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PARENTAL ATTITUDES TOWARDS THE USE OF HUMANOID ROBOTS IN PEDIATRIC (RE)HABILITATION

STAVOVI RODITELJA O PRIMENI HUMANOIDNIH ROBOTA U DEČJOJ (RE)HABILITACIJI

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Summary

Introduction. The advancement of technology in the world is more and more evident, as is its implementation in almost all spheres of life, and so is its application in medicine. The use of robotics in medicine has become increasingly important, with a wide scope of application. Thus, the aim of this study was to determine parental attitudes towards the robot-assisted therapy in pediatric (re)habilitation and to assess the degree of parental acceptance and apprehension towards humanoid robots, along with their expectations. Material and Methods. The study included 32 parents of both genders, whose children took part in the treatment using a mobile anthropomorphic robot with cognitive skills, and who completed the Frankenstein Syndrome Questionnaire. Results. The study showed that parental attitudes towards humanoid robots and robot-assisted therapy were positive. Conclusion. In our study, parents showed neutral attitudes and positive expectations of humanoid robots. They have accepted them socially, without negative feelings on the religious and psychosocial levels.

Key words: Communication; Robotics; Therapy, Computer-Assisted; Social Perception; Health Knowledge, Attitudes, Practice; Parents; Child; Rehabilitation; Surveys and Questionnaires

Sažetak

Uvod. Napredak tehnologije u svetu je svakodnevno sve očigledniji kao i njena implementacija u skoro svim sférama života, pa je tako i s njenom primenom u medicini. Robotika u medicini je sve značajnija, a područje primene je veoma široko. Ciljevi ovog rada bili su da se utvrdi stav roditelja o primeni humanoidnih robotima i roboti- asistirane terapije u dečjoj (re)habilitaciji. MATERIJAL I METODE. U našoj sredini roditelji imaju neutralan stav i pozitivna očekivanja od humanoidnih robotova; prihvatili su ih – nemaju negativna osećanja na religioznom i psihosocijalnom nivou.

Ključne reči: komunikacija; robotika; kompjuterski asistirana terapija; socijalna percepcija; znanje o zdravlju, stavovi, praks; roditelji; dete; rehabilitacija; istraživanja i upitnici

Introduction

Rapid advances in the field of technology have resulted in their implementation in almost all life domains, including medicine. The use of robotics in medicine has become increasingly important, and its scope of implementation is very broad. Therapeutic use of robots is a relatively recent phenomenon, as it necessitates a certain degree of technological advancement, as well as a high degree of safety and reliability to provide suitability for use with patients, especially children [1–3]. The multidisciplinary approach is one of the core principles of modern medicine related to the field of medical robotics [4].

The term robot was first used by Karel Capek in his play “Rossum’s Universal Robots” (R.U.R) in 1921 [5]. It derives from a Czech word “roba” meaning “forced labor” or “hard labor.” On the other hand, robotics was first mentioned in the short story “Runaround” authored by the American writer Isaac Asimov in 1942 [5].

Humanoid robot is the term used for a machine that looks and behaves like a human, based on the principles of artificial intelligence (AI) [6]. The advantages of using robots in medicine include higher work quality and productivity, increased safety and risk reduction, and greater operational flexibility [7]. In sum, robots can enhance quality of life and output, while reducing medical costs [8]. Moreover, robots have been shown to improve patient motivation and thus outcome of rehabilitation [9]. Robotics in medicine is presently classified into surgical, medical, service and rehabilitation categories [4].

The first humanoid robot that has been introduced into medical practice in our country is MARKO (acronym for Mobile Anthropomorphic
Abbreviations
MARKO – mobile anthropomorphic robot with cognitive skills
FSQ – Frankenstein syndrome questionnaire
SPSS – Statistical Package for Social Sciences

Robot with Cognitive Characteristics) and it has since been used in the treatment of children affected by cerebral palsy [10].

The term “Frankenstein syndrome” was first described by Isaac Asimov, who defined it as fear of robots [11]. However, its origins can be traced back to the early 1900s, when Mary Shelley published her novel Frankenstein, or the Modern Prometheus (1818). At the time, people were apprehensive of technology and artificial beings, which they perceived as a threat to humanity [11–13].

Frankenstein syndrome is a term used for assessing acceptance of humanoid robots, including extent of anxiety, i.e. Frankenstein Syndrome Questionnaire (FSQ) [14].

The aim of the present study was to determine parental attitudes towards robot-assisted therapy as part of pediatric (re)habilitation, i.e., corrective exercise program, and to assess parental views of humanoid robots, their expectations and degree of apprehension.

