

Quality of life and personality traits in patients with malignant pleural mesothelioma and their first-degree caregivers

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Abstract: Asbestos exposure causes significant pleural diseases, including malignant pleural mesothelioma (MPM). Taking into account the impact of MPM on emotional functioning and wellbeing, this study aimed to evaluate the quality of life and personality traits in patients with MPM and their first-degree caregivers through the World Health Organization Quality of Life–BREF (WHOQOL–BREF) and the Minnesota Multiphasic Personality Inventory–2 Restructured Form (MMPI–2–RF). The sample was composed of 27 MPM patients, 55 first-degree relatives enrolled in Casale Monferrato and Monfalcone (Italy), and 40 healthy controls (HC). Patients and relatives reported poorer physical health than the HC. Patients had a higher overall sense of physical debilitation and poorer health than relatives and the HC, more numerous complaints of memory problems and difficulties in concentrating, and a greater belief that goals cannot be reached or problems solved, while often claiming that they were more indecisive and inefficient than the HC. First-degree relatives reported lower opinions of others, a greater belief that goals cannot be reached or problems solved, support for the notion that they are indecisive and inefficient, and were more likely to suffer from fear that significantly inhibited normal activities than were HC. In multinomial regression analyses, partial models indicated that sex, physical comorbidities, and the True Response Inconsistency (TRIN–r), Malaise (MLS), and Behavior–Restricting Fears (BRF) dimensions of the MMPI–2–RF had significant effects on group differences. In conclusion, health care providers should assess the ongoing adjustment and emotional wellbeing of people with MPM and their relatives, and provide support to reduce emotional distress.

Keywords: asbestos, cancer, MMPI–2–RF, Casale Monferrato, Monfalcone, Italy

Introduction

Asbestos is a generic term used to identify a number of well-known silicate minerals, which may produce thin and flexible fibers when crushed; in the last century asbestos was extensively used because of its thermoelectrical and sound absorptive properties, as well as its resistance to chemical and biological agents.¹ Asbestos exposure is responsible for several pleural diseases, including pleural plaques, diffuse pleural thickening, benign asbestos-related pleural effusions, and malignant pleural mesothelioma (MPM).²

MPM is a rare and rapidly fatal tumor that is closely related to the inhalation of asbestos fibers and accounts for approximately 1% of all cancer deaths in the world.³ In Italy, the Italian National Register, the national surveillance system of MPM, recorded a case list of 8,868 MPM between 1993 and 2004, equivalent to standardized incidence rates of 3.49 per 100,000 inhabitants for men and 1.25 for women, with a wide interregional variability.⁴

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MPM is recognized as a disease that is mostly associated with occupational exposure, though in some cases, the exposure may occur in the environment near industrial or natural sources of asbestos. Cases of indirect exposure can also be found among those who live with people who are occupationally exposed to asbestos.⁵ In Italy, Marinaccio et al⁴ reported that over 69% of the patients with MPM they interviewed had been exposed to asbestos in an occupational setting; 4.4% of patients were the result of cohabitating with someone who was occupationally exposed; and 6% of the respondents were exposed to asbestos through the general environment or leisure activities.

Despite advances in chemotherapy, radiotherapy, and surgical approaches, MPM remains largely resistant to treatment, with an estimated median survival time of 9 months.⁶ The impact of MPM is multidimensional and is associated with several physical symptoms (eg, pain, breathlessness, fatigue, cough, sleep disturbance, appetite loss, and sweating), lower emotional functioning (eg, anxiety, depression, fear, and isolation), and changes in social roles and interpersonal relationships.⁷

Despite MPM's severe impact on emotional functioning and the wellbeing of individuals and their families, most information about the quality of life (QoL) of patients with MPM and their caregivers is anecdotal, and systematic studies are rare. Recently, the British Lung Foundation (BLF) survey of MPM patients and their caregivers indicated that emotional functioning in patients with MPM and their family members is significantly impaired.^{8,9} Furthermore, caregivers reported higher levels of personal distress than did patients, received less guidance and support, and were far less likely to feel well-informed throughout the process of diagnosis.⁸

Thus, the aim of this study was to investigate both the QoL and personality of patients with MPM and their caregivers (ie, the relatives or family members who provide direct care to the person with MPM). We hypothesized that both patients with MPM and their relatives who provide direct care and support may have a poor QoL.

