

## Family Size Effect on Mental Health and medication Adherence on a Sample of Copd Patients. The Moderating Role of Financial Strain

Dimitris Mazetas<sup>1</sup>, Mary Gouva<sup>2\*</sup>, Athina Economou<sup>3</sup>, Irini Gerogianni<sup>1</sup> and Konstantinos I Gourgoulianis<sup>1</sup>

<sup>1</sup>Department of Respiratory Medicine, University General Hospital of Larissa, Greece

<sup>2</sup>Research Laboratory Psychology of Patients, Families & Health Professionals, Department of Nursing, School of Health Sciences, University of Ioannina, Greece

<sup>3</sup>Department of Economics, University of Thessaly, Greece

### \*Corresponding Author

Mary Gouva, Research Laboratory Psychology of Patients, Families & Health Professionals, Department of Nursing, School of Health Sciences, University of Ioannina, Greece.

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### Abstract

**Aim:** The aim of the study is to evaluate the family size and the financial strain effects on medication adherence, testing in particular the hypothesis that mental health mediates the relation between family size and medication adherence.

**Methods:** The results of the study are based on a purposive sample of 105 COPD patients (94 male, 11 female) with an average age of 68.9 (SD = 9.2). The participants completed the 8-Item Morisky Medication Adherence Scale (MMAS-8) and the 36-item Short Form health survey (SF-36) from which their medication-taking behavior and their mental health was evaluated. Further, they were asked to complete a sociodemographic questionnaire including self-evaluation items about their current financial situation and the impact of the economic crisis on family, health, and treatment. A path analysis approach was used to test the indirect effect of family size on medication adherence and the moderating role of impact and mortgage debt, controlling for age, duration of COPD illness, and income of the respondents.

**Results:** Financial health, as is reflected in the monthly income and an obligation to repay a mortgage debt was found to be positively associated with medication adherence. The impact of the financial crisis was significantly associated with mental health for the patients that experienced parenthood in families with 2 or more children. Not an analogous effect was reported for patients having been parents of one child or no children. That is, the family size effect on mental health is moderated by the impact of the financial crisis. No significant effect on mental health was reported on medication adherence. Further, neither age nor illness duration was found to have a significant effect on both mental health and adherence.

**Conclusions:** Financial health is confirmed to be positively related to medication adherence. The hypothesized mediating role of mental health in the relation between family size and adherence is not confirmed. Having been a parent of a large family is associated with a greater vulnerability to the effects of financial strain on mental health in the long run.

**Keywords:** Family Size, Copd, Medication Adherence, Financial Health, Mental Health.

### 1. Introduction

The term adherence has evolved to reflect the extent to which a person's behavior—taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider [1]. It is estimated that half of the patients suffering from chronic illnesses are not taking medications as prescribed [2,3].

The consequences of non-adherence are poorer health quality, higher long-term mortality, and significantly increased healthcare costs [4,5]. Accordingly, a great effort has been devoted to enlightening the factors that affect the adherence of patients with chronic illnesses and several dozens of factors have been highlighted, categorized as either patient factors, therapy factors, clinical condition factors, healthcare system factors, or socio-economic factors [6-8].

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This study considers a sample of Chronic Obstructive Pulmonary Disease (COPD) patients which is the third leading cause of death worldwide, causing 3.23 million deaths in 2019 [9]. Currently, there is no cure for COPD, but optimal management may slow the progression of the disease and improve the patient's quality of life. However, this goal requires a change of perception of a patient's role in their own healthcare and the long-term commitment of the patient to the suggested treatment, a premise that is not usually observed [10].

COPD along with diabetes and sleep problems are reported to be the chronic illnesses with the lowest medical adherence [11]. It is estimated that half of the patients with COPD do not adhere to the prescribed regimen [12-14]. Other studies estimate that the COPD patients performing correctly all essential steps of the treatment vary from 10% to 30% [15-17].

Previous research has indicated that adherence to respiratory therapy is associated with age, current smoking status, number of respiratory drugs, number of daily respiratory drug doses, and quality of life. On the other hand, no significant effects have been reported for gender, GOLD stage, FEV1, or COPD medication costs [18]. Further, COPD patients are reported to be more likely to adhere to treatment when they believe it will improve disease management or anticipate serious consequences related to non-adherence [19].

In the context of COPD, the relative research is of great importance, since the corresponding financial burden for the national health systems has been adequately demonstrated in numerous studies in Western countries [20-22].

### **1.1. The Importance of Financial Burden on Medication Adherence**

The reported effect of demographic characteristics on adherence is small and moderated by sample, regimen, and measurement variables [11]. However, financial prosperity seems to have a persistent over-time effect on the quality of health and medication adherence [23,24]. The patient-side financial burden of the prescribed medication is routinely reported to be a factor affecting medication adherence. Indicatively, it is estimated that a COPD patient living in the US pays \$6,246 more per year in direct medical costs than other people [25].

Analogous are the findings among patients of other chronic diseases. In it was found that a significant proportion of cancer patients with atherosclerotic cardiovascular disease have trouble paying medical bills, high financial distress, cost-related medication non-adherence, food insecurity, and/or foregone/delayed care due to cost [26]. In, in a sample of patients with acute coronary syndromes or acute decompensated heart failure, the financial strain was associated with lower adherence and worse self-rated health [27]. In a sample with multiple comorbid chronic conditions, financial constraints, along with family responsibilities and lifestyle preferences were identified as barriers to medication adherence

[28]. Low income was also associated with non-adherence in a sample of 772 Parkinson's disease patients, while a study on a sample of hypertension patients showed that low income is associated with a larger excess mortality risk by non-adherence [29,30].

However, there are also reports indicating a less significant impact of financial health on adherence. In, not an analogous financial status effect was reported for patients in need of heart failure medication, and similar were the results of on a sample of patients received oral anticancer medication. Further, rather contrarily, employed and insured depressive patients were found to have greater odds of medication non-adherence than unemployed ones [31-33].

Overall, the connection of financial health with adherence seems to be adequately supported by the evidence although there are also aspects of this relation that need further clarification.