Material and Methods

This prospective study was part of a research project (No III44008) approved by the Ministry of Education, Science and Technological Development of the Republic of Serbia and by the Ethics Committee of the Institute of Child and Youth Health Care of Vojvodina.

The study included 32 parents (N = 32), male and female, whose children had been referred to a two-week-long corrective exercise training program due to poor posture, and who agreed to participate in a course facilitated by humanoid robot MARKO. The research was conducted at the Clinic of Child Habilitation and Rehabilitation at the Institute of Child and Youth Health Care of Vojvodina in Novi Sad, between December 17, 2018 and December 28, 2018.

All participating parents completed the FSQ. The FSQ is an instrument that has been translated and linguistically adapted for the purpose of this investigation, and is used to obtain information pertaining to respondents’ attitudes and degree of acceptance of humanoid robots. It includes two sections, the first of which is related to general information such as age, gender and profession, while the second contains 30 items on humanoid robots rated on a 7 point Likert scale (1 - Strongly disagree, 2 - Disagree, 3 - Slightly disagree, 4 - Not sure, 5 - Slightly agree, 6 - Agree, 7 - Strongly agree).

Statistical data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 21. For quantitative variables, average values (arithmetic mean) and variability (range and standard deviation - SD) were reported, while for qualitative variables, frequencies and percentages were calculated. Quantitative between-group comparisons were performed via nonparametric Mann-Whitney test, whereas correlations were determined through Pearson correlation coefficient, with p < 0.05 set as statistically significant.

Results

The study sample included 32 parents of both genders, 25 (78.1%) women and 7 (21.9%) men. The youngest parent was 27, and the oldest 67 years old, with the average age of 41 years.

The greatest number of participating parents (n = 16.50%) had a university degree (UD), while 14 (43.8%) had a high school degree (HSD), and the remaining 2 (6.3%) had only completed a primary school (PS).

When completing the FSQ, parents first responded to questions on their attitudes towards humanoid robots. The majority (n = 19.59%) of respondents indicated that they have seen humanoid robots in the media, while 7 (21.9%) reported seeing them in person, and the remaining 6 (18.8%) had never seen one.

All the FSQ items required responses on a 7 point Likert scale. However, for ease of interpretation, these were grouped into three subscales, pertaining to the degree of negative feelings towards humanoid robots (Subscale 1), positive expectations (Subscale 2), and social acceptance of humanoid robots (Subscale 3).

The minimum and maximum ratings on Subscale 1 were 2 and 6, respectively, with the average of 4.06, indicating a neutral attitude towards humanoid robots (Table 1). For the Subscale 2, 2 was the minimum and 7 the maximum rating, resulting in the average score of 5.31, indicating that parents mostly had positive expectations of humanoid robots (Table 1).

Finally, the minimum 1 and maximum 5 rating on Subscale 3, with the average of 1.88, suggested that humanoid robots were socially accepted by the parents, in the sense that they had no negative feelings on the religious or psychosocial levels (Table 1).

Table 2 shows the educational attainment for each subscale, whereby statistically significant differences are only noted for the subscale measuring negative feelings towards humanoid robots (Subscale 1). It can also

Table 1. Distribution of the sample regarding the results obtained using the Frankenstein Syndrome Questionnaire (FSQ)

| Attitudes/Stavovi | N/Broj | Min/Min | Max/Maks | Average/Prosek | SD       |
|-------------------|--------|---------|----------|----------------|----------|
| Subscale 1/Supska 1 | 32     | 2       | 6        | 4.06           | 0.840    |
| Subscale 2/Supska 2 | 32     | 2       | 7        | 5.31           | 1.148    |
| Subscale 3/Supska 3 | 32     | 1       | 5        | 1.88           | 1.185    |
be observed that less educated parents showed more negative attitudes towards humanoid robots compared to those holding a university degree (Table 2).

In regard to gender distribution, no statistically significant differences were seen in any of the three subscales, as shown in Table 3. Finally, when responses in the three subscales were examined in relation to the examinees’ age, no statistically significant differences were found in Subscale 1 (Pearson correlation $r = 0.389$; $p = 0.249$). On the other hand, statistically significant differences were observed in Subscale 2 ($r = 0.383$; $p = 0.031$), implying that older parents had more negative feelings towards humanoid robots. Finally, no statistically significant differences were found in the level of social acceptance of humanoid robots between older and younger parents (Subscale 3; Pearson correlation $r = 0.032$; $p = 0.861$).

