

Use of methylphenidate among medical residents in Paraná

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Abstract

Medical residency programs are characterized by intense workloads and high demands, favoring the use of substances to sustain cognitive performance. This cross-sectional and quantitative study investigated the prevalence and repercussions of methylphenidate use among first-year medical residents in Paraná. 81 residents (6.37% of the estimated population) responded to an online questionnaire addressing sociodemographic data, the use and effects of methylphenidate hydrochloride, and the DASS-21 scale. The prevalence of use was 25.9%, with the main objectives being to increase concentration (66.7%) and to reduce fatigue (38.1%). Among the adverse effects, tachycardia (52.4%) and anxiety (38.1%) stood out. A significant association was found between methylphenidate use and higher stress levels ($p=0.009$). The use of stimulants showed subjective benefits but was also associated with negative impacts on mental health, indicating the need for educational and institutional actions to discourage its non-medical use.

Keywords: Methylphenidate. Medical staff, hospital. Cognition.

Resumo

Uso de metilfenidato entre médicos residentes do Paraná

O programa de residência médica é caracterizado por intensa carga horária e alta exigência, favorecendo o uso de substâncias para sustentação do desempenho cognitivo. Este estudo transversal e quantitativo investigou a prevalência e as repercussões do uso de metilfenidato entre médicos no primeiro ano de residência no Paraná. Oitenta e um residentes (6,37% da população estimada) responderam a questionário on-line que abordava dados sociodemográficos, uso e efeitos do cloridrato de metilfenidato e a escala DASS-21. A prevalência de uso foi de 25,9%, sendo os principais motivos: aumento da concentração (66,7%) e redução do cansaço (38,1%). Entre os efeitos adversos, destacaram-se taquicardia (52,4%) e ansiedade (38,1%). Houve associação significativa entre uso de metilfenidato e maiores níveis de estresse ($p=0,009$). O uso de estimulantes mostrou benefícios subjetivos, mas se associou a impacto negativo sobre a saúde mental, indicando a necessidade de ações educativas e institucionais que desestimulem seu uso não médico.

Palavras-chave: Metilfenidato. Corpo clínico hospitalar. Cognição.

Resumen

Uso de metilfenidato entre médicos residentes de Paraná

El programa de residencia médica se caracteriza por una intensa carga horaria y una alta exigencia, lo que favorece el uso de sustancias para mantener el rendimiento cognitivo. Este estudio transversal y cuantitativo investigó la prevalencia y las repercusiones del uso de metilfenidato entre médicos en el primer año de residencia en Paraná. 81 residentes (6,37% de la población estimada) respondieron un cuestionario en línea que abordaba datos sociodemográficos, el uso y los efectos del clorhidrato de metilfenidato y la escala DASS-21. La prevalencia de uso fue del 25,9%, siendo los principales motivos: aumento de la concentración (66,7%) y reducción del cansancio (38,1%). Entre los efectos adversos, destacaron la taquicardia (52,4%) y la ansiedad (38,1%). Se observó una asociación significativa entre el uso de metilfenidato y mayores niveles de estrés ($p=0,009$). El uso de estimulantes mostró beneficios subjetivos, pero se asoció con un impacto negativo en la salud mental, lo que indica la necesidad de acciones educativas e institucionales que desincentiven su uso no médico.

Palabras-clave: Metilfenidato. Cuerpo médico de hospitales. Cognición.

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Medical residency, considered the gold standard in specialist training, is conceptualized as a graduate education mode in the form of a specialization program on the basis of on-the-job training, under the guidance of medical professionals with high ethical and professional qualifications¹. Resident physicians—the vast majority of whom are recent graduates—assume medical responsibility in parallel with their theoretical and practical studies, for their better training. This dynamics is characterized by a greater accumulation of responsibilities and, consequently, an excessive workload².

In Brazil, the recently increased number of medical schools has not been matched by the number of specialization positions, and the competition for these positions has become fiercer, requiring better preparation for medical residency exams. Thus, preparation for exams begins during the medical undergraduate program, especially during the internship period. Selection processes for admission to medical residency require good academic and curricular training, including extracurricular activities, such as article publications, extension projects, and undergraduate research programs, among others, encouraging students to seek even higher performance during this preparatory phase³.

