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Music Performance Anxiety: Priority Targets in Prevention and Intervention

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Abstract

Background: Music Performance Anxiety (MPA) is a major setback for musicians with diverse backgrounds and expertise. MPA can be managed with adequate strategies, and success will improve if information and professional help is widely available and if musicians are willing to seek such help. Research on MPA has focused on the correlates (potential causes) of MPA, but results are scattered across studies. Also, the correlates of musicians' willingness to mitigate MPA remain underexplored.

Method: To address the referred gaps, we inspected eleven sociodemographic and music-related predictors of MPA in a single sample and investigated potential correlates of musicians' coping strategies and openness to professional help.

Results: Results from 184 Portuguese and Brazilian musicians pointed to age, sex, and discrepancies between real and ideal self as a musician as the most relevant predictors of MPA. Regarding coping strategies, we found that females, Portuguese, classical performers and those exposed to higher levels of external judgment resort more than males, Brazilians, non-classical and low-exposure musicians to physiology-related methods. Openness to professional help was lower in Portuguese, classical and high-exposure musicians, and in low-MPA performers.

Conclusion: These findings contribute to better identifying individuals at risk of developing and perpetuating MPA, thus allowing more efficient awareness campaigns and intervention programs.

Keywords: music performance anxiety, predictors, adult musicians, cross-cultural, musical self, coping strategies

Music Performance Anxiety: Priority Targets in Prevention and Intervention

Like all activities combining complex skills and public exposure, music performance generates anxiety (Kenny, 2006). Music performers must have remarkably high levels of motor coordination, attention and memory to focus both on the execution and interpretation of a musical piece (Kenny, 2004; Papageorgi & Kopiez, 2018). The presence of an audience adds load to the performance, and some musicians tend to feel anxious, mostly about the possibility of negative judgments (Burin et al., 2019). Even though a certain level of anxiety may be expected for some musicians in these circumstances, many of those experience major negative consequences of it, regardless of their backgrounds and expertise, namely low levels of professional well-being, lower-quality performance, or even the inability to perform (Bastos, 2012; Burin & Osorio, 2017; De Figueiredo Rocha et al., 2011). When any of this happens, musicians face the problem of Music Performance Anxiety (MPA).

The ultimate goal of investigating MPA is to devise effective solutions to this problem. One way of achieving this is to answer a set of pivotal questions: the first is about the characteristics of musicians that are more prone to develop MPA (question 1). This allows determining who is at increased risk and should be a priority target of intervention, as well as defining specific MPA-related characteristics as therapeutic targets when these are amendable (e.g., music repertoire can be changed more or less easily; age cannot). Two other questions relate to musicians' attitudes towards MPA, more specifically, whether and how they face this problem, that is, what drives musicians to adopt coping strategies of their own and what makes them choose one strategy or another, e.g., pharmaceutical approaches vs. distraction with other activities (question 2). This allows determining if musicians with certain characteristics are more passive than others, and thus promote proactivity in the former. Finally, it is also important to know the characteristics of musicians who are less open

to professional help (question 3), such that these can be made priority targets of awareness campaigns on the benefits (and costs) of psychological intervention.

One way of addressing question (1) is to determine the strongest correlates of MPA. The literature on this topic points to multiple potential correlates, but results are mixed and scattered across studies. Among sociodemographic correlates, studies on *sex* show consistent findings of increased MPA in females (Coşkun-Şentürk & Çırakoğlu, 2018; Huston, 2001; Kenny, 2004, 2005; Osborne & Franklin, 2002; Papageorgi, 2022; Sinden, 1999). For *age*, the literature is mixed (for a review see Fernholz et al., 2019), supporting both positive associations (e.g., Kenny et al., 2014; Steptoe & Fidler, 1987) and null findings (no association; Van Kemenade et al., 1995; Wesner et al., 1990), and suggesting that adolescence may be the most critical age (Kenny & Osborne, 2006; Papageorgi, 2022). The *country of origin* is also likely to play a role — samples from different countries usually exhibit highly variable prevalence levels of MPA (Brugués, 2009; Papageorgi, 2022). For instance, while a 24% prevalence rate of MPA has been reported for Brazilian musicians (Barbar et al., 2014), values for Portuguese performers reached 86.7% in one study (Damas, 2017).

Correlates of MPA related to music practice (music-related correlates, hereafter) have also been widely investigated. Regarding professional status, direct comparisons between amateurs and professionals reported both null evidence of cross-group differences (Barbar et al., 2013) and lower MPA levels in amateurs (Damas, 2017). These mixed findings are in line with the cross-study variability in professional musicians' levels of MPA, which range from 16% to 60% (Fernholz et al., 2019). The relation of MPA with the repertoire played by musicians has also been investigated and points to null evidence: popular musicians do not differ from classical ones in MPA levels, even though concerns about technical failure are more evident in classical musicians (Yoshie et al., 2009). The type of musical group seems to make a difference: Ryan and Andrews (2009) found that choir singers experience higher levels of MPA when performing with an instrumental ensemble than in

choir-only ensembles. Regarding the role of musicians, i.e., whether they are more (soloists) or less exposed (group members), Ryan and Andrews (2009) found increased MPA for soloists. The presence (or not) of explicit external evaluation – e.g., playing for a jury vs. playing in the street – also relates to MPA. Not surprisingly, evidence supports the idea that external evaluation is associated with increased MPA (Yoshie et al., 2009). Finally, the musical self is a music-related correlate of MPA that taps into the self-representations that musicians have on their musical abilities. The musical self is the distance between the real self – the characteristics, qualities and potential that musicians recognize in themselves, and the ideal self – the qualities they would like to have as musicians (Castiglione et al., 2018). Studies have shown that larger discrepancies between the real and the ideal self in any area of life promote negative feelings (Jack et al., 2023). In the music performance field, such discrepancies tend to increase MPA (Castiglione et al., 2018). The fact that different studies address the music-related MPA correlates using diverse measures (e.g., different approaches to classify amateur vs. professional musicians), samples (e.g., musicians from different cultural origins and/or nationalities), and test a limited number of correlates per study, makes it difficult to draw meaningful conclusions on the more relevant music-related MPA correlates. The first goal of the current study was to address this problem by including a large number of music-related predictors, as well as sociodemographic factors, and simultaneously investigate their association with MPA.

