

Impact of the COVID-19 Pandemic on Adherence to Exercise Prescription: The case of Cardiac Rehabilitation Programs

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Abstract - Cardiac Rehabilitation Programs (CRPs) are an important tool of secondary prevention and their implementation within health services, despite the uneven geographical distribution, has been receiving attention from decision-makers in recent years. Adherence to the CRPs is one of the great challenges faced by the multidisciplinary team, and there are several strategies to maintain adherence, particularly in CRP-Phase III, which occurs outside the hospital environment. One of the strategies followed is the use of remote performance monitoring and recording of possible alert symptoms. With the pandemic due to COVID-19, these challenges have become even more evident as Phase II programs have been suspended, thus increasing the importance of the home-based CRPs. In this work, the results of a study aiming to understand the impact of the pandemic on adherence to the prescription of exercise and the perception of patients regarding the effects of physical activity on health conditions are shown. The results indicate that the pandemic did not have a major effect on the adherence to home-based exercises, in particular, in patients undergoing programs using a telemonitoring system. Moreover, the perception of the importance of physical activity for health and well-being was reinforced in the context of the pandemic.

Keywords – Exercise Prescription; Cardiac Rehabilitation Program; COVID-19

I. INTRODUCTION

Cardiac rehabilitation, implemented through Cardiac Rehabilitation Programs (CRPs) as a secondary prevention strategy, allows the patient to recover after an acute cardiovascular event with a multidisciplinary perspective [1-3]. This approach aims to return the patient to daily life as early as possible and contributes to an increase in their quality of life. In addition, the integrated and multidisciplinary approach that is carried out in CRPs allows for a psychological follow-up that reduces negative effects and contributes to changes in behavior and lifestyle of patients who attend CRPs, increasing the adherence to these programs.

A CRP includes medical evaluation, nutritional counseling, risk factor control, psychosocial and professional counseling, physical activity counseling, and exercise prescription [4]. All rehabilitation processes in

general, as well as cardiac rehabilitation, are processes that include a temporal sequence. CRPs involves three sequential phases with distinct objectives and durations. Phase I, also known as the hospital phase, corresponds to the phase of acute care and hospitalization, with an average duration of just over a week. In Phase II, the hospital discharge process begins, which comprises an outpatient phase lasting up to 12 weeks, in which the program is carried out in dedicated facilities (e.g., Cardiovascular Rehabilitation Center) with specific equipment. The various components of the CRP are administered on a face-to-face basis 3 to 4 times per week, where physical exercise is performed on-site, with clinical supervision and continuous monitoring via telemetry systems. In Phase III, patients move to the community phase, and ideally, should be followed up in primary health care regularly, as part of health programs and to maintain the practice of physical activity and healthy lifestyles permanently.

Adherence to CRP by patients is difficult for several reasons. One of them is the need for patients to travel to the rehabilitation center (during Phase II, around 3 days a week) which in many cases involves traveling long distances, and with the associated costs as one more penalizing reason for the participation.

Maintaining the motivation to practice regular physical activity in the community phase of CRP is a very important challenge, as patients report fear of having an acute event again. In recent years, several proposals have been made to ensure patient safety and maintain motivation, through telemonitoring and individualized supervision and prescription [5].

With the COVID-19 pandemic and the necessary reorganization of hospital care services to deal with the large influx of respiratory patients, and restrictions on mobility imposed to control the spread of the virus, Phase II with face-to-face monitoring of CRPs was mostly suspended (or reformulated to be performed at home). In some cases, due to the implementation of a supervised prescribing program integrated into the CRPs Phase II, although in an outpatient or hybrid setting, was maintained with prescription and supervision through mobile technology.

This paper presents the results of a survey addressed to patients who were enrolled in CRPs during the pandemic (May 2021) having two objectives. The first one was to understand the impact of the pandemic on three rehabilitation programs in Portugal, and the second one was to understand how the pandemic period influenced those patients' perception of the importance of physical activity and healthy lifestyles as a health conditioning factor.

