possible misinterpretation. All the answers were analyzed using a narrative approach to summarize whatever themes emerged [19].

Phase 2 (M-RUQ development and psychometric testing) and Phase 3 (M-RUQ construct validity and reliability) consisted in two different phases consistent with the methodology of the cross-sectional studies. Nurses coming from four hospitals for Phase 2 and two hospitals for Phase 3 were invited to fill the questionnaires (translated RUQ for Phase 2 and M-RUQ for Phase 3) and a sociodemographic form to describe the sample. The only restriction (exclusion criteria) used to select the sampling was the professional role of the eligible nurses, i.e., they had to be clinical nurses (Table 5).

#### Data Analysis

Content validity was assessed using the scoring of the involved panelists. Specifically, their scores were computed to determine the content validity ratio (CVR), following the formula  $CVR = (N_e - N/2) / (N/2)$ , where  $N_e$  is the number of panelists indicating essential and  $N$  is the total number of panelists [17]. CVR varies between +1 and -1. Higher scores indicate agreement among panelists on the necessity to keep the item in the scale. Second, the same panel of experts was asked to rate translated RUQ items in terms of their relevancy to the construct underlying the scale, using a four-point

ordinal scale (1 = not relevant; 2 = somewhat relevant; 3 = quite relevant; 4 = highly relevant). Thus, the content validity index (CVI) was calculated at both items level [content validity index to the items' level (I-CVIs)] and scale level [content validity index to the scale level (S-CVI)]. To obtain the relevancy of each item (I-CVIs), the number of panelists judging the item as relevant (i.e., ratings  $\geq 3$ ) was divided by the total number of panelists. Furthermore, S-CVI was defined as the proportion of items judged to possess content validity and was computed as the average of the I-CVIs. If the items did not reach the threshold of .80 in CVR or I-CVIs indices, the items may be considered for removal [20].

In Phase 2 (M-RUQ development and psychometric testing), descriptive statistics were performed on the demographic characteristics of the sample and for the items, including the skewness and kurtosis to ascertain their normality. Data were analyzed by exploratory factor analysis (EFA) using maximum likelihood estimation. Factor analysis reduces multivariate data to only a few underlying dimensions, thus explaining the shared variance in the data [21]. The number of factors to be extracted was determined based on an analysis of the eigenvalues, the scree test, which led to the most plausible theoretical structure [19]. A Promax rotation method was adopted to maximize the factor loading of items on their latent factors while simultaneously minimizing the loadings of these items on the remaining latent factors [19]. Items whose loading value was  $\geq .35$  were kept, whereas weak loadings (i.e.,  $\leq .35$ ) or items showing cross loading were removed [19]. Before proceeding with the EFA, a Bartlett's test and the Kaiser–Meyer–Olkin index were used to assess the factorability of the correlation matrix. Cronbach's  $\alpha$  coefficient was used to assess internal consistency.

Also for Phase 3, descriptive statistics were carried out to assess the sample demographic characteristics and for items' answering, also considering the skewness and kurtosis to ascertain their normality. After the removal of items whose loading value was  $\leq .35$  or items with cross-loadings (Phase 2), confirmatory factorial analysis (CFA) was performed on Sample B to validate the most plausible factor structure model derived from the EFA for Sample A. The following fit indices were considered to evaluate the CFA model: omnibus fit indices, such as Chi-square ( $\chi^2$ ); comparative fit index (CFI) (values  $> .900$  indicated an acceptable fit); root mean square error of approximation (RMSEA) (values  $< .060$  indicated an acceptable fit); and the weighted root mean square residual (WRMR) (values 1.0 indicated an acceptable fit). To determine the M-RUQ stability, reliability was measured using the test–retest method, testing it after approximately 20 days from the first administration and using a sample of 20 nurses, randomly invited to complete the M-RUQ a second time. We used the intraclass correlation coefficient (ICC) and 95% confident interval (CI) of the ICC estimate to assess the test–retest. All statistics were calculated on the basis of  $\alpha = .05$ , using SPSS, version 22 (IBM Corp., Armonk, NY, USA) and Mplus 7.1 (Muthén & Muthén, Los Angeles, CA, USA).