### **1.2. Size of Family, Parental Mental Health, and Medication Adherence**

In the 19th century, the number of offspring was associated with reduced physical health and greater mortality of parents [34]. More recent findings suggest that having three or more children is associated with higher odds of lifetime depression for parents, an association that was similar across age groups and sexes [35]. This effect may be attributed to the increased experienced economic hardship for the family with three or more children, as well as to the decreasing amount of emotional support that spouses receive from each other [36]. A larger family need a larger home; thus it may be necessary to get a mortgage loan in order to provide the necessary living space to the children. However, that choice is accompanied by a multi-year obligation of repaying the debt and increasing psychological pressure, especially during a multi-year economic crisis.

On the other hand, mental health has been related to medication adherence in various chronic diseases, specifically for COPD patients [37-39]. In, in a sample of severe, poorly controlled hypertension patients, Short Form 36 health survey (SF-36) mental component summary was found to be significantly related to lower medication adherence [40].

### **1.3 Aim of this Study**

The research so far indicates a well-established relationship between family size and mental health as well as between mental health and medication adherence [35,37,39]. Thus, a natural question emerges about the mediating role of mental health between family size and medication adherence, a hypothesis that has not been encountered in the literature.

The aim of this study is to fill this research gap by using a path analysis approach to test the above hypothetical relation between family size, mental health, and medication adherence.

In that context, financial status factors as is the monthly income

and the impact of the financial crisis are also considered possible moderators or regressors of the aforementioned relations since it has been sufficiently established in the literature that low income is associated with several lifetime mental disorders, while medication non-adherence is common among low-income patients or patients that were significantly affected by the financial crisis [3,41,42].

### 1.3.1. Path Model Construction

The first part of the model tests the hypothesized relationship between the size of family and mental health. In that context, a mortgage loan was positioned as a moderator between the size of the family and mental health as possessing a mortgage loan is a significant long-term financial decision that has a de facto relationship with the housing needs of the family. In the same vein, the impact of the financial crisis was considered also as a moderator between family size and mental health, since it has been adequately shown

to be associated with negative changes in the relationships among family members thus affecting also parental mental health [43].

The second part of the model tests the hypothesized relationship between mental health and medication adherence, controlling for the financial crisis impact and the mortgage debt effect. Further, in both parts of the model, the COPD illness status was also taken into account, by setting the patients' age and the duration of the illness as covariates to both mental health and medication adherence score.

In summary, the mediation model of Figure 1 was tested, where mental health mediates the relationship between family size and medication adherence, while the impact of the financial crisis and the mortgage loan moderates the relation between family size and mental health, controlling for the respondent's income, the age and the duration of COPD illness.

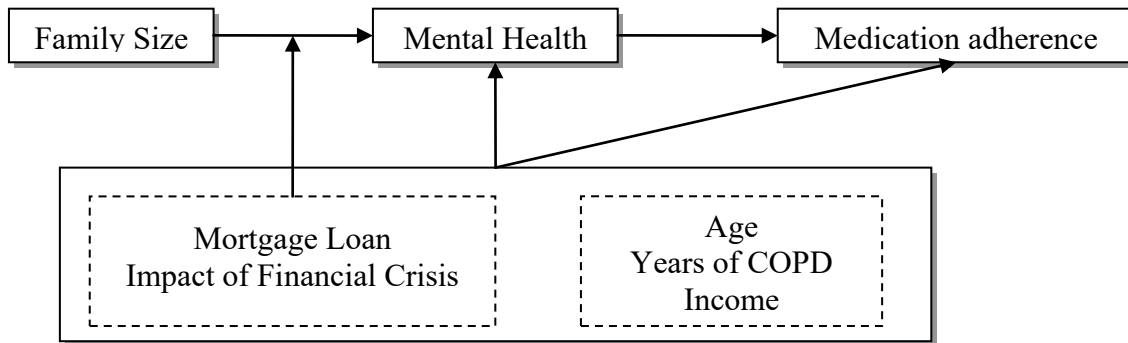


Figure 1: The conceptual model

In the above context, mental health was represented by the mental component score of the Short Form 36-items (SF-36) scale, medication adherence was reflected on the total score of the 8-item Moriski scale and income was calculated as the average of the net personal and family monthly income.

## 2. Method

### 2.1. Participants and Study Design.

The participant patients were selected by the research team, by purposive sampling at the pulmonary clinic of Larisa University Hospital. Any adult COPD patient who attended the hospital for their regular COPD check-ups was eligible to participate in the study. The patient was informed of the purpose of the study and gave his consent prior to completing the questionnaire.

The data collection was carried out in the spring and summer of 2020. One hundred thirty-nine Greek adults participated in the study. Of them, 34 were excluded from the analysis of the present study due to incomplete data in the sociodemographic questionnaire. Thus, the results of the present study were derived from a sample of 105 patients, 94 men (89.5%) and 11 women (10.5%), aged 42 to 87 (M = 68.9, SD = 9.2). They had been diagnosed with

COPD 1 to 21 years before participating in the study (Mode = 2 yrs, Median = 4 yrs, Mean = 6.1 yrs, SD = 5.3 yrs). Most of them were married (N = 83, 89%), graduated from primary school (N = 63, 60%) retired (N = 100, 95.2%) or unemployed (N = 5, 4.8%), and live in the Thessaly (N = 57, 54.3%). Seventy (66.7%) had no to repay bank loans, 17 had debt of minor significance (credit card or small professional loans) and 18 had a mortgage debt.

### 2.2. Measurements

Each participant completed a sociodemographic questionnaire including additional questions concerning their personal and family monthly income as well as their perceived impact of the financial crisis on their family, on their health, and on their COPD treatment. Further, the 8-Item Morisky Medication Adherence Scale (MMAS-8) was administered to the participants, from which their medication-taking behavior was described. A higher total score on the scale may be evaluated as a more adherent attitude towards medication, while a lower score may be presumed to identify a difficulty in adhering to the treatment provided.

In addition, the SF-36 health survey (McHorney, Ware & Raczek, 1993) was used [44]. With that questionnaire, the general health

of the respondent was evaluated with 8 scales (PF: physical functioning, RP: role limitations due to physical health, BP: bodily pain, GH: general health perceptions, RE: role limitations due to emotional health, VT: vitality, MH: mental health, SF: social role functioning), from which, two composite scores are calculated representing overall physical (PCS) and mental (MCS) health, by summing PF, RP, BP, GH and RE, VT, MH, SF respectively.

