ANÁLISE COMPUTADORIZADA DO EQUILÍBRIO POSTURAL ENTRE IDOSAS FISICAMENTE ATIVAS E INATIVAS: PERSPECTIVA PARA A SAÚDE FÍSICA

Computerized analysis of postural balance among physically active and inactive older women: a perspective for physical health

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Abstract: Objective: Analyzing postural balance among older women who practice different physical activities and those physically inactive. **Methods:** The present research has three arms analyses. Forty-four older women (≥ 60 years) participated in this study. Nineteen performed general physical activities (i.e. gymnastics, stretching, and dance), fifteen performed hydrogymnastics and ten were not engaged in any regular physical activity. Postural balance analysis was conducted with participants standing with open and closed eyes on the Wii Balance Board at 40 Hz frequency. Total displacement and mean velocity of center of pressure were analyzed. ANOVA was used to compare groups ($p \leq 0.05$). This analysis was adjusted with Bonferroni post hoc test ($p \leq 0.016$). The statistical software used was SPSS 22®. **Results:** There was no statistically significant difference between hydrogymnastics and general physical activity ($p > 0.05$). However, physically inactive showed worse postural balance compared to hydrogymnastics and general physical activities ($p < 0.01$). **Conclusion:** Regular land-based or aquatic physical activities provide benefits regarding postural balance of older women.

Keywords: Aging; Balance; Motor Control; Physical Activity.

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Resumo: Objetivo: Analisar o equilíbrio postural entre idosas que praticam diferentes atividades físicas e idosas fisicamente inativas. **Metodologia:** O presente estudo tem três grupos distintos para análise. Participaram quarenta e quatro idosas (≥ 60 anos). Dezenove praticavam atividades físicas gerais (ex. ginástica, alongamento e dança), 15 faziam hidroginástica e 10 não realizavam atividade física regularmente. O equilíbrio postural foi avaliado em pé com os olhos abertos e fechados por meio da *Wii Balance Board* com frequência de 40 Hz. Foram analisados o deslocamento total e a velocidade média do centro de pressão. A ANOVA foi utilizada para comparação entre os grupos ($p \leq 0,05$). A análise foi ajustada com teste *post hoc* Bonferroni ($p < 0,016$). O software estatístico utilizado foi SPSS 22®. **Resultados:** Não houve diferença estatisticamente significativa entre o grupo hidroginástica e grupo de atividades físicas gerais ($p > 0,05$). No entanto, o grupo de idosas fisicamente inativas apresentou equilíbrio postural inferior comparado ao de hidroginástica e de atividades físicas gerais ($p < 0,01$). **Conclusão:** Atividades físicas regulares, no solo ou aquáticas fornecem benefícios no equilíbrio postural de idosas.

Palavras-chaves: Envelhecimento; Equilíbrio; Controle Motor; Atividade Física.

INTRODUCTION

Throughout the aging process a sum of disabilities triggers the decline of physical aptitudes, such as muscle strength and power, balance, aerobic fitness, flexibility and mobility.[1] Balance is important for the development of many activities of daily living (ADLs)[2] such as climbing stairs, do domestic activities as well as standing and walking. Control postural changes can lead to a decrease of practice of physical activity and/or sedentary lifestyle, thus reducing significantly older adults' physical aptitudes. Consequently, the practice of physical activity by means of physical exercises will promote changes in their physical aptitudes, improving ADLs performance.

One of the most effective interventions to prevent postural balance decline and maintain older adults' independence consists of engaging in regular exercise[3]. The higher level of physical activity and regular exercise practice are crucial to prevent chronic diseases and physical disabilities.[4] The most popular physical activities in Brazil are hydrogymnastics and diversified activities managed by public health programs (performed at public squares) such as stretching, dance and gymnastics.[5]

Hydrogymnastics is an appreciated activity among elderly due to its applicability to individuals with physical limitations, especially due to its low impact on joints. Physical principles of hydrostatic pressure and flotation allow a more comfortable environment for older adults to perform movements, regardless of the physical limitations, by influencing the pressure exerted on the body and body weight distribution, respectively.[6] In relation to the different physical activities developed in land environment, studies reveal the improvement of physical aptitudes.[4, 5]

Although exercise improves many physical capacities[4], comparisons of postural balance among Brazilian older adults who perform physical activities in land-based and aquatic environments are scarce.[7] The choice of a physical activity and the physical benefits achieved provide a greater functional autonomy to older adults. Aging interferes with the ability to maintain and restore balance in different ADLs, which may increase the incidence of falls and disabilities.[8-11] Therefore, investigate different interventions to improve balance control

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is necessary.