In what follows, in section II the sample will be characterized as well as the questionnaire presented, and in section III the results are presented. In the last section, some conclusions are presented.

II. METHODOLOGY

The research methodology applied a questionnaire as a means of data collection. The questionnaire begins with a declaration of consent from the volunteers regarding participation in the study and follows with a characterization of the sample regarding personal data and the type and rehabilitation program that he is being followed. This is a non-probabilistic convenience sample, to whom the questionnaire was presented via the email registered in the administrative file of the patients. Users of three rehabilitation centers in Portugal participated in the study (7 in Phase II and 31 patients in Phase III). In one of them, supervised prescription methodology encompassing an online monitoring scheme through mobile technology and wearable.

To answer the two main questions identified in this study, the IPAQ (International Physical Activity Questionnaire) long version [6], in Portuguese [7], was included in the online survey which was divided into three parts. In the first part, the questions are addressed to the characterization of the sample (age, sex, CRP Phase, CRP Center, local of residency), the second part is dedicated to measuring the level of Physical Activity during the pandemic (by applying the IPAQ questionnaire), and in the third part, the questions are dedicated to assessing the perception of the importance of Physical Activity in health and wellbeing.

III. RESULTS

The sample is composed by the answers of 38 volunteers, with 81.6% male, mean age of 58 years. Participants are patients enrolled in CRPs in 3 Portuguese hospitals (30 in the Center region and 8 in the Lisbon region) spread over 12 municipalities.

In general, regarding the number of days that participants reported engaging in vigorous physical activity, it can be seen that the number of responses with 3 or more days increased during the pandemic, from 16 to 18. Regarding the time of moderate physical activity, for the time intervals defined in the graph in Fig. 1, it is possible to see the reduced variation when comparing the two studied periods (before or during the pandemic). However, when analyzing the graph of Fig. 2 about the duration of practices of vigorous physical activity (for time intervals between 15 minutes and 60 minutes) an increased profile was verified, maintaining the number of

responses in which the time of vigorous activity longer than 60 minutes is reported.

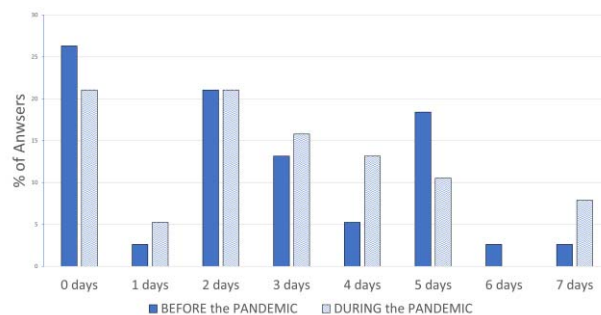


Figure 1: Number of days reporting vigorous Physical Activity before and during the pandemic

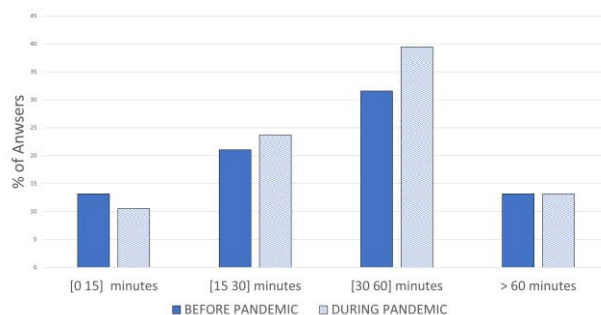


Figure 2: Duration of the practices of Physical Activity before and during the pandemic

Regarding the number of days in which participants walked for at least 10 minutes, as it is possible to see through the bar graph in Fig. 3, despite the restrictions of the pandemic, patients as a whole, continue to walk (at least ten minutes/day) in more than 5 days a week. One aspect to note is the number of users who reported this practice every day of the week that doubled. About the time the participants report being seated during the day, the data are presented in the bar graph shown in Fig. 4. It is possible to see that regarding short periods of sitting (up to 3 hours) there are no variations associated with the effect of the pandemic. As for longer time intervals of sitting, it is possible to observe that the number of responses in the period between 3 to 6 hours decreased with the effect of the pandemic. Regarding long periods (more than 6 hours) there is a double increase in responses associated with the pandemic period.