Methods

Design and procedure

This was a cross-sectional study investigating QoL in patients with MPM and their caregivers. The cases used in this study involved patients with MPM who lived in Casale Monferrato and Monfalcone. To enroll cases, flyers were sent to some nonprofit organizations that were active in Casale Monferrato and Monfalcone, such as the Relatives and Victims of Asbestos Association, the Exposed to Asbestos Association,

and the Work Invalids and Maimed National Association. Furthermore, the researchers contacted physicians of the Santo Spirito Hospital in Casale Monferrato, who publicized the research to their patients. Casale Monferrato and Monfalcone were selected as centers to enroll patients because in these towns there are the most important facilities for the treatment of asbestos in Italy.

In order to be included in the study patients had to be 18 years of age and over and be diagnosed with MPM. Patients were excluded if they were at the terminal stage of the disease, had any disease of the central nervous system or major medical comorbidities (eg, diabetes, cardiac disease, or non-MPM tumors that were or were not associated with asbestos exposure), or any diagnosis on Axis I or Axis II of the Diagnostic and Statistical Manual of Mental Disorders, fourth edition—text revised (DSM-IV-TR).¹⁰ First-degree relatives were expected to live in the same geographical areas of the patients, be 18 years or older, and provide direct care and support to the person with MPM. First-degree relatives were excluded from the study if they had any disease of the central nervous system, major medical conditions including MPM or other diseases associated with asbestos exposure, or any DSM-IV-TR diagnosis.¹⁰

Controls were selected using judgmental sampling in towns homogeneous to Casale Monferrato and Monfalcone for geographical area, population density and demographic stratification. Subjects were recruited among people who were not exposed to asbestos, using flyers that were sent to nonprofit organizations that were active in both areas. The same inclusion/exclusion criteria as for first-degree relatives were used for the control group.

All subjects participated anonymously in the study and gave their informed consent. The study protocol was approved by the local Institutional Review Board (IRB).

Participants

In total, 153 subjects were enrolled in the study, but 19 patients (12% of the total) died before the assessment was complete. Similarly, 12 subjects (8% of the total) were excluded because they either did not complete the World Health Organization Quality of Life—BREF (WHOQOL-BREF)¹² (31%) or the Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF)¹³ (32%), or because they had an invalid profile in the MMPI-RF (37%).

The final sample was composed of 27 patients (eight women and 19 men) affected by MPM, with a mean age of 61.41 ± 8.82 years; 55 first-degree relatives (43 women and 12 men), with a mean age of 56.51 ± 13.66 years;

and 40 healthy controls (22 women and 18 men), with a mean age of 44.63 ± 13.02 years.

All the patients had occupational exposure to asbestos. The diagnosis of MPM was made between January and June 2010, and they all claimed to have received treatment for MPM, including surgery, radiotherapy, chemotherapy, and immunotherapy.¹¹

Measures

Subjects were administered the WHOQOL-BREF¹² in order to measure QoL, and the MMPI-2-RF.¹³ The WHOQOL-BREF is a 26 item self-report questionnaire measuring four broad domains of QoL: physical health, psychological health, social relationships, and environmental health.

The MMPI-2-RF is a revised, 338-item version of the MMPI-2 that is conceptually and empirically linked to modern theories and models of psychopathology and personality. It is composed of 51 scales: nine validity scales, three higher-order scales, nine restructured clinical scales (RC), five somatic/cognitive scales, nine internalizing scales, four externalizing scales, five interpersonal scales, two interest scales, and five personality psychopathology scales (see Table 1 for descriptions of the dimensions). The Italian adaptation of the MMPI-2-RF has psychometric properties that have been found to be comparable to those of the American version.¹⁴ Factor analyses on the higher-order and the RC scales conducted on a 1,234 normative sample and 464 psychiatric patients confirmed the factorial structure of the original version. Moreover, internal consistency estimates were comparable to those found with the American population, and good discriminant and concurrent validity were found.¹⁴