One way to assess postural balance is through total displacement and velocity of center of pressure (CoP) in different directions (anteroposterior, mediolateral, and both combined), which allow us to analyze neuromuscular response to body sway.[8-10, 12-14] However, up to date no study has reported analyses of postural balance in Brazilian aged people who perform different types of physical activity in land-based and aquatic environment. Address this comparison would provide substantial data to prescribe exercise to improve health and well-being of older adults. Therefore, the aim of this study was to analyze postural balance between physically active and inactive older women.

METHODOLOGY

Study design

The present research has three arms analyses. All volunteers signed the consent term agreeing to participate in this study, which was approved by the Ethical Committee of the State University Montes Claros (number 1.365.041/2015). Data are part of the project “Physical Exercise, Physical and Mental Health of Elderly”.

Participants

Forty-four older women participated of this study. Nineteen carried out general physical activities (GPA) in public squares (i.e. dance, walking, stretching, gymnastics) provided by the public health service in Brazil, 15 were engaged in hydrogymnastics (HYD), and 10 did not perform any regular physical activity, stated as control physically inactive (PI).[15] All participants met the inclusion criteria: i) aged 60 or older, ii) capacity to communicate, and iii) independent locomotion. Exclusion criteria were: i) psychotropic drugs use, ii) diagnosed neurodegenerative diseases, iii) severe cognitive impairment, and iv) acute musculoskeletal injury. Both groups (GPA and HYD) carried out their activities two to three times a week for 60 minutes each session in a comfortable pace (with no intensity control). Everyone performed these activities at least for six months. The HYD group carried out its activities using equipment to increase the water

resistance and the training was basically aerobic. The participants of PI group performed only their ADLs with no additional physical activity.

Computerized posturography

We used *Wii Balance Board (WBB)* (Nintendo®, Kyoto, Japan) to obtain data of postural balance. The signal was available at a 40Hz frequency. A digital low pass (second order) Butterworth filter was used to reduce noise. A cut-off point of frequency was selected based at 12 Hz.[9, 14]

Each participant remained in static position on the WBB for one minute (30 s to familiarize the correct position, and 30 s to collection of signal). Assessments with eyes opened and closed were performed with one resting minute between each test. To avoid bias related to different feet position each participant stayed with his/her comfortable feet position (feet shoulder-width apart). Total displacement (TD, cm) and mean velocity (MV, cm/s) of CoP were used to analyze postural balance. This procedure met patterns previously published[9, 14] ("see Figure1").

"Figure 1 here"

Statistical Analyses

Data on the dependent variables (TD and MV, eyes closed) did not meet the assumptions for parametric analysis. Descriptive values are shown as median, minimum, maximum, mean and standard deviation. We used one-way analysis of variance (ANOVA) to analyze the parametric data (age, weight, height, and MV – eyes opened) between groups. This analysis was adjusted with Bonferroni post hoc test. The Kruskal-Wallis test was used only for non-parametric data. In this case, a Mann-Whitney U test was used in each pair of comparison to identify possible statistical differences. In these comparisons, a Bonferroni adjustment was done to correct p value. Therefore, when the Mann-Whitney U test was applied to p value ≤ 0.016, it has been considered significant. Other analyses were significant when the p value was ≤ 0.05. The statistical software used was SPSS 22®. Additionally, the effect size was calculated to analyze clinical effect between groups, according to Cohen's d.[16]

RESULTS

Investigated outcomes and sample characteristics are shown in Tables 1and 2, respectively. TD (eyes

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opened) was lower in GPA and HYD than in PI (p<0.01) while TD (eyes closed) was lower only in GPA compared to PI (p<0.01) (see Figures 2 and 3).

There was no statistically significant difference in TD (eyes opened or closed) between the GPA and HYD. These findings show better postural balance in these groups than in control group (PI). There was no statistically difference in MV between any groups.

