

# Chest mobility and health-related quality of life in students during the COVID-19 pandemic

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## Abstract

**Background:** Over the past ten years, there has been a growing trend in utilizing non-invasive techniques for monitoring respiratory function, with a particular emphasis on assessing chest expansion during both maximum inhalation and exhalation, which have gained popularity as research tools. The existing research conducted unequivocally affirms that the coronavirus disease 2019 (COVID-19) pandemic has had a substantial impact on multiple dimensions of Health-Related Quality of Life (HRQoL).

**Aims:** This study aimed to assess chest mobility and HRQoL among female students at the Faculty of Physical Rehabilitation, University of Physical Education in Kraków, using an online approach amidst the backdrop of the COVID-19 pandemic.

**Material and methods:** In a research project that included 40 women with an average age of  $22.75 \pm 1.51$  years and an average BMI of  $22.15 \pm 3.81$  kg/m<sup>2</sup>, self-reported chest mobility was remotely gauged using a measuring tape, while HRQoL was evaluated utilizing the 15D instrument. In order to perform the survey while maintaining the hygiene rules during the COVID-19 pandemic, an individual interview was conducted with each respondent using Microsoft Teams. The 15D questionnaire was then sent to the female students as a Google form.

**Results:** The average variance in chest circumference between maximum inspiration and maximum expiration in the women un-

## Key words

HRQoL,  
telerehabilitation,  
COVID-19  
pandemic,  
chest mobility.

der study was  $6.32 \pm 2.12$  cm. Half of the female students in the study group, totaling twenty individuals, exhibited normal chest mobility, with those who smoked cigarettes displaying reduced chest mobility. Among the dimensions assessed by the 15D questionnaire, sleep received the lowest ratings. No noteworthy correlation was found between the results from the 15D questionnaire and the chest mobility of the women examined.

**Conclusions:** Measuring chest mobility using a tape measure is feasible in telerehabilitation settings, and it is advisable to establish standardized norms and protocols for conducting this assessment, whether in-person or online. In the future, healthcare providers should pay greater attention to sleep hygiene and advocate for the significance of both the quantity and quality of nightly rest in enhancing HRQoL.

## Introduction

Respiration is a function that determines human life and influences its quality. In the last decade, non-invasive methods of monitoring respiratory function, particularly the measurement of chest expansion during maximal inspiration and expiration, have become popular research methods [1-3]. Assessment of chest motion provides diagnostic information regarding respiratory function [3], and it is important that such measurement is inexpensive, simple, accurate, and reproducible. A study by Lanza et al. [2] indicates that chest circumference measured with tape measure at two levels, in the anterior axillary line and at the tip of the xiphoid process in healthy subjects correlates with respiratory muscle strength and lung function: the larger the axillary and thoracic cytometry measurement, the greater the maximum inspiratory pressure, maximum expiratory pressure and lung volumes.

Age- and sex-dependent norms for difference in chest circumference measured with a tape measure during maximal inspiration and expiration in an unselected group of normal subjects were reported in 1972 by Moll et al. [4] and in a measurement performed at the level of fourth intercostal space on subjects unclad to the waist, standing with hands on head and arm flexed in the frontal plane. The normative range of difference in chest circumference between maximum inhalation and maximum exhalation decreases with age (by 50-

60% between 15 and 75 years of age) and is 20% greater in men compared with women [4]. For healthy women aged 15-24 years, the normative result was  $5.5 \pm 1.62$  cm, and for those aged 25-34 years, it was  $7.37 \pm 5.46$  cm. The measurement of chest mobility seems to be differentiated and variable in healthy and sick subjects, whereby the norm for the difference in chest circumference during maximal inspiration and expiration should oscillate in the range of 4-7 cm in healthy subjects [3]. In research projects conducted so far using this research tool, different procedures have been applied regarding the starting position, the place of measurement, or the position of the arms [1-3]. Many researchers rightly point out that the lack of uniform procedures for assessing thoracic mobility with the use of a tape measure contributes to the differences in the analysis and interpretation of the results of this trial. Therefore, attempts to establish standards for performing this measurement are advisable [3].