Statistical analysis

Chi-squared tests (χ^2) and analysis of variance tests (ANOVA) were used for bivariate analyses. Benjamini and Hochberg's correction was used for multiple testing.¹⁵ When ANOVAs were significant after correction for multitesting, we used Tamhane's T_2 tests for post hoc comparisons among groups. All variables that were significant at the bivariate analyses after correction for multitesting were inserted as independent variables in a series of multinomial regression analyses with groups as criteria. Due to the higher number of variables included in the study and the lower number of subjects included in some groups, we performed three analyses with single blocks of variables: in the first model, we inserted sociodemographic variables; in the second model, we inserted the validity scales of the MMPI-2-RF; and in

the third model, we inserted the clinical scales of the MMPI-2-RF. In a final model, we inserted all the variables that had been significant in the previous analyses and the WHOQOL Physical Health. As measures of model fit, we reported the -2 log likelihood statistic (-2 LL), the likelihood χ^2 , and the Pearson's χ^2 . As measures of effects significance, we reported the -2 LL for reduced model and the likelihood ratio test. As measures of association, we reported odds ratios (OR) and their 95% confidence intervals (CI). ORs greater than 1 indicated a higher risk for patients or their relatives when compared with healthy controls.

All the analyses were performed with the statistical package for the social sciences SPSS for Windows 19.0 (IBM, Armonk, NY, USA).

Results

Differences among groups

Table 2 lists the sociodemographic characteristics of the groups. Groups differed for most sociodemographic variables even after the correction for multitesting. The healthy controls (compared with the other groups) were younger, more likely to be women, more likely to live alone, and were less likely to have had low school attainment. The controls also had a lower rate of physical comorbidities than did the other groups. Finally, the groups did not differ in terms of employment.

The groups differed only on one single dimension of the WHOQOL (see Table 3). Both patients and their relatives reported poorer physical health than did the healthy controls. Despite this, the raw scores on psychological health and environmental health were lower for patients and their relatives than for controls. The differences were not significant after controlling for multitesting.

The groups also differed on several dimensions of the MMPI-2-RF (see Table 4). Patients had a higher overall sense of physical debilitation and poorer health (MLS) than did first-degree relatives and healthy controls and complained of memory problems and difficulties in concentrating (COG) more often than did the healthy controls. They were also more likely to believe that goals cannot be reached or problems solved (HLP) and that they were more indecisive and inefficient (NFC) than were the healthy controls.

First-degree relatives of patients reported lower opinions of others (RC3), were more likely to believe that goals cannot be reached or problems solved (HLP) and often thought themselves to be more indecisive and inefficient (NFC) than did the healthy controls (see Table 4). Furthermore, they were more likely to report the presence of fears that

Table 1 Acronyms and description of each dimension of the Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF)**Validity scales: revised version of seven MMPI-2 validity indicators, one new infrequency scale, and one new measure of response bias**

VRIN-r	Variable Response Inconsistency	Random responding
TRIN-r	True Response Inconsistency	Fixed responding
F-r	Infrequent Responses	Responses infrequent in the general population
Fp-r	Infrequent Psychopathology Responses	Responses infrequent in psychiatric populations
Fs	Infrequent Somatic Responses	Somatic complaints infrequent in medical patients
FBS-r	Symptom Validity	Somatic and cognitive complaints associated at high levels with over-reporting
RBS	Response Bias	Non credible memory complaints
L-r	Uncommon Virtues	Rarely claimed moral attributes
K-r	Adjustment Validity	Avowals of good psychological adjustment associated at high levels with underreporting

Higher-order (H-O) scales: broad dimensional scales measuring emotional, thought, and behavioral dysfunction

EID	Emotional/Internalizing Dysfunction	Symptoms and difficulties associated with mood and affect
THD	Thought Dysfunction	Problems associated with thought disturbance
BXD	Behavioral/Externalizing Dysfunction	Problems associated with behavioral acting-out proclivities

Cognitive scales

MLS	Malaise	Overall sense of physical debilitation and poor health
GIC	Gastrointestinal Complaints	Complaints about recurring upset stomach, vomiting, nausea
HPC	Head Pain Complaints	Complaints about head and neck pain
NUC	Neurological Complaints	Various neurological complaints such as dizziness, weakness, loss of control over movement
COG	Cognitive Complaints	Complaints associated with memory problems and difficulties concentrating

Interpersonal Scales

FML	Family Problems	Negative family experiences
IPP	Interpersonal Passivity	Being submissive and unassertive
SAV	Social Avoidance	Avoiding or not enjoying social events
SHY	Shyness	Feeling uncomfortable and anxious around others
DSF	Disaffiliativeness	Disliking people and being around them