Table1.Characteristics of the sample in each group (mean and standard deviation).

	GPA	HYD	PI
Age (years)	68 ± 4	65 ± 5	70 ± 6
Weight (kg)	63 ± 10	72 ± 13*	57 ± 10
Height (cm)	152 ± 4	157 ± 5#	152 ± 4
BMI (kg/m²)	27.1 ± 3.8	29.0 ± 5.3	24.9 ± 5.2

Note: GPA– general physical activities; HYD- hydrogymnastics; PI – physically inactive persons; BMI – body mass index; *p= 0.02 between HYD and PI; # p= 0.01 between GPA and HYD.

Table 2. Comparison of main outcomes among groups. Data are shown as median (minimum, maximum) for Total Displacement (TD) and Mean Velocity (MV).

	GPA	HYD	PI
TD EO (cm)	69 (39, 126)*	63 (45, 121)**	112 (74, 207)
TD EC (cm)	79 (38, 179)*	67 (45, 224)	137 (63, 251)
MV EO (cm/s)	2.3 (1.3, 4.2)	2.2 (1.5, 4.7)	2.09 (1.6, 2.9)
MV EC (cm/s)	2.6 (1.2, 5.9)	2.2 (1.5, 6.0)	2.32 (1.9, 3.8)

Note: GPA – general physical activities; HYD - hydrogymnastics; PI – physically inactive persons; EO – eyes opened; EC – eyes closed;*p< 0.01 between GPA and PI; **p< 0.01 between HYD and

Figure 1. Basic design of the study. Cross-sectional assessments were performed with all participants. GPA–general physical activities; HYD - hydrogymnastics; PI – physically inactive persons; EO –eyes opened; EC – eyes closed; TD–total displacement; MV– mean velocity.

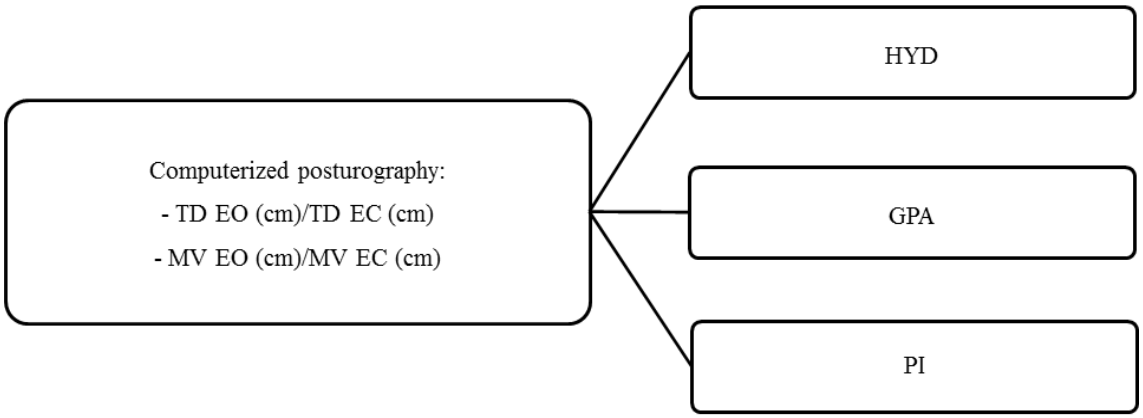
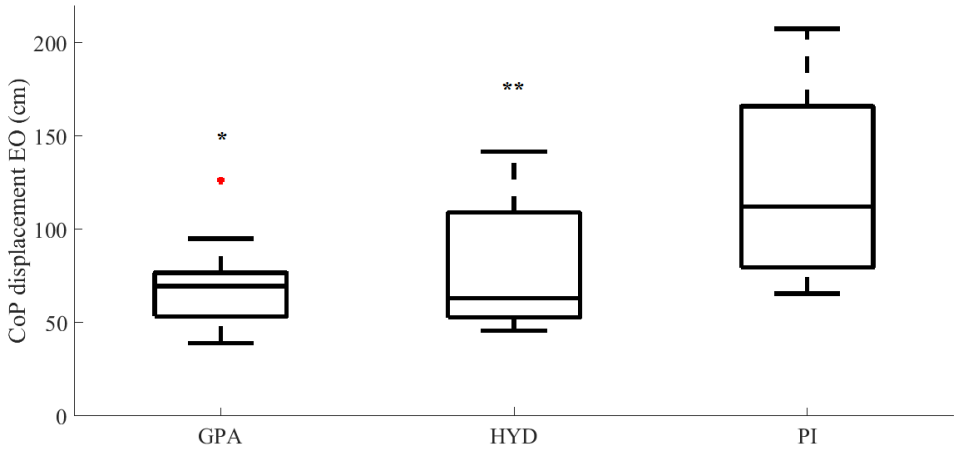


