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Original Article

Down syndrome: Knowledge and attitudes among future healthcare providers

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الملخص

أهداف البحث: تعتبر المعرفة والموقف تجاه متلازمة داون محددات مهمة لرعاية ودعم ودمج الأشخاص ذوي متلازمة داون. هدفت الدراسة إلى تقييم معرفة وموقف مقدمي الرعاية الصحية المستقبليين، طلاب العلوم الطبية والصحية، تجاه المصابين بمتلازمة داون.

طريقة البحث: أجريت الدراسة باستخدام تصميم مسح مقطعي في إحدى جامعات العلوم الطبية والصحية في الإمارات العربية المتحدة. تم استخدام استبانة خاص بالدراسة، تم اختباره ميدانيا، وتم التحقق من صحته لتسجيل إجابات الطلاب.

النتائج: بشكل عام، أبلغ 74٪ من المشاركين في الدراسة عن معرفة إيجابية بمتلازمة داون. وبالمثل، كان لدى 67.2٪ من المشاركين في الدراسة موقف إيجابي تجاه الأشخاص الذين يعانون من متلازمة داون. العمر > 25 سنة، جنس الأنثى، كلية التمريض، السنة الأولى من الدراسة والوضع الفردي كانوا المتنبئين المستقلين لمستوى المعرفة. علاوة على ذلك، تضمنت المؤشرات المستقلة للموقف العمر > 25 عاما، السنة الأولى من الدراسة والوضع الفردي.

الاستنتاجات: كان العمر والجنس والكلية وسنة الدراسة والحالة الاجتماعية من العوامل الهامة التي تنبئ بمعرفة وموقف طلاب العلوم الطبية والصحية تجاه الأشخاص المصابين بمتلازمة داون. نحن نبلغ عن المعرفة الإيجابية والموقف تجاه الأشخاص الذين يعانون من متلازمة داون بين عينتنا من مقدمي الرعاية الصحية في المستقبل. يجب القيام بالمزيد من البحث في هذه المعرفة والموقف مع مرور الوقت وتنفيذها الفعلي في الممارسة.

الكلمات المفتاحية: متلازمة داون؛ المعرفة؛ الموقف؛ الشمول؛ الإمارات العربية المتحدة

Abstract

Objectives: Knowledge and attitudes regarding Down syndrome (DS) are important determinants of care, support and inclusion for people with DS. The study was aimed at evaluating the knowledge and attitudes of medical and health sciences students, as future healthcare providers, regarding people with DS.

Methods: The study used a cross sectional survey design and was performed at a medical and health sciences university in the United Arab Emirates. A study-specific, field-tested and validated questionnaire was used to record the responses of the students.

Results: Overall, 74.0% of the study respondents reported positive knowledge regarding DS, with a median knowledge score of 14.0 (IQR 11.0–17.0). Likewise, 67.2% of the study respondents had positive attitudes toward people with DS, with a median attitude score of 7.5 (IQR 4.0–9.0). Age >25 years (aOR: 4.39, 95% CI: 1.88–21.93), female gender (aOR: 1.88, 95% CI: 1.16–3.07), enrollment in nursing college (aOR: 3.53, 95% CI: 1.84–6.77), senior year of study (aOR: 9.10, 95% CI: 1.94–42.65) and single relationship status (aOR: 9.16, 95% CI: 4.19–20.01) were independent predictors of knowledge level. Moreover, independent predictors of attitudes included age >25 years (aOR: 10.60, 95% CI: 1.78–62.96), senior year of study (aOR: 11.57, 95% CI: 3.20–41.83) and single relationship status (aOR: 7.23, 95% CI: 3.46–15.11).

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Conclusion: Age, gender, college, year of study and marital status were significant predictors of the knowledge and attitudes of medical and health sciences students regarding people with DS. We report positive knowledge and attitudes regarding people with DS among our sample of future health care providers. Further research is warranted to investigate knowledge and attitudes over time and actual implementation in practice.