Methylphenidate hydrochloride (MPH), commercially known as Ritalin, has been widely used in academic settings for cognitive enhancement. With psycho-stimulant action, similar to the mechanism of action of amphetamines, it was approved by the National Health Surveillance Agency (ANVISA) in 1998 for the treatment of attention deficit hyperactivity disorder (ADHD) in children and adults and narcolepsy in adults. On the other hand, its off-label use is spreading due to users frequently associating it with the stimulation of longer wakefulness, which supposedly contributes to concentration, attention, and focus, with a perceived improvement in academic and professional performance⁴.

The drug acts as a central nervous system (CNS) stimulant, increasing the availability of dopamine and norepinephrine in the extraneuronal space, thereby promoting sustained attention by increasing wakefulness, which facilitates concentration, while reducing motor activity, providing better efficiency and sustained attention

as short-term effects. Despite its benefits, as an agent that is very similar to amphetamine, MPH has abuse potential; as a result, it is a controlled substance⁵.

Long-term MPH use by individuals without ADHD is a controversial practice, as there are no proven significant impacts on learning and cognitive skill development over extended periods. Consequently, abuse of the substance can be considered harmful due to the development of adverse effects, in addition to the risks related to mental health and chemical dependency⁶.

The increased use of psycho-stimulant substances seeking cognitive performance enhancement demonstrates the need for more studies on medications such as MPH. Furthermore, the issue has become evidently important for medical higher education institutions that provide support to students, with a view to improving training and discussing educational difficulties⁷.

This study aims to provide the population with a study on their use among university students, mainly as a cognitive tool for approval in medical residency selection processes, which is an extremely relevant, yet little addressed issue. The objective is to identify individuals who have used (or still use) off-label methylphenidate hydrochloride and determine the prevalence of possible adverse effects.

Method

This is a cross-sectional study with a quantitative approach, conducted at a public university in the Southern region of Brazil. The project was approved by a research ethics committee (REC). All participants signed an informed consent form, as per National Health Council (CNS) Resolution 466/2012⁸.

The target population was first-year resident physicians from the State Medical Residency Commissions (COREME) of Paraná, estimated at around 1,272 first-year residents (R1)⁹. The study sample consisted of first-year residents from the COREME of Paraná who agreed to participate in the research. The final sample consisted of 81 participants, representing approximately 6.37% of the estimated population of first-year medical

residents in the state of Paraná. Although lower than the ideal estimated value for a 5% margin of error ($n=296$), the sample was considered valid for exploratory data analysis, with an estimated $\pm 10.7\%$ margin of error and a 95% confidence level. The low participant adherence was recognized as a limitation of the study.

Two questionnaires were applied simultaneously, in a standardized, self-administered, and individualized manner among the resident physicians, via Google Forms, in the months of May, June, and July 2025. The first questionnaire referred to sociodemographic and economic data, with questions about age group, gender identity, sexual orientation, race, marital status, financial income, training institution, COREME and program area, overtime hours needed for survival, need for preparatory courses for residency, and about the use of methylphenidate hydrochloride according to the objective to be achieved, frequency, and experienced effects.

The second part of the questionnaire consisted of the Depression, Anxiety, and Stress Scale (DASS-21), a psychometric tool validated in Brazil in 2011, divided into subscales with seven items each, developed to assess individual levels of depression, anxiety, and stress during the week prior to the assessment, which enables measuring the intensity of these symptoms and how they affect the psychological well-being of the subject, providing a quick and efficient assessment of their emotional conditions. Based on answers indicating the frequency of events on a scale, the participants were classified on a scale from 0 to 3, where 0: "Did not use in any way"; 1: "Used to some extent, or for a short time"; 2: "Used to a considerable extent, or for a good part of the time"; 3: "Used very much, or most of the time."

