





# Factors Influencing Public Knowledge and Willingness to Participate in Biomedical Research in Jordan: A National Survey

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**Purpose:** Recruitment of adequate numbers of research participants is important for advancement in biomedical fields. Awareness and knowledge of the population about biomedical research are expected to enhance willingness to participate in such research. Therefore, in the current study, participants' awareness, knowledge, and willingness to participate in scientific research in Jordan were examined.

**Methods:** This was a survey-based, cross-sectional study conducted from December 2019 to February 2020 among the public in Jordan. After written informed consent had been obtained from study participants, a structured questionnaire was used to survey research participants. The final questionnaire contained three parts: part I was about demographics and general information, part II assessed participants' awareness and willingness to participate in biomedical research, and part III assessed participants' knowledge about biomedical research studies.

**Results:** A total of 2,000 subjects agreed to participate, of which 67.4% were female (n=1339). More than half the respondents were aware of biomedical research (58.6%), of which 18.1% had previously participated in biomedical research. In addition, 55.5% reported that they were willing to participate in biomedical research, while a lower proportion (31.1%) were willing to volunteer in a clinical trial. The overall knowledge of participants about biomedical research was deemed moderate (total score 12.9 out of 20). Finally, willingness to participate in biomedical research was associated with being male, being married, having a biomedicine-related degree, and higher knowledge score.

**Conclusion:** A majority of Jordanians had moderate levels of awareness and knowledge about biomedical research. Such factors as sex, type of education, and knowledge contribute to willingness to participate in biomedical research.

**Keywords:** willingness, knowledge, biomedical research, public, Jordan

## Introduction

Biomedical research is considered an important element in discovering new knowledge or revising current knowledge.<sup>1</sup> It has an important role in the development of scientific literature and the advancement of health care provided to individuals and communities.<sup>2</sup> Advances of biomedical research are highly dependent on the successful recruitment and participation of human subjects. Unfortunately, human participation in different types of biomedical research is inadequate and considered one of the main challenges facing researchers in the biomedical field.<sup>3,4</sup>

Inadequate involvement in biomedical research may give rise to several challenges, including insufficient sample size, which may affect the power of the study,

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increasing the likelihood of increasing type II error, and adversely influencing the generalizability of results to the general population.<sup>5,6</sup> Therefore, to improve the success of biomedical research, it is vital to identify and recognize factors influencing the willingness of an eligible individual to participate in biomedical research.<sup>7</sup>

Lack of public awareness about biomedical research is considered one of the main factors hindering subjects' participation in biomedical research.<sup>8</sup> Awareness about the anticipated benefits of taking part in research, possible risk, and understanding of what is required of participants may all influence their willingness to participate in biomedical research.<sup>8</sup> Additionally, sociodemographic factors, including education, income, and religion, may influence participants' decision to provide their consent and to participate in biomedical research.<sup>9-12</sup>

There have been few studies that have evaluated awareness of participants about biomedical research and factors affecting their willingness to participate in biomedical research in the Middle East,<sup>13,14</sup> and none has been conducted within the Jordanian community. Accordingly, the aim of the current study was to assess the knowledge and awareness of public in Jordan about biomedical research and to determine factors associated with their participation in various types of biomedical research studies.

## Methods

This was a cross-sectional study conducted from December 2019 to February 2020 among the public in Jordan. Convenience sampling was used. Adults (≥18 years old) from both sexes were approached in public places, at gatherings, and at their homes to fill out a self-administered questionnaire. Written informed consent was obtained before questionnaire administration from each participant, as requested by the Institutional Review Board of Jordan University of Science and Technology (approval23/128/2019). A detailed explanation of the study protocol was provided prior to handing the questionnaire to the participants.

We used G\*Power software version 3.1.9.7 to calculate the sample size, resulting in a significance level of 0.05, power of 0.95, small-effect size of 0.15, and minimum number of subjects of 1,979. Based on an anticipated dropout rate of 10%, the target number of participants was 2,100. We performed an analysis of the data from 2,000 subjects.