Discussion

The modern way of life and environmental influences during childhood and adolescence have led to the growing prevalence of health conditions that can be successfully resolved through (re)habilitation as a therapeutic mode. In the present study, robot-assisted therapy, including corrective exercises, was provided to children and adolescents with poor posture. One of the most important obstacles to the therapy success in this population is lack of motivation. Use of robots for medical purposes has opened a new era in this field, requiring a multidisciplinary approach [7, 9, 14].

No matter how advanced the technology, its true potential can only be ascertained by its adoption in everyday life, by making it accessible, and by determining people’s attitudes towards its use. In this study, we aimed to establish the utility of humanoid robots in pediatric (re)habilitation by seeking input from parents whose children took part in the treatment involving a humanoid robot MARKO. As the majority of study participants were women, it may be assumed that mothers tend to be more involved in corrective exercise programs.

At present, there is paucity of research on attitudes and acceptance of humanoid robots. The youngest parent in our study was 27 years of age, while the oldest was 67 years old, with the average age of 41. Some of the prior studies on this topic, on the other hand, have been focused on students [15].

Data for this study were obtained via the FSQ. Other similar investigations used online surveys to
obtain participant input. Social and individual acceptance of new technologies is an increasingly relevant research domain. In particular, it is important to establish how new technologies are incorporated in everyday life, and if there are differences in attitudes with respect to gender, age, educational attainment, and cultural background. The FSQ is one of the instruments that can be used to assess the degree of humanoid robot acceptance [15, 16].

The article published by Kaplan was among the first to describe the Frankenstein syndrome, while also providing reasons for greater acceptance of humanoid robots in Japan compared to Western countries. As Japan is the world leader in the development of humanoid robots, its robotics culture is also most advanced [1, 17]. As mentioned above, there are hardly any researches in our area dealing with the attitudes and acceptance of humanoid robots. The results of our research show that parents have a neutral attitude towards humanoid robots and that their expectations of humanoid robots are positive.

To facilitate interpretation of findings yielded by the questionnaire, the items were grouped into three subscales, in line with the approach adopted by Nomura et al. in their investigation of human attitudes [18–20].

Results pertaining to Subscale 1 indicate that parents have neutral attitude towards humanoid robots, while those in Subscale 2 suggest that their expectations of humanoid robots are positive, and Subscale 3 findings show that parents have no negative feelings towards humanoid robots on the religious and psychosocial levels.

As expected, less educated parents have shown more negative feelings towards humanoid robots, as insufficient understanding can induce mistrust in patients, i.e., parents, due to anxiety and difficulty in accepting humanoid robots. Social acceptance of humanoid robots is affected by a wide range of factors, including gender, age and cultural background [1, 14, 19]. Kaplan, for example, demonstrated the influence of culture, as his findings indicated that Japanese are “technology lovers” unlike their Western counterparts [1]. The results of our research show that there is no difference in the acceptance of humanoid robots with respect to gender, but that there is a difference with respect to age, that is, older parents have more negative feelings towards humanoid robots.

Some authors have also examined the effects of age on the degree of acceptance of humanoid robots. For example, Nomura et al. found that older individuals tend to have more positive expectations from practical application of this technology [19].

Bartneck et al. on the other hand, noted that gender was not the influential factor in the participants’ attitudes towards humanoid robots, but found that nationality exerted significant effect on the degree of acceptance, whereby respondents from Netherlands and China exhibited lower degree of social acceptance of humanoid robots compared to Japanese participants [17].

In 2001, Syrdal et al. reported no statistically significant differences in attitudes of men and women from Japan and Great Britain, while age emerged as an influential factor. However, it is worth noting that the average respondent age in Japan was 24, while it was 29 in the sample from the United Kingdom [15, 20].

One of the main obstacles to robot use is fear of dehumanization, i.e., apprehension related to robots taking over human roles. Robots can be humanized in our society by modifying their visual appearance and interaction mode, which must be as human-like as possible, as well as by promoting their role as collaborators and friends [12, 21].

**Conclusion**

The findings of this investigation showed that parental attitudes towards humanoid robots and robot-assisted therapy are positive, and that most of them are informed of the latest technological advances through media. In our society, parents have neutral attitudes and positive expectations of humanoid robots and have accepted them socially, in the sense that they showed no negative feelings on religious or psychosocial levels. These attitudes are primarily influenced by educational attainment, as less educated parents were more apprehensive of technology, whereas no gender-related differences were observed. Parental attitudes are also affected by age, whereby older parents tend to be more anxious.

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