## Results

The process of developing the RUQ translation and cultural adaptation did not reveal any problematic items or terms for translation purposes. Particularly, translation, back-translation, and forward-translation by four independent bilingual speakers (i.e., English and Italian) did not show any significant differences between the original scale and the Italian-translated version. The characteristics of the panelists asked to ascertain the content and face validity of the translated instrument are shown in Table 1.

As Table 2 shows, CVR ranged from  $-.50$  to  $+1.00$ , prompting the removal of items whose CVR indices were  $< .80$  (i.e., Items 1–8). According to CVR, I-CVIs also indicated low indices for Items 1–8,

**Table 1** Panelists' Characteristics, Phase 1 (N = 20).

Characteristics	N	%
Gender		
Men	5	25.0
Women	15	75.0
Profession		
Clinical nurse	6	30.0
Research nurse	10	50.0
Nursing professor	4	20.0
Education		
Bachelor	10	50.0
Master degree	8	40.0
Doctor degree	2	10.0
Age (yrs)	Median	IQR
	44.8	14.1

Note. IQR = interquartile range; yrs = years.

suggesting their inadequacy for the Italian context. After the removal of Items 1–8, S-CVI was recalculated at .90, indicating the adequacy of the overall translated RUQ.

EFA was performed on Sample A (n = 504 for the Phase 2 of this study), with participant characteristics shown in Table 3. The

Bartlett test of sphericity was significant ( $\chi^2 = 549.88$ ;  $d.f. = 168$ ;  $p < .001$ ), and the Kaiser–Meyer–Olkin index was .91. Therefore, the correlation matrix was considered suitable for factor analysis. The study of the eigenvalues, scree test, and semantic interpretation of the items suggested the extraction of three dimensions. Factor loadings are shown in Table 4. Each factor, after rotation, explained 16.2%, 15.3%, and 18.1% (respectively) of the common variance (49.6% overall). Items with weak factor loadings (i.e.,  $\leq .35$ ) were removed to develop the M-RUQ. Considering the semantic meaning of each item within its factor of belonging, the authors labeled them “negative attitude”, “positive attitude”, and “research utilization”. M-RUQ's three-dimensional factor structure was the best model to be validated with CFA for Sample B.

Sample B (n = 362 for the Phase 3 of this study) participant characteristics are shown in Table 3. The M-RUQ has 22 items, and CFA confirmed the appropriateness of the M-RUQ three-dimensional factor structure with a satisfactory fit to the data,  $\chi^2_{(92)} = 114.47$ ;  $p < .001$ ; CFI = .91; RMSEA = .051 (90% CI = 0.04–0.06),  $p = .010$ ; WRMR = 1.00, and all other loadings were higher than .50 (Table 4). This model explained 54.5% of the total variance. Specifically, “negative attitude” had a moderate

**Table 2** Content Validity (CVR, I-CVIs, and S-CVI).

Item	Domain	Ne	CVR	Interpretation	I-CVI	Interpretation	S-CVI
1	Support	6	-.40	Remove	.25	Inadequate	.90
2		5	-.50	Remove	.35	Inadequate	
3		9	-.10	Remove	.25	Inadequate	
4		4	-.60	Remove	.40	Inadequate	
5		8	-.20	Remove	.35	Inadequate	
6		5	-.50	Remove	.45	Inadequate	
7		6	-.40	Remove	.25	Inadequate	
8		5	-.50	Remove	.40	Inadequate	
9	Attitude	18	.80	Relevant	.85	Adequate	
10		17	.70	Relevant	.90	Adequate	
11		16	.60	Relevant	.85	Adequate	
12		15	.50	Relevant	.90	Adequate	
13		16	.60	Relevant	.85	Adequate	
14		18	.80	Relevant	.95	Adequate	
15		18	.80	Relevant	1.00	Adequate	
16		17	.70	Relevant	.80	Adequate	
17		16	.60	Relevant	.95	Adequate	
18		16	.60	Relevant	.85	Adequate	
19		17	.70	Relevant	.90	Adequate	
20		18	.80	Relevant	.95	Adequate	
21		19	.90	Relevant	.90	Adequate	
22		20	1.00	Relevant	.90	Adequate	
23		20	1.00	Relevant	.85	Adequate	
24		19	.90	Relevant	.90	Adequate	
25		16	.60	Relevant	.85	Adequate	
26		17	.70	Relevant	.95	Adequate	
27	18	.80	Relevant	1.00	Adequate		
28	19	.90	Relevant	.80	Adequate		
29	20	1.00	Relevant	.95	Adequate		
30	Research availability	20	1.00	Relevant	.90	Adequate	
31		19	.90	Relevant	.85	Adequate	
32		16	.60	Relevant	.90	Adequate	
33		16	.60	Relevant	.85	Adequate	
34		20	1.00	Relevant	.95	Adequate	
35		19	.90	Relevant	1.00	Adequate	
36		20	1.00	Relevant	.80	Adequate	
37	Utilization	20	1.00	Relevant	.95	Adequate	
38		19	.90	Relevant	.85	Adequate	
39		20	1.00	Relevant	.90	Adequate	
40		19	.90	Relevant	.90	Adequate	
41		17	.70	Relevant	.85	Adequate	
42		17	.70	Relevant	.90	Adequate	
43		18	.80	Relevant	.85	Adequate	
44		19	.90	Relevant	.95	Adequate	
45		18	.80	Relevant	1.00	Adequate	
46		19	.90	Relevant	.80	Adequate	