For analysis, the scores of each subscale were obtained by averaging the responses to their respective items¹⁰. Based on the percentage distributions of the original version of the scale, cut-off points were adopted to classify the average scores of each subscale as: normal (<2.34), mild (2.34 to 2.60), moderate (2.61 to 2.84), severe (2.85 to 2.93), and extremely severe (≥ 2.94). These ranges were applied equivalently to the depression, anxiety, and stress subscales, and we decided to use the average scores (instead of

the total sum multiplied by two), as the DASS-21 maintains its dimensional structure and predictive validity even with this adaptation, as proposed in the international literature^{10,11}.

The depression subscale includes items 3, 5, 10, 13, 16, 17, and 21, related to depressed mood, lack of interest, low self-esteem, and anhedonia. The anxiety subscale is composed of items 2, 4, 7, 9, 15, 19, and 20, which assess symptoms such as excessive worry, nervousness, exacerbated autonomic response, and a feeling of panic. The stress subscale includes items 1, 6, 8, 11, 12, 14, and 18, focused on persistent tension, irritability, difficulty relaxing, and impatience.

For the description of sociodemographic and economic variables, as well as the use of MPH and its related experiences, we used absolute and relative frequencies, in addition to descriptive statistical measures. Possible cases of stress, anxiety, and depression were assessed according to the DASS-21 standardization. Thus, to analyze the association between frequent or infrequent use of MPH with the objective of increasing cognitive performance and possible mental health implications, we used Pearson's chi-square tests and Shapiro-Wilk normality tests, which did not show a normal distribution, and thus the non-parametric Mann-Whitney U test was chosen. The respective confidence intervals were 95%, and statistical significance was established with a p -value <0.05 .

Results

The comparative analysis between the target population and the studied sample shows that both are composed mainly of women and physicians that graduated from private higher education institutions (Table 1).

There was no statistically significant difference for the variables "gender," "age," "training institution," and "medical residency program area" (Table 2). Among those who use MPH, the study population's profile is maintained—the majority are women ($n=16/21$, 76.2%), with training in private educational institutions ($n=17/21$, 80.1%). Consequently, it is more used by individuals aged between 26-30 years ($n=12/21$, 57.1%).

Table 1. Comparison between the target population and the studied sample

Variable		Target population		Sample	
		<i>n</i>	<i>col%</i>	<i>n</i>	<i>col%</i>
<i>n total</i>		1,272	100.0	81	100.0
Sex	Female	740	58.2	58	71.6
	Male	532	41.8	23	28.4
Training Institution	Public	473	38.2	21	25.9
	Private	799	62.8	60	74.1

n: absolute frequency; *col%*: relative frequency in relation to the column

Table 2. Comparison between samples regarding MPH use

Variable		Total		Uses MPH		Does not use MPH		<i>p-value*</i>
		<i>N</i>	<i>col%</i>	<i>N</i>	<i>row%</i>	<i>N</i>	<i>row%</i>	
Sex	Female	58	71.6	16	27.6	42	72.4	0.7946
	Male	23	28.4	5	21.7	18	78.3	
Age	21-25 years	16	19.8	5	31.3	11	68.7	0.5884
	26-30 years	51	62.9	12	23.5	39	76.5	
	31-35 years	10	12.4	4	40.0	6	60.0	
	36-40 years	1	1.2	0	0	1	100.0	
	41-50 years	3	3.7	0	0	3	100.0	
Training Institution	Public	21	25.9	4	19.1	17	80.9	0.5848
	Private	60	74.1	17	28.3	43	71.7	

n: absolute frequency; *col%*: relative frequency in relation to the column; *row%*: relative frequency in relation to the row; * Pearson's chi-squared test

The areas of vascular surgery ($n=1$, 100%), neurology ($n=4$, 80%), dermatology, intensive medicine, and orthopedics (all three with $n=1$, 50%) have the individuals with the highest use of the medication. Furthermore, these variables did not show a statistically significant difference ($p=0.1926$).