In the third part, the questions addressed to the participants aim to assess whether the pandemic has changed their perception of the importance of physical activity as a means to maintain individual well-being and health. About the importance of being physically active, and also about the reduction of anxiety levels by practicing physical activity, the results are shown in Fig. 5. Regarding the reduction of anxiety levels, it was verified that there is an increase in the level of agreement that can be seen in the responses associated with the pandemic period, but that there is a significant number of responses where there is no established opinion. About the association of reduced cardiovascular risks with physical activity, the reinforcement of this positive association during the pandemic period is evident.

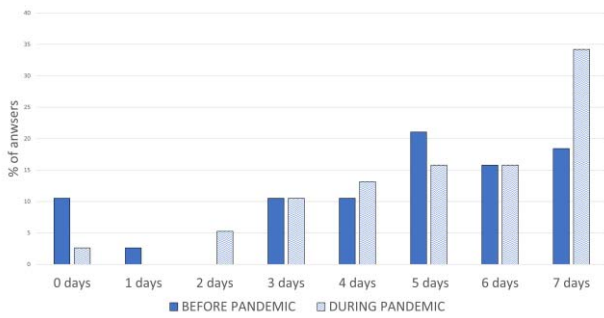


Figure 3: Number of days having at least 10 minutes walking

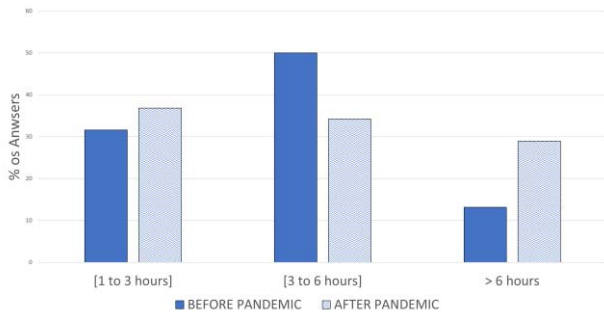


Figure 4: Period of time seated before and during the pandemic

In the remaining questions of the third part of the questionnaire, it was possible to verify, in a transversal way, that the participants are most in agreement with the association between physical activity and health benefits, and that this perception was reinforced by the pandemic. These data can be found in Fig. 6, where is possible to find the graphs referring to the effect of physical activity and healthy habits on self-esteem, sleep quality, General Health Status, and resistance to diseases.

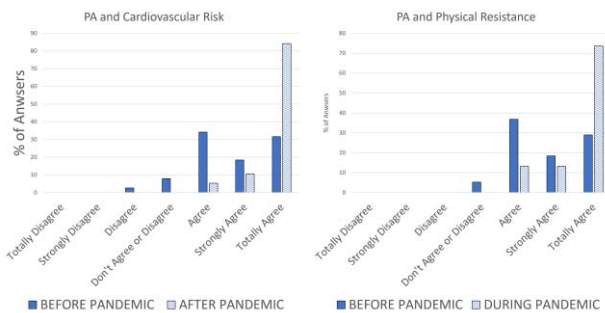


Figure 5: Relation between Physical Activity (PA) and Cardiovascular Risk (at left) and Physical Resistance (at right)

As previously mentioned, in one of the three cardiac rehabilitation centers patients were using a monitoring and prescription platform integrated into the CRP. This platform allows users to be monitored using a smartphone, and the data is automatically forwarded to the monitoring and prescription portal of the CRP team that carries out the online follow-up. To verify any trend that may be associated with the use of the electronic platform, the database was disaggregated to separate patients from this rehabilitation center, totalizing 30 valid responses.