One of the roles of physiotherapists and occupational therapists is to persuade patients to change their lifestyles into "pro-healthy" ones. If medical personnel behave in ways that protect their health, then the health education information they communicate to patients becomes more important. Due to the nature of their profession, these therapists are exposed to a variety of difficulties in both the physical and mental spheres.

Therefore, future physiotherapists and occupational therapists must know about the proper breathing pattern and techniques to optimize the breathing process and are able to assess it. Proper breathing is also important because of its impact on sleep quality, physical performance, and gastrointestinal function. Scientific studies have shown that a characteristic feature of patients with depression and chronic fatigue syndrome is reduced mobility of the lower ribs and a disturbed breathing pattern [5].

The coronavirus disease 2019 (COVID-19) pandemic led to the physical, periodic closure of educational institutions worldwide, and classes were and continue to be delivered online or as a “hybrid” of in-person and online. In a systematic review by Tri Sakti et al. [6], it was concluded that in school populations, four notable impacts of COVID-19 were identified: impacts on mental health, teaching and learning, quality of life, and physical health. The knowledge, attitudes, and practices (KAP model), commonly used to explain how individual knowledge and attitudes affect health behavior changes, was used towards COVID-19 among college students in China in the systematic review with meta-analysis by Li et al. [7]. The authors suggested that students’ overall awareness of COVID-19-related knowledge was relatively optimistic, but their awareness of specific content, such as preventive measures, still needs to be improved.

In two systematic reviews analyzing COVID-19 and the mental health of medical students, it was pointed out that the symptoms of depression, anxiety, and stress can be regarded as problematic to the examined cohorts of future physicians and that research is needed to ensure that they have adequate tools needed to provide high quality and empathetic care to future patients [8,9].

The need for larger-scale use of telemedicine technologies, including telerehabilitation, has increased. Kiani et al. [10] evaluated m-Health-rehabilitation for respiratory disorders, and the results of their systematic review show that using the

m-Health apps for pulmonary rehabilitation can be useful during the COVID-19 pandemic. Bugh-rara et al. [11] emphasized that the various educational adaptations that emerged uniquely during the COVID-19 pandemic, such as telehealth services or video conferencing tools, can be utilized in a post-pandemic environment (**Table 1A**).

The randomized, controlled trial by Moll-Khosrawi et al. [12] proved that virtual reality (VR) proved to be effective in supporting teaching methods in undergraduate first-year medical students during the COVID-19 pandemic. In the randomized, controlled study by Wu et al. [13], it was concluded that the Nintendo Ring Fit Adventure (RFA) intervention could either maintain or improve University Students’ physical fitness during the COVID-19 pandemic and thereby provide a good solution for people involved in distance learning or those who have not exercised for an extended period. Analyzing the results of the projects with the college students during the pandemic, Li et al. [14] suggested that the aerobic and resistance training (WeActive) and mindful exercise (We Mindful) virtual interventions were effective in increasing resilience from pre-test to 6-week follow-up. Also, the preliminary results of the study by Philippot et al. [15] show promise for broader application among higher education students of an online High-Intensity Interval Training (HIIT) program to reduce stress and depressive symptoms (**Table 1B**).

Studies conducted so far clearly confirm that the COVID-19 pandemic has significantly influenced various aspects of Health-Related Quality of Life (HRQoL) [16,17]. Furthermore, as noted in an observation conducted in early 2020 by Wang et al. [18], in order to better understand the levels of psychological impact, anxiety, depression, and stress during the initial stage of the COVID-19 outbreak, female gender, student status, and poor self-rated health status were significantly associated with a greater psychological impact of the outbreak and higher levels of stress, anxiety, and depression ( $p < 0.05$ ). Therefore, in our study, in

order to assess health-related quality of life in females, we opted to use the 15D instrument, which is a general, comprehensive (15-dimensional),

and standardized instrument for measuring health-related quality of life in individuals over 16 years of age.