Restructured Clinical (RC) Scales: assessing the valuable descriptive and distinctive core features of the MMPI-2 Clinical Scales

RCd-(dem)	Demoralization	Unhappiness and life dissatisfaction
RC1-(som)	Somatic Complaints	Multiple physical health complaints
RC2-(lpe)	Low Positive Emotions	Lack of positive emotional experiences
RC3-(cyn)	Cynicism	Non self-reliant beliefs expressing a highly negative view of human nature
RC4-(asb)	Antisocial Behavior	Behavior that fails to conform to societal norms and expectations
RC6-(per)	Ideas of Persecution	Persecutory self-referential beliefs
RC7-(dne)	Dysfunctional Negative Emotions	Negative emotional experiences, such as maladaptive anxiety and irritability
RC8-(abx)	Aberrant Experiences	Unusual thoughts and perceptual experiences
RC9-(hpm)	Hypomanic Activation	Over-activation, mood instability, poor impulse control

Personality Psychopathology Five (PSY-5) Scales, revised

AGGR-r	Aggressiveness-revised	Instrumentally aggressive behavior
PSYC-r	Psychoticism-revised	Experiences associated with thought disturbance
DISC-r	Disconstraint-revised	Poor controlled behavior
NEGE-r	Negative Emotionality/Neuroticism-revised	Anxiety, insecurity, and fear
INTR-r	Introversion/Low Positive Emotionality-revised	Avoidance of social situations and low positive emotional experiences

Internalizing scales

SUI	Suicidal/Death Ideation	Reports of suicidal ideation and attempts
HLP	Helplessness/Hopelessness	Belief that problems cannot be overcome and feeling pessimistic
SFD	Self-Doubt	Lack of confidence and feeling useless
NFC	Inefficacy	Belief that one is incapable of making decisions
STW	Stress/Worry	Preoccupation with disappointments and with time pressure
AXY	Anxiety	Significant anxiety and anxiety related problems
ANP	Anger Proneness	Becoming easily upset, impatient and irritable
BRF	Behavior-Restricting Fears	Fears that significantly inhibit normal activities
MSF	Multiple Specific Fears	Disparate specific fears of blood, fire, thunder, etc

Externalizing scales

JCP	Juvenile Conduct Problems	Undesirable school and home conduct
SUB	Substance Abuse	Current and past alcohol and drugs abuse
AGG	Aggression	Violent and physically aggressive behavior
ACT	Activation	Heightened excitation and energy level

(Continued)

Table 1 (Continued)

Interest scales		
AES	Aesthetic-Literary Interests	Interest about activities such as theatre or music
MEC	Mechanical-Physical Interests	Interests about activities such as fixing and building things

significantly inhibit normal activities (BRF) than were the healthy controls.

There were also differences in the validity scales of the MMPI-2-RF (see Table 3). Patients and their first-degree relatives had higher scores on True Response Inconsistency (TRIN-r), Infrequent Responses (F-r), Infrequent Somatic Responses (Fs), and Symptom Validity (FBS-r) than did the controls. Thus, these groups endorsed “true” response more incoherently (fixed responding), and they more frequently endorsed responses that were infrequent in the general population, somatic complaints that were infrequent in medical populations, and somatic and cognitive complaints associated with higher levels of overreporting.

All the variables significant at the bivariate analyses were inserted as independent variables in a series of multinomial regression analyses, with groups as criteria (see Tables 5 and 6). The partial models indicated that sex, physical comorbidities, and the TRIN-r, MLS, and BRF dimensions of the MMPI-2-RF had significant effects on group differences (see Table 5). These variables were inserted into a final model, which fitted the data well and explained 66% of the variability of the data (Nagelkerke $R^2 = 0.66$) (see Table 6).

In the final model, all the independent variables, except for the BRF and physical health, had a significant effect on group differences. Patients (compared with healthy controls) were: less likely to be women (OR = 0.12; 95% CI: 0.02–0.78) ($P < 0.05$); less likely to live alone (OR = 0.08; 95% CI: 0.01–0.51) ($P < 0.01$); more likely to have physical comorbidities (OR = 27.43; 95% CI: 3.17–237.50)

($P < 0.01$); and more likely to report higher scores on the TRIN-r (OR = 1.99; 95% CI: 1.22–3.22) ($P < 0.01$) and on the MLS (OR = 1.88; 95% CI: 1.15–3.08) ($P < 0.05$). First-degree relatives (compared with healthy controls) were: less likely to live alone (OR = 0.20; 95% CI: 0.05–0.80) ($P < 0.05$); and more likely to have had lower amounts of schooling (OR = 5.16; 95% CI: 3.17–237.50) ($P < 0.05$).