Note. CVR = content validity ratio; I-CVIs = content validity index to the items' level; S-CVI = content validity index to the scale level. The S-CVI was computed excluding inadequate I-CVIs.

**Table 3** Samples' Characteristics: Phases 2 (Sample A) and 3 (Sample B).

Characteristics	Sample A (n = 504)		Sample B (n = 362)	
	n	%	n	%
Gender				
Men	148	29.4	71	19.6
Women	356	70.6	291	80.4
Education				
Bachelor of Science in Nursing (BSN)	450	89.3	346	95.6
Master of science	52	10.3	15	4.1
Doctoral degree	2	0.4	1	0.3
Working setting				
Surgical field	73	14.5	54	14.9
Medical field	112	22.2	98	27.1
Pediatrics	80	15.9	23	6.4
Critical care	150	29.8	160	44.2
Outpatient	63	12.5	19	5.2
Other	26	5.1	8	2.2
	Median	IQR	Median	IQR
Age (yrs)	42.3	14.1	39.7	10.3
Length of service (yrs)	16.2	13.4	15.7	13.2

Note. IQR = interquartile range; years = yrs.

negative relationship with “positive attitude” ( $r = -.46; p = .007$ ) and with “research utilization” ( $r = -.41; p = .003$ ). Conversely, “research utilization” had a positive correlation with “positive attitude” ( $r = .29; p = .009$ ).

Cronbach's  $\alpha$  was satisfactory for each domain and for the overall scale (negative attitude = .86; positive attitude = .89; research utilization = .91; overall scale = .93). Furthermore, test–retest method ( $n = 20$  participants) showed an adequate stability between the two measurements obtained at an interval of 20 days (ICC = .82; 95% CI = 0.79–0.89). Finally, the M-RUQ scores ranged from 22 to 110, with higher values indicative of greater research utilization.

**Discussion**

This study aimed to develop the modified form of the RUQ (M-RUQ), with adequate content and face validity, construct validity, and reliability among Italian nurses. This is the first study which provides the RUQ items' latent structure. No particular issues emerged during the translation phase. Content and face validity