While the literature on the correlates of MPA is vast, the same does not apply to musicians' attitudes towards MPA as described above – whether they adopt spontaneous coping strategies and which strategies are these (question 2), and the extent to which they are open to professional help (question 3). Studies on the effect of coping strategies on MPA are available (e.g., Coşkun-Şentürk & Çırakoğlu, 2018), as well as descriptive findings for musicians living in a particular country (Burin et al., 2019). However, and to our knowledge, research interest on the correlates of these

attitudes has been low. Since the correlates (potential predictors) of these attitudes - expressing musicians' willingness to change - are crucial, determining some of these correlates was our second goal.

In sum, our goals were to deepen our knowledge on what drives both MPA (question 1) and the willingness to manage it (questions 2-3). To that end, we asked Portuguese and Brazilian musicians for information on their MPA levels, sociodemographic (sex, age, nationality) and music-related (professional status, type of musical group, repertoire, role, evaluation in performance context) characteristics – (potential correlates), current use of coping strategies and openness to professional help. We added music education (formal/informal) and music experience in years to the potential music-related correlates, since it was reasonable to expect that formal and less experienced musicians could show higher levels of MPA. Results on coping strategies and openness to professional intervention (willingness to manage APM) were analyzed according to their association with MPA itself, as well as with the sociodemographic and music-related variables. Taking into account the current literature, it is difficult to precisely anticipate which sociodemographic and music-related factors may predict MPA — prior studies addressed this topic in a scattered manner, i.e., each study inspected a limited number of predictors. However, some factors, such as age and sex, emerge more consistently in the literature on MPA, as well as on the studies approaching anxiety disorders in the general population. Thus, we expected that at least age and sex may also arise here as predictors of MPA. Regarding the musicians' attitudes towards MPA, that are related to the current use of coping strategies and openness to intervention, the investigation is quite exploratory, and thus, it is difficult to outline specific hypotheses about their sociodemographic and music-related predictors.

METHOD

Participants

One hundred and eighty-four adult musicians (93 males) participated in this study. They were from Portugal ($n = 101$) and Brazil ($n = 83$). Ages ranged between 18-59 years, with a mean of 28.42 years ($SD = 9.88$). They were amateurs and professional musicians (82 professionals), and all did at least one public presentation in the last five years. We defined *having performed in public in the last five years* as an inclusion criterion to ensure that musicians were active performers, but also that those with low experience (i.e., less than 5 years) and/or performing fewer times in public were also included in the sample; this approach increases the sample heterogeneity and allows to draw conclusions that are not limited to a specific cluster of musicians.

An a priori power analysis with G*Power 3.1 (Faul et al., 2009) indicated that a sample size of at least 123 would be required to detect a medium effect size ($f^2 = 0.15$) in a regression model including eleven predictors (i.e., age, sex, nationality, musical education, musical experience, professional situation, musical group, role as a musician, evaluation, musical repertoire, and musical self) and considering an alpha level of 0.05 and 80% power.

This study was approved by the local ethics committee, Faculty of Psychology and Educational Sciences of the University of Porto (reference 2021/09-07b), and it was conducted in agreement with the Declaration of Helsinki. Written informed consent was obtained from all the participants.

Measures

Musicians completed a questionnaire that included three sections: (1) sociodemographic and music-related variables, (2) the Kenny Music Performance Anxiety Inventory (K-MPAI; Osborne & Kenny, 2005), and (3) participants' attitudes in relation to MPA. We used the Portuguese (Figueiredo, 2020) or Brazilian (De Figueiredo Rocha et al., 2011) versions of the K-MPAI inventory

according to the nationality of the participant. K-MPAI is a self-report questionnaire used to assess symptoms associated with musical performance anxiety (MPA), including memory alterations and negative cognitions. The K-MPAI comprises 30 items in the Portuguese version and 40 items in the Brazilian one, and both present an excellent internal consistency, with a Cronbach's alpha of 0.92 and 0.96, respectively. For both versions, the response scale is Likert-type with seven response options, where "0" corresponds to "strongly disagree" and "6" to "strongly agree". Since the Portuguese and Brazilian versions do not have the same number of items, an average of the participants' answers was used as an individual global score in the analyses.

Procedure

Participants completed the questionnaire by accessing a link that was disseminated via social media and the University website. Before the completion, they signaled their consent for participation.

Data analysis

Variable coding

We present below a detailed description of the 11 sociodemographic and music-related variables and their coding, as well as of the two variables related to attitudes towards MPA.

Sociodemographic and music-related variables

Age. Age is a continuous variable.

Sex. Sex was collected through a forced choice question with two options, i.e., *female* and *male*.

Nationality. Nationality was coded as *Portuguese* or *Brazilian* based on the participants' answer to a forced choice question with these two options.

Musical education. Participants' musical education was categorized based on two questions: (1)

"Have you had music lessons?" (answer: yes vs. no), and "What was the type of musical education

that you received?" (answer: music conservatory, informal/particular classes, basic/secondary education, higher education, or other). Answering "no" in the first question was coded as *without studies*, selecting "yes" for the first question, and "informal/particular classes" or "basic/secondary education" in the second question was coded as *informal musical education*, and answering "yes" in the first question, and "music conservatory" or "higher education" in the second question was coded as *formal musical education*.

Musical Experience. Musical experience was collected to a forced choice question with four options, namely ≤ 5 years, 6 - 10 years, 11 - 15 years, and > 15 years.