Discussion

Previous studies have indicated that family members of patients with cancer – particularly spouses – share many caregiving tasks.^{16,17} In our sample, patients with MPM were frequently men who were over 50-years-old. Their caregivers were frequently women who were over 50-years-old, indicating that the MPM patients’ wives were the ones who provided direct care to their relatives.

The sociodemographic characteristics of our sample are concordant with those of the sample that participated in the BLF survey.⁸ In fact, MPM was most commonly contracted by adult individuals working in male-dominated trades or industries during the period in which asbestos was most frequently used.

Patients with MPM reported significantly poorer physical health on the WHOQOL and higher scores on the MMPI-2-RF MLS (overall sense of physical debilitation and poor health) and COG (complaints associated with memory problems and difficulties concentrating) scales than did controls, and almost all had physical comorbidities. MPM patients also had lower scores on all areas of QoL investigated with the WHOQOL

Table 2 Sociodemographic characteristics of the groups

Variables	1	2	3	Test	P<	Post hoc tests		
	Patients (N = 27)	First-degree caregivers (N = 55)	Healthy controls (N = 40)			Mean difference		
						12	13	23
Women	29.6%	78.2%	55.0%	$\chi^2_2 = 18.34$	<0.001**			
Age	61.41 ± 8.82	56.51 ± 13.66	44.63 ± 13.02	$F_{2,119} = 16.95$	<0.001**	4.90	16.78*	11.88*
Living alone	48.0	56.4	90.0	$\chi^2_2 = 16.11$	<0.001**			
School ≤8 years	60.0	47.3	7.5	$\chi^2_2 = 23.18$	<0.001**			
Job				$\chi^2_4 = 6.76$	0.15			
Employed	88.5	75.5	75.5					
Unemployed	7.7	3.8	3.8					
Other	3.8	20.8	20.8					
Physical comorbidities	92.0	59.3	30.8	$\chi^2_4 = 23.52$	<0.001**			

Notes: Benjamini–Hochberg correction for multitestings. *Significant for $P < 0.05$; **significant for $P < 0.01$. Tamhane’s post hoc tests.

Table 3 WHOQOL and validity scales of the MMPI-RF

Variables	1	2	3	Test	P<	Post hoc tests		
	Patients (N = 27)	First-degree relatives (N = 55)	Healthy controls (N = 40)			Mean difference		
						12	13	23
WHOQOL								
Physical health	57.28 ± 15.83	63.95 ± 14.54	75.40 ± 11.58	$F_{2;119} = 14.75$	<0.001**	-6.67	-18.12*	-11.45*
Psychological health	57.37 ± 15.34	61.09 ± 13.48	65.83 ± 10.77	$F_{2;119} = 3.47$	0.03			
Social health	62.50 ± 18.14	65.53 ± 14.97	69.17 ± 16.47	$F_{2;119} = 1.39$	0.25			
Environmental health	57.01 ± 16.20	56.23 ± 14.80	64.53 ± 11.73	$F_{2;119} = 4.32$	0.02			
Validity scales								
VRIN-r	5.04 ± 2.88	4.84 ± 2.43	4.30 ± 2.44	$F_{2;119} = 0.81$	0.45			
TRIN-r	12.96 ± 2.43	11.96 ± 2.03	10.63 ± 1.55	$F_{2;119} = 11.80$	<0.001**	1.00	2.34*	1.34*
F-r	6.11 ± 4.29	5.04 ± 4.30	3.13 ± 3.28	$F_{2;119} = 4.98$	0.008*	1.08	2.99*	1.91*
Fp-r	2.22 ± 1.95	2.25 ± 1.83	2.25 ± 1.63	$F_{2;119} = 0.003$	1.00			
Fs	3.48 ± 2.23	2.35 ± 2.14	1.18 ± 1.65	$F_{2;119} = 10.83$	<0.001**	1.14	2.31*	1.17*
FBS-r	11.74 ± 3.46	10.38 ± 4.48	8.10 ± 3.52	$F_{2;119} = 7.40$	0.001**	1.36	3.64*	2.28*
L-r	5.44 ± 2.04	5.55 ± 2.10	5.03 ± 2.85	$F_{2;119} = 0.59$	0.56			
K-r	6.00 ± 2.50	5.87 ± 2.88	7.50 ± 2.91	$F_{2;119} = 4.30$	0.02			

Notes: Benjamini–Hochberg correction for multitest. *Significant for $P < 0.05$; **significant for $P < 0.01$. Tamhane's post hoc tests.