The study instrument was developed via brainstorming within the research team and by referring to previous

literature.<sup>15,16</sup> The initial draft of the questionnaire was face-validated via a group of experts, where input was taken and the questionnaire adjusted accordingly. Thereafter, the questionnaire was pilot-tested, where feedback from 30 participants who had been encouraged to provide comments about the clarity and comprehensibility of each item of the questionnaire was taken. Data from the pilot sample were not included in the final analysis.

The instrument was composed of three parts. Part I was about demographics and general information, including age, sex, education, employment, income, marital status, residence, religion, and general health status. Part II assessed participants' awareness of and willingness to participate in biomedical research. In this section, participants were asked six questions to assess any previous participation in medical research and their future willingness to participate in medication research with different objectives (shown in Table 1). Part III assessed participants' knowledge about biomedical research studies, and

**Table 1** Participants' awareness of and willingness to participate in medical research (n=2,000)

	n (%)
<b>Have you heard about medical research?</b>	
• Yes	1,164 (58.6%)
• No	822 (41.4%)
<b>Have you participated in any medical research?</b>	
• Yes	361 (18.1%)
• No	1,631 (81.9%)
<b>Are you willing to participate in medical research?</b>	
• Yes	1,107 (55.5%)
• No/unsure	886 (44.4%)
<b>Are you willing to have new drugs tested on you?</b>	
• Yes	620 (31.1%)
• No/unsure	1,375 (68.9%)
<b>Are you willing to have approved drugs tested on you?</b>	
• Yes	913 (46.1%)
• No/unsure	1,069 (53.9%)
<b>Are you willing to allow any of your family member to participate in any medical research?</b>	
• Yes	840 (42.2%)
• No/unsure	1,149 (57.8%)

**Table 2** Assessment of study-participant knowledge about medical research studies (n=2,000)

	Correct answer, n (%)
Medical research is limited to survey studies <sup>a</sup>	883 (44.6%)
Participants' consent is required only in medical research involving drug treatment <sup>a</sup>	1,527 (76.9%)
Filling survey on patients' opinions about healthcare topics is considered a medical research <sup>b</sup>	1,527 (76.9%)
Experiments on animals is considered medical research <sup>b</sup>	1,003 (50.6%)
Studies to test new drugs or procedures on humans is considered medical research <sup>b</sup>	1,231 (62.2%)
Observational studies to determine risk factors of diseases is considered medical research <sup>b</sup>	1,366 (68.9%)
Observationals to assess the safety of medication on patient health is considered medical research <sup>b</sup>	1,403 (70.8%)
Testing new devices on humans is considered medical research <sup>b</sup>	1,221 (61.4%)
Ethical guidelines are present to regulate the conduct of medical research <sup>b</sup>	1,233 (62.1%)
Researchers can recruit patients/participants without their approval <sup>a</sup>	1,480 (74.2%)
Participants can withdraw freely from any medical research at any time <sup>b</sup>	981 (49.2%)
Confidentiality of personal information is essential to know about before giving consent to participate in a study <sup>b</sup>	1,813 (91.1%)
Anticipated benefits are essential to know about before giving consent to participate in a study <sup>b</sup>	1,689 (85.0%)
Foreseeable risks are essential to know about before giving consent to participate in a study <sup>b</sup>	1,627 (82.0%)
Alternative procedures or courses of treatment are essential to know about before giving consent to participate in the study <sup>b</sup>	1,490 (72.1%)
Research aims are essential to know about before giving consent to participate in a study <sup>b</sup>	1,588 (80.2%)
The voluntary nature of participation is essential to know about before giving consent to participate in a study <sup>b</sup>	1,425 (64.7%)
Possible compensation is essential to know about before giving consent to participate in a study <sup>b</sup>	940 (47.6%)
The right to withdraw and its consequence are essential to know about before giving consent to participate in the study <sup>b</sup>	1,194 (60.4%)
The number of participants needed is essential to know about before giving consent to participate in the study <sup>a</sup>	575 (29.0%)
Knowledge score, mean $\pm$ SD (out of 20)	12.9 $\pm$ 3.8

**Notes:** <sup>a</sup>False; <sup>b</sup>true.

included 20 items, as shown in Table 2. For each correct item, the participant gained one point, while in the case of incorrect recognition they gained no points. Then, a knowledge score out of 20 was calculated for each participant. Overall knowledge scores were treated according to a quartile scale, where the third and fourth quartiles (<10) were considered inadequate knowledge, the second (10–<15) considered moderate knowledge, and the first ( $\geq$ 15) good knowledge.

