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Medical Research Ethics in Morocco: Perspectives of Interns and Resident Physicians

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Abstract

In Morocco, the 2015 medical education reform formally incorporated training in research ethics into the national curriculum. That same year, the country adopted a dedicated law aimed at safeguarding the rights and welfare of individuals involved in biomedical research. These two developments (curricular reform and new legislation) were expected to enhance future physicians' understanding of research ethics and, in turn, strengthen their attitudes and conduct in this domain. The primary goal of the present study was to evaluate the level of attitudes, knowledge, and practices concerning medical research ethics among Moroccan physicians at the early stage of their professional careers, specifically interns and residents. In 2021, a multicenter cross-sectional study was carried out among physicians in Morocco. To evaluate participants' understanding and engagement with research ethics, three separate scores measuring knowledge, attitudes, and practices were developed and validated. The data analysis included descriptive statistics, followed by univariate analyses, and multivariate binary logistic regression was employed to identify factors influencing the calculated scores.

The study enrolled 924 physicians, with a mean age of 27.8 ± 2.2 years. While only 40.7% demonstrated strong knowledge of medical research ethics, a larger proportion (68.8%) exhibited positive attitudes toward ethical conduct. Knowledge and attitudes were higher among older participants, residents, and those who had received ethics training during their studies. However, ethical practices were less consistently applied: only 29.9% of physicians with research experience adhered to recommended ethical standards. Practice scores were significantly better among residents and physicians familiar with research ethics concepts. Incorporating comprehensive ethics training into the medical curriculum is crucial for improving researchers' knowledge, attitudes, and practices. Strengthening these competencies can ultimately contribute to both a higher volume and improved quality of medical research in Morocco.

Keywords: Research ethics, Medical research, Morocco, Interns, Residents

Introduction

The World Health Organization (WHO), founded in 1946, has defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" [1]. This broader concept of health is recognised globally as a basic human right [2, 3]. Advancing and protecting this right depends heavily on medical research, which—through observational or interventional approaches—produces evidence-based guidance to improve population health and quality of life. The atrocities committed in the name of medical experimentation during World War II [4] triggered the creation of the first formal ethical framework, the Nuremberg Code (1947) [5]. In 1964, the World Medical Association issued the Declaration of Helsinki, setting out binding ethical standards for all physicians conducting research on human participants [6, 7]. Although these documents explicitly banned inhumane studies [8], serious breaches persisted [9]. To address ongoing concerns, the United States formed the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research in 1974, which

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produced the Belmont Report [10]. This influential document established the four cornerstone principles of research ethics—respect for persons (autonomy), beneficence, non-maleficence, and justice—that continue to guide the field worldwide [11, 12].

From the late 1970s onward, the Council for International Organizations of Medical Sciences (CIOMS), working with WHO, developed detailed international guidelines that translate universal ethical norms into practical, context-adapted recommendations [13]. These CIOMS-WHO guidelines are now a key global benchmark that every researcher is expected to follow [14].

Multiple studies have highlighted persistent gaps in researchers' knowledge and attitudes toward research ethics, with the problem being especially pronounced in low- and middle-income countries [15–17]. Such deficiencies create major risks for the ethical conduct of studies in these settings.

In Morocco, formal instruction in medical research ethics was introduced into the national medical curriculum through the 2015 educational reform [18]. That same year, Law 28-13 was passed, creating the country's first legally enforceable framework for protecting research participants [19]. Before these developments, Moroccan investigators relied exclusively on non-binding international standards, primarily the Declaration of Helsinki. The combined effect of mandatory ethics teaching and a national law was anticipated to strengthen future physicians' knowledge, attitudes, and ethical behaviour in research.

Currently, however, no structured research-ethics education is offered after the final year of general medical training in Morocco. To establish whether newly qualified physicians possess the necessary understanding, mindset, and skills to engage responsibly in human-subjects research, we undertook this study. Its principal aim was to evaluate the knowledge, attitudes, and practices regarding medical research ethics among Moroccan doctors who had recently completed general medical training (first- and second-year interns, peripheral internal doctors, and residents).

Materials and Methods

Study design

This multicenter, cross-sectional study was carried out in 2021, involving physicians from multiple university hospital centers (UHC) as well as regional hospitals across Morocco.