Abbreviations: F-r, Infrequent Responses; FBS-r, Symptom Validity; Fp-r, Infrequent Psychopathology Responses; Fs, Infrequent Somatic Responses; K-r, Adjustment Validity; L-r, Uncommon Virtues; MMPI-RF, Minnesota Multiphasic Personality Inventory-2 Restructured Form; TRIN-r, True Response Inconsistency; VRIN-r, Variable Response Inconsistency; WHOQOL, World Health Organization Quality of Life.

(emotional, social, and environmental health), but the differences did not reach statistical significance. Nevertheless, the differences in QoL between patients with MPM and controls were moderate in terms of both Psychological Health and Environmental Health (Cohen's $D = 0.53$ [for Environmental Health] to 0.64 [for Psychological Health]), with MPM patients complaining of poorer health. We did not directly investigate the presence of affective symptomatology, mood disturbances, and chronic pain, or emotions such as sadness, grief, anger, and anxiety.¹⁸ Such emotions may not have been associated only with illness per se, but possibly also with the fact that most of them were exposed to asbestos prior to the implementation of occupational safety standards – thus, patients and families may have felt anger towards employers who did not inform them of these types of environmental and workplace hazards.¹⁸ Finally, it has been seen that patients and families have distress linked to lengthy legal battles, as they seek financial compensation from their employers for having developed an occupationally associated illness.¹⁸ In the BLF survey of MPM patients and their caregivers, approximately one out of two patients with MPM reported feeling depressed some or most of the time since diagnosis, 67% of them reported feeling anxiety some or most of the time, and 59% reported feeling fear.⁸

The caregivers of MPM patients also reported poorer physical health than did the controls, and frequent comorbidities with physical illness.¹⁷ Their scores on other areas of QoL, as measured by the WHOQOL, were constantly

higher than those of patients but lower than those of controls, except for environmental health, where they had the lowest raw scores and where the difference between them and controls was moderate, although not significant (Cohen's $D = 0.62$). This data could be linked to the fact they had been exposed to the fibers for years and now live in fear of succumbing to illness due to their long exposure to the carcinogenic stimulus.¹⁹

Our results are somewhat inconsistent with those of the BLF survey of MPM patients and their caregivers, in which more caregivers than patients with MPM reported that they had felt depressed since the diagnosis (around 80% of caregivers reported feeling depressed some or most of the time). The BLF survey suggested that feeling isolated was another common emotion among the caregivers of MPM patients (in that study, around 78% of caregivers reported feeling isolated/alone some or most of the time). In our sample, the caregivers reported a poorer perception of the environment and significantly higher scores than did controls in the RC3. Caregivers typically display increasingly cynical behavior and are often unable to understand the selflessness and helpfulness of others, many of which are perceived as being alien and less inclined to help and provide support to the patient. The content of this scale focuses on a cynical view of human nature and a generally negative view of the motivations of other people, reflecting the key idea that other people are looking out for their own interests most of the time and cannot be trusted.²⁰