Data were analyzed using SPSS version 22. The descriptive analysis was undertaken using means and standard deviations for continuous variables and percentages for qualitative variables. Checking for data normality was carried out using the Shapiro–Wilk test (with  $P \geq 0.05$  indicating a normally distributed continuous variable). Screening of factors affecting participants' willingness to participate in biomedical research was carried out using univariate and multivariate logistic regression. Following univariate logistic regression analysis, any variables found to be significant at the single-predictor level ( $P < 0.25$ ) were entered into the multiple logistic regression analysis to explore those that were significantly and independently associated with participants' willingness to participate in biomedical research. Variables were selected

after checking their multicollinearity, where tolerance values  $>0.1$  and variance inflation-factor values  $<10$  were checked to indicate the absence of multicollinearity among the independent variables in regression analysis.  $P < 0.05$  was considered statistically significant.

## Results

The mean age of the sample was 29.1 $\pm$ 10.3 years (Table 3). Around two-thirds of participants were female (n=1,339, 67.4%). Additionally, almost half the participants were married (n=913, 45.8%). Most (1762, 88.9%) had a personal income of <JD500. Around half the participants had a bachelor's or postgraduate degree (n=948, 47.7%), with few having a biomedicine-related degree (n=206, 10.4%). Participants who were studying made up 32.3% of the sample (n=642), while the remaining were working full-time, part-time, retired, self-employed, homemaking, or looking for a job. Most of the participants were Jordanian (n=1,904, 95.4%), Muslim (1,967, 98.4%), and living outside Amman (n=1,820, 91.4%).

With regard to participants' health status (Figure 1), 45.6% (n=910) believed that their general health was excellent and 52.4% (n=1,047) reported their general health to be good, with only 2.0% (n=40) stating they were in poor

**Table 3** Demographic characteristics of the study sample at baseline (n=2000)

	Mean (SD)	n (%)
<b>Age (years)</b>	29.1 (10.3)	
<b>Sex</b>		
• Female		1,339 (67.4%)
• Male		648 (32.6%)
<b>Education</b>		
• Low (school or lower)		1,040 (52.3%)
• High (university or higher)		948 (47.7%)
<b>Employment</b>		
• Working full-time		560 (28.6%)
• Working part-time		115 (5.8%)
• Retired		51 (2.6%)
• Self-employed		97 (4.9%)
• Homemaking/caregiving		304 (15.3%)
• Studying		642 (32.3%)
• Looking for work		211 (10.6%)
<b>Personal income</b>		
• <JD500 month		1,762 (88.9%)
• >JD500 JD		219 (11.1%)
<b>Marital status, n (%)</b>		
• Married		913 (45.8%)
• Nont married (single, divorced, widowed)		1,079 (54.2%)
<b>Religion</b>		
• Muslim		19,67 (98.4%)
• Christian		20 (1.0%)
• Other		11 (0.6%)
<b>Residence</b>		
• Amman		171 (8.6%)
• Other		1,820 (91.4%)
<b>Biomedicine-related degree</b>		
• Yes		206 (10.4%)
• No		1,768 (89.6%)

Note: US\$1 = JD0.71.

health. A majority reported not having any long-term disability (n=1,927, 96.7%) or chronic comorbidity (n=1,863, 95.0%). On awareness about biomedical research and their willingness to participate in such research (Table 1), responses demonstrated that more than half had heard about biomedical research (n=1,164, 58.6%), and only 18.1% (n=361) had participated in biomedical research. With regard to willingness to participate in biomedical research, 55.5% (n=1,107) reported that they were willing, while fewer were willing to have new drugs (n=630, 31.1%) tested on them or have approved drugs tested on them

(n=913, 46.1%). On the other hand, 42.2% of participants (n=840) revealed that they were willing to allow their family members to participate in biomedical research.