### 2.3. Statistical Analysis

The average individual and personal income was computed as an income indicator with no significant gender difference. Categorical PCA (CATPCA) was applied in order to integrate the three 5-item Likert responses concerning the impact of financial crisis on health, family and treatment into a single scale indicator reflecting the overall impact of the financial crisis.

Then, a mediation model was applied to test the theoretical model (Figure 1). The PROCESS function for R was used for a custom model describing the hypothesized relations [13]. In that model, 8-item Moriski score (MMAS) was positioned as the dependent variable, the family size was positioned as the independent variable and the SF-36 mental component score (MCS) was positioned as the mediator. Age, illness duration, and income was defined as covariates of both the mental component score and the 8-item Moriski score, while the impact of the financial crisis and the bi-

nary variable of mortgage debt was positioned as moderators of the relationship between family size and mental component score. In that context, family size was expressed as a set of two dummy variables aiming to compare the families with 4 members and the families with 5 or 6 members with the first category consisting of the families with 2 or 3 members. The analysis assessed

- The effect of family size on mental health.
- The moderation effect of the financial crisis impact and financial strain due to mortgage debt on the relationship between family size and mental health.
- The effect of mental health on medication adherence.
- The indirect effects of family size on medication adherence via the mental health.
- The effect of the financial crisis impact and financial strain due to mortgage debt on the medication adherence.

All data were analyzed using SPSS statistical package (version 21) and R statistical language (R Core Team, 2017) equipped with PROCESS function [13].

### 2.4. Data Recoding

#### 2.4.1 Patient's Monthly Income

The personal and the family reported monthly net income are presented in Figure 2 (Individual Income:  $M = €648.7 \pm 384.4$ , Family Income:  $M = €943.7 \pm 511.1$ ).

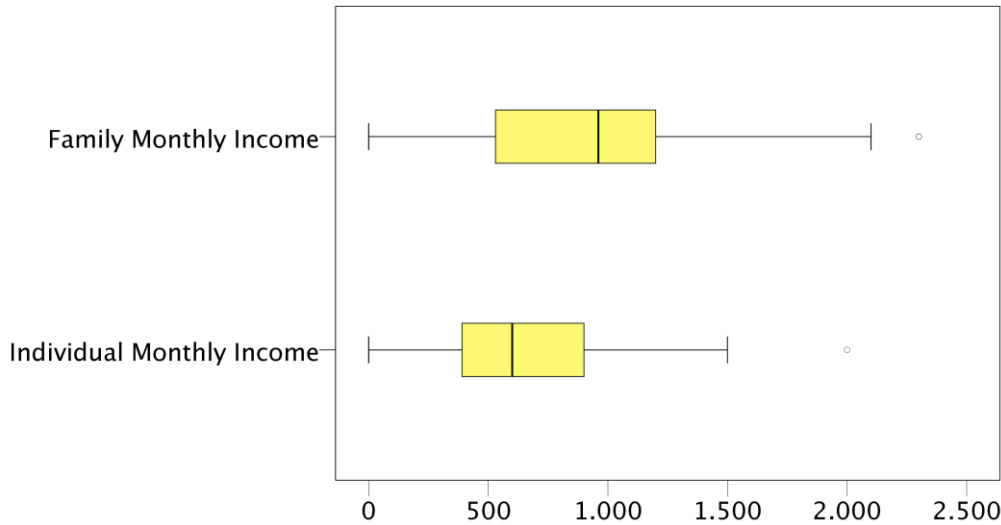
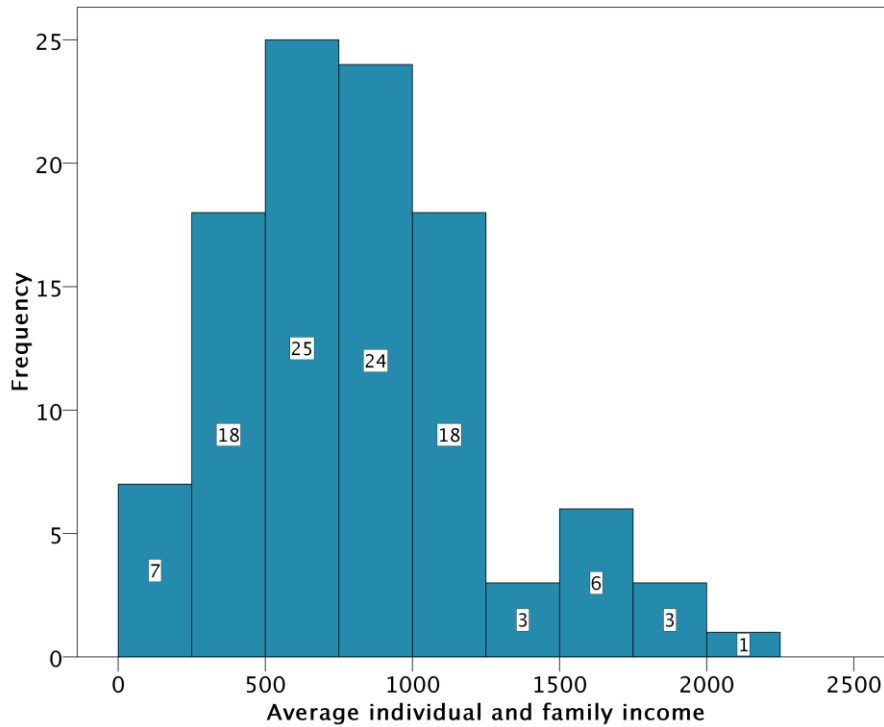


Figure 2: Individual and family income distribution



**Figure 3:** Average individual and family income distribution

Women had significantly smaller personal income than men (€364.4 vs €682,  $t(103) = 2.667$ ,  $p = 0.009$ ) thus, the average of personal and family income for each respondent was computed as a single income indicator for all patients. The mean of the resulting average income was  $€796.2 \pm 384.4$  (Figure 3), with no significant difference between sexes ( $t(103) = 1.664$ ,  $p = 0.099$ ). The resulting average income was further divided by 100 to simplify the interpretation of the results.