**Table 1.** The systematic reviews and the randomized, controlled trials (RCTs) in COVID-19 students, HRQoL.

<b>A: The systematic reviews</b>
1. Tri Sakti AM, Mohd Ajis SZ, et al. Impact of COVID-19 on School Populations and Associated Factors: A Systematic Review. <i>Int J Environ Res Public Health</i> . 2022 Mar 29;19(7):4024. doi: 10.3390/ijerph19074024. PMID: 35409707; PMCID: PMC8997877.
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3. Al Mamun F, Hosen I, et al. Mental Disorders of Bangladeshi Students During the COVID-19 Pandemic: A Systematic Review. <i>Psychol Res Behav Manag</i> . 2021; 14:645-654. Published 2021 May 31. doi:10.2147/PRBM.S315961.
4. Paz DC, Bains MS et al. COVID-19 and mental health: A systematic review of international medical student surveys. <i>Front Psychol</i> . 2022 Nov 25; 13:1028559. doi: 10.3389/fpsyg.2022.1028559.
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<b>B: The randomized, controlled trials (RCTs)</b>
1. Moll-Khosrawi P, Falb A et al. Virtual reality as a teaching method for resuscitation training in undergraduate first-year medical students during COVID-19 pandemic: a randomized controlled trial. <i>BMC Med Educ</i> . 2022 Jun 22;22(1):483. doi: 10.1186/s12909-022-03533-1. PMID: 35733135; PMCID: PMC9214467.
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3. Li K, Walczak-Kozłowska T, Lipowski M, et al. The effect of the Baduanjin exercise on COVID-19-related anxiety, psychological well-being, and lower back pain of college students during the pandemic. <i>BMC Sports Sci Med Rehabil</i> . 2022;14(1):102. Published 2022 June 8. doi:10.1186/s13102-022-00493-3.
4. Philippot A, Moulin P, et al. Feasibility of Online High-Intensity Interval Training (HIIT) on Psychological Symptoms in Students in Lockdown During the COVID-19 Pandemic: A Randomized Controlled Trial. <i>Front Psychiatry</i> . 2022 June 21;13:904283. doi: 10.3389/fpsyg.2022.904283. PMID: 35800026; PMCID: PMC9253394.

## Aims

In this project, an attempt was made to evaluate chest mobility and HRQoL in female Physiotherapy and Occupational Therapy students during the COVID-19 pandemic – in an online format in order to align the study with the current health regime and to test the utilitarian value of performing these measurements. The studies mentioned above with chest expansion assessment indicate the utility of using a chest circumference difference assessment using a tape measure, but studies have never been conducted remotely.

## Material and methods

The study was conducted online by a physiotherapist using the Teams Platform available for free to the students as well as teachers of the Academy of Physical Education in Kraków in March 2021 in accordance with the principles of the Helsinki Declaration with the amendments from 2013. The project was carried out on the basis of a study protocol approved by the Bioethical Commission of the Regional Medical Chamber in Krakow, Poland (opinion no. 368/KBL/OIL/2021). Informed consent was obtained for this experiment, and the study group included 40 young women (**Table 2**).

Inclusion criteria: (1) written consent to participate in the study; (2) women who are students of Physiotherapy or Occupational Therapy faculty at The Academy of Physical Education in Kraków. Exclusion criteria: (1) history of surgical procedure within the chest; (2) chronic lower respiratory diseases (for instance, bronchial asthma of various etiologies, chronic obstructive pulmonary disease); (3) rhinitis at the time of taking measurement; and (4) presence of rheumatic disorders (for instance ankylosing spondylitis, rheumatoid arthritis).