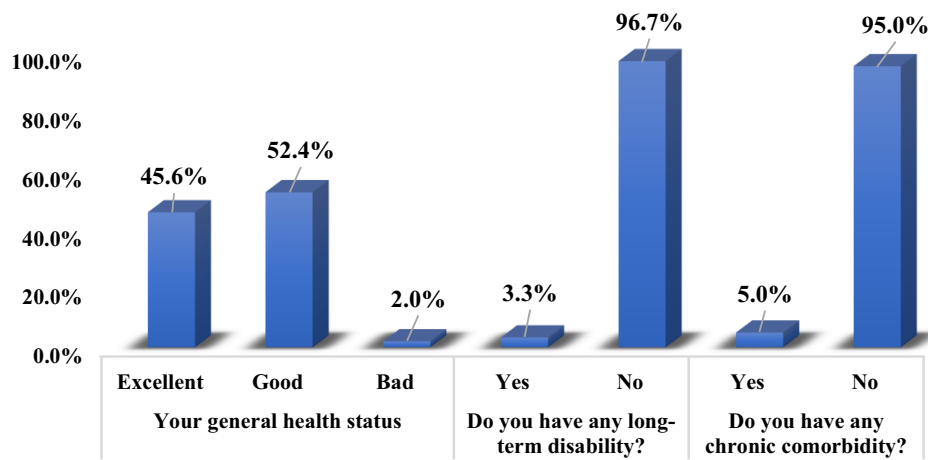
For participants' knowledge about biomedical research (Table 2), responses demonstrated that more than half knew the correct answers to the statements, apart from four statements. The first statement was "Biomedical research is limited to survey studies", where only 44.6% (n=883) knew that this was false. The second statement was "Participants can withdraw freely from any biomedical research at any time", where only 49.2% (n=981) knew that they could. Additionally, 47.6% (n=940) knew that "Possible compensation is essential to know about before giving consent to participate in a study". Finally, only 29.0% of participants (n=575) knew that the number of participants needed was not essential to know about before giving consent to participate. The overall knowledge score (out of 20) was 12.9±3.8. Univariate and multivariate logistic regression analysis of factors affecting participants' willingness to participate in biomedical research emphasized that being male, being married, having a biomedicine-related degree, and higher knowledge score resulted in significantly higher willingness to participate in biomedical research ( $P<0.05$ , Table 4).

## Discussion

In the current study, participants' awareness, knowledge of, and willingness to participate in biomedical research in Jordan were examined. The results showed that the majority were aware of biomedical research and willing to participate in such studies. In addition, about a third were willing to participate in clinical studies that involved drug testing. The overall knowledge of participants about biomedical research was moderate.

Biomedical research covers areas of science that include examining biological process, etiology of diseases, preventive medicine, medication discovery and testing, management of diseases, and others. It is a multidisciplinary area that involves researchers from both health and basic sciences and an essential area for the discovery of new medicines and therapies for diseases. Advancement in biomedical research requires many research participants. In this case, the awareness and knowledge of the population about biomedical research are expected to enhance participation in biomedical and health-related studies.<sup>17,18</sup>

The findings showed that more than half the surveyed participants were aware (58.6%) of biomedical research and



**Figure 1** Participants' health status (n=2,000).

willing (55%) to participate in same. Such findings are similar to those reported from several studies in other countries. For example, in a study conducted in Saudi Arabia, about 69% reported a positive attitude toward biomedical research.<sup>14</sup> In the UK, a majority of participants (61%) were positive toward participation and willing to donate their blood for biomedical research.<sup>19</sup> In the US studies, about 64% of those surveyed had good awareness about biomedical research<sup>20</sup> and about 46% were willing to participate.<sup>21</sup> However, higher rates of willingness to participate in biomedical research have been reported in Tunisian (80%) and Swedish (86%) studies.<sup>9,22</sup> The present study showed that about 31% were willing to volunteer in clinical trials involving drug testing. Willingness to participate in clinical studies is expected to be low compared to other types of biomedical research.<sup>23–25</sup> Lower percentages to volunteer in clinical studies were shown in the Tunisian study (38%),<sup>9</sup> and a report from the US (32%).<sup>26</sup>