Study population

The study targeted three groups of physicians: peripheral internal doctors, who are final-year medical students completing their peripheral internships; interns, who have finished all required medical coursework and are engaged in a two-year supervised internship within university hospital centers (UHC), practicing medicine under close faculty supervision; and residents, who are medical doctors undergoing specialized departmental training under professor oversight. Physicians who opted not to participate were excluded from the study.

Based on data from the University Hospital Center of Fes in September 2021, there were 820 interns and residents. From this, it is estimated that across the five major UHCs in Morocco, roughly 4,500 interns and residents were present during 2021, the period in which the study took place.

Questionnaire development process

The study team developed a French-language questionnaire based on an extensive literature review and the guidance of a multidisciplinary expert panel, which included ethicists, medical professors, practicing physicians, medical students, and administrative staff. The panel met periodically to draft the questionnaire, which was structured into three domains: (a) knowledge, designed to measure participants' factual understanding of research ethics; (b) attitudes, capturing participants' beliefs, opinions, and perspectives regarding ethical issues in research; and (c) practices, assessing participants' real-world application of ethical principles in research.

Before final deployment, the questionnaire underwent a pilot test at the University Hospital Center (UHC) of Fes with 5 interns and 5 residents. They completed the questionnaire, identified ambiguous items, and suggested modifications, which were subsequently incorporated to refine the instrument.

The knowledge section consisted of 19 items addressing the definition of research ethics, Moroccan laws governing medical research, foundational documents, core ethical principles, and the role of ethics committees. The attitude section included 14 items examining physicians' positions on informed consent, protection of vulnerable groups, confidentiality, conflict of interest, and interaction with ethics committees. The practice section contained 4 items focused on the behaviors of physicians who had participated in research, particularly regarding consent procedures. For each question, respondents were asked to select all options they considered correct based on their own knowledge, attitudes, or practices.

To quantify responses, three scores were calculated for knowledge, attitudes, and practices. Correct responses were scored as 1, while incorrect responses were scored as 0. Section scores were computed by summing individual item scores, resulting in potential ranges of 0–19 for knowledge, 0–14 for attitudes, and 0–4 for practices.

For analytical purposes, each score was divided into two categories using the 75th percentile as the threshold: scores below the 75th percentile were classified as "low," and those at or above were classified as "high."

Data collection

Data were collected through an electronic questionnaire completed directly by eligible participants. The questionnaire began with an introductory section outlining the study's objectives and methodology, and participants provided their informed consent by indicating agreement to participate.

Participants were reached via their academic email addresses as well as social media platforms. Upon enrollment in medical faculties across Morocco, students are assigned a permanent academic email account, which facilitates communication with their institutions. Using this system, we obtained the email addresses of our target population from various medical faculties. To further increase participation, the questionnaire was also shared through social media channels, including WhatsApp and Facebook groups for physicians and medical students, recognizing that these platforms are often more actively used than email.

The questionnaire collected information on the demographic and educational characteristics of participants, including age, gender, year of training, and medical faculty affiliation. It also gathered information on prior exposure to research ethics, distinguishing between those who had received formal training or practical experience in medical research ethics and those who had only heard about research ethics without formal instruction, through sources such as hospitals, faculties, media, or scientific publications. Finally, the questionnaire assessed participants' knowledge, attitudes, and practices concerning medical research ethics.

Validation

After beginning data collection, the final questionnaire was validated using responses from the initial 100 participants. To assess reliability, Cronbach's alpha was calculated for the three domains—Knowledge, Attitudes, and Practices—with values of 0.70 or higher considered acceptable [20]. Construct validity was examined using multitrait analysis, which measured how well each item correlated with its own total score (convergent validity) and with the scores of other sections (discriminant validity). Items were considered convergent if the correlation with their respective total score was at least 0.40, while discriminant validity was achieved when an item showed a significantly stronger correlation with its own score than with the other scores [21].

All three scores demonstrated high reliability, with Cronbach's alpha values of 0.82 for Knowledge, 0.86 for Practices, and 0.88 for Attitudes. Both the Attitudes and Practices scores showed full item convergence ($r = 0.490–0.781$ and $r = 0.616–0.902$, respectively) and complete discrimination ($r = -0.247–0.550$ and $r = 0.077–0.435$, respectively). The Knowledge score achieved 89.5% convergence, with 17 of the 19 items meeting the threshold, and 78.9% discrimination, as 15 items correlated significantly more strongly with the Knowledge score than with other scores.