#### 2.4.2 Impact of Financial Crisis

The impact of the financial crisis was reported in a set of 3 questions answered in a 5-item Likert scale (Table 1). Categorical PCA (CATPCA) provided a single factor with an eigenvalue of 2.037, explaining the 67.9% of the common variation of the responses and over 80% of variability for each item (Table 1).

Impact of financial crisis...	...on the family	...on health	...on the treatment
Responses			
Very Low	9 (8.6%)	32 (30.5%)	49 (46.7%)
Below Average	6 (5.7%)	17 (16.2%)	9 (8.6%)
Average	24 (22.9%)	20 (19.0%)	23 (21.9%)
Above Average	27 (25.7%)	18 (17.1%)	14 (13.3%)
Very High	39 (37.1%)	18 (17.1%)	10 (9.5%)
Categorical PCA			
Variance Explained	80.1%	83.5%	83.5%
Spearman's Correlation	0.786	0.799	0.821

**Table 1:** Impact of the financial crisis and unique factor statistics

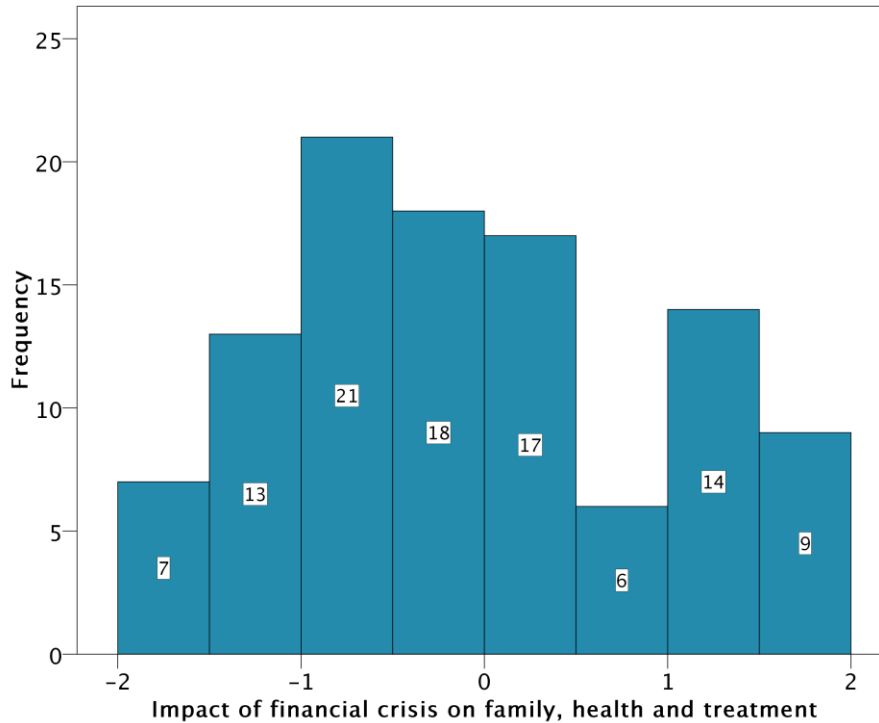
Lower values of the component score corresponded to lower reported overall impact, whereas higher values corresponded to a higher overall impact of the financial crisis. The distribution of this single financial crisis impact score is presented in Figure 4.

### 2.4.3 Family Size

The respondent's family size (parents plus number of offspring) was ranged from 2 to 6 (Table 2). For the purposes of the study, the family size was recoded into a variable with values 1 (2 or 3 persons, N = 13, 12.4%), 2 (4 persons, N = 57, 54.3%), and 3 (5 or 6 persons, N = 35, 33.3%).

Size	2	3	4	5	6	M (SD)
(N, %)	8 (7.6%)	5 (4.8%)	57 (54.3%)	29 (27.6%)	6 (5.7%)	4.2 (0.9)

**Table 2: Family size (parents plus offspring)**



**Figure 4: Composite impact of financial crisis factor**

### 3. Results

The mental health summarizing component score (MSC) was significantly correlated with RE, VT, and MH, confirming relevant literature (Table 3) [45]. An exception was the Vitality subscale

that was not significantly related with MCS, a finding that is not first time reported and raises questions about the validity of the specific subscale in samples of patients suffering from a chronic illness [46].

		RE	VT	MH	SF
	M (SD)	69.2 (46.2)	57.6 (13.3)	66.1 (21.7)	72.1 (38.2)
MCS	265.1 (91.5)	.914**	.026	.615**	.935**

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 3: Correlation between mental component summaries and subscales**

The impact of financial crisis factor was negatively correlated with both individual ( $r(105) = -0.329, p < 0.01$ ) and family income

( $r(105) = -0.360, p < 0.01$ ), as well as with the mental component score ( $r(105) = -0.432, p < 0.01$ ).

Family size	2 – 3 members (N = 13)	4 members (N = 57)	5 – 6 members (N = 35)	p
M (SD)	7,6 (1,1)	7,3 (1,6)	6,5 (2,2)	0.056

**Table 4: Medication Adherence score among family size categories**

The Morisky Medication Adherence Scale (MMAS) score ranged from 0 to 8 (M = 7.1 ± 1.8). MMAS score was not significantly correlated with financial crisis impact score (r(105) = -0.091), nor patient's age (r(105) = 0.067) or illness duration (r(105) = 0.101). The patients that have been parents of large families (5–6 mem-

bers) had lower MMAS score than the other respondents, being however a difference that was not statistically significant (Table 4, F(2, 102) = 2.966, p = 0.056). Further, having to repay a mortgage debt was significantly related with a lower MMAS score (5.8 ± 2.6 vs 7.4 ± 1.5, t(103) = 3.528, p = 0.001).