In the current study, willingness to participate in biomedical research was associated with being male, being married, having a biomedicine-related degree, and higher knowledge scores. In a study from Taiwan, male respondents and those with a biomedical degree or whose household family members had one were more likely to participate in biomedical research.<sup>10</sup> Sex has also been reported to be a factor in participation in biomedical research in studies conducted in UK and US.<sup>27,28</sup> In the present study, knowledge of participants about biomedical research aspects was rated as moderate (score 12.9 out of 20). Strong association between willingness to participate in biomedical research and knowledge was reported. Knowledge about biomedical research has been shown strongly to influence willingness to participate.<sup>29</sup> In

an Italian study, 52% of respondents had knowledge about biomedical research, which was reflected in their attitude to participate in biomedical studies.<sup>30</sup> Enhancing knowledge of research subjects has been shown to improve willingness to participate in clinical research among African Americans. In addition, level of education was a factor that contributed to participation in genetic research in the US.<sup>31</sup> The present study showed that age was not among the factors influencing participation in biomedical research. Previous studies showed that age contributed significantly to attitudes toward participation.<sup>9,19–21</sup> This could be due to the nature of the participants in the current study, where the majority were young, healthy, and well educated. Notably, such a sample reflected the general characteristics of the population, with median population age of 23.8 years and a literacy rate of >99%.<sup>32</sup> More studies on factors that contribute to willingness to participate in research with a broad age-group are recommended to be done in the studied population. Finally, increasing awareness and knowledge of Jordanians about biomedical research might significantly improve willingness to participate in research studies. This could be achieved via inclusion of topics related to biomedical research awareness within school and university curricula. The use of directed social media is another tool recommended to increase public awareness about biomedical research participation.

## Conclusion

The majority of Jordanians had acceptable levels of awareness and knowledge about biomedical research. Such factors as sex, type of education, and knowledge contributed to willingness to participate in biomedical research.



**Table 4** Assessment of factors affecting participants' willingness to participate in medical research (n=2,000)

	Willingness to participate (0, no; 1, yes)					
	OR	95% CI	P-value <sup>#</sup>	OR	95% CI	P-value <sup>§</sup>
<b>Age (years)</b>	1.010	1.001–1.018	0.032	0.988	0.947–1.002	0.082
<b>Sex</b>						
• Female	Reference					
• Male	1.192	0.985–1.441	0.071	1.281	1.010–1.626	0.041*
<b>Education</b>						
• Low (school or lower)	Reference					
• High (university or higher)	1.412	1.181–1.688	<0.001	1.165	0.934–1.453	0.176
<b>Personal income</b>						
• <JD500/month	Reference					
• >JD500/month	1.800	1.335–2.427	<0.001	1.259	0.876–1.808	0.213
<b>Marital status, n (%)</b>						
• Married	Reference					
• Nont married (single, divorced, widowed)	0.669	0.559–0.800	<0.001	0.646	0.489–0.853	0.002*
<b>Religion</b>						
• Muslim	Reference					
• Other	0.573	0.279–1.176	0.129	0.666	0.280–1.583	0.357
<b>Residence</b>						
• Amman	Reference					
• Other	0.907	0.660–1.245	0.545	—	—	—
<b>Nationality</b>						
• Jordanian	Reference					
• Others	0.642	0.421–0.980	0.040	0.834	0.493–1.410	0.498
<b>Biomedicine-related degree</b>						
• Yes	Reference					
• No	0.777	0.587–1.044	0.094	0.673	0.473–0.957	0.027*
<b>Knowledge score</b>	1.169	1.136–1.203	<0.001	1.161	1.126–1.197	<0.001*

Notes: <sup>#</sup>Using simple logistic regression; <sup>§</sup>using multiple logistic regression; \*P<0.05.

## Ethics Approval and Informed Consent

Written informed consent was obtained before questionnaire administration from each participant, as requested by the Institutional Review Board of Jordan University of Science and Technology (approval 23/128/2019).

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## Disclosure

Non-financial competing interests. The authors report no other possible conflicts of interest for this work.

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