Professional situation. Musicians' professional situations were characterized based on two questions: "Are you an amateur or professional musician?" and "Is musical performance your main source of income in the last five years?". The musicians who answer "amateur" were coded in this manner in relation to their professional situation, while those answering "professional musician" were coded as "without music as the main source of income" or "with music as the main source of income" depending on their answer to the second question.

Musical group. Musicians classified the type of musical group in which they played according to seven options, i.e., musical band (rock/pop, indie, metal), philharmonic band, orchestra, chamber ensemble, solo musician, choir, and others. Their answers were later organized according to three categories, namely group, solo or both performances.

Role as a musician. The role of musicians was coded as *small*, *medium*, or *major spotlight*, based on their answer to a forced choice question that included these three options.

Evaluation. Musicians were asked to indicate the place where they usually play, i.e., theater, pubs, street, or other, in order to classify these places as with or without evaluation (or both).

“Theaters” were coded as *with evaluation*, and “pubs”, “street”, and “other” as *without evaluation*; when the option “theaters” was selected together with any of the other options, the answer was coded as *both*. We considered a performance *with evaluation* when the public main purpose is to listen attentively to the musicians (i.e., at theaters), who are aware of such judgment; the remaining contexts, where evaluation is not necessarily present (e.g., streets, pubs), were defined as *without evaluation*.

Musical repertoire. The type of musical repertoire played by the musicians was collected in a question of open answer, and coded in three categories: *classical*, *pop*, or *more than one style*.

Musical self. For musical self, musicians should quantify the extent to which they felt the musician they expected to be. They did it, on a scale from 0 to 6 with 0 meaning they are very far away, and 6 that they were exactly the musician they expected to be. Musical self was treated as a continuous variable in the analyses.

Attitudes towards MPA

Current coping strategies. The current coping strategies were collected through the open question “What resources do you usually use to reduce MPA”. The answer to this question was coded in four categories: *none*, *physiological*, *non-physiological* or *both*. Physiological strategies were those involving body and/or physiological changes, such as medications, muscular relaxation, and breathing exercises, while non-physiological strategies involved no direct physiological modulation, such as talking with colleagues, praying, warming up or practice with the instrument.

Openness to intervention. Regarding the question “Do you consider that it would be helpful for you to participate in a program to reduce MPA? If so, please leave us your email so that, in future opportunities, we can contact you.”, participants who gave their email for future contact were

coded as being receptive to future intervention (*Yes*), while those who did not give the email were coded as non-receptive (*No*).

Statistical analysis

Pearson correlations and multiple regression analyses were conducted to test for associations between our variables of interest. The data was analyzed using standard frequentist and Bayesian analyses conducted with JASP v. 0.17.2.1 (JASP Team, 2023). We combined frequentist and Bayesian approaches to better inform our inferences on the tested associations. While p -values only enable us to accept or reject the null hypothesis, the Bayes Factor (BF_{10}) informs us about the likelihood of the observed data given the alternative and null hypotheses. BF_{10} values were interpreted according to Jeffreys' guidelines (Jarosz & Wiley, 2014; Jeffreys, 1961), i.e., values below 1 are evidence in favor of the null hypothesis (anecdotal evidence: 0.33 - 1; substantial evidence: 0.10 - 0.33; strong evidence: 0.03 - 0.10; very strong evidence: 0.01 - 0.03; and decisive evidence: < 0.01), and values above 1 are evidence in favor of the alternative hypothesis (anecdotal evidence: 1 - 3; substantial evidence: 3 - 10; strong evidence: 10 - 30; very strong evidence: 30 - 100; and decisive evidence: > 100). We regarded an association as present if $p < .05$ and $BF_{10} > 3$, while for an absent association the criteria were $p > .05$ and $BF_{10} < 0.33$.

The full dataset can be found here:

https://osf.io/xycrk/?view_only=e23daff2e26b42f49a0214c22c1791e5

RESULTS

Correlates of Music Performance Anxiety

Participants presented an average MPA of 2.59, on a scale from 0 to 6, which varied widely among musicians, from 0.30 to 5.13 ($SD = 1.11$). There was no substantial departure from normality in the

MPA data (skewness = 0.08–0.18; kurtosis = –0.73–0.36). Portuguese musicians presented an average MPA of 2.67 ($SD = 1.15$), which was significantly lower than the MPA reported in the Portuguese validation study ($M = 3.33$), $t(100) = -5.81$, $p < .001$, $BF_{10} > 100$. Brazilian musicians presented an average MPA of 2.49 ($SD = 1.06$), which was similar to the MPA reported in the validation study ($M = 2.72$), $t(81) = -1.98$, $p = .05$, but evidence in favor of the null hypothesis was anecdotal, $BF_{10} = 0.78$.

Table 1 shows associations between the main variable, MPA as measured by K-MPAI, and sociodemographic and music-related variables (please see Supplementary Table 1 for descriptive statistics).

Table 1

Associations between Music Performance Anxiety (MPA) and sociodemographic and music-related variables

	MPA		
	Test (r , t or F)	p	BF_{10}
Age	-.38	< .001	> 100
Sex	-4.76	< .001	> 100
Nationality	-1.08	.28	0.28
Musical education	0.42	.66	0.13
Musical experience	8.71	<.001	> 100
Professional situation	2.21	.11	0.39
Musical group	0.11	.90	0.09
Role as a musician	0.29	.75	0.10
Evaluation	0.16	.86	0.06
Musical repertoire	2.53	.08	0.51
Musical self	-.34	< .001	> 100

Note. Due to missing values, $185 > N > 163$.

For age, and musical self, test values represent Pearson correlation coefficients; for sex and nationality, test values represent t -values (two-tailed independent sample t -tests); and for the remaining variables, test values represent one-way analysis of variance (ANOVA).