Effect	B	SE	t	p	95% C.I.	
					Lower	Upper
Constant	348.744	66.199	5.268	0.000	217.285	480.202
Family size						
4 persons <sup>(2)</sup>	1.085	25.795	0.042	0.967	-50.139	52.308
5 – 6 persons <sup>(2)</sup>	-35.404	27.310	-1.296	0.198	-89.636	18.828
<b>Impact of financial crisis</b>	<b>-44.446</b>	<b>8.642</b>	<b>-5.143</b>	<b>0.000</b>	<b>-61.606</b>	<b>-27.285</b>
Family size x Impact						
<b>4 persons<sup>(2)</sup> x Impact</b>	<b>-26.119</b>	<b>11.600</b>	<b>-2.252</b>	<b>0.027</b>	<b>-49.153</b>	<b>-3.084</b>
<b>5 – 6 persons<sup>(2)</sup> x Impact</b>	<b>-46.875</b>	<b>11.938</b>	<b>-3.927</b>	<b>0.000</b>	<b>-70.581</b>	<b>-23.169</b>
Mortgage debt	11.556	23.309	0.496	0.621	-34.731	57.843
Family size x Mortgage debt						
4 persons <sup>(2)</sup> x Mortgage debt	2.573	12.193	0.211	0.833	-21.640	26.785
5 – 6 persons <sup>(2)</sup> x Mortgage debt	9.983	11.082	0.901	0.370	-12.023	31.990
Age	-1.073	0.884	-1.214	0.228	-2.829	0.682
Illness duration	-1.792	1.509	-1.187	0.238	-4.789	1.205
Income	0.651	2.138	0.305	0.761	-3.595	4.898

(1) R<sup>2</sup> = 0.356, F(11, 93) = 4.670, p < 0.001.

(2) Reference Level: Families with 2 or 3 members (parents possessing one child or none)

**Table 5: Prediction model of mental health score<sup>(1)</sup>**

### 3.2. Family Size Effect on Mental Component Score

No significant direct effect was reported for respondent's age (p = 0.228), illness duration (p = 0.238), income (p = 0.761) and mortgage debt (p = 0.621) (Table 5). Further, no significant interaction between family size and mortgage debt was found on mental health (4 persons x Mortgage debt: p = 0.833 and 5 – 6 persons x Mortgage debt: p = 0.370).

On the other hand, the impact of financial crisis found to have a significant direct effect on mental health (b = -44.446, p < 0.001, 95% C.I. -61.61 – -27.285), while a significant moderation effect

of impact of financial crisis on family size and mental health relation was found (4 persons x Impact: b = -50.91, p = 0.027, 95% C.I. -97.69 – -6.129 and 5 – 6 persons x Impact: b = -99.34, p < 0.001, 95% C.I. -149.6 – -49.1). The financial crisis impact effect on mental health was significantly larger for patients that were experienced parenthood at families with over 4 members (that is 3 or 4 children) comparing to parents of families with 2 or 3 members (Figure 5). This difference is still remarkable between patients that had been parents of 2 children comparing to patients that had been parents of 1 or no children (Figure 5).

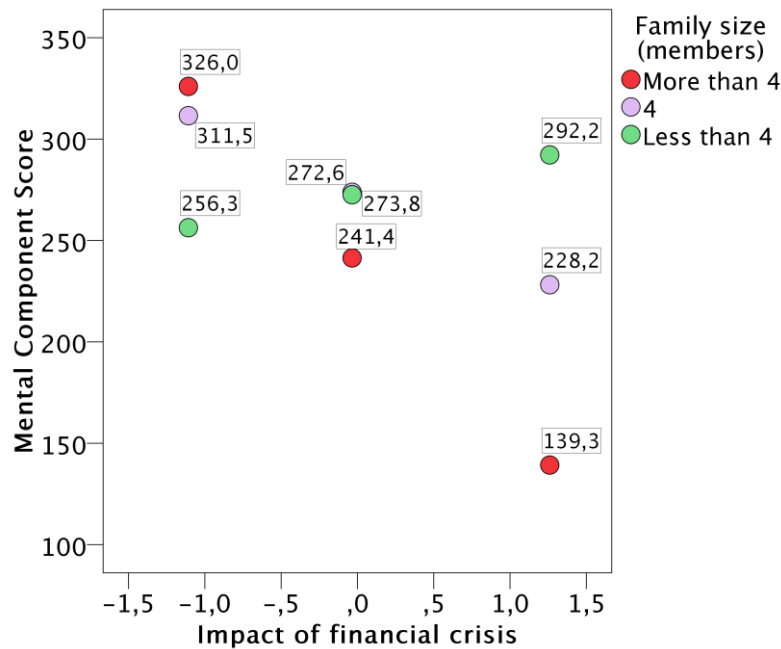


Figure 5: Conditional effect of financial crisis on mental health by family size

### 3.3. Mental Health Effect on Medication Adherence Score

No significant direct effect was reported for respondent's age ( $p = 0.897$ ), illness duration ( $p = 0.126$ ), impact of financial crisis ( $p = 0.417$ ) and mental component score ( $p = 0.871$ ) (Table 6).

Effect	B	SE	t	p	95% C.I.	
					Lower	Upper
Constant	6.529	1.450	4.503	0.000	3.652	9.406
Mental Component Score (MCS)	-0.000	0.002	-0.163	0.871	-0.004	0.004
Impact of the financial crisis	0.164	0.202	0.815	0.417	-0.236	0.565
Mortgage debt	-2.034	0.476	-4.272	0.000	-2.979	-1.089
Age	-0.002	0.019	-0.130	0.897	-0.040	0.035
Illness duration	0.050	0.033	1.542	0.126	-0.014	0.115
Income	0.114	0.044	2.571	0.012	0.026	0.202

(1)  $R^2 = 0.187$ ,  $F(6, 98) = 3.756$ ,  $p = 0.002$ .

Table 6: Prediction model of medication adherence score<sup>(1)</sup>

On the other hand, a significant negative direct effect of mortgage debt ( $b = -2.034$ ,  $p < 0.001$ , 95% C.I.  $-2.979 - -1.089$ ) as well as a significant positive direct effect of income on adherence ( $b = 0.114$ ,  $p = 0.012$ , 95% C.I.  $0.026 - 0.202$ ) was reported. That is, in the context of the tested model, possession of a mortgage debt corresponded to a medication adherence score lower than the other respondent by 2.034 units while each 100-euro larger income corresponded to an additional medication adherence score of 0.114 units. Since mental health did not have a significant effect on adherence, no bootstrap method was applied to compute indirect effects between family size and medication adherence.