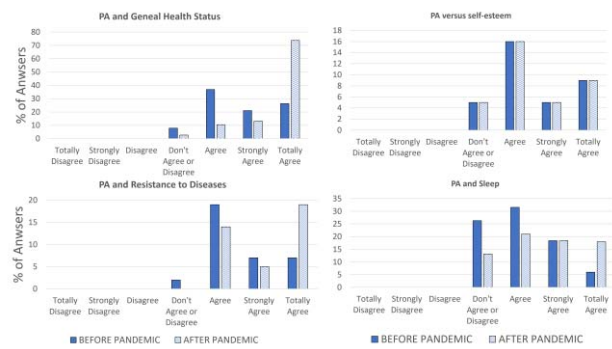


Figure 6: Perception of Physical Activity (PA) influence in general health status (top left), self-esteem (top right), resistance to diseases (bottom left), and sleep (bottom right)

For the group of participants who were not using the prescription and monitoring platform, it was possible to verify that the trend found in the overall results no longer occurred. Thus, regarding the number of answers with 3 or more days of vigorous Physical Activity, in this group, we found no differences concerning the pattern of physical activity before or during the pandemic. Furthermore, regarding the days with a walk of at least 10 minutes, the pattern of activity was maintained, without the increase reported in the overall results. The abovementioned results can be seen in Fig. 7.

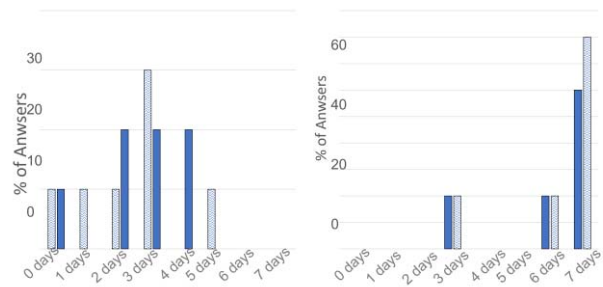


Figure 7: Number of days with vigorous Physical Activity (at left) and the number of days having walked at least 10 minutes (at right). In both cases, the results are for patients under a classical CRP

The perception regarding the importance of physical activity and healthy lifestyles did not show different characteristics in this group when compared with the overall results.

IV. DISCUSSION

The pandemic we are still experiencing has brought many challenges to the community, with particular emphasis on health services. Society has mobilized through various structures (social sector, companies, and research) to provide a concerted and effective response. In the initial phase, where many uncertainties persisted about the virus, its virulence, and how to prevent transmission, a containment strategy was adopted. This measure, although drastic for the economy, was the way to reduce the number of infections in the various waves we have been through. Given the high number of patients with respiratory symptoms, hospitals have been adapting their response to this type of patient, diverting resources from the remaining non-urgent care [8, 9]. Thus, rehabilitation programs (particularly CRPs) were affected and most of

them suspended on-site activities. In cases where CRPs were equipped with some form of telemonitoring, it was possible to adapt the programs to be carried out exclusively at home (although with online supervision).

To make a correct analysis of the obtained data, it is important to have in mind that all participants are (or have been) enrolled in a rehabilitation program, which in addition to physical activity includes education to risk modification and psychology, nutrition, and psychology sessions (related to motivational issues for adherence to a healthier lifestyle). Accordingly, some of the questions about lifestyle and behavioral changes have already been previously worked with these participants.

Through the presented results, it is possible to verify from all the participants' answers, that the pandemic did not have a very significant impact on physical activity practices. It was also possible to verify that the number of days on which vigorous physical activity is practiced has increased. This effect is certainly related to the fact that we are talking about patients who, having experienced a severe acute event (mostly myocardial infarction), know the key role of regular physical activity in their lives. It should be noted in this regard that the number of patients reporting 7 days of walking (of at least 10 minutes) doubled with the pandemic, which is associated with the adaptation to the context of the home-based exercise.

It was possible to verify with data disaggregation that in the group of participants in classic CRP programs (in which activity during the pandemic was no longer supervised) there are changes in the results, with a drop in reported days of physical activity (vigorous or moderate).