Keywords: Attitude; Down syndrome; Inclusion; Knowledge; United Arab Emirates

Introduction

Down syndrome (DS) is a prevalent chromosomal abnormality associated with intellectual disability and growth problems. A wide range of congenital abnormalities, medical conditions and dysmorphic features occur in people with DS.[1] Worldwide, the estimated incidence of DS is 1 in 1000 live births. DS accounts for approximately 3000 to 5000 live births annually.[2] In the United Arab Emirates (UAE), the overall incidence of DS is 1 in 449 live births, approximately twice the global incidence.[3]

Perceptions of DS and societal attitudes toward individuals with DS are important determinants of their inclusion in society and the support of their families.[4] Misperceptions regarding their personalities, behaviors and developmental potential are likely to foster unfavorable attitudes and subsequent feelings of rejection, pity or discomfort.[5] Inclusion is beneficial for individuals with DS, and has been found to result in better academic development, enhanced language and communication, improved social skills and better quality of life.[6,7]

Several studies in various settings have been conducted to examine people's knowledge and attitudes regarding individuals with DS. Many of these studies have reported that people have misconceptions about the intellectual abilities of individuals with DS and believe that they cannot lead independent lives. Furthermore, people have limited knowledge regarding DS and hold stereotypical attitudes toward individuals with this disorder.[8–10] Most studies have focused on the general population and community members,[5,6,9,11] or specific groups, such as educators and teachers,[12–15] parents and caregivers,[8,16,17] or school students.[7,18] However, very few studies have assessed the knowledge and attitudes of the medical and health sciences students, who will be the future health care providers, regarding DS.[19,20]

A lack of knowledge regarding DS can contribute to negative societal perception, particularly among future generations.[21] Studies have shown that better-educated individuals have favorable opinions and positive attitudes toward people with DS.[22] Medical and health sciences students are a highly educated segment of society and will be the future healthcare providers. Therefore, they must have accurate knowledge and appropriate attitudes toward people with DS. Given these beliefs, the present study was performed to evaluate knowledge and attitudes of students at a medical and health sciences university regarding people with DS.

Materials and Methods

Study population

This study used a cross sectional survey design and was performed at a medical and health sciences university in the UAE. Students from the university's four academic programs—medical, dentistry, pharmacy and nursing—were included in the study. The sample size for the study was computed with OpenEpi Version 3.01.[23] The minimum sample size, on the basis of the total number of students at the university (1100), with a 95% confidence level and a 5% margin of error, was calculated to be 285. The questionnaire was sent to 1100 students at the university in hard copy as well as online. A total of 585 students gave informed consent and agreed to participate in the study. Eighty-five students submitted incomplete questionnaires and therefore were excluded from the study. Data from 500 students were collected and analyzed.

Study instrument

A study-specific, field-tested and validated questionnaire was used to collect the responses of the students. The questionnaire consisted of 34 questions adapted from previous surveys,[5,8,9,11] which were intended to evaluate students' knowledge and attitudes regarding DS. The questionnaire included eight subscales: demographic data (six items), general knowledge of DS (four items), knowledge of clinical manifestations of DS (two items), risk factors for DS (three items), disorders associated with DS (five items), screening for DS (two items), treatment of DS (two items) and attitudes toward DS (ten items). The knowledge and attitude items were scored as either 0 or 1; the maximum score was 18 on the knowledge scale and 10 on the attitude scale. A panel of experts consisting of an internal medicine specialist, neurologist, pediatrician and other healthcare personnel assessed the questionnaire's content validity. Reliability analysis for the questionnaire was performed with Cronbach's α.

Data analysis

Statistical Package for the Social Sciences (SPSS) version 26.0 was used to analyze the study data. The characteristics of the study sample were analyzed with descriptive statistics. Knowledge and attitude scores were determined by summation of the respective item scores. Positivity for knowledge and attitudes was established according to a 70% cut-off score. The Shapiro–Wilk test was used to determine the normality of the data distribution. Continuous variables are reported as median and inter-quartile range (IQR), whereas categorical variables are reported as frequency and percentages with 95% confidence intervals (CIs). Chi square test or Fisher's exact test was used for analyzing respondents'

characteristics and attitudes toward DS. The median test was used to compare the median knowledge and attitude scores across groups. Spearman's rho correlation was used for establishing the relationship between knowledge and attitude scores. Predictors of knowledge and attitudes regarding DS were identified with univariate and multivariate logistic regression analyses. The results are presented as odds ratios (OR) with 95% CIs. $p < 0.05$ was considered to indicate statistical significance.