**Table 4** RUQ Psychometric Evaluation and M-RUQ Development (Phase 2); M-RUQ Construct validity (Phase 3).

RUQ items	Phase 2		Phase 2			Phase 3		Phase 3		
			EFA factor loadings (Sample A)					CFA factor loadings (Sample B)		
	Mean	SD	Negative Attitude	Positive Attitude	Research Utilization	Mean	SD	Negative Attitude	Positive Attitude	ResearchUtilization
Item 9	4.08	0.92	.271	<b>.628</b>	.321	4.01	0.90		<b>.681</b>	
Item 10	4.01	0.94	.145	<b>.659</b>	.222	3.98	0.97		<b>.712</b>	
Item 11	4.04	0.87	.011	<b>.891</b>	.144	4.01	0.98		<b>.863</b>	
Item 12	4.17	0.89	.201	<b>.814</b>	.154	4.05	0.87		<b>.851</b>	
Item 13	1.78	0.85	.302	.291	.257	–	–			
Item 14	4.35	1.01	.275	.261	.001	–	–			
Item 15	1.95	0.79	.147	.214	.124	–	–			
Item 16	2.32	0.96	.301	.245	.210	–	–			
Item 17	2.01	0.87	.010	.007	.101	–	–			
Item 18	3.66	0.82	.146	.214	.211	–	–			
Item 19	1.76	0.82	.020	<b>.805</b>	.121	1.98	1.01		<b>.845</b>	
Item 20 <sup>1</sup>	3.26	0.80	<b>.658</b>	.301	.201	3.17	0.98	<b>.713</b>		
Item 21 <sup>1</sup>	3.96	1.02	<b>.666</b>	.021	.102	3.52	1.04	<b>.726</b>		
Item 22 <sup>1</sup>	2.97	1.12	<b>.688</b>	.120	.009	2.84	1.06	<b>.788</b>		
Item 23 <sup>1</sup>	2.18	1.12	<b>.620</b>	.251	.131	2.04	1.01	<b>.699</b>		
Item 24 <sup>1</sup>	2.73	1.12	<b>.649</b>	.141	.012	2.68	1.15	<b>.601</b>		
Item 25	1.93	1.05	.231	<b>.547</b>	.157	1.86	1.02		<b>.610</b>	
Item 26	3.53	0.99	.122	.111	<b>.345</b>	3.68	1.05			<b>.412</b>
Item 27 <sup>1</sup>	2.05	1.09	<b>.762</b>	.201	.222	2.01	0.99	<b>.723</b>		
Item 28 <sup>1</sup>	2.51	1.02	<b>.686</b>	.042	.231	2.37	1.11	<b>.711</b>		
Item 29	2.54	1.03	.025	.111	.032	–	–			
Item 30	3.17	1.20	.002	.201	.111	–	–			
Item 31	3.08	1.25	.301	.222	.199	–	–			
Item 32	2.19	1.25	.147	.111	.212	–	–			
Item 33	2.66	1.19	.154	.254	.168	–	–			
Item 34	2.81	1.25	.122	.193	.009	–	–			
Item 35	3.27	1.22	.219	.214	.259	–	–			
Item 36	2.99	1.23	.158	.296	<b>.775</b>	3.14	1.01			<b>.801</b>
Item 37	3.43	0.98	.102	.261	<b>.803</b>	3.49	0.89			<b>.811</b>
Item 38	3.52	0.96	.103	.025	.021	3.71	0.96			
Item 39	2.31	1.11	-.026	.028	<b>.837</b>	2.89	1.18			<b>.741</b>
Item 40	3.59	0.92	.222	.010	<b>.803</b>	3.64	0.87			<b>.841</b>
Item 41	3.55	0.98	.302	-.010	<b>.760</b>	3.51	1.01			<b>.781</b>
Item 42	3.76	0.90	.269	.254	<b>.749</b>	3.87	0.96			<b>.785</b>
Item 43	3.40	0.98	-.154	.179	<b>.823</b>	3.89	0.99			<b>.817</b>
Item 44	3.63	0.92	.136	.235	-.010	3.54	1.01			
Item 45	2.19	1.07	.210	.111	<b>.752</b>	2.99	0.87			<b>.799</b>
Item 46	3.59	0.99	.118	.320	.291	3.69	0.79			
Variance explained (%)			16.2	15.3	18.1	Variance explained (%)		17.2	19.7	17.5

Note. CFA = confirmatory factorial analysis; EFA = exploratory factor analysis; M-RUQ = modified research utilization questionnaire; RUQ = research utilization questionnaire; SD = standard deviation.

Bold factor loadings indicate values higher than 0.40; (1) = reverse items.