Figure 1 presents MPA scores for the variables with which an association was present, i.e., $p < .05$ and $BF_{10} > 3$. MPA was associated with age, $r = -.38$, $p < .001$, $BF_{10} > 100$, sex, $t(181) = -4.76$, $p < .001$, $BF_{10} > 100$, musical experience, $F(3,179) = 8.71$, $p < .001$, $BF_{10} > 100$, and musical self, $r = -.34$, $p < .001$, $BF_{10} > 100$. Specifically, we found that (1) MPA decreases with age, (2) male musicians have lower MPA than female musicians ($M_{\text{difference}} = -0.74$, $SE = 0.16$), (3) musicians with more than 15 years of experience present lower MPA than those with 11 to 15 ($M_{\text{difference}} = -0.82$, $SE = 0.19$), 6 to 10 ($M_{\text{difference}} = -0.92$, $SE = 0.21$) and 5 or less than 5 years of experience ($M_{\text{difference}} = -1.01$, $SE = 0.33$), and (4) musicians whose self-perception is closer to their ideal present lower MPA. No significant associations were found for the additional sociodemographic and music-related variables ($p > .05$), and, for most variables, i.e., nationality, musical education, musical group, role as a musician, and evaluation, substantial to strong evidence supported the absence of a relationship with MPA ($0.03 < BF_{10} < 0.33$). In relation to professional situation and musical repertoire, the evidence in favor of the null hypothesis was anecdotal ($0.33 < BF_{10} < 1$).

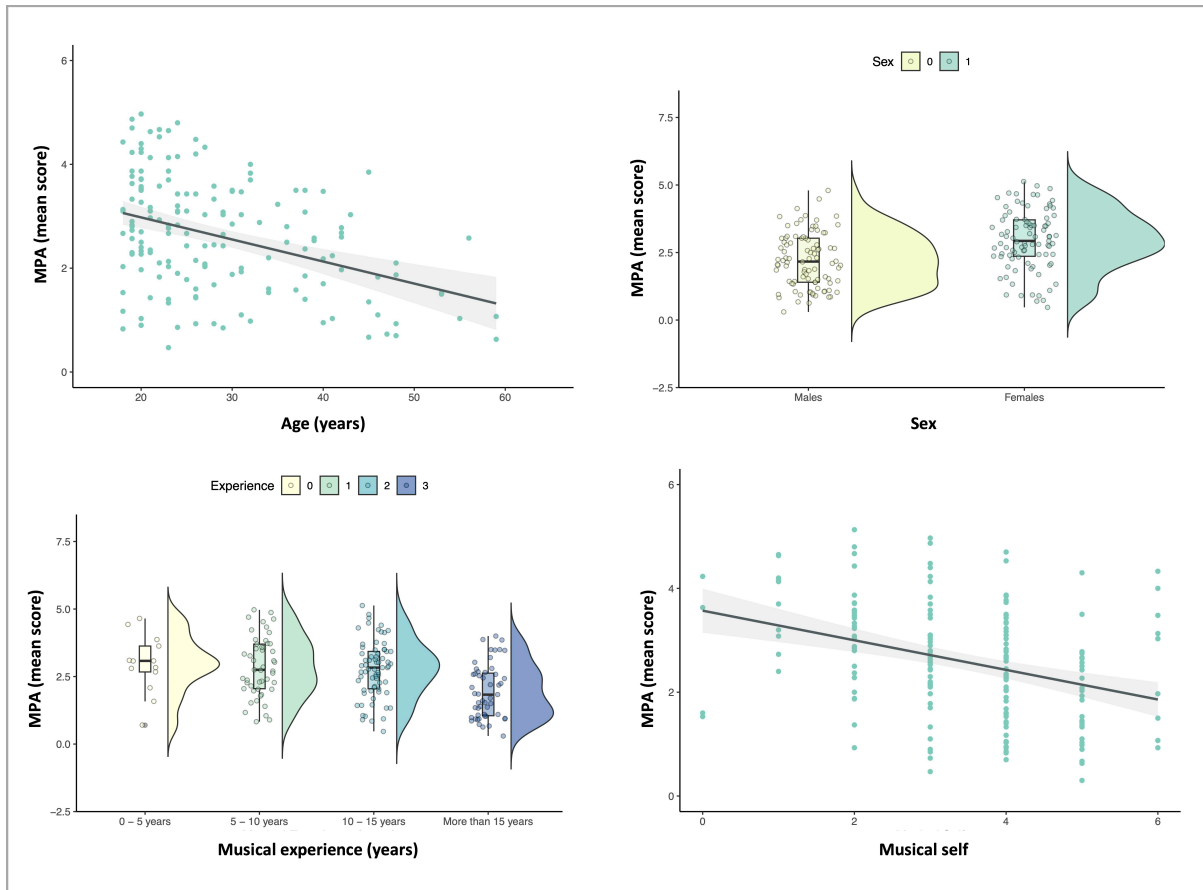


Figure 1. Plots depicting Music Performance Anxiety (MPA) scores as a function of age, sex, musical experience, and musical self.

We used multiple regression to model MPA as a function of age, sex, musical experience and musical self. This model explained 23.48% of the variance, $R = .50$, $F(4,158) = 13.43$, $p < .001$, $BF_{10} > 100$. Independent contributions were evident for age, partial $r = -.21$, $p = .008$, $BF_{10} = 3.46$; sex, partial $r = .24$, $p = .003$, $BF_{10} = 9.65$; and musical self, partial $r = -.25$, $p = .002$, $BF_{10} = 13.28$, but not for musical experience, $p = .55$, $BF_{10} = 0.12$. Since musical experience did not give and independent contribution to MPA when considered within the multiple regression analysis but proved to be related to MPA when the relationship was tested in isolation, we carried out further analyses for clarification. We inspected whether musical experience was associated with age, and that proved to be true, $F(3,160) = 66.22$, $p < .001$, $BF_{10} > 100$, particularly when the comparison was made between musicians with > 15 years of experience and the remaining groups, $ps < .001$,

$BF_{10,U} > 100$. Furthermore, when removing this group from the analysis, and retaining the three groups differing in their experience, but not in their age, musical experience did not predict MPA, $p = .85$, $BF_{inclusion} = 0.73$, even when age is not included in the regression, $p = .72$, $BF_{inclusion} = 0.73$.