Results

Demographic characteristics

The questionnaire was sent to 585 participants who agreed to be part of the study. Of these 585 participants, responses were received from 500 participants, thus yielding a response rate of 85.5%. The demographic characteristics of the study respondents are presented in Table 1. Most study respondents were female (n = 343, 68.6%, 95% CI: 64.4–72.6) and were unmarried (n = 434, 86.8%, 95% CI: 83.8–89.8). Nearly equal proportions of study respondents were enrolled in the medical (n = 172, 34.4%, 95% CI: 30.2–39.0), pharmacy (n = 154, 30.8%, 95% CI: 26.6–35.0) and dental (n = 118, 23.6%, 95% CI: 19.8–27.6) colleges of the university. However, students in the nursing college were under-represented in the study (n = 56, 11.2%, 95% CI: 8.8–14.0). Most students belonged to the age group of 20-21 years (n = 190, 38.0%, 95% CI: 33.6–42.4) and were Arabs (n = 251, 50.2%, 95% CI: 45.8–54.6).

Table 1: Demographic characteristics of the study respondents.

	Frequency n = 500	Percentage (%)	95% CI
Age group			
18–19	152	30.4	26.4–34.4
20–21	190	38.0	33.6–42.4
22–23	111	22.2	19.0–25.8
24–25	27	5.4	3.6–7.4
>25	20	4.0	2.4–5.8
Gender			
Male	157	31.4	27.4–35.6
Female	343	68.6	64.4–72.6
College			
Pharmacy	154	30.8	26.6–35.0
Medical	172	34.4	30.2–39.0
Dental	118	23.6	19.8–27.6
Nursing	56	11.2	8.8–14.0
Year of study			
Year 1	113	22.6	19.2–26.4
Year 2	111	22.2	18.8–25.8
Year 3	99	19.8	16.4–23.6
Year 4	135	27.0	23.2–31.0
Year 5	42	8.4	6.0–10.8
Marital status			
Single	434	86.8	83.8–89.8
Married	66	13.2	10.2–16.2
Ethnicity			
Arab	251	50.2	45.8–54.6
Non-Arab	249	49.8	45.4–54.2

CI: confidence interval.

Validity and reliability of the study instrument

The Cronbach alpha reliability score for the knowledge scale was 0.807, and that for the attitude scale was 0.842.

Knowledge of respondents regarding down syndrome

Overall, 74.0% of the study respondents had positive knowledge of DS. The median knowledge score of the study respondents was 14.0 (IQR 11.0–17.0). Medical students had significantly higher knowledge scores [15.0 (IQR: 14.0–17.0), $p < 0.001$] than nursing [14.0 (IQR: 12.0–16.0)], pharmacy [13.0 (IQR: 10.0–16.0)] and dental college [12.0 (IQR: 9.0–15.0)] students (Figure 1). Most students were cognizant of the genetic etiology of DS (n = 439, 87.8%, 95% CI: 84.8–90.6) and recognized DS as the most common cause of intellectual disability worldwide (n = 425, 85.0%, 95% CI: 82.2–88.2). In addition, most study respondents knew about the clinical manifestations of DS (n = 425, 85.0%, 95% CI: 81.8–88.2). Furthermore, most students recognized that prenatal screening is essential for the detection of DS (n = 426, 85.2%, 95% CI: 82.2–88.2). Table 2 depicts the responses of the study respondents to the different items of the knowledge scale.

Attitudes of respondents toward people with Down syndrome

Overall, 67.2% of the study respondents had positive attitudes toward people with DS (Fig. 2). The median attitude score of the study respondents was 7.5 (IQR 4.0–9.0). However, no significant differences were observed in the median attitude scores of respondents from the different colleges (Figure 3). A significantly greater proportion of older than younger respondents believed that people with DS should be integrated into the community (90.0% vs 55.3%, p = 0.017), had positive attitudes toward prenatal testing of DS (75.0% vs 47.4%, $p < 0.001$) and agreed that treatment can improve quality of life (80.0% vs 61.2%, p = 0.018). Women had significantly better attitudes toward DS than