The youngest female participant was 20, and the oldest participant was 26 years old. The highest value of BMI ( $36.16 \text{ kg/m}^2$ ) was observed in a 23-year-old female student of physiotherapy and a 21-year-old female student of occupation-

al therapy, while the lowest value ( $18.03 \text{ kg/m}^2$ ) was observed in a 22-year-old female student of physiotherapy. It was noted that a normal body mass index characterized 35 subjects (87.5% of the study group). One woman (2.5% of the surveyed students) was overweight, while 2 participants (5%) were obese. Two individuals (5% of the study group) were underweight. At the beginning of the research project, those who were interested in participating were asked to sign an informed consent to participate in the study. Within the seven days prior to the study (sanitary regime during the COVID-19 pandemic period), paper tape measures were given to all participants. Then, using the Microsoft Teams platform, the physiotherapist conducted individual remote assessments. The students performed their self-measurements with a tape measure of the difference in chest circumference, during which all participants were encouraged to obtain the most remarkable difference between the maximum inhalation and exhalation from the chest. They also completed a self-administered HRQoL questionnaire, the 15D instrument.

### Online evaluation of thoracic mobility

For online evaluation of chest wall mobility, self-measurement of chest circumference performed at the level of the xiphoid cartilage with a 100 cm long paper tape measure graduated in 1 cm increments and 1 mm accuracy was used. Before performing this test, all students set up their electronic devices with real-time video and audio transmission functions in a well-lit room on a stable surface at chest height, at a distance of approximately 1m from the torso. The measurement took place in a standing position, without shoes, socks, and undershirt (in a bra if the student consented) or in such clothing that it was visible how the tape measure adhered directly to the skin. Before proceeding with the self-measurement of chest mobility, the following instructions were presented to the test subject:

**Table 2.** General characteristics of the female students.

Variable	n (%)	Mean (SD)
Physiotherapy students	30 (75)	
Occupational therapy students	10 (25)	
Age (years)		22.75 ± 1.51
Weight (kg)		61 ± 9.82
Height (cm)		1.66 ± 0.05
BMI (kg/m <sup>2</sup> )		22.15 ± 3.81
Conditions		
- Smokers	6 (15)	
- Spine disorders	13 (32)	

*Please maintain a relaxed body position with feet hip-width apart and placed parallel to one another. Please unfold the tape measure and place it around your chest parallel to the floor at the level of the xiphoid cartilage in a way that the graduation scale faces you and the tape does not fold. Please hold the beginning of the tape with one hand at all times while you use your other hand to adjust the measuring tape so that it is always around your chest and placed parallel to the floor. Now I will check the tape measure alignment - Please turn sideways in relation to the camera.*

If the tape measure was positioned correctly, the physiotherapist supervising the test asked the student to take the measurement at the peak of inspiration, with the airway maximally filled with air, and at the peak of exhalation by the command:

*Please take a deep breath to maximize the size of your chest at the height of the tape position and read the result. Now, please do a maximal exhalation and read the measurement out loud.*

The supervisor recorded the results that were given by the students. In addition, it was permitted to verbally encourage the subject during the measurement by the commands:

*Please take an even deeper inhalation, please make an even larger exhalation.*

Supervised online trials of the procedure were performed three times to measure the difference between maximum inhalation and maximum exhalation (to the nearest 0.5 cm), and the mean of these measurements was used in the analysis of results [3,4].

#### **Online assessment of life quality related to health using a 15D instrument**

HRQoL refers to a person's perceived physical and mental health and the impact of disease and its treatment on the quality of life and functioning of an individual. In this study, to assess HRQoL, the 15D questionnaire was used, which allows us to collect information on the following factors:

mobility, vision, hearing, breathing, sleep, nutrition, speech, excretion, daily activities, intellectual abilities, medical conditions and symptoms, depression, vitality, and emotional state. The entire questionnaire takes about 5 minutes to complete, and each dimension is divided into five levels, from which the subject selects the response that best describes his or her current health status. Based upon the original 15D questionnaire, a version has also been developed for adolescents aged 12-15 years (16D, also used until the age of 18) and for children aged 8-11 years (17D, which can be used by parents for children of even younger ages) [19]. The simplicity of the 15D tool allows the health status of the same patients to be measured frequently and with a high degree of consistency. This is a great advantage since quick changes in quality of life are easily detectable. Moreover, the 15D instrument can be used both as a profile and as a single scoring indicator [19]. In order to perform the survey while maintaining the hygiene rules during the COVID-19 pandemic, an individual interview was conducted with each respondent using Microsoft Teams. The 15D questionnaire was then sent to the female students as a Google form. The study subjects maintained a