Table 4 Personality profile broken down by group

Variables	1	2	3	Test	P<	Post hoc tests		
	Patients (N = 27)	First-degree relatives (N = 55)	Healthy controls (N = 40)			Mean difference		
						12	13	23
MMPI-2-RF Higher-Order (H-O) and Restructured Clinical (RC) scales								
EID	14.96 ± 6.24	13.93 ± 8.09	11.68 ± 6.72	$F_{2;119} = 1.89$	0.16			
THD	4.56 ± 3.84	3.91 ± 3.51	2.45 ± 2.96	$F_{2;119} = 3.54$	0.03			
BXD	5.52 ± 3.30	4.60 ± 2.76	5.98 ± 4.68	$F_{2;119} = 1.78$	0.17			
RCd	8.74 ± 4.97	7.56 ± 6.24	5.20 ± 4.90	$F_{2;119} = 3.70$	0.03			
RC1	8.00 ± 3.28	7.78 ± 4.70	5.68 ± 4.19	$F_{2;119} = 3.54$	0.03			
RC2	5.00 ± 2.66	4.67 ± 2.85	4.83 ± 2.69	$F_{2;119} = 0.13$	0.88			
RC3	9.26 ± 3.05	9.25 ± 2.84	7.33 ± 3.79	$F_{2;119} = 4.83$	0.01*	0.01	1.93	1.93*
RC4	4.15 ± 2.94	3.56 ± 2.27	5.00 ± 4.54	$F_{2;119} = 2.18$	0.12			
RC6	2.56 ± 2.33	2.25 ± 2.33	1.48 ± 1.69	$F_{2;119} = 2.45$	0.09			
RC7	8.56 ± 4.59	8.69 ± 5.15	6.45 ± 4.67	$F_{2;119} = 2.73$	0.07			
RC8	4.44 ± 3.72	3.31 ± 3.05	2.28 ± 3.06	$F_{2;119} = 3.72$	0.03			
RC9	12.56 ± 4.64	11.47 ± 4.23	11.20 ± 5.01	$F_{2;119} = 0.757$	0.47			
MMPI-2-RF Somatic/Cognitive and Internalizing Scales								
MLS	4.74 ± 2.09	2.96 ± 2.01	2.33 ± 1.62	$F_{2;119} = 13.36$	<0.001**	1.78*	2.42*	0.64
GIC	0.93 ± 1.44	0.80 ± 1.22	0.40 ± 1.01	$F_{2;119} = 1.89$	0.16			
HPC	1.85 ± 1.13	2.07 ± 1.70	1.20 ± 1.22	$F_{2;119} = 4.35$	0.02			
NUC	2.59 ± 1.69	2.31 ± 1.71	2.23 ± 1.82	$F_{2;119} = 0.38$	0.69			
COG	3.56 ± 2.75	2.29 ± 2.46	1.60 ± 1.96	$F_{2;119} = 5.49$	0.01*	1.27	1.96*	0.69
SUI	0.56 ± 0.75	0.49 ± 0.79	0.15 ± 0.43	$F_{2;119} = 3.86$	0.02			
HLP	2.59 ± 1.28	2.22 ± 1.26	1.40 ± 0.87	$F_{2;119} = 9.96$	<0.001**	0.37	1.19*	0.82*
SFD	1.11 ± 1.09	1.13 ± 1.17	0.60 ± 0.90	$F_{2;119} = 3.20$	0.04			
NFC	4.85 ± 2.43	4.45 ± 2.57	3.00 ± 2.32	$F_{2;119} = 5.83$	0.004*	0.40	1.85*	1.46*
STW	3.22 ± 1.50	3.20 ± 1.52	2.75 ± 1.69	$F_{2;119} = 1.14$	0.33			
AXY	1.30 ± 1.10	1.27 ± 1.27	0.68 ± 0.86	$F_{2;119} = 3.99$	0.02			
ANP	2.15 ± 1.79	2.16 ± 1.61	1.95 ± 1.74	$F_{2;119} = 0.21$	0.82			
BRF	2.00 ± 1.21	2.67 ± 1.83	1.45 ± 1.43	$F_{2;119} = 7.02$	0.001**	-0.67	0.55	1.22*
MSF	3.67 ± 2.08	4.29 ± 2.43	3.43 ± 2.19	$F_{2;119} = 1.81$	0.17			
Externalizing, Interpersonal, and Interest Scales								
JCP	1.37 ± 1.52	0.91 ± 0.93	1.43 ± 1.66	$F_{2;119} = 2.06$	0.13			
SUB	0.48 ± 0.75	0.36 ± 1.10	1.00 ± 1.40	$F_{2;119} = 3.77$	0.03			
AGG	2.44 ± 1.60	2.05 ± 1.38	2.15 ± 1.89	$F_{2;119} = 0.54$	0.59			
ACT	2.78 ± 1.55	2.65 ± 1.72	2.33 ± 1.69	$F_{2;119} = 0.71$	0.50			
FML	2.04 ± 1.87	1.80 ± 2.04	2.30 ± 2.27	$F_{2;119} = 0.67$	0.51			