Figure 2. CoP displacement comparisons between groups with eyes open.* $p<0.01$ between GPA and PI; ** $p< 0.01$ between HYD and PI. GPA: general physical activity; HYD: hydrogymnastics; PI: physically inactive.



DISCUSSION

The characterization of the clinical, demographic and epidemiological profile of oncology patients is fundamental, due to the changes accompanying the health/disease process and this varies from region to region, individual to individual in equivalence to their vulnerability.

In this study, the sociodemographic characteristics of patients were similar to the national literature in relation to patients with cancer diagnosis.[12-14] From the data analysis it was verified that 66.4% of the patients were male, predominantly elderly (50.1%), with greater frequency in the age range from 51 to 70 years (50.7%).

A study conducted in João Pessoa, Paraiba, which aimed to evaluate the health-related quality of life of patients with cancer in palliative care and its association with sociodemographic and clinical aspects, identified a population mostly of elderly patients (60.7%), ranging in age from 50 to 69 years (51.9%), females predominate, with 59.1%.[12]

Whereas in research that sought to describe the clinical and epidemiological profile of elderly patients in an outpatient clinic of a referral hospital in oncological treatment in the state of Pará, Brazil, showed higher frequency of the female sex and age range between 61 to 80 years, representing 56% and 83.5%, respectively.[13] In a survey conducted in the city of Vitória da Conquista, Bahia, pointed prevalence of females (59%).[14]

In this study, the characteristics in relation to age and age of patients were similar to the literature, however it differs regarding gender. It is emphasized that the profile found can be justified due the processes of demographic and epidemiological transitions, in which it is noted the significant growth of elderly people and people with chronic diseases.

It is noteworthy that men more than women, have a less healthy life style, which predisposes to chronic diseases, and it is corroborated to this the rejection of the possibility of getting ill, which may be related to the difficulty in recognizing their health needs. In this sense, it is necessary to

know the personal characteristics and socioeconomic factors, since they are determinants on the man's health , favoring the promotion of health and prevention of diseases that affect the population.[15]

Concerning the assistance in oncology in public health services, this must be organized to meet the patient in his or her entirety and it must subsidize planned, organized and controlled oncologic assistance by means of state and municipal departments according to the needs of each region.[16]

Regarding the assistance, Santa Casa de Montes Claros had the largest number of care services for these patients. Considered city-pole in the north of Minas Gerais, Montes Claros has hospital and outpatient care in the oncology service by means of two hospitals considered Unit of High Complexity in Oncology (UNACONS), hospital Dilson de Quadros Godinho and Santa Casa. Definitive diagnosis and treatment of cancers more prevalent in regions where they are inserted are UNACON's responsibility, offering at least surgical treatments, chemotherapy and radiotherapy with formal contractual obligation.[16]

The treatment is carried out by means of the diagnosis of the tumor histopathological examination in conjunction with other exams and staging in which will indicate the potential of aggressiveness and how the disease spread through the body to perform the final diagnosis, treatment and care to be provided to this patient.[17]

Difficulties in access to health care professionals, diagnosis and release of the results at an opportune time for patients, entailing a delay in the initiation of therapy, which in turn can associate the tumor growth thus reducing the chances of cure.[18]

In relation to the treatment of the results found, shows that the most commonly used therapy, combination of radiotherapy and chemotherapy, are in accordance with the literature. In a study conducted on chemotherapy in lung cancer of non-small cell, authors report about the use of concomitant chemotherapy and radiotherapy. They highlight the increased survival and decrease in loco-regional recurrence with association of these therapies. They emphasize that this treatment with neo-adjuvant therapy followed by surgical procedure have attested survival in two years between 50 and 70% and reinforce that even patients with vertebral involvement may be benefited.[19]