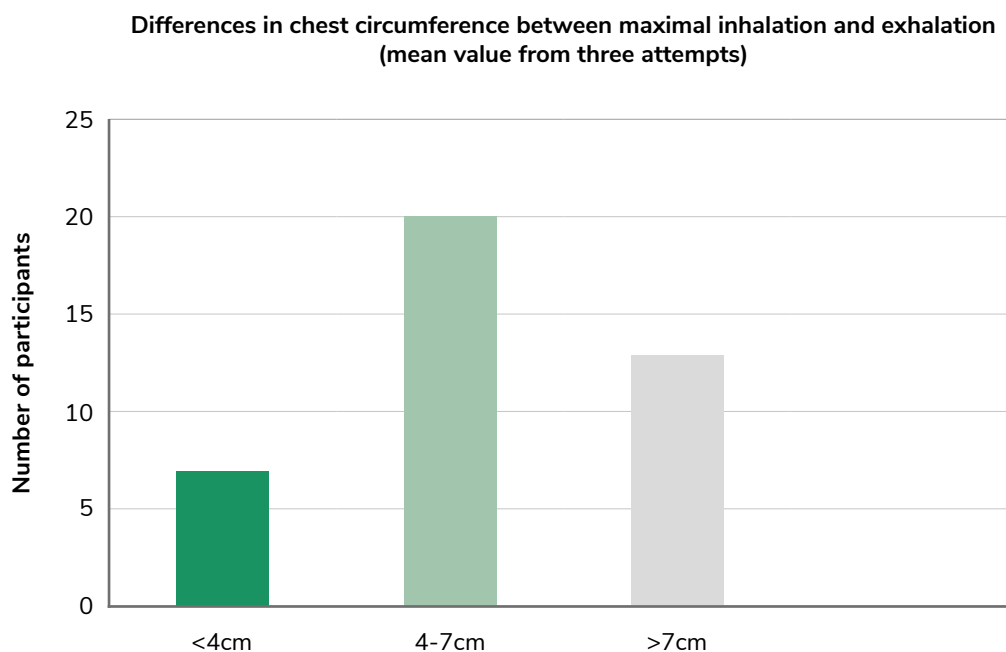
constant internet connection with the investigator and could ask for assistance at any time.

## Results

### Thoracic mobility

The minimum value of the mean measurement of the difference in chest circumference between maximum inhalation and exhalation was 2.5 cm, and the maximum was 11.5 cm (in a subject with spinal dysfunction), both of which were recorded in 23-year-old smoking female Physiotherapy students with normal BMI. In the study group of young subjects, 20 women (50% of the total group) obtained a mean result from 3 attempts to measure thoracic mobility falling within the norm of 4-7cm [1,3], while seven students (17.5%) obtained a result below and 13 (32.5%) above the norms indicated by Reddy et al. [3] and by Debouche et al. [1] (**Fig. 1**).

Using the Shapiro-Wilk test, it was established that a normal distribution characterized chest mobility in the tested group. No correlation was established between chest mobility and BMI since the vast majority of the students (87.5% of examined women) were characterized by normal BMI.



**Figure 1.** The results of the study group's chest mobility in relation to norms indicated by Reddy et al. [3] and Debouche et al. [1].