Current coping strategies

The level of MPA was significantly associated with the coping strategies used, $F(3,179) = 3.07$, $p = .03$, but evidence in its support was anecdotal, $BF_{10} = 1.25$.

Table 2 shows the association between the attitudes towards MPA, i.e., current coping strategies, and openness to future intervention, and sociodemographic and music-related variables. When the relationship with sociodemographic and music-related variables was tested, we found that current coping strategies are related to sex, nationality, evaluation, and the type of musical repertoire ($p_s < .05$), and substantial ($BF_{10} > 3$) to decisive evidence ($BF_{10} > 100$) supported these associations. Specifically, results demonstrated that female musicians' resort more to physiological strategies than male musicians, and the opposite occurs to male musicians, i.e., male musicians' resort more to therapies without physiological implications than female musicians (Figure 2A). Regarding nationality, there are more Portuguese musicians who do not use any therapy or resort to physiological therapies to deal with MPA than Brazilian musicians, and more Brazilian musicians (than Portuguese) using strategies that do not implicate a physiological intervention (Figure 2B). Musicians who play in settings with evaluation are more prone to use physiological therapies than those playing in settings without evaluation or those that play in both type of settings (i.e., with and without evaluation), and the latter resort more to non-physiological therapies than those playing in musical settings with evaluation (Figure 2C). In relation to musical repertoire, musicians who play classical repertoire resort less to non-physiological therapies than those playing pop music or a mix of styles and are more prone to use physiological therapies than pop musicians; musicians playing a mix of styles did not differ from classical or pop musicians in

terms of using physiological measures to deal with MPA (Figure 2D). For age and musical group, the association with current coping strategies was also significant (for musical group, $p = .049$), but evidence in its support was anecdotal ($1 < BF_{10} < 3$). No significant associations were found between the current coping strategies and musical education, musical experience, professional situation, role as a musician, and musical self ($p < .05$) and the evidence supporting the absence of an association ranged from substantial ($BF_{10} < 0.33$) to decisive ($BF_{10} < .01$).

Table 2

Associations between attitudes towards Music Performance Anxiety (MPA), i.e., current coping strategies and openness to future intervention, and sociodemographic and music-related variables

	Current coping strategies Test, p , BF_{10}	Openness to future intervention Test, p , BF_{10}
Age	$F(3,160) = 3.29, p = .02$ <i>1.84</i>	$t(162) = -0.05, p = .96$ <i>0.17</i>
Sex	$\chi^2(3) = 19.31, p < .001$ <i>> 100</i>	$\chi^2(1) = 0.02, p = .90$ <i>0.19</i>
Nationality	$\chi^2(3) = 27.27, p < .001$ <i>> 100</i>	$\chi^2(1) = 28.82, p < .001$ <i>> 100</i>
Musical education	$\chi^2(6) = 11.45, p = .08$ <i>0.02</i>	$\chi^2(2) = 1.65, p = .44$ <i>0.06</i>
Musical experience	$\chi^2(9) = 12.13, p = .21$ <i>0.01</i>	$\chi^2(3) = 1.43, p = .70$ <i>0.03</i>
Professional situation	$\chi^2(6) = 7.09, p = .31$ <i>0.01</i>	$\chi^2(2) = 8.03, p = .02$ <i>2.38</i>
Musical group	$\chi^2(6) = 12.67, p = .05$ <i>1.09</i>	$\chi^2(2) = 0.49, p = .79$ <i>0.08</i>
Role as a musician	$\chi^2(6) = 1.39, p = .97$ <i>< 0.01</i>	$\chi^2(2) = 5.18, p = .08$ <i>0.45</i>
Evaluation	$\chi^2(6) = 18.91, p = .004$ <i>4.13</i>	$\chi^2(2) = 8.97, p = .01$ <i>4.58</i>
Musical repertoire	$\chi^2(6) = 19.82, p = .003$ <i>14.82</i>	$\chi^2(5) = 9.67, p = .008$ <i>6.71</i>
Musical self	$F(3,179) = 1.27, p = .29$ <i>0.15</i>	$t(181) = -1.86, p = .07$ <i>0.80</i>

BF_{10} values are indicated in italics.