Statistical analysis

Descriptive statistics were used to summarize participants' demographics as well as their responses regarding knowledge, attitudes, and practices. Categorical data were presented as counts and percentages, while continuous variables were expressed as mean ± standard deviation.

To examine the relationship between knowledge, attitudes, and practices categories and potential explanatory factors, univariate logistic regression analyses were performed. Results were reported as crude odds ratios (ORc) with 95% confidence intervals, and a significance threshold of 5% was applied.

Factors independently associated with participants' scores were then explored using multivariate binary logistic regression, controlling for potential confounders such as age, year of training, prior exposure to research ethics, and formal ethics education during medical school. Variables with p-values below 0.20 in univariate analyses were included in the initial multivariate model, and a 5% significance level was used for the final model. Adjusted odds ratios (Adj ORs) with 95% confidence intervals were reported. All analyses were carried out using SPSS version 26.

Results and Discussion

The study included 924 participants, corresponding to an approximate response rate of 20.5% (924 out of 4,500).

General and training characteristics of participating physicians

The participants' ages averaged 27.8 ± 2.2 years, with a slightly higher proportion of women (56.3%). Residents represented almost half of the study population (48.3%). Regarding exposure to research ethics, 67.2% of the physicians were familiar with the concept, 10.2% had undergone formal training during their medical education, and only 0.8% had participated in practical ethics training **(Table 1)**.

Table 1. Demographic and educational background of the participating physicians

Characteristic	n	%
Total participants	924	100%
Age (mean ± SD)	27.8 ± 2.2 years	-
Gender		
Female	520	56.3%
Male	404	43.7%
Training level		
Interns (1st–2nd year) & peripheral internal doctors	478	51.7%
Residents	446	48.3%
Faculty of medical education		
Fez	262	28.4%
Rabat	195	21.1%
Casablanca	179	19.4%
Oujda	138	14.9%
Marrakech	150	16.2%
Ever heard about medical research ethics		
Yes	621	67.2%
No / Don't remember	303	32.8%
Sources of information on research ethics (among those who had heard about it, n = 621; multiple answers possible)		
Medical faculty	564	90.8%
Hospital / clinical setting	305	49.1%
Scientific publications	339	54.6%
Media	99	15.9%
Received theoretical training in medical ethics during medical studies		
Yes	94	10.2%
No / Don't remember	830	89.8%
Received practical training in medical research ethics		
Yes	7	0.8%
No / Don't remember	917	99.2%

Participant's attitudes, practices, and knowledge in medical research ethics

Regarding knowledge assessment, 50.1% of participants correctly identified the definition of research ethics, while 41.8% were aware of the existence of a Moroccan law regulating research ethics, with only 5.4% able to recall its specific designation, Law n° 28−13. Awareness of key foundational documents on research ethics—such as the Belmont Report, Declaration of Helsinki, Nuremberg Code, and the CIOMS International Ethical Guidelines for Biomedical Research Involving Human Subjects—was limited to 37.3% of respondents, and 45.6% were familiar with the fundamental principles outlined in these documents **(Table 2)**.

Table 2. Description of participant's practices, knowledge and attitudes in research ethics

Category	Item	n	%
Total participants		924	100%
KNOWLEDGE ASSESSMENT			
Correctly define ethics in medical research		463	50.1%
Aware that a Moroccan law regulates research ethics		386	41.8%
Know the exact law number (Law 28-13) (among the 386 aware)		21	5.4%
Know the main international reference documents in research ethics		345	37.3%
Know the fundamental principles of research ethics		421	45.6%
Know that informed consent is mandatory		752	81.4%
Know that participants must be informed of all potential risks		616	66.7%
Know that vulnerable persons (children, mentally disabled) cannot give consent themselves		621	67.2%
Know that a legal representative must give consent for vulnerable persons		621	67.2%
Know that anonymizing data protects privacy and confidentiality		669	72.4%
Know that participants can withdraw from the study at any time		701	75.9%
Know that risks and benefits must be equitably distributed		732	79.2%
Know that exclusion based on culture, language, etc., is prohibited		596	64.5%
Know that reasons for excluding groups must be justified to ethics committees		638	69.0%
Know that confidentiality can be breached if the participant poses a risk to others		777	84.1%
Know that autonomy should be regularly reassessed in persons lacking capacity		665	72.0%
Aware of the existence of ethics committees in Morocco		501	54.2%
Aware of an ethics committee within their own faculty		530	57.4%
Know the roles and responsibilities of research ethics committees		435	47.1%
Overall knowledge score	High knowledge	376	40.7%
	Low knowledge	548	59.3%
ATTITUDES TOWARD RESEARCH ETHICS			
Always obtain permission/informed consent before including a participant		775	83.9%
Maintain confidentiality except when others are at risk of harm		760	82.3%
Store consent forms separately and securely		734	79.4%
Explain informed consent in the participant's native language		765	82.8%
Inform participants about compensation in case of research-related injury		666	72.1%
Provide complete information about the study (duration, risks, etc.)		716	77.5%
Require informed consent for use of biological samples		644	69.7%
Avoid research on vulnerable persons if it can be done on non-vulnerable persons		686	74.2%
Not ask vulnerable persons directly for consent		643	69.6%