## 4. Discussion

The present study aimed to test the family size effect on mental health and the mental health effect on adherence in the sample of COPD patients. Besides, its purpose was to quantify the indirect effect of family size on adherence that was observed in favor of parents of smaller families.

### 4.1. Family Size Effect on Mental Health

The findings are in accordance to the family stress model, suggesting that economic hardship results in practical difficulties for families and, especially in greater economic pressure, it creates an environment that affects the mental health of adults [47]. The pres-



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ent study contributes to the literature by showing that the effect of a harsher financial environment is depended on the past psychological strain that was experienced by the patient. That is, among the COPD patients, having been parents of large families (more than 3 children) a significantly larger sensitivity to the impact of the financial crisis was detected than among patients having been parents of small families (up to 2 children). It is confirmed that the long-term psychological strain experienced by the parents of a large family induce significantly larger psychological consequences at later stages of life [35,48].

#### **4.2. Mental Health Effect on Medication Adherence**

Mental health score did not have a significant effect on medication adherence, a finding that seemingly contradicts previous results [39,40]. This may indicate that the effect is real but the size of the effect is not detectable when a small departure from mental normality is present, an hypothesis that deserves to be examined in a further study. In contrast, both mortgage loan and income variables were found to have significant effects on adherence, confirming analogous previous results that relate to financial health and adherence [23,24].

It was also found that age and illness duration is not significantly related to medication adherence, reaffirming previous reports on samples of COPD patients of analogous mean age and contrary to usual finding concerning samples of younger patients [49-51]. That is, it is indicated that initiatives aiming to enhance medication adherence among COPD patients similar to this study age category should be equally addressed to all the patients independently of their experience with the disease.

#### **4.3. An Indirect Effect of Family Size on Medication Adherence**

The examined path model provides the opportunity to test the hypothesis that family size has a indirect effect on adherence. The path model was constructed in the light of previous research findings pointing out that larger families create greater psychological strain to the parents than smaller families do while long term exposure at stress is expected to create significant psychological consequences [35,48]. In turn, psychological strain has routinely been reported to affect medication adherence [37-40].

Unfortunately, although a significant relation between family size and adherence was reported in our data, the hypothesis that mental health mediates the family size and adherence relation was not confirmed, suggesting that either the magnitude of the hypothesized effect is small and a larger sample is needed in order to be identified, or there are other confounding factors that explain the observed relation between family size and medication adherence and did not encountered in the present study, or even that the observed relation is due to a random variation. Thus, the initial question is still open about whether the observed relation between family size and medication adherence consist a real effect and if affirmative, what is the exact nature of this relation.

#### **4.4. A Promising Research Direction for Future Research**

Greek society is characterized by a traditional nuclear family construct where family has been the main organization unit providing support at its members [52]. It is also known that the support experienced by the members of a family depends on the quality of family functioning [53]. Moreover, the emotional support that spouses receive from each other is known to be related to increased mental and physical health [36].

The above remarks are highlighting family functioning as a candidate for the missing mediator that could explain the observed effect between family size and adherence. This direction is further pointed up from previous results indicating that family functioning is related to family size as well as medication adherence whereas, in the same vein, practical social support is associated with greater medication adherence [54-58]. Overall, the quantification of the family functioning moderator or mediator effect on the relation between family size and medication adherence is suggested as a promising research direction for a future study.

#### **5. Conclusion**

COPD is an illness with a high mental health impact on patients that are routinely reported to feel restricted in terms of achieving life goals, socializing with others, and providing usual family care [59]. This study is an attempt to model the relation between family size and medication adherence. The suggested hypothetical model did not provide the desired answers, leaving unanswered the initial question. However, trying to do so, the increasing strain of being parent of a large family was highlighted, demonstrating in particular the increased vulnerability of patients having supported for all their life a large family, as far as the financial crisis effect on their mental health is concerned. Further, the positive relation of financial prosperity on the medication adherence was verified, whereas, nor age or illness duration found to have an analogous effect. The findings of the present study may enhance the ability of policy makers to provide adequate support to patients in order to improve their attitude towards the received medication and enhance their physical and mental state of health.

#### **6. Limitations of the Study**

There are some limitations of the study that should be reported. First, the impact of the financial crisis was subjectively reported as three 5-item responses concerning impact on family, on health and on treatment. A composite score that would include specific measurable quantities as is the decrease in the pension or the increase at the prices of the treatment would reflect the impact of the crisis with a greater accuracy. Further, the size of the sample was rather small for this kind of analysis, indicating reduced power in the analysis findings. In particular, the repetition of the study in a larger sample is suggested.

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### Conflict of interest statement

The authors have no conflict of interest to declare.