Regarding the use situations, 66.7% ($n=14/21$) state they use it to improve concentration and/or increase focus; 38.1% ($n=8/21$) to reduce fatigue; and 9.5% ($n=2/21$) to improve memory and/or for other reasons. In addition, 52.4% ($n=11/21$) state they perceive significant improvement in concentration and/or memory capacity, while 38.1% ($n=8/21$) considered there was slight but not significant improvement, and 9.5% ($n=2/21$) say they have not used the medication enough to

assess its beneficial effects. On the other hand, regarding the negative effects experienced, 52.4% ($n=11/21$) reported tachycardia and/or reduced appetite; 38.1% ($n=8/21$), anxiety; 33.3% ($n=7/21$), tremors; 19.1% ($n=4/21$), insomnia and/or irritability and/or other effects; 14.3% ($n=3/21$), headaches; 4.8% ($n=1/21$), increased blood pressure; and 14.3% ($n=3/21$) did not perceive negative effects.

The assessment of the subscales through the DASS-21 enabled the classification of individual average scores. Regarding depression and anxiety, 98.7% are classified as normal score ($n=80$, mean score <2.34) and 1.23% as extremely severe ($n=1$, mean score ≥ 2.94). Regarding stress, 96.3% have a normal score ($n=78$); 1.23% have mild stress ($n=1$); 1.23% have

moderate stress ($n=1$, mean score 2.61 to 2.84); and 1.23% have severe stress ($n=1$, mean score 2.85 to 2.93).

Regarding the prevalence of depression, anxiety, and stress, assessed by the DASS-21, a normal distribution was not observed using the Shapiro-Wilk test. Thus, we chose to use the non-parametric Mann-Whitney U test, in which,

for the variables of depression and anxiety, there was no statistically significant difference, with $p=0.2107$ for depression and $p=0.178$ for anxiety, due to the median value being 0. On the other hand, regarding stress observed among resident physicians that use MPH, there was a statistically significant difference, demonstrated by $p=0.009$, as shown in Table 3.

Table 3. Comparative analysis of the DASS-21 subscales in relation to resident physicians that use MPH

DASS-21		Mean	Median	SD	Min	Max	p -value ^θ
Depression	Total	0.44	0	0.71	0	3	–
	Uses	0.62	0	0.80	0	2	0.2107
	Does not use	0.38	0	3.00	2	3	
Anxiety	Total	0.28	0	0.60	0	3	–
	Uses	0.43	0	0.75	0	3	0.178
	Does not use	0.23	0	0.53	0	2	
Stress	Total	0.93	0.86	0.72	0	2.86	–
	Uses	1.24	1.14	0.62	0.14	2.86	0.009
	Does not use	0.83	0.71	0.73	0	2.71	

mean: mean in relation to the analyzed score; median: median in relation to the analyzed score; SD: standard deviation in relation to the analyzed score; min: minimum value in relation to the analyzed score; max: maximum value in relation to the analyzed score; θ : Mann-Whitney U test

Discussion

It is observed that 25.9% ($n=21/81$) of first-year medical residents in the state of Paraná use MPH to enhance cognitive performance. Although national data on resident physicians remains scarce, surveys with medical students show similar or even higher prevalences. Consequently, among Brazilian university students, an average of 16% to 20% of those who make use are from health-related programs^{12,13}. In international comparison, there is variation from less than 5% in Asian countries to over 30% in North American university populations, reflecting cultural, regulatory, and methodological differences between studies¹⁴. This variability contributes to the heterogeneity found in this study.

Regarding effectiveness, there is the subjective perception of benefits related to use, especially concerning the concentration

and/or memory capacity. However, experimental evidence demonstrates that, despite MPH improving vigilance and sustained attention, there are no consistent gains in long-term memory or complex learning. As demonstrated by Batistela, Bueno, and Pompéia¹⁵, in healthy adults—without an ADHD diagnosis—the positive effects are limited to specific vigilance tasks, such as motor vigilance and sustained attention (simple reaction time tests and continuous stimulus monitoring), with no real evidence of impact on academic performance and episodic memory¹⁵. Thus, it is possible that the improvement perceived by individuals that use MPH to enhance concentration and increase focus merely reflects a subjective perception, being related to social expectations on the use of the drug itself, functioning as a placebo effect.