**Table 5** Modified Research Utilization Questionnaire (M-RUQ).

Instruction: indicate the degree to which you agree with each of the following items by placing a check in the appropriate box		1 = strongly disagree	2	3	4	5 = strongly agree
M-RUQ items (original language: Italian. English version in italics)						
<b>Domain: Negative Attitude</b>						
Item 1 (rev)	Trovo che la ricerca sia un argomento noioso. <i>Research is a dull, boring subject.</i>					
Item 2 (rev)	Il pensiero della ricerca non è stimolante. <i>The thought of research turns me off.</i>					
Item 3 (rev)	La ricerca non è applicabile nella mia realtà pratica. <i>Research is not applicable to my practice.</i>					
Item 4 (rev)	È difficile applicare la ricerca alla pratica. <i>It is hard to apply research to practice.</i>					
Item 5 (rev)	I risultati della ricerca sono irrilevanti nella pratica <i>Research findings are not relevant to use in practice</i>					
Item 6 (rev)	La qualità della ricerca non è adeguata per essere applicata alla pratica. <i>The quality of research is not adequate for application to practice.</i>					
Item 7 (rev)	I risultati della ricerca sono troppo complessi per utilizzarli nella pratica. <i>Research findings are too complex to use in practice.</i>					
<b>Domain: Positive Attitude</b>						
Item 8	Vorrei cambiare la mia pratica in base ai risultati della ricerca. <i>I would change my practice based on research findings.</i>					
Item 9	Voglio basare la mia pratica sulla ricerca. <i>I want to base my practice on research.</i>					
Item 10	Usare la ricerca mi aiuta a raggiungere i miei obiettivi come infermiere. <i>Using research helps me meet my goals as a nurse.</i>					
Item 11	La pratica infermieristica dovrebbe essere basata sulla ricerca. <i>Nursing practice should be based on research.</i>					
Item 12	Più infermieri dovrebbero usare la ricerca nella loro pratica. <i>More nurses should use research in their practice.</i>					
Item 13	La ricerca aiuta a costruire una base di conoscenze scientifiche per l'infermieristica. <i>Research help to build a scientific knowledge base for nursing.</i>					
<b>Domain: Research Utilization</b>						
Item 14	Basare la pratica sui risultati della ricerca mi fa risparmiare tempo e risorse. <i>Basing practice on research findings saves time and money.</i>					
Item 15	Io baso la mia pratica clinica sulla ricerca. <i>I base my practice on research.</i>					
Item 16	Le mie decisioni di assistenza infermieristica sono basate sulla ricerca. <i>My nursing care decisions are based on research.</i>					
Item 17	Applico i risultati della ricerca alla mia pratica professionale. <i>I apply research results to my own practice.</i>					
Item 18	Faccio uso dei risultati della ricerca per la pianificazione dell'assistenza. <i>I use research findings in planning patient care.</i>					
Item 19	La ricerca mi aiuta a rendere validi i miei interventi assistenziali. <i>Research helps me to validate my nursing actions.</i>					
Item 20	Aiuto gli altri ad applicare la ricerca nella pratica. <i>I help others to use research in practice.</i>					
Item 21	Usa la ricerca per guidare la mia pratica infermieristica. <i>I use research to guide my nursing practice.</i>					
Item 22	Cerco i risultati della ricerca relativi alla pratica clinica. <i>I seek out research related to clinical practice.</i>					

Note. To score M-RUQ, first, reverse items 1–7 and then sum all the single scores. In case of missing data, the authors suggest to replace them with the mean values computed from the sample statistics.

supported the translation, which involved 20 expert panelists for scoring the pertinence and relevance of each item. Panelists agreed to consider the evaluation of research support independently from research utilization. In fact, panelists suggested that Items 1–8 be omitted. These items aimed to investigate if such health professionals support more nursing research (i.e., support subscale), rather than assess elements intrinsically related to research utilization. Consequently, the first eight items of the original RUQ were not included in the M-RUQ. All other items (i.e., Items 9–46) were determined to possess good content and face validity, considering CVR, I-CVIs, S-CVI, and panelists' responses to open-ended questions pertaining to their interpretations of the items [19].

Phase 2 involved the actual development of the M-RUQ. In this phase, EFA for Sample A drove the choice to remove or keep items from the RUQ, considering low factor loadings and cross-loadings as necessitating the removal of items. The three-dimensional factor structure was the product of having analyzed the eigenvalues, scree test, and semantic interpretation of items [22]. In the third phase,

the three-dimensional factor structure was again confirmed using other sampling (i.e., Sample B) and CFA analysis. Therefore, Phase 3 supports the construct validity of the M-RUQ, considering that it measured “negative attitude”, “positive attitude”, and “research utilization”. This new factor structure represents the major novelty from this research. In fact, some items from the original RUQ were deleted, and a new domain structure was identified and confirmed by the CFA analysis. Within the frame of this new factor structure, the items of the former broad domain of attitude are currently explained by two different aspects of the same attitude, which are the positive and the negative attitude. Furthermore, research availability and utilization are currently explained by the domain of research utilization. These three factors revealed correlations consistent with the theoretical expectation, where “negative attitude” had a negative relationship with “positive attitude” and “research utilization”. Moreover, the analysis of internal consistency and stability provided good evidence to support M-RUQ reliability.