### References

1. World Health Organization (2003). Adherence to long-term therapies: Evidence for action.
2. Brown, M. T., & Bussell, J. K. (2011, April). Medication adherence: WHO cares?. In *Mayo clinic proceedings* (Vol. 86, No. 4, pp. 304-314). Elsevier.
3. Fernandez-Lazaro, C. I., Adams, D. P., Fernandez-Lazaro, D., Garcia-González, J. M., Caballero-Garcia, A., & Miron-Cancelo, J. A. (2019). Medication adherence and barriers among low-income, uninsured patients with multiple chronic conditions. *Research in Social and Administrative Pharmacy*, 15(6), 744-753.
4. Iuga, A. O., & McGuire, M. J. (2014). Adherence and health care costs. *Risk management and healthcare policy*, 35-44.
5. Roebuck, M. C., Liberman, J. N., Gemmill-Toyama, M., & Brennan, T. A. (2011). Medication adherence leads to lower health care use and costs despite increased drug spending. *Health affairs (Project Hope)*, 30(1), 91-99.
6. Goh, H., Kwan, Y. H., Seah, Y., Low, L. L., Fong, W., & Thumboo, J. (2017). A systematic review of the barriers affecting medication adherence in patients with rheumatic diseases. *Rheumatology international*, 37, 1619-1628.
7. Yap, A. F., Thirumorthy, T., & Kwan, Y. H. (2016). Systematic review of the barriers affecting medication adherence in older adults. *Geriatrics & gerontology international*, 16(10), 1093-1101.
8. Yeam, C. T., Chia, S., Tan, H. C. C., Kwan, Y. H., Fong, W., & Seng, J. J. B. (2018). A systematic review of factors affecting medication adherence among patients with osteoporosis. *Osteoporosis International*, 29, 2623-2637.
9. World Health Organization. (2020). WHO Global Health Estimates.
10. Rogliani, P., Ora, J., Puxeddu, E., Matera, M. G., & Cazzola, M. (2017). Adherence to COPD treatment: myth and reality. *Respiratory medicine*, 129, 117-123.
11. DiMatteo, M. R. (2004). Variations in patients' adherence to medical recommendations: a quantitative review of 50 years of research. *Medical care*, 200-209.
12. Gillespie, C. W., Morin, P. E., Tucker, J. M., & Purvis, L. (2020). Medication adherence, health care utilization, and spending among privately insured adults with chronic conditions in the United States, 2010-2016. *The American Journal of Medicine*, 133(6), 690-704.
13. Hayes, A. F. (2018). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. (2nd Edition). New York, NY: Guilford. Horvat, N., Locatelli, I., Kos, M. & Janežič, A. (2018). *Acta Pharmaceutica*, 68(1) 117-125.
14. Kokturk, N., Polatli, M., Oguzulgen, I. K., Saleemi, S., Al Ghobain, M., Khan, J., ... & El Hasnaoui, A. (2018). Adherence to COPD treatment in Turkey and Saudi Arabia: results of the ADCARE study. *International journal of chronic obstructive pulmonary disease*, 1377-1388.
15. Galal, I. H., Mohammad, Y. M., Nada, A. A., & Mohran, Y. E. (2018). Medication adherence and treatment satisfaction in some Egyptian patients with chronic obstructive pulmonary disease and bronchial asthma. *Egyptian Journal of Bronchology*, 12, 33-40.
16. Restrepo, R. D., Alvarez, M. T., Wittnebel, L. D., Sorenson, H., Wettstein, R., Vines, D. L., ... & Wilkins, R. L. (2008). Medication adherence issues in patients treated for COPD. *International journal of chronic obstructive pulmonary disease*, 3(3), 371-384.
17. Bollmeier, S. G., Seaton, T. L., Prosser, T. R., Chou, Y. T., Reckenberg, K., Hahn, B., ... & Ray, R. (2019). Assessment of symptom burden and adherence to respiratory medications in individuals self-reporting a diagnosis of COPD within a community pharmacy setting. *Journal of the American Pharmacists Association*, 59(4), 479-488.
18. Agh, T., Inotai, A., & Meszaros, A. (2011). Factors associated with medication adherence in patients with chronic obstructive pulmonary disease. *Respiration*, 82(4), 328-334.
19. Bourbeau, J., & Bartlett, S. J. (2008). Patient adherence in COPD. *Thorax*, 63(9), 831-838.
20. Gutiérrez, Villegas, C., Paz-Zulueta, M., Herrero-Montes, M., Parás-Bravo, P., Madrazo, Pérez, M. (2021). Cost analysis of chronic obstructive pulmonary disease (COPD): a systematic review. *Health Econ Rev* (11), 31.
21. Kuehn, B. M. (2020). Lung diseases affecting US workers cost billions annually. *JAMA*, 324(8), 734-734.
22. Løkke, A., Lange, P., Lykkegaard, J., Ibsen, R., Andersson, M., de Fine Licht, S., & Hilberg, O. (2021). Economic burden of COPD by disease severity—a nationwide cohort study in Denmark. *International journal of chronic obstructive pulmonary disease*, 603-613.
23. Averett, S. L., & Smith, J. K. (2014). Financial hardship and obesity. *Economics & Human Biology*, 15, 201-212.
24. Weida, E. B., Phojanakong, P., Patel, F., & Chilton, M. (2020). Financial health as a measurable social determinant of health. *PLoS One*, 15(5), e0233359.
25. Patel, J. G., Coutinho, A. D., Lunacsek, O. E., & Dalal, A. A. (2018). COPD affects worker productivity and health care costs. *International journal of chronic obstructive pulmonary disease*, 2301-2311.
26. Valero-Elizondo, J., Chouairi, F., Khera, R., Grandhi, G. R., Saxena, A., Warraich, H. J., ... & Nasir, K. (2021). Atherosclerotic cardiovascular disease, cancer, and financial toxicity among adults in the United States. *Cardio Oncology*, 3(2), 236-246.
27. Osborn, C. Y., Kripalani, S., Goggins, K. M., & Wallston, K. A. (2017). Financial strain is associated with medication non-adherence and worse self-rated health among cardiovascular patients. *Journal of health care for the poor and underserved*, 28(1), 499.
28. Mishra, S. I., Gioia, D., Childress, S., Barnett, B., & Web-