The association between MPH use and the DASS-21, mainly regarding the statistically significant stress score ($p=0.009$), suggests that,

instead of functioning as a protective factor, its use may be associated with greater emotional overload. Previous studies with medical residents and interns have demonstrated the high prevalence associated with psychological distress, burnout, and even suicidal ideation². In a recent review on substance use and abuse among medical students and residents, Salisbury, Chamanadjian, and Nguyen¹⁶ observed that the use of stimulants is often associated with attempts to cope with excessive workload demands, without lasting impact on well-being or clinical performance. A certain pattern reinforces the need to understand the use of psychostimulants beyond MPH, not just as an individual choice, but also as a reflection of the structural pressures of medical residency.

Regarding associated factors, McCabe and West¹⁷ demonstrate that the availability of the drug, despite being controlled, as well as cultural permissiveness in academic settings, significantly increase the risk of off-label use. In Brazil, Amaral and collaborators⁷ note that medical students frequently resort to MPH as a strategy to cope with the curricular overload, suggesting that medical residents may follow a similar pattern, especially in the face of the intensity involved in their specialization. On the other hand, Fallah and collaborators¹⁸ warn about the possibility of this behavior consolidating self-medication patterns, in addition to normalizing the use of controlled substances among healthcare professionals under training without the real need supported by a diagnosis. The emotional overload, already high among these individuals, can be potentiated by negative effects associated with and reported with the use of the medication. The presence of insomnia, anxiety, and irritability, for example, affects sustained attention and, consequently, cognitive performance, which contributes to the maintenance of drug seeking and use, making self-medication a vicious cycle.

From an ethical standpoint, the use of MPH for cognitive performance enhancement raises debates about equity, indirect coercion, and risks of dependence. Plumber et al.¹⁹ reiterate that institutional pressure induces consumption, even among those who do not wish to use it, creating inequality in the training setting. This fact, in turn, emphasizes the relevance of the discussion, especially in the context of medical

residency, where performance is constantly evaluated and compared.

Among the limitations of this study, the sample size, although valid for exploratory analysis, was lower than the ideal calculated for a 5% margin of error. Furthermore, the relative frequency data for the division between sexes and public or private training institutions of the Brazilian population were admitted as equal for the medical resident population of the state of Paraná, as no demographic data separated by state were found. Despite that, the findings contribute to the literature with original data on resident physicians in Brazil, a category still little explored in studies on the use of psychostimulants.

Final considerations

MPH use among first-year medical residents in the state of Paraná to enhance cognitive performance is associated with predominantly subjective effects, with prevalence associated with higher stress scores, as demonstrated by DASS-21, in addition to the presence of negative effects such as insomnia, irritability, and anxiety. These, in turn, indicate that the recourse to the drug does not represent a protective strategy. This study reinforces that its use is not an isolated phenomenon, but rather integrates a broader context of overload, psychological distress, and the pursuit of coping strategies in this stage of training.

Therefore, it becomes fundamental to understand the use of psychostimulants not only as an individual choice, but also as a reflection of the structural demands of medical training. The results reinforce the need for institutional and public policies geared toward promoting the mental health of professionals under training and preventive strategies that reduce the pressure to use substances as a coping mechanism. Future studies, with larger samples and longitudinal designs, are essential to evaluate the long-term impacts on mental health and clinical performance and to support educational interventions that discourage self-medication and non-medical use of methylphenidate not only among resident physicians but also among university students in general.

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Julia Schuster Dalacorte contributed in the study conception, methodology development, data collection and analysis, results analysis and interpretation, and manuscript writing. Leticia Alves de Oliveira, Roberta Rafaelle Dalzotto, and Gabriella Cristina Chicalski contributed in the manuscript drafting, review and editing. Felício de Freitas Netto, and Tatiana Menezes Garcia Cordeiro contributed in the critical content review.

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