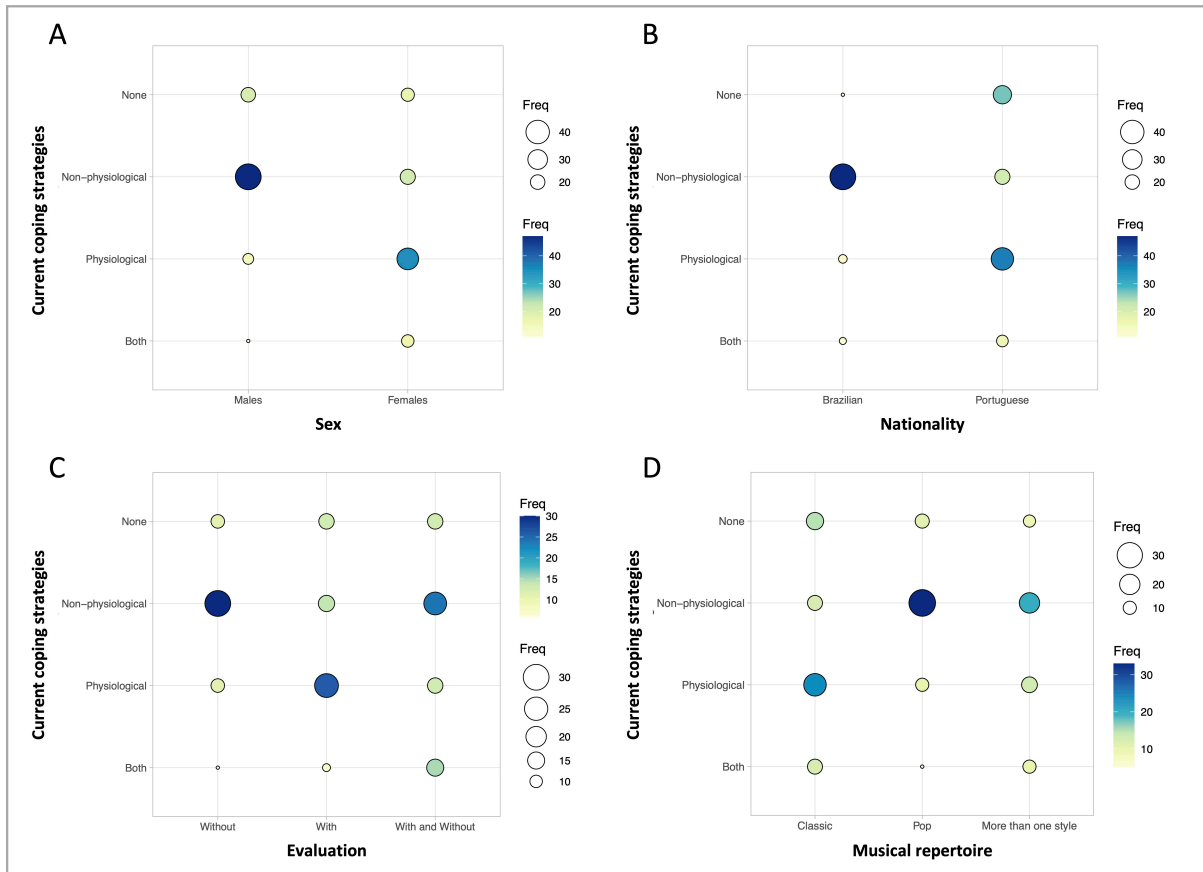


Figure 2. Contingency plots on the association between the current strategies used to deal with Musical Performance Anxiety (MPA) and sex (A), nationality (B), presence of evaluation (C), and musical repertoire (D).

Openness to future intervention

Higher MPA was associated with more openness to future intervention, $t(181) = -2.72$, $p = .01$, and substantial evidence supported this association, $BF_{10} = 4.84$. We tested the relationship between openness to future intervention and sociodemographic and music-related variables, and found significant associations with nationality, evaluation and musical repertoire ($p < .05$), that were supported by substantial evidence for evaluation and musical repertoire ($3 < BF_{10} < 10$), and by decisive evidence for nationality ($BF_{10} > 100$; Table 2). In specific, results showed that (1) most Brazilian musicians were open to future intervention on MPA, while the opposite was true for Portuguese musicians (Figure 3A); (2) musicians playing in settings with evaluation were

predominantly non-receptive to a future intervention, while the contrary was noted for those playing in settings without evaluation (Figure 3B), and most musicians playing classic repertoire were not receptive to future intervention on MPA, while the contrary was reported by those playing pop music (Figure 3C). For professional situation, the association with openness to intervention was significant ($p = 0.2$), but evidence in its support was anecdotal ($BF_{10} = 2.38$). No significant association was found between openness to intervention and age, sex, musical education, musical experience, musical group, role as a musician, and musical self. The absence of an association was supported by substantial ($BF_{10} < 0.33$) to very strong evidence ($BF_{10} < 0.03$), except for role as a musician and musical self for which evidence supporting an absent association was anecdotal ($0.33 < BF_{10} < 1$).