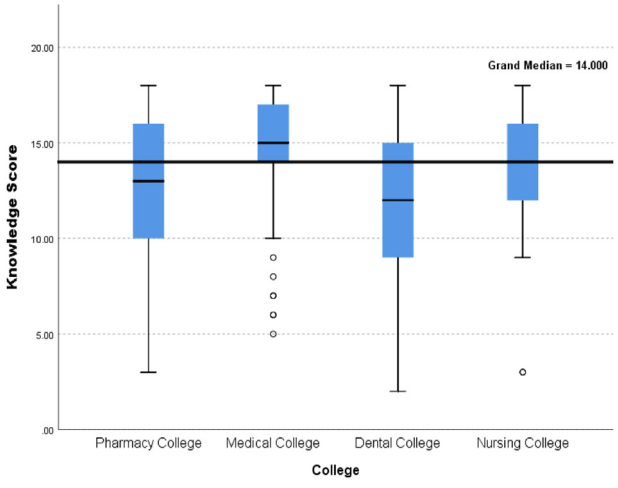

Figure 1: Median knowledge scores of the study respondents.

Table 2: Knowledge of respondents regarding Down syndrome.

Statements	Positive responses	
	n (%)	95% CI
Down syndrome (DS) is a genetic disorder	439 [87.8]	84.8–90.6
DS is caused by an extra copy of chromosome 21	290 [58.0]	53.8–62.2
DS is the most common cause of intellectual disability globally	425 [85.0]	82.2–88.2
The incidence of DS in UAE is twice the global rate	233 [46.6]	42.0–51.0
Physical manifestations of DS are poor muscle tone; short neck; flattened facial profile and nose; upward slanting eyes; and small head, ears, and mouth	425 [85.0]	81.8–88.2
People with DS have cognitive manifestations such as cognitive impairment; problems with thinking and learning; and delayed language and speech development	289 [57.8]	53.6–62.0
Maternal age is a risk factor	199 [39.8]	35.0–44.2
A previous child with DS is a risk factor	367 [73.4]	69.2–77.2
A carrier parent is a risk factor	381 [76.2]	72.4–80.2
Congenital heart disease is associated with DS	381 [76.2]	72.4–80.0
Vision problems are associated with DS	347 [69.4]	65.8–73.6
Hearing loss is associated with DS	328 [65.6]	61.2–69.8
Infections are associated with DS	312 [62.4]	58.0–66.6
Hypothyroidism is associated with DS	338 [67.6]	63.2–72.0
Prenatal testing is essential for detecting DS	426 [85.2]	82.2–88.2
Prenatal screening is performed by an ultrasound scan and biochemical serum tests	384 [76.8]	73.2–80.6
There is no medical cure for DS	397 [79.4]	75.6–82.8
DS is managed by a combination of therapies, such as physical, speech, emotional and behavioral therapies, and drugs and supplements	320 [64.0]	59.4–68.2

CI: confidence interval, DS: Down syndrome.

men. A significantly greater proportion of women than men supported caring attitudes toward people with DS (85.7% vs 75.2%, p = 0.003). Medical college students were more likely to have positive attitudes toward DS than students in other colleges (Table 3). Significant associations were observed between the respondents' year