- ster, R. L. (2011). Adherence to medication regimens among low-income patients with multiple comorbid chronic conditions. *Health & social work, 36*(4), 249-258.
29. Daley, D. J., Myint, P. K., Gray, R. J., & Deane, K. H. O. L. (2012). Systematic review on factors associated with medication non-adherence in Parkinson's disease. *Parkinsonism & related disorders, 18*(10), 1053-1061.
30. Lee, H., Park, J. H., Floyd, J. S., Park, S., & Kim, H. C. (2019). Combined effect of income and medication adherence on mortality in newly treated hypertension: nationwide study of 16 million person-years. *Journal of the American Heart Association, 8*(16), e013148.
31. Oosterom-Calo, R., Van Ballegooijen, A. J., Terwee, C. B., Te Velde, S. J., Brouwer, I. A., Jaarsma, T., & Brug, J. (2013). Determinants of adherence to heart failure medication: a systematic literature review. *Heart failure reviews, 18*, 409-427.
32. Verbrugge, M., Verhaeghe, S., Lauwaert, K., Beeckman, D., & Van Hecke, A. (2013). Determinants and associated factors influencing medication adherence and persistence to oral anti-cancer drugs: a systematic review. *Cancer treatment reviews, 39*(6), 610-621.
33. Eshtehardi, S. S., Taylor, A. A., Chen, T. A., de Dios, M. A., Correa-Fernández, V., Kendzor, D. E., ... & Reitzel, L. R. (2021). Sociodemographic determinants of nonadherence to depression and anxiety medication among individuals experiencing homelessness. *International Journal of Environmental Research and Public Health, 18*(15), 7958.
34. Penn, D. J., & Smith, K. R. (2007). Differential fitness costs of reproduction between the sexes. *Proceedings of the National Academy of Sciences, 104*(2), 553-558.
35. Giannelis, A., Palmos, A., Hagenaars, S. P., Breen, G., Lewis, C. M., & Mutz, J. (2021). Examining the association between family status and depression in the UK Biobank. *Journal of affective disorders, 279*, 585-598.
36. Ross, C. E., Mirowsky, J., & Goldsteen, K. (1990). The impact of the family on health: The decade in review. *Journal of Marriage and the Family, 52*(4), 1059-1078.
37. Goldstein, C. M., Gathright, E. C., & Garcia, S. (2017). Relationship between depression and medication adherence in cardiovascular disease: the perfect challenge for the integrated care team. *Patient preference and adherence, 547-559*.
38. Grenard, J. L., Munjas, B. A., Adams, J. L., Suttorp, M., Maglione, M., McGlynn, E. A., & Gellad, W. F. (2011). Depression and medication adherence in the treatment of chronic diseases in the United States: a meta-analysis. *Journal of general internal medicine, 26*, 1175-1182.
39. Qian, J., Simoni-Wastila, L., Rattinger, G. B., Zuckerman, I. H., Lehmann, S., Wei, Y. J. J., & Stuart, B. (2014). Association between depression and maintenance medication adherence among Medicare beneficiaries with chronic obstructive pulmonary disease. *International journal of geriatric psychiatry, 29*(1), 49-57.
40. Konerman, M., Weeks, K. R., Shands, J. R., Tilburt, J. C., Dy, S., Bone, L. R., ... & Young, J. H. (2011). Short Form (SF-36) Health Survey Measures Are Associated With Decreased Adherence Among Urban African Americans With Severe, Poorly Controlled Hypertension. *The Journal of Clinical Hypertension, 13*(5), 385-390.
41. Sareen, J., Afifi, T. O., McMillan, K. A., & Asmundson, G. J. (2011). Relationship between household income and mental disorders: findings from a population-based longitudinal study. *Archives of general psychiatry, 68*(4), 419-427.
42. Tsiligianni, I. G., Papadokostakis, P., Prokopiadou, D., Stefanaki, I., Tsakountakis, N., & Lionis, C. (2014). Impact of the financial crisis on adherence to treatment of a rural population in Crete, Greece. *Quality in primary care, 22*(5), 238-244.
43. Fonseca, G., Cunha, D., Crespo, C., & Relvas, A. P. (2016). Families in the context of macroeconomic crises: A systematic review. *Journal of Family Psychology, 30*(6), 687.
44. Framework, I. C. (1992). The MOS 36-item short-form health survey (SF-36). *Med Care, 30*(6), 473-83.
45. Ware, J. E., & Kosinski, M. (2001). Interpreting SF&-36 summary health measures: A response. *Quality of life research, 10*, 405-413.
46. Jenkinson, C., Stewart-Brown, S., Petersen, S., & Paice, C. (1999). Assessment of the SF-36 version 2 in the United Kingdom. *Journal of Epidemiology & Community Health, 53*(1), 46-50.
47. Conger, R. D., & Conger, K. J. (2002). Resilience in Midwestern families: Selected findings from the first decade of a prospective, longitudinal study. *Journal of marriage and family, 64*(2), 361-373.
48. McFARLANE, A. C. (2010). The long-term costs of traumatic stress: intertwined physical and psychological consequences. *World Psychiatry, 9*(1), 3.
49. Gast, A., & Mathes, T. (2019). Medication adherence influencing factors—an (updated) overview of systematic reviews. *Systematic reviews, 8*, 1-17.
50. Jin, H., Kim, Y., & Rhie, S. J. (2016). Factors affecting medication adherence in elderly people. *Patient preference and adherence, 2117-2125*.
51. Berner, C., Erlacher, L., Fenzl, K. H., & Dorner, T. E. (2019). Medication adherence and coping strategies in patients with rheumatoid arthritis: a cross-sectional study. *International Journal of Rheumatology, 2019*.
52. Georgas, J., Berry, J. W., Van de Vijver, F. J., Kagitçibasi, Ç., & Poortinga, Y. H. (Eds.). (2006). *Families across cultures: A 30-nation psychological study*. Cambridge University Press.
53. Ladner, J., El Badrawy, M., Nofal, A., Saba, J., & Audureau, E. (2020). A cohort study of medication adherence among patients with chronic obstructive pulmonary disease in Egypt. *NPJ primary care respiratory medicine, 30*(1), 31.
54. Wagner, M. E., Schubert, H. J., & Schubert, D. S. (1985). Family size effects: A review. *The Journal of genetic psychology, 146*(1), 65-78.
55. Ni, H., Lin, Y., Peng, Y., Li, S., Huang, X., & Chen, L. (2022). Relationship between family functioning and medication adherence in Chinese patients with mechanical heart valve re-

- 
- placement: a moderated mediation model. *Frontiers in Pharmacology*, 13, 817406.
56. Iloh, G. U., Collins, P. I., & Amadi, A. N. (2018). Family functionality, medication adherence, and blood glucose control among ambulatory type 2 diabetic patients in a primary care clinic in Nigeria. *Int J Health Allied Sci*, 7(1), 23-30.
57. Sun, Y., Wang, M., Zhou, Y., Wang, L., Zhang, H., Lv, Y., & Li, G. (2019). The mediating effect of family function and medication adherence between symptoms and mental disability among Chinese patients with schizophrenia: a cross-sectional study. *Psychology, health & medicine*, 24(5), 559-569.
58. Scheurer, D., Choudhry, N., Swanton, K. A., Matlin, O., & Shrank, W. (2012). Association between different types of social support and medication adherence. *The American journal of managed care*, 18(12), e461-7.
59. Fletcher, M., Albrow, H., Jenkins, C., & Walker, S. (2011). The individual social and financial burden of COPD.

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