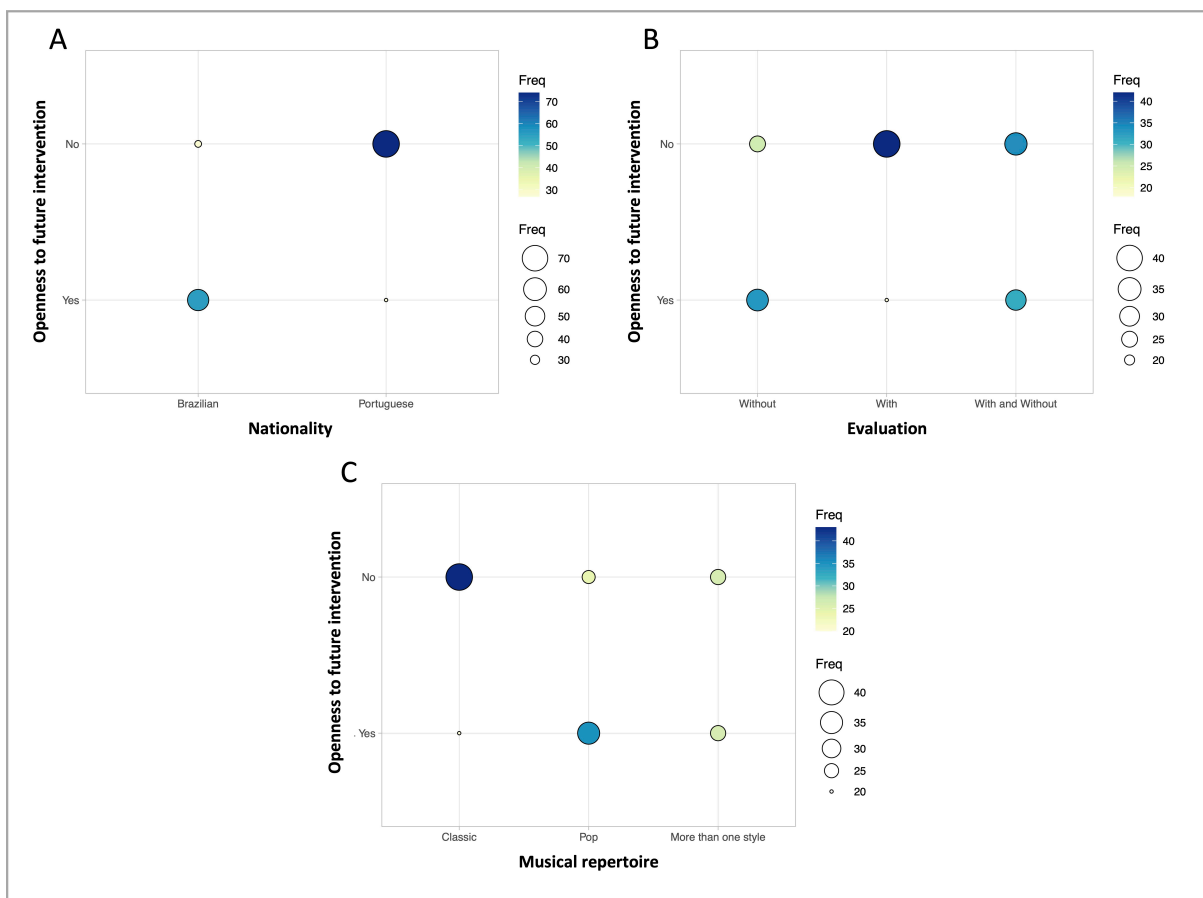


Figure 3. Contingency plots on the association between openness to future intervention on Musical Performance Anxiety (MPA) and nationality (A), presence of evaluation (B), and musical repertoire (C).

DISCUSSION

In the present study, our goal was twofold. We wanted to (1) determine the strongest correlates of MPA among a predefined set of 11 variables, and to (2) investigate potential correlates of the willingness to manage MPA. To that end, we analyzed the associations of MPA with 11 potential correlates selected from the literature, and the associations of participants' coping strategies and openness to professional intervention with MPA itself and with its correlates.

Regarding the first goal, regression analyses showed that only age, sex and musical self, gave an independent contribution to MPA. Female performers, younger ones and performers with larger discrepancies between real and ideal self as a musician (lower musical self) were more prone to develop MPA than males, older participants and participants with smaller discrepancies between real and ideal self as a musician (higher musical self), respectively. The results for sex are in line with the literature (for a review see Fernholz et al., 2019), and may reflect either increased levels of MPA in female or sex-related measurements bias and a male trend to less likely disclose mental health issues (Smith et al., 2018). The reduction of MPA with age is consistent with evidence of a peak in adolescence (Kenny & Osborne, 2006; Papageorgi, 2022) and contradicts the null evidence obtained by Wesner et al. (1990) and Van Kemenade et al. (1995). The key to this association might be that more anxious musicians end their career early and engage in new professional occupations. Considering that a similar age-related pattern is visible in other anxiety disorders (Bandelow & Michaelis, 2015), a further reason might be that musicians (as the general population) improve their strategies to deal with anxiety across age. This suggests that age may act here as a proxy of maturation, which may affect the valuation of the events and their

relevance, and ultimately impact MPA. Note that we did not find evidence of age as a proxy of musical experience, rather the reverse pattern: when controlling for age, musical experience was no longer associated with MPA. Future studies should explore in more detail how age, and the life experience associated with getting older, influence MPA; this approach may have important implications for intervention programs targeting MPA. As for the importance of the musical self, it is in agreement with the literature (Castiglione et al., 2018), likely reflecting the increased distress of musicians with low musical self (too low self-evaluation or too high standards) when facing external evaluation. The negative impact of keeping standards too high has been suggested by Kenny (2011) when referring to the positive association between perfectionism and MPA; the association between perfectionism and MPA has been consistently reported across studies (e.g., Butković et al., 2022; Diaz, 2018; Dobos et al., 2019; Kenny et al., 2004). As for the other eight remaining correlates, no association with MPA was found; this included variables with convergent positive results, such as nationality (Burgués, 2009) or presence of external evaluation (Yoshie et al., 2009). Different from prior studies, MPA was identical among musicians from different countries (i.e., Portuguese and Brazilian musicians). We anticipate that this similarity may be due to similar historical and language backgrounds and/or related to features of our sample, such as the inclusion of musicians with diverse demographic (e.g., age) and music-related characteristics (e.g., instrument played, musical experience). The heterogeneity of our sample may also be the explanation for the absent link between the MPA level and the presence (vs. absence) of evaluation. If we take the study of Yoshie et al. (2009) as an example, they investigated skilled pianists in very strict evaluation conditions (rehearsal vs. competition), while here we investigated musicians with different expertise/backgrounds and in diverse evaluation conditions, e.g., it is different being evaluated in a theater for an individual competition or while performing in an

orchestra. The heterogeneity of the sample may therefore be at the root of these differences in the results compared to previous studies.

For the second goal, we found that MPA does not relate to participants' spontaneous coping strategies. Regarding the coping strategies correlates, physiology-related methods like muscular relaxation or medication were more present in Portuguese musicians, female, those performing under more explicit evaluation, and classical musicians, while physiology-unrelated approaches were preferred by Brazilians, males, those performing under less explicit evaluation and popular musicians. Finally, openness to intervention was higher in high-MPA participants, as well as in Brazilians, non-classical musicians and performers exposed to little explicit evaluation. Regarding preference for physiology-related methods like muscular relaxation or medication, it was chosen by the more prone to develop MPA (females) or those that are subject to more formal settings (presence of valuator or classical repertoire). One explanation may be that these methods are seen as more reliable simply because they act directly upon the body, and concerns about body responses (hand trembling, voice failures) are usually at the core of MPA. Like female, classical musicians and those receiving external evaluation, Portuguese participants also showed preference for acting on the body. This may relate to cultural differences regarding the idea of cure, which may be more biased towards traditional medicine and other biologically-based approaches in Portuguese than in Brazilian individuals (Silva et al., 2020; Quintana et al., 2015). The profile of those who were more open to external help overlapped substantially with that of those preferring non-physiological approaches to deal with MPA: Brazilians, musicians under low levels of evaluation, and those playing non-classical repertoire, particularly pop music, were more open. One way of looking at this profile is to think about street players, who play in less-controlled settings, usually with little evaluation. Perhaps musicians playing in these least controlled settings,

such as street players, have higher levels of openness in general (openness to experience), and this may also be the reason why they perform in less formal spaces.