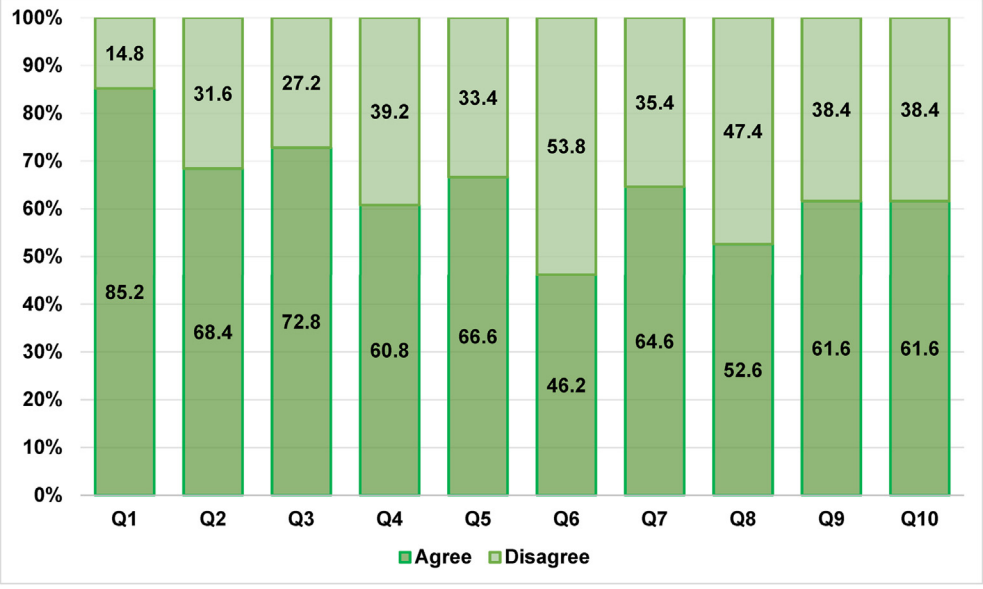

Figure 2: Attitudes of respondents toward people with Down syndrome. Q1: Appropriate management of DS can improve the quality of life of the patient. Q2: Prenatal testing helps to plan management of the pregnancy and delivery. Q3: We should have caring and understanding attitudes toward people with DS. Q4: Children with DS need special schooling. Q5: Children with DS will benefit from regular schooling. Q6: Including students with DS in regular schools affects other students. Q7: Children with DS can maintain good relationships with their peers. Q8: People with DS can live and work independently. Q9: People with DS can be integrated into the community. Q10: People with DS should live in family homes.

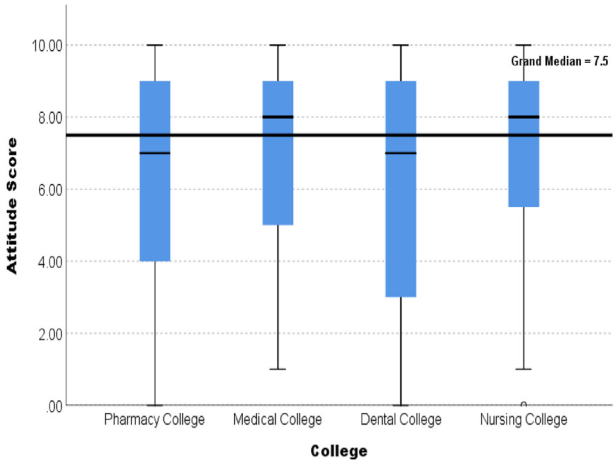

Figure 3: Median attitude scores of the study respondents.

of study and all items on the attitude scale except items six and eight. Overall, with increasing year of study, attitudes toward DS significantly improved.

Correlation between knowledge and attitude scores

A positive correlation was found between knowledge of DS and attitudes toward people with DS ($p < 0.001$), thus implying that respondents with greater knowledge of the disease had significantly better attitudes (Table 4).

Predictors of knowledge and attitudes toward people with Down syndrome

Table 5 shows the results of the univariate and multivariate logistic regression analyses of the knowledge and attitude levels of the study respondents. In univariate analyses, gender, college, year of study, nationality and marital status were found to be significant predictors of the positive knowledge level. Women were more likely to have positive knowledge of DS than men. Students in nursing college were 3.5 times more likely to have positive knowledge of DS than students in pharmacy college. Final year students were 5.3 times more likely to be aware of DS than first year students. Arabs were 1.7 times more likely to have positive knowledge of DS than non-Arabs. Unmarried study respondents had 5.30 times more positive knowledge of DS than married respondents. Furthermore, multivariate analyses revealed that age >25 years (aOR: 4.39, 95% CI: 1.88–21.93), female gender (aOR: 1.88, 95% CI: 1.16–3.07), nursing college (aOR: 3.53, 95% CI: 1.84–6.77), fifth (aOR: 9.10, 95% CI: 1.94–42.65) and fourth (aOR: 2.28, 95% CI: 1.03–5.06) years of study, and single relationship status (aOR: 9.16, 95% CI: 4.19–20.01) were independent predictors of knowledge level.

For attitude level, univariate analyses revealed that study respondents >25 years of age were 5.4 times more likely to have positive attitudes toward people with DS than respondents 18–19 years of age. In addition, students in nursing college (1.6 times), unmarried students (3.3 times),

Table 3: Attitudes of respondents toward people with Down syndrome.