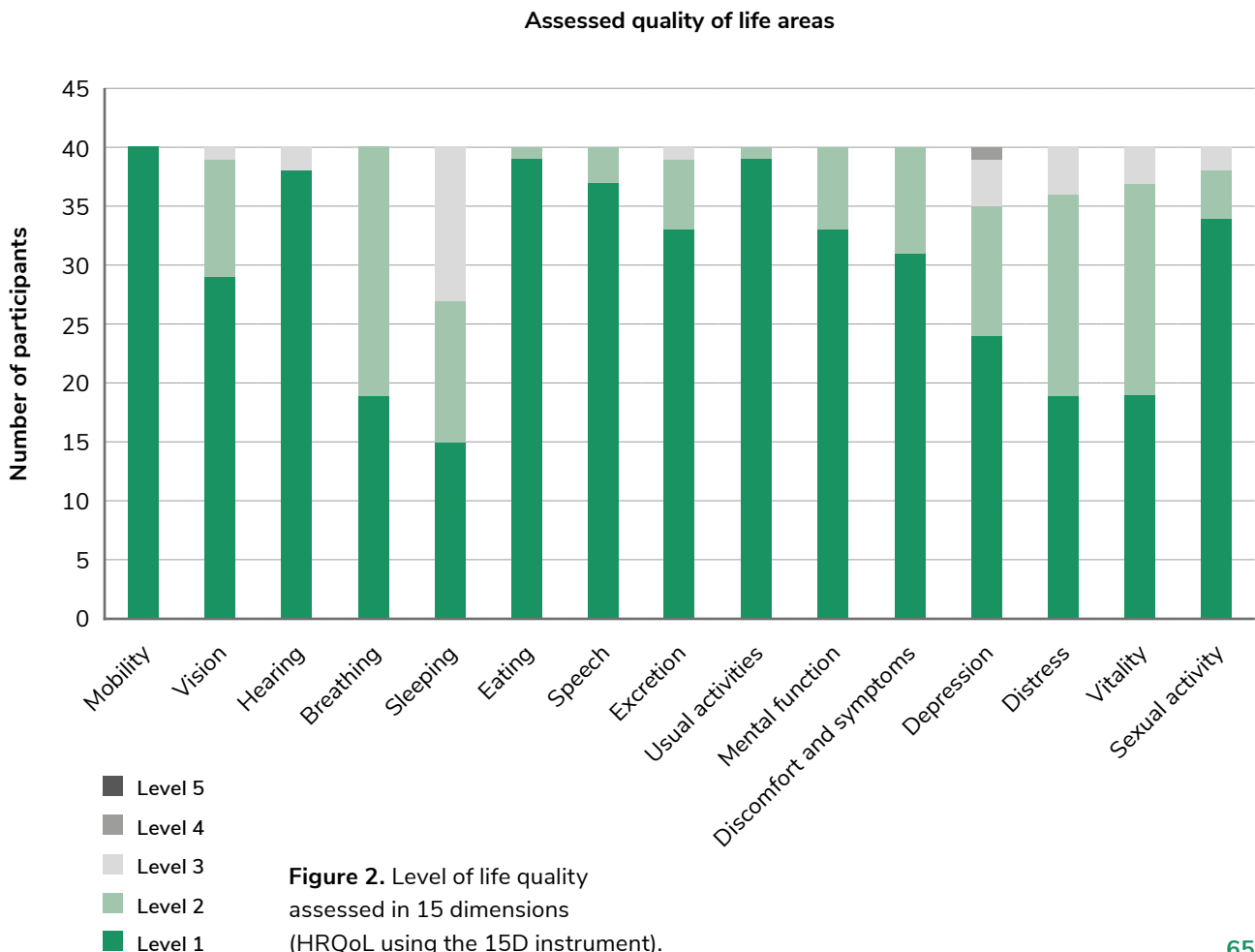
### 15D questionnaire

When analyzing HRQoL using the 15D questionnaire, it was found that sleep was the most disturbing of the 15 factors. As many as 13 female students (32.5% of respondents) indicated that they had moderate sleep problems, such as restless sleep or feeling that the night's rest was not long enough (feeling sleep deprived), and 12 women (30%) were observed to have mild difficulties such as difficulty falling asleep or intermittent sleep. The emotional state was another area of disturbance in HRQoL, with one person (2.5% of respondents) describing that she was very agitated, stressed, or irritated, four people (10%) indicating that they were agitated, stressed or moderately irritated, while 11 women (27.5%) declared mild emotional problems. Other areas of the HRQoL survey indicating a disturbance in the study group included the following categories: vitality, depression, breathing, vision, ailments and

symptoms, sexual activity, and excretion. It was found that six non-smoking female students did not report any impairment in the fifteen analyzed areas of HRQoL.