The offerings of the treatments provided by the Unified Health System

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(SUS) were anchored in national policy for cancer prevention and control in the network of health care for people with chronic diseases. Their diversity of treatments shows various effects and limitations in which each therapeutic modality exercises individually on the patients.[20]

Adverse reactions are notable even when the medication is administered by infusion pump following prescription with standardization of volume and speed. These reactions can be immediate or late, mild, moderate or severe, may present local and systemic manifestations such as hyperemia, xerostomia, *skin rash* , febrile neutropenia, nausea, vomiting, alopecia, diarrheas, weight loss, among others.[21]

It should be emphasized that patients in chemotherapy treatment experience physical suffering related to pain. [18] In a study conducted in Minas Gerais Center Western ratified that due to bureaucratic obstacles, such as lack of fill for preparation of documents for opening and authorization procedures of High Complexity (APAC), this document required for registration of the patient, medication for chronic pain are not obtained. It should be pointed out that the same are offered for free through SUS for oncology patients according to Decree no.1083/2012) of the Brazilian Ministry of Health.[22-23]

In the survey conducted in João Pessoa, Paraiba, which evaluated the quality of life of patients with cancer in palliative care it was verified that other aggravating important factors that corroborate for the weakness is the socioeconomic conditions presented by the majority of patients with cancers that are retired and survive due to this benefit, however they are taxpayers with family income.[12]

Data from the present study are in accordance to the studies presented noting that most of the patients sought Associação Presente in search of medicines. Another concordance is the similarity of the therapy used by these patients prevailing association of radiotherapy and chemotherapy.

In this study, the neoplasia of C&P was predominant (20.9%). The cancer of C&P or C&P carcinomas is a malignant tumor of the upper tract, which includes the oral cavity, pharynx, larynx. In Brazil, this neoplasia represents the 5th place in males and in

7th place in the female population, being more frequent in individuals over the age of 45 years. It is noteworthy that this neoplasm is possible to be healed, especially when early diagnosis is performed.[24-25]

In research conducted in Belém, Pará, which sought to characterize the clinical and epidemiological profile of patients with cancer of C&P, a predominance of males was verified in the age range from 50 years.[26]

In this analysis, the cancer of C&P was the second most prevalent in men, in women is the fourth most incident cancer, corroborating with the scientific literature, in which this neoplasia is more prevalent in males when compared to females, considering the risk factors such as smoking, and alcoholism are more frequent among men.[25-26]

It is corroborated to this the fragility regarding the implementation of health education programs for this public that presents higher risks or measures that will minimize the percentage or development of new tumors.[24]

It is emphasized that the epidemiological profile of C&P can vary in each region of the country, making it necessary to know the profile to detect changes in behavior and risk factors and work activities of promotion and prevention in health, besides providing an early diagnosis aiming at a more effective treatment.[26]

Considering the prevalence of cancers among genders, this study highlights the prostate cancer in men and breast cancer in women, as observed in table 3.

Prostate cancer is considered by the National Cancer Institute the second most incident cancer in the male population. In research conducted in the north of the country, it was found that this cancer was more prevalent in males, representing 38.6%.[13] In a study that evaluated patients of a clinic specialized in chemotherapy that covers 80 municipalities in the southwestern region of Bahia, pointed to the prostate cancer as the second most incident (16.5%), just behind breast cancer.[14]

It is pointed that such cancer has an insidious onset and is present in the daily life of many men without causing any type of discomfort, sign or symptom. As an indicator for containment of cases of this neoplasia, the following are highlighted: prostate-specific antigen (PSA) and the rectal. These help in the early detection of the disease contributing to effective treatment and presenting with chances of cure of up to 80% of cases.[27]

However, the influence of the social imaginary about the disease cancer and about the stigma of screening for prostate cancer can accommodate, inhibit or cause fear and shame to the man that will be subjected to the examinations. Therefore, one should understand how a given population, or a specific group of risk perceive, feel and live the health, because it is the first step to define more efficient and appropriate intervention strategies to the real needs of health of the male gender.[28]

Regarding breast cancer, similar to other studies[13-14,29], this is the type of neoplasm that most affects women, deserving special attention from health services.