Parameter		Q1 (% agreeing)	Q2 (% agreeing)	Q3 (% agreeing)	Q4 (% agreeing)	Q5 (% agreeing)	Q6 (% agreeing)	Q7 (% agreeing)	Q8 (% agreeing)	Q9 (% agreeing)	Q10 (% agreeing)
Age group	18–19	61.2	47.4	88.2	59.2	65.1	46.7	58.6	54.6	55.3	57.9
	20–21	69.5	43.2	80.0	69.5	65.8	48.9	60.5	46.3	66.3	61.1
	22–23	79.3	68.5	76.6	68.5	67.6	47.7	61.3	47.7	65.8	64.0
	24–25	77.8	74.1	81.5	85.2	55.6	63.0	70.4	55.6	55.6	55.6
	>25	80.0	75.0	95.0	75.0	95.0	45.0	85.0	60.0	90.0	90.0
	p-value	**0.018**	**<0.001**	**0.060**	**0.050**	**0.062**	**0.628**	**0.185**	**0.452**	**0.017**	**0.078**
Gender	Male	66.2	49.0	75.2	65.6	60.5	58.0	56.1	50.3	56.7	58.6
	Female	71.7	54.8	85.7	67.9	69.4	44.3	63.8	50.1	66.2	63.0
	p-value	**0.128**	**0.135**	**0.003**	**0.339**	**0.053**	**0.003**	**0.049**	**0.524**	**0.026**	**0.373**
College	Pharmacy	68.2	50.6	79.9	64.9	66.9	44.2	64.3	44.2	64.3	60.4
	Medical	75.0	58.1	91.3	70.9	66.9	54.1	74.4	54.1	62.2	62.2
	Dental	61.9	40.7	79.7	60.2	62.7	42.4	55.1	43.2	61.0	59.3
	Nursing	76.8	69.6	89.3	76.8	73.2	57.1	71.4	57.1	67.9	67.9
	p-value	**0.065**	**0.001**	**0.008**	**0.093**	**0.590**	**0.080**	**0.005**	**0.099**	**0.822**	**0.727**
Year of study	Year 1	59.3%	43.4	73.5	59.3	56.6	51.3	58.4	52.2	56.6	49.6
	Year 2	60.4%	45.0	78.4	61.3	72.1	48.6	57.7	44.1	59.5	65.8
	Year 3	63.6%	50.5	75.8	58.6	60.6	39.4	61.6	46.5	59.6	59.6
	Year 4	77.0%	63.7	86.7	69.6	69.6	54.1	73.3	50.4	67.4	64.4
	Year 5	88.1%	69.0	92.9	88.1	83.3	45.2	73.8	52.4	81.0	78.6
	p-value	**<0.001**	**0.001**	**0.014**	**0.004**	**0.007**	**0.239**	**0.032**	**0.726**	**0.041**	**0.009**
Ethnicity	Arab	69.0	69.9	82.2	55.6	64.9	47.4	71.2	49.0	72.9	61.8
	Non-Arab	63.7	61.5	78.5	66.7	68.3	51.9	62.2	48.1	63.0	61.4
	p-Value	**0.153**	**0.048**	**0.209**	**0.016**	**0.429**	**0.216**	**0.035**	**0.470**	**0.022**	**0.944**

Q1: Appropriate management of DS can improve the quality of life of the patient. Q2: Prenatal testing helps to plan management of the pregnancy and delivery. Q3: We should have caring and understanding attitudes toward people with DS. Q4: Children with DS need special schooling. Q5: Children with DS will benefit from regular schooling. Q6: Including students with DS in regular schools affects other students. Q7: Children with DS can maintain good relationships with their peers. Q8: People with DS can live and work independently. Q9: People with DS can be integrated into the community. Q10: People with DS should live in family homes.

Table 4: Correlation between knowledge and attitude scores.

			Knowledge score	Attitude score
Spearman's rho	Knowledge score	Correlation coefficient	1.000	0.350**
		Sig. (two-tailed)	–	0.000
		N	500	500
	Attitude score	Correlation coefficient	0.350**	1.000
		Sig. (two-tailed)	0.000	–
		N	500	500

** Correlation is significant at the 0.01 level (two-tailed).

Table 5: Predictors of knowledge and attitudes toward Down syndrome.