**Figure 2** shows the number of subjects who selected a particular level (number 1 - indicates the highest rated quality of life for a given factor and 5 - the lowest) in the 15 analyzed life areas.

Statistica software was used to show the relationship between chest mobility, sleep quality, and smoking. Spearman's rank-order correlation was used, which revealed no correlation (Tables with Spearman's rank-order correlation not shown). In order to demonstrate the relationship between chest mobility and cigarette smoking, the student's t-test was used. The correlation was statistically significant (Table 3). It was observed that mean thoracic mobility was lower among cigarette smokers compared to non-smokers.





**Table 3.** Correlation of chest mobility and smoking cigarettes.

	Do you smoke cigarettes? Group 1: 0 = no Group 2: 1 = yes						
	Mean 0	Mean 1	t	DF	p	N significance 0	N significance 1
Mean chest mobility	6.618	4.611	2.242	38	0.0308	34	6

### Discussion

In today's world based on globalization, travel, and integration between countries, pandemics are among the greatest global risk factors and cause both high morbidity and mortality as well as negative socioeconomic impacts. In November 2019, in the city of Wuhan (Hubei Province) in China, the first cases of a new type of coronavirus, SARS-CoV-2, appeared, which causes the COVID-19 disease manifesting primarily as an acute respiratory illness, also affecting multiple organs such as kidneys, heart, gastrointestinal tract, and nervous system. The virus proved to be highly contagious and rapidly spread to many parts of the world, reaching pandemic proportions, which the World Health Organization (WHO) declared on March 11, 2020. With pandemic restrictions in place necessitating remote study and work, new opportunities for online activities have developed that were not previously popular or available.

The rapid development of telemedicine, telephysiotherapy, or telepsychiatry, dictated by the needs of patients, has broadened the field of work of therapists and allowed them to continue working with patients who had already been under the care of specialists [20]. Therapy performed online is not always satisfactory for the patient [20], but in the era of the pandemic, it seems to be one of the best possible options for contact with members of the medical professions without the risk of SARS-CoV-2 coronavirus infection. In the case of online learning at the university lev-

el, prolonged use of a phone or laptop, combined with chronic stress caused by the pandemic, as well as student responsibilities and substance abuse, are factors that can lead to a number of chronic diseases, weakening of the immune system, and insomnia. Current scientific reports indicate that as a result of the COVID-19 pandemic and its resulting quarantine, the quality of life of young people in higher education has decreased.

In the observations conducted by Szczepańska and Pietrzyka [16], the students surveyed almost unanimously stated that their quality of life had deteriorated due to social distancing, while the severity of the restrictions during the pandemic and the reduction in their level of activity in public spaces resulted in a significant decline in their physical and psychological well-being. In addition, the surveyed students claimed that the lack of face-to-face social interaction could only be partially compensated for by distance contact, such as via the Internet or cell phones. Although the surveyed students belong to the digital generation and have been interacting with modern technologies and virtual communication tools since childhood, most of them had a negative attitude towards actions related to restrictions on movement and interaction. Survey results showed that social distance rules increased students' appreciation of face-to-face interactions, especially with friends. Furthermore, a study involving both physically active and inactive students of the Per-

sian Gulf University using the HRQoL Questionnaire (SF-12) concluded that regardless of physical activity, the COVID-19 pandemic has led to a significant decline in quality of life in both male and female students [21].