Require the presence of a legal representative for vulnerable participants		680	73.6%
Refuse to enroll patients under external pressure (financial, hierarchical, etc.)		655	70.9%
Refuse to falsify or suppress results under pressure		686	74.2%
Disclose any conflict of interest to participants		596	64.5%
Accept supervision by an ethics committee		824	89.2%
Overall attitudes score	Adequate attitudes	636	68.8%
	Inadequate attitudes	288	31.2%
PRACTICES (among the 119 participants who had already conducted or participated in research)			
Requested written/oral informed consent		96/119	80.7%
Explicitly told participants they were part of a research study		87/119	73.1%
Obtained consent in the participant's local language		86/119	72.3%
Obtained consent from legal representative for vulnerable participants (n=117)		32/117	27.4%
Overall practices score (n=117 with complete data)	Adequate practices	29.4	29.9%
	Inadequate practices	68.9	70.1%

A knowledge score of 14.5, corresponding to the 75th percentile, identified 40.7% of participants as having a high level of knowledge. This higher score was associated with increasing age and was notably greater among residents, as well as physicians who had either previously heard about research ethics or received formal training in the subject **(Table 3)**.

Table 3. Associated factors with practices, scores, attitudes and knowledge

Predictor	**Knowledge Score (High vs Low)**		**Attitudes Score (Adequate vs Inadequate)**		**Practices Score* (Adequate vs Inadequate)**
	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)
Age (per 1-year increase)	1.4 (1.3–1.5)	1.2 (1.1–1.4)	1.4 (1.3–1.5)	1.2 (1.1–1.4)	–
Training level					
• Interns & peripheral doctors (reference)	1	1	1	1	1
• Residents	4.0 (3.0–5.3)	2.1 (1.4–3.3)	3.4 (2.5–4.7)	1.8 (1.1–3.0)	4.9 (2.1–11.7)
Ever heard about research ethics					
• No / Don't remember (reference)	1	–	1	–	1
• Yes	47.9 (23.9–93.4)	–	12.1 (8.7–16.8)	–	5.4 (2.1–14.2)
Received any ethics training during studies					
• No / Don't remember (reference)	1	1	1	1	–
• Yes	2.0 (1.3–3.1)	2.4 (1.5–3.8)	2.0 (1.7–5.6)	3.7 (1.9–7.1)	–
Knowledge score					
• Low (reference)	–	–	–	–	1
• High	–	–	–	–	2.6 (1.0–6.6)

Participants displayed relatively strong ethical attitudes, particularly in areas such as obtaining informed consent, safeguarding confidentiality, protecting vulnerable individuals, accepting ethics committee oversight, and disclosing conflicts of interest. Using the 75th percentile cut-off of 10.5 for the attitude score, 68.8% of the respondents were classified as having adequate attitudes **(Table 2)**. These positive attitudes were significantly more pronounced in older participants, residents, and those who had been exposed to research ethics (either through prior awareness or formal training) **(Table 3)**.

In terms of actual practice, only 119 participants (12.9% of the total sample) had ever been involved in conducting health research. Of these, 80.7% reported having sought informed consent. Nevertheless, when scored comprehensively, only 29.9% of this experienced subgroup reached the threshold (75th percentile = 3) for adequate ethical practices **(Table 2)**. Superior practice scores were significantly linked to resident status, prior awareness of research ethics, and higher knowledge levels **(Table 3)**.