Predictors	Knowledge		Attitude	
	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
Age group (18–19 years)				
>25	1.76 (0.49–6.35)	4.39 (1.88–21.93)**	5.40 (1.21–24.14)**	10.60 (1.78–62.96)**
24–25	1.09 (0.41–2.90)	1.78 (0.44–7.15)	2.64 (0.95–7.36)	1.80 (0.47–6.90)
22–23	1.02 (0.57–1.81)	1.38 (0.58–3.28)	1.32 (0.79–2.23)	0.74 (0.34–1.59)
20–21	0.66 (0.40–1.06)	0.63 (0.33–1.19)	1.14 (0.73–1.79)	0.66 (0.37–1.18)
Gender (male)				
Female	1.86 (1.21–2.82)**	1.88 (1.16–3.07)**	1.02 (0.68–1.53)	0.84 (0.53–1.33)
College (pharmacy)				
Nursing	3.54 (1.97–6.36)***	3.53 (1.84–6.77)***	1.68 (1.04–2.70)**	2.01 (0.92–4.40)
Dental	0.52 (0.32–0.86)**	0.52 (0.30–0.92)**	0.77 (0.47–1.27)	0.79 (0.46–1.35)
Medical	1.61 (0.78–3.32)	1.83 (0.87–4.17)	1.86 (0.92–3.77)	1.56 (0.92–2.65)
Study year (1st year)				
5th year	5.36 (1.55–18.57)**	9.10 (1.94–42.65)**	7.88 (2.64–23.59)***	11.57 (3.20–41.83)***
4th year	1.38 (0.78–2.45)	2.28 (1.03–5.06)**	2.58 (1.50–4.43)**	4.42 (2.10–9.30)***
3rd year	0.72 (0.41–1.29)	1.21 (0.57–2.55)	1.49 (0.86–2.59)	2.75 (1.36–5.55)**
2 nd year	1.17 (0.65–2.10)	2.33 (1.16–4.69)**	1.64 (0.95–2.81)	2.65 (1.43–4.93)**
Ethnicity (non-Arab)				
Arab	1.77 (1.18–2.66)**	1.19 (0.75–1.91)	1.04 (0.71–1.51)	0.79 (0.52–1.21)
Marital status (married)				
Single	5.30 (3.08–9.10)***	9.16 (4.19–20.01)***	3.34 (1.95–5.72)***	7.23 (3.46–15.11)***

**$p < 0.05$, ***$p < 0.001$, CI: confidence interval, OR = odds ratio, aOR = adjusted odds ratio.

and fifth year (7.8 times) and fourth year (2.5 times) students were more like to have positive attitudes toward DS. Furthermore, multivariate analyses revealed that age >25 years (aOR: 10.60, 95% CI: 1.78–62.96), senior year of study (aOR: 11.57, 95% CI: 3.20–41.83) and single relationship status (aOR: 7.23, 95% CI: 3.46–15.11) were independent predictors of attitude level.

Discussion

Our study investigated the knowledge and attitudes of medical and health sciences students regarding people with DS. Factors including age, gender, ethnicity, college and year of study influenced the respondents' knowledge and attitudes. The findings of this study highlighted positive knowledge and attitudes regarding people with DS among our sample of medical and health sciences students, on the basis of high median knowledge scores. Previous studies have investigated the awareness and attitudes of people toward individuals with DS in various settings, such as the general population and community members,[5,6,9,11] educators and teachers,[12–15] parents and caregivers,[8,16,17] and school students.[7,18] However, data on the awareness and knowledge of medical and health sciences students regarding people with DS are scarce. Uysal et al. have investigated the attitudes of nursing students toward people with disabilities in general[19] and have reported moderate attitudes of nursing students toward people with disabilities. Furthermore, Hall et al. have evaluated the effects of an educational workshop on the attitudes of medical students toward DS.[20] The attitudes of medical students toward people with DS significantly improved after the educational workshop.

Most medical and health sciences students in our study had positive knowledge and attitudes regarding DS. These findings contrast with those from a study conducted in a business and management higher education institution by Ahmad et al., who have reported inadequate awareness, knowledge and attitudes of students regarding people with DS.[24] These differences in findings may be explained by our respondents having been enrolled at a medical and health sciences university where students are taught topics related to genetic diseases such as DS. In addition, medical students had significantly greater knowledge of DS than nursing, pharmacy and dental college students. Medical students are more extensively taught about the etiology,

clinical manifestations, diagnosis and management of different diseases than students in other colleges.