The frequency of sleep disorders during the COVID-19 pandemic is high, affecting approximately 40% of individuals in the general and health-care populations, with an even higher prevalence in COVID-19 patients [22]. Sleep medicine is a promising new area of work for physiotherapists. Therapists should consider how physical condition negatively affects sleep, but also how sleep quality negatively affects a patient's physical status and health, which can help to guide future therapy [23]. In our study, to assess the HRQoL of female student therapists-to-be, we used a questionnaire that assesses as many as 15 quality-of-life factors and allows for a simple and quick review of a large number of areas in which individuals in higher education might declare limitations [19]. Analysis of the data obtained from the 15D instrument revealed that the most disturbed area of HRQoL was sleep – more than 60% of the surveyed women indicated problems with this quality of life assessment factor. The alarming results of the female physiotherapy and occupational therapy students obtained in the 15D questionnaire in the area of sleep may provide a basis for early therapeutic interventions, as poor sleep hygiene has a significant impact not only on daily human functioning but also on long-term mental and physical health, constituting a risk factor for many chronic diseases [24]. Researchers have shown that increasing knowledge and practice in terms of sleep hygiene is an effective treatment method for insomnia [25] and should be included in the program of studies in the field of physiotherapy [26]. In addition, it is important for students to master the science of time management [27]. Quality of sleep and the right amount of sleep at the right time is essential for survival. Sleep deprivation impairs learning, memory formation, concentration, and quick reactions [26]. Cell phone and laptop use, especially during

times of pandemic and distance learning, affects the quality of sleep of students; therefore, it is important to develop educational strategies and perform large-scale screening tests for internet addiction among students to determine its association with sleep disorders and insomnia [28].

Many students have been observed to experience chronic stress and sedentary lifestyles as a result of the pandemic state and the difficulties of academic life, which can cause problems with respiratory quality [5,26]. A self-measurement of chest mobility in the standing position was used to assess respiratory function in a non-contact format, as other researchers have already used this position for the study, and the self-manipulation with a tape measure in this position is facilitated. The tape used was placed at the height of the xiphoid process due to the ease of localization of this structure and the use of such a method in other studies [2,3].

Even though measurement of thoracic mobility with a tape measure is widely used in clinical practice, there are no standardized norms for either measurement position, number of performed attempts, or results [3]. As comparative values in this study, the norms given in the papers by Reddy et al. [3] and Debouche et al. [1] were used, and it was found that half of the studied women were characterized by normal thoracic mobility.

Chest mobility diagnostics with assessment of chest mobility by tape measure, which is proposed for use in telerehabilitation, can be used not only to reduce cross-infection in studies conducted in the clinical environment [29] but also as a simple tool for the quick assessment of respiratory pattern abnormalities in telemedicine. In patients treated in the clinical setting for COVID-19, after hospital discharge, it has been noted that chest physiotherapy in the form of respiratory muscle exercises, coughing exercises, diaphragmatic exercises, and stretching exercises, improves the functioning of the respiratory system, as well as quality of life in patients, and reduces symptoms of anxiety and depression [29].

Although there was no statistically significant correlation found between chest mobility and sleep quality in the examined students, the participants were informed about the negative effects of sleep deprivation. There is an important role of the diaphragm, which has its attachments to the sternum, lower ribs, and spine, i.e., structures directly related to chest mobility, in optimizing the breathing process, which is also connected with maintaining correct body posture. Correct function of the diaphragm, in particular, regulates muscle tension, reduces stress levels, and prevents professional burnout in healthy adults [30].

### Limitations

The study was conducted with a small group of female students without a control group. The self-measurement of thoracic mobility was performed using a tape measure, which, despite the careful supervision of the physiotherapist, may have caused the results of the study to be subject to measurement error.

### Conclusions

In conclusion, the presented work raises important issues related to the health of young women and future therapists. Chest mobility of 50% of the study group fell within the norm, whilst it was below the norm among participants who smoked. There was no significant correlation found between HRQoL evaluated with the 15D questionnaire and chest mobility of examined women, but it is recommended to continue research with a larger number of participants. It is possible to introduce self-measurement of chest circumference evaluated online under the supervision of a therapist during maximal inhalation and maximal exhalation at the level of the xiphoid process in order to assess breathing function quickly and without contact with the field of telemedical services. Among the 15 areas assessed in HRQoL using the 15D instrument, difficulties with sleep were most commonly cited. Therefore, particu-

larly during the COVID-19 pandemic, it is recommended to introduce early intervention activities in this field both at the level of education and in terms of treatment. Any other researchers have not yet described the results of the study on online measurements of chest mobility. Hence, it would be important to continue similar studies on a larger group of subjects and to establish uniform standards in terms of the methods of measurement and normative values.

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