Regarding practical implications, our findings suggest that different targets should be established for awareness campaigns and intervention. For awareness initiatives about MPA, more attention should be given to female and younger musicians, while for initiatives on resistance to professional help, attention should be focused on Portuguese musicians (or similar cultures) and those performing in more conservative settings, such as musicians playing classical repertoire and those exposed to aware evaluation. The exposure to campaigns about physiological or non-physiological coping strategies depend on sex, nationality and features of the musical setting. Importantly, the musical self should be considered both in the psychological assessment and intervention.

Among the limitations of this study, one of the greatest was the absence of potentially relevant correlates of MPA, this including personality and clinical variables like generalized anxiety, social anxiety, depression, and consumption of recreational drugs or alcohol (Barbar et al., 2013; Burin et al., 2019; Damas, 2017; Van Kemenade et al., 1995). Future studies could address this, by combining the three strongest correlates we found here with these variables. In addition, although there is suggestive evidence of a relevant relation between the musical self and MPA, we cannot be sure about the direction of it. Thinking about the alternative direction to the one we assumed, MPA could not be responsible for age or sex, but it could be for a low musical self. The answer to this question may only be provided by longitudinal studies, where either MPA or the musical self are manipulated. The lack of qualitative data is also a limitation. Adopting qualitative methods to explore how sociodemographic, cognitive and music-related factors modulate MPA is critical to further clarify such relationships and better inform clinical practice.

Despite its limitations, our study contributed to tackle an underexplored topic in MPA research - musicians' willingness to fight the problem. When combined with results on the correlates of MPA, the results we had on this topic raise new questions for future research. For instance, musicians with high levels of MPA adopt coping strategies as much as those with low levels, but they are more open to professional help (though they do not necessarily look for it). Why is it so? One explanation may be that the locus of control of high-MPA individuals is dominantly external: they do not act in proportion to the magnitude of their problem, but they feel that an external intervention could be helpful. This explanation could be consistent with the importance of the musical self in MPA, in that the two concepts relate to the (in)ability to change one's life. Another interesting finding was that females report higher levels of MPA and, at the same time, resort to physiological coping strategies (relaxation, drugs). The question here may be the direction of the relation: are physiological strategies seen as more reliable when anxiety is stronger, or is it they are less effective and, thus, do not reduce MPA in the long term? Finally, MPA decreases with age, but the use of coping strategies and openness to intervention is not highest at younger ages (when MPA peaks). Could it mean that younger musicians maintain an inadequate mindset, wherein they feel MPA in an acute manner but do not act accordingly? These challenges remain for future research.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1

Sample characterization and Music Performance Anxiety (MPA) for each variable category

	Sample descriptive statistics	MPA
Age	28.42 ± 9.88 (18 - 59)	-
Sex		
Females	91	2.96 ± 1.10 (0.47 - 5.13)
Males	92	2.22 ± 1.00 (0.30 - 4.80)
Nationality		
Portuguese	101	2.67 ± 1.15 (0.47 - 4.97)
Brazilian	82	2.49 ± 1.06 (0.30 - 5.13)
Musical education		
Without studies	11	2.68 ± 1.05 (1.05 - 4.43)
Informal	41	2.71 ± 1.11 (0.85 - 4.97)
Formal	131	2.54 ± 1.12 (0.30 - 5.13)
Musical experience		
≤ 5 years	13	2.96 ± 1.09 (0.70 - 4.65)
6 - 10 years	49	2.88 ± 1.09 (0.83 - 4.97)
11 - 15 years	70	2.77 ± 1.05 (0.47 - 5.13)
> 15 years	51	1.95 ± 0.99 (0.30 - 4.00)
Professional situation		
Amateur	101	2.62 ± 1.15 (0.30 - 4.97)
Professional - music not main source	47	2.73 ± 0.91 (0.70 - 4.80)
Professional - music main source	34	2.23 ± 1.18 (0.63 - 5.13)
Musical group		
Solo	17	2.68 ± 1.53 (0.30 - 4.87)
Group	117	2.56 ± 1.09 (0.63 - 5.13)
Mix	47	2.61 ± 1.04 (0.67 - 4.67)
Role as a musician		
Small	14	2.50 ± 1.26 (0.83 - 4.53)
Medium	87	2.64 ± 1.07 (0.30 - 5.13)
Major	75	2.52 ± 1.14 (0.47 - 4.87)
Evaluation		
With	58	2.65 ± 1.07 (0.67 - 4.97)
Without	59	2.61 ± 1.16 (0.30 - 4.87)
Both	65	2.54 ± 1.11 (0.83 - 5.13)
Musical repertoire		
Classic	63	2.79 ± 1.17 (0.47 - 4.87)
Pop	58	2.58 ± 1.05 (0.30 - 4.80)
More than one style	52	2.34 ± 0.99 (0.86 - 4.97)
Musical self	3.45 ± 1.35 (0 - 6)	-
Current coping strategies		
None	38	2.39 ± 1.14 (0.47 - 4.80)

Non-physiological	67	2.37 ± 1.04 (0.30 - 4.87)
Physiological	50	2.88 ± 1.13 (0.73 - 4.97)
Both	28	2.85 ± 1.09 (0.90 - 5.13)
Openness to intervention		
No	102	2.39 ± 1.14 (0.47 - 5.13)
Yes	81	2.83 ± 1.04 (0.30 - 4.97)

For age and musical self, values in *Sample descriptive statistics* represent mean, standard deviation, minimum and maximum values, i.e., mean ± SD (min-max); and for the remaining variables, values represent sample size for each variable category. For MPA mean, standard deviation and minimum and maximum values are presented.