After adjustment in multivariable models **(Table 3)**: Greater knowledge and more favorable attitudes were independently predicted by older age, being a resident, and having received ethics training during the medical curriculum (simple awareness of the topic was no longer significant after adjustment). Better self-reported practices were independently predicted only by resident status and having previously heard of research ethics; age, formal training during studies, and overall knowledge no longer retained independent associations with practice scores.

The primary aim of this study was to evaluate the knowledge, attitudes, and practices concerning medical research ethics among Moroccan interns and residents. Results showed that 40.7% achieved a high knowledge score and 68.8% demonstrated adequate attitudes. Both scores were positively linked to older age, resident status, and prior exposure to research ethics training within the medical curriculum. Regarding practices, only 12.9% of participants had ever been involved in a research project, and among this group, just 29.9% exhibited fully adequate ethical practices.

Knowledge of the core definition of research ethics, its foundational principles, and major international and national guidelines was notably weak—a pattern commonly observed across many developing nations [17, 22]. Strikingly, 41.8% were unaware that Morocco has specific legislation regulating biomedical research, and only 5.4% could correctly identify Law 28-13. These figures are substantially lower than those reported in Nigeria (69%) and India (59.7%), where physicians were far more familiar with their national ethics codes [23, 24]. The difference is likely attributable to the much more recent enactment of Morocco’s law compared with the long-established codes in those countries [25, 26].

Despite the official inclusion of research ethics in the Moroccan medical curriculum since the 2015 reform, nearly 90% of participants reported never receiving such training. This gap probably stems from delayed or uneven implementation across faculties. A similar shortfall exists in most low- and middle-income settings, including Arab and sub-Saharan African countries [27, 28]. A large survey covering 42 developing nations found that only 36% of health-research institutions offered any ethics training to their staff [29]. Such deficits are unacceptable, especially given robust evidence that structured ethics education markedly improves knowledge, attitudes, and conduct in both clinical care and research [30]. The World Medical Association has long urged that research ethics be a mandatory, well-staffed component of undergraduate medical education [31].

The relatively low knowledge levels align with findings from Sri Lanka (18.8%) and India (30%) [24, 32], whereas the favorable attitudes observed here mirror results from Jordan, where residents also scored highly on issues of consent and confidentiality [17].

Participants who had actually received ethics training during their studies showed significantly better knowledge and more positive attitudes, corroborating earlier Nigerian studies that documented clear benefits from such instruction [33, 34]. A later Nigerian study, however, found no such association and attributed the discrepancy to variations in training content or delivery methods [16]. Regardless, ongoing education appears critical: a Sri Lankan survey revealed that 95.3% of physicians felt continuous ethics training was necessary to strengthen both knowledge and attitudes [32]. The same study noted that 79.2% believed junior doctors tend to adopt the ethical behavior modeled by their seniors, underscoring the powerful influence of role models in shaping good practice.

Research involvement among the participants was extremely limited (12.9%), consistent with the broader pattern of low research output in developing countries [35], even as the volume of human-subject studies in these settings continues to rise [36, 37]. This contributes to the stark global imbalance in scientific publications, with only about 2% of articles in indexed journals originating from low- and middle-income countries [38]. In our cohort, better self-reported practices were linked primarily to prior awareness of research ethics, reinforcing evidence that training and institutional support are pivotal for building ethical research capacity in resource-limited settings [39].

This is the first investigation of knowledge, attitudes, and practices in research ethics specifically among Moroccan interns and residents, and the first to explore predictors of each domain. Conducted across multiple centers with a large nationwide sample, the findings are broadly generalizable to the Moroccan medical workforce. The questionnaire demonstrated strong reliability, as well as convergent and divergent validity, and multivariate analyses appropriately adjusted for potential confounders.

As an online survey, the study may be affected by self-selection bias and social-media recruitment effects. Most importantly, the small number of participants with actual research experience (n = 119) restricted statistical power for fully exploring how knowledge and attitudes translate into real-world practice.

Conclusion

Although Morocco has taken steps to strengthen research ethics, including the enactment of Law 28−13 and the inclusion of ethics training in medical education, physicians' knowledge, attitudes, and practices in this domain remain suboptimal. Strengthening these areas is therefore crucial to enhance both the quality and the volume of research conducted in the country.

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