Research has shown that through inclusion, peoples' attitudes and perceptions regarding individuals with DS can improve in several ways.[25] In addition, inclusion and integration in the community provide various opportunities for people with DS, such as better social adjustment in life, higher academic performance, and improved communication skills and peer relationships.[26] Most of our study respondents supported such inclusion and integration, and agreed with the statement that "people with DS should be integrated into the community and should live in family homes." Prenatal screening and diagnosis aid in identifying fetuses at high risk of having congenital abnormalities such as DS, and in the planning and management of pregnancy and delivery.[27] An encouraging finding of our study was the students' positive knowledge and attitudes regarding prenatal screening and diagnosis of DS. Furthermore, women and older respondents had better attitudes toward people with DS than men and younger respondents. Similar findings have been reported by studies assessing the attitudes of students toward people with disabilities.[28,29]

A key finding of our study was the positive correlation between knowledge of DS and attitudes toward people with DS. This finding indicated that students' attitudes toward DS improved as their understanding of the condition was enhanced. These findings indicate that knowledge can significantly alter people's perceptions of genetic disorders such as DS. These findings are consistent with those from earlier studies revealing better attitudes toward diseases such as thalassemia[30] and breast cancer[31] with increasing knowledge.

Studies have reported several factors, such as age, gender, education, ethnicity and contact with people with disabilities, that influence students' awareness and attitudes regarding people with disabilities, including DS.[7,18–20,24] In our study, age was a predictor of the knowledge and attitudes of students regarding DS. This finding may be explained by students becoming more aware and mature with age. However, Ahmad et al.[24] and Uysal et al.[19] have reported contrasting findings indicating an inverse relationship between age and attitudes of students toward people with DS and disability. Furthermore, we report that female gender is an independent predictor of knowledge of DS. This finding is in agreement with those from other studies reporting that female gender is a significant factor in determining knowledge and attitudes regarding people with DS.[11,29]

One interesting finding of our study was that students in nursing college were relatively more likely to have positive knowledge and attitudes regarding DS. This finding was attributed to most of the nursing students at our study site hailing from Arab countries where the incidence of DS is high, thus resulting in greater familiarity with the disease. Furthermore, year of study was identified as a predictor of knowledge and attitudes toward DS; this finding may be attributable to students gaining greater exposure and awareness of different types of disease conditions, including genetic disorders such DS, as their study progresses.

Although the overall incidence of DS in the UAE is higher than the global incidence, and a lack of awareness of this condition persists among the general public.[3,32] Students in the medical and health sciences, who will be the future health care providers, can play an important role in raising awareness and promoting positive attitudes toward DS, as well as providing care, support and empowerment for people with DS. However, students must have adequate knowledge and positive attitudes regarding people with DS. Herein, we report encouraging findings of positive knowledge and attitudes regarding people with DS among our sample of future health care providers. Consequently, students must maintain positive awareness and attitudes toward people with DS during their education, and apply them in practice after they graduate and become healthcare providers.

Strengths and limitations

Our study has several strengths and limitations. The main strength of our study was that it focused on the knowledge and attitudes of future healthcare providers regarding DS, an important genetic disorder in the UAE. The high survey response rate of the study (85%) was another strength. The multiethnic study population also added to the strength of our study. The limitations of the study included its cross-sectional nature, potential response bias and a sample representative of a single center, thus limiting the generalizability of the findings.

Conclusion

Age, gender, college, year of study and marital status were significant predictors of the knowledge and attitudes of medical and health sciences students regarding people with DS. We report positive knowledge and attitudes regarding people with DS among our sample of future health care providers. The positive knowledge and attitudes of future healthcare inspire hope that they will have progressive and productive roles in the care, support and empowerment of people with DS. Further research should investigate the changes in knowledge and attitudes over time and actual implementation in practice.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

RAK Medical and Health Sciences University Research and Ethics Committee provided ethical clearance for the study (RAKMHSU-REC-10-2016-UG-P).

Authors contributions

SAR: Conceptualization; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing. MSM: Conceptualization; Data curation;

Investigation; Writing—review & editing. GAA: Conceptualization; Data curation; Investigation; Writing—review & editing. FAA: Conceptualization; Data curation; Investigation; Writing—review & editing. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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