The studies indicate that whenever there is a CRP with a telemonitoring scheme, patients show greater adherence and levels of motivation that allows them to maintain healthy habits for a longer period of time [10]. Here too, regardless of the pandemic, the same pattern is observed. Regarding the reported perception of the importance of healthy lifestyles (including regular physical activity), there are no differences between groups (with or without telemonitoring) or associated with the effect of the pandemic.

This is a study with a small sample, so the results must be interpreted with caution. Still, it is possible to conclude that the changes in the CRPs do not have a major impact on patients' adherence to CRPs, particularly in those who are following a home-based supervised program. Moreover, the perception of the importance of regular physical activity and healthy habits to improve the health status does not change with the effect of the pandemic.

V. CONCLUSION

The COVID-19 pandemic has forced the social structures to constantly adapt so that we can continue to live with the virus until it becomes endemic. The reorganization of health services was one of the actions carried out and the cardiovascular rehabilitation programs were no exception.

To understand the impact of the pandemic on cardiovascular rehabilitation programs, this survey was

elaborated and distributed to patient in CRPs. The main conclusion points to an ability of users to adapt the programs to a home-based scheme. Based on the collected data it is not possible to affirm substantial changes in physical activity practices attributed to the pandemic, in patients following a CRP. Regarding the second objective of the study, it is possible to conclude by analyzing the data that the perception of the importance of physical activity for health and well-being did not change with the effect of the pandemic.

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REFERENCES

- [1] Balady, G. J., Williams, M. A., Ades, P. A., Bittner, V., Comoss, P., Foody, J. M., . . . Southard, D. (2007). Core components of cardiac rehabilitation/secondary prevention programs: 2007 update. A scientific statement from the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation*.
- [2] Fonseca-Pinto, R., Silva, E., Martinho, R., Rijo, R., Januário, F., & Antunes, A. (2020). MOVIDA. eros: an eHealth Solution for Cardiac Rehabilitation Programs. In 2020 43rd International Convention on Information, Communication and Electronic Technology (MIPRO) (pp. 361-364). IEEE.
- [3] Silva, E., Rijo, R., Martinho, R., Assunção, P., Seco, A., & Fonseca-Pinto, R. (2018). A Cardiac Rehabilitation Program Supported by mHealth Technology: The MOVIDA. eros Platform. *Procedia computer science*, 138, 119-124.
- [4] Silveira, C., & Abreu, A. (2016). Reabilitação cardíaca em Portugal. Inquérito 2013-2014. *Revista Portuguesa de Cardiologia*, 35(12), 659-668
- [5] Cabral, M., Santos, R., Januario, F., Antunes, A., & Fonseca-Pinto, R. (2021). Hybrid cardiac rehabilitation program as a potential enhancer of adherence to cardiac rehabilitation in smoking patients with coronary heart disease—a retrospective single-centre analysis. *European Journal of Preventive Cardiology*, 28(Supplement_1), zwab061-347.
- [6] Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., . . . & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & science in sports & exercise*, 35(8), 1381-1395.
- [7] Cruz, J., Jácome, C., Morais, N., Oliveira, A., & Marques, A. (2018). Concurrent validity of the Portuguese version of the Brief physical activity assessment tool. *BMC Health Services Research*, 18, P150.
- [8] Silva, C. J., Cantin, G., Cruz, C., Fonseca-Pinto, R., Passadouro, R., Dos Santos, E. S., & Torres, D. F. (2021). Complex network model for COVID-19: human behavior, pseudo-periodic solutions and multiple epidemic waves. *Journal of mathematical analysis and applications*, 125171.
- [9] Silva, C. J., Cruz, C., Torres, D. F., Muñuzuri, A. P., Carballosa, A., Area, I., . . . & Mira, J. (2021). Optimal control of the COVID-19 pandemic: controlled sanitary deconfinement in Portugal. *Scientific reports*, 11(1), 1-15.
- [10] Batalik, L., Filakova, K., Batalikova, K., & Dosbaba, F. (2020). Remotely monitored telerehabilitation for cardiac patients: a review of the current situation. *World journal of clinical cases*, 8(10)