The measurement of attitudes to research is important given its relationship to the gap between evidence and practice. Current evidence suggests that senior nurse managers are more likely to have positive attitudes toward research, with university education on nursing research having had a significant influence on attitudes and research utilization [23]. The M-RUQ seems to have the necessary qualities for use in empirical research, meaning that it may prove useful in describing the relationship between attitudes and research utilization.

Another important issue is the nurses' level of research finding understanding, which could lead to misinterpretations when those findings have to be used in practice [24]. Those issues are strictly related to the highly technical scientific writing, which is easily understandable for academic nurses and advanced practitioners, rather than an average registered nurse [25]. In other words, the issue of understanding represents the problem of knowledge related to research methods and statistics among clinical nurses, which should be addressed during education at a postgraduate level or within the workplace.

The M-RUQ can be used by researchers to investigate the degree of research utilization whenever such utilization is needed. Understanding the relationships between attitude to research, research utilization, and individual or contextual variables has a strategic role formerly than implementing strategies aimed to improve research utilization among nurses. At present, the evidence suggests that clinical systems, computerized decision-making support, and prompts that support practice have a positive effect on aligning practices with the evidence [26].

Although multiple EBP models are available and have been used in a variety of clinical settings, research utilization transcends each of these models, playing an important role in the promotion of EBP [23]. Moreover, studies that investigate research utilization across a variety of health-care settings can be used to enhance the empirical foundation of the translational power of nursing. In fact, nursing has a strong potentiality to translate in practice the research findings, often shaping methods, interventions, and contextual variables to improve clinical and operational decision-making in health care [23,27,28]. According to this scenario, the M-RUQ—having been shown to be both a valid and reliable instrument—may prove to be a rapid and useful tool for understanding and describing research utilization among nurses. It could also be useful for educators and policy-makers to enhance programs aimed to help nurses in improving their attitude toward research utilization in practice.

### Scoring

According to recent recommendations to score self-report scales, the M-RUQ total score can be obtained summing each item's raw score [21]. Although this might be the most desirable approach, there is little evidence with which to attest to the M-RUQ's reliability and validity, especially considering that the M-RUQ is a newly developed tool. In addition, the sum preserves the variation in the original data. Beyond M-RUQ total score, each domain score can be obtained computing the means of raw factor scores. Domain average scores should help to retain the scale metric, thus facilitating interpretation. Also, average scores are useful for making comparisons across domains, considering that there are differing numbers of items per factor [21].

### Study Limitations

Currently, the M-RUQ has limited generalizability, having only been tested among a sample of Italian nurses. Consequently, the main limitation of the M-RUQ relates to the strong influence of the Italian context. In other words, the validity and reliability of the M-

RUQ are significant, but validation studies in other contexts are needed to be sure that the M-RUQ performs in the same way.

Moreover, the M-RUQ is a self-reporting tool, thus increasing the risk of reporting bias such as social desirability responses. However, the analysis presented in this study showed that socially desirable responses appear unlikely, especially considering the preliminary descriptive statistics of each item, such as their skewness and kurtosis indices. These indices were within the absolute value 1, and there were sufficient variances for each item scoring as shown in Table 3 by reporting standard deviation in both Sample A and Sample B.

Finally, this study has a cross-sectional design and uses convenience sampling in the second and third phases. That said, the sample size was consistent with the recommended rule of thumb of having five participants per variable to ensure sufficient stability for psychometric testing. Future longitudinal studies should be more exhaustive in describing research utilization among nurses and in integrating evidence for the validity and reliability of the M-RUQ.

### Conclusion

The M-RUQ could be considered a valid instrument to measure research utilization and attitude. It could also be helpful at an international level when its validity will be proven in other contexts than the Italian one. Moreover, programs aimed at encouraging positive attitudes toward research utilization and the transplantation of knowledge from educational environments to clinical practice should be deeply described to best assess the pitfalls undermining EBP models and promote best practice. The M-RUQ should be considered by educators as a driver to implement EBP as it allows assessing the nurses' educational needs when their scoring about utilization or attitude is low. Moreover, the M-RUQ could also be useful for every study, where research utilization and attitude have to be measured.

### Conflicts of interest

No conflict of interest has been declared by the authors.

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### Appendix A. Supplementary data

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