The development of the country corroborates to submit worrying figures of the disease in the country and the indices of mortality increase each year. It is essential the early detection for a good diagnosis and the possibility of cure by means of guidance and adherence to self-examination in women with greater vulnerability.[30]

With implementation of programs such as SISCAN (Cancer Information System) that replaces the SISCOLO and SISMAMA systems (National Program for the Control of Cervix of the Uterus and Breast Cancer) the information is updated and improved, allowing longitudinal follow up of these patients, who are to be monitored and their registration does not adhere in findings.[31]

The discussion of the national policy of integral care to women's health within SUS is important, because it is necessary to think in differentiated strategies to reach this audience.[32] It is stood out as an indispensable tool for early detection of breast cancer, investment by means of screening tests for early, as the mammogram.[30]

Findings of this study show a higher prevalence of breast cancer in women in accordance with papers cited making inference about the weaknesses in women's health, reinforcing the importance of better public health policies geared to this population.

Regarding the municipality of origin, it was found in this study that 84.9% of the patients are from small cities of Minas Gerais, mainly in the north of Minas Gerais.

In a study that sought to discuss the regionalization of health in Minas

Gerais, associating it with assistance to patients with breast cancer in the municipalities that compose the Expanded Region of Northern Health (RASNorte), it was found that in addition to the municipalities belonging to the North of Minas Gerais, other regions in other Brazilian states as Bahia, Santa Catarina and Rio Grande do Norte seek treatment in UNACONS from Montes Claros due to lack of service in the northern portion of the state, being the same concentrated in the southern portion.[16]

In accordance with the data presented, patients from other municipalities that compose RASNorte, seek by hospitals UNACONS of Montes Claros, showing weakness in the services offered.

In research conducted in João Pessoa, Paraiba, it was found that 53.5% of patients receiving care were inhabitants of other cities in the interior of the State, concentrating the specialized assistance and the flow of overcrowding in services in the municipalities of João Pessoa (capital) and Campina Grande. This information highlights the lack in care of patients with cancer of the interior of the State.[12]

It is noted that many patients as a way to circumvent the system, have addresses of friends or relatives who reside in the city to receive rapid and appropriate treatment in other networks that do not fall within their area of coverage, bringing serious complications, such as the increased flow in health services hindering the access of the population to completion of exams, outpatient surgeries, among others.[16]

The data obtained in this study show that 381 patients live outside of Montes Claros reinforcing fragility in services of high complexity in oncology and ratifying lack of decentralization of service. In this context it is necessary to overcome geographical barriers that impede the formation of a decentralized, hierarchical system, which can meet these patients in their comprehensiveness and equity favoring timely , effective treatment, improving health indicator and favoring economy for the services.

The regionalization of health in Minas Gerais is under construction, however, this whole process should be analyzed constantly to achieve good results, efficiency and thus ensure access of oncologic patients, especially those potentially lethal.[16]

For better compliance with public health policies the regionalization plan is necessary (PDR). The SUS regionalization

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through the PDR emerges as the main document that guides the conformation of the regions in the states of the federation. Through this instrument it is allowed to organize the flow of people, distribution of units and the accessibility of the population to the network of SUS services. In this sense, the management is performed and directs the health area in order to decentralize these services in order to provide access for these users within their respective regions.[16.33]

This analysis showed some limitations, there are institutional issues relating to the filing of records which resulted in losses of sampling and excluded variables that have increased the proportion of non-responses. The lack of association of diseases with their respective risk factors are also highlighted.

CONCLUSION

From the results it is possible to check that the majority of the patients were elderly, male and the diagnosis is more prevalent in both sexes the neoplasia of C&P. Regarding the benefits sought by them in support institution prevailed the medication and lodging. The most often used treatment was the association of radiotherapy and chemotherapy.

The result of this study demonstrates relationship with the description of the literature on the topic, but suggests further studies, mainly in what refers to the association of diseases with their respective risk factors in order to establish strategies for the prevention and control of these diseases.

It is recommended monitoring and good practices related to the completion of medical records, for which the assistance given is recorded, characterizing an integral and individualized care, enhancing the services provided, corroborating for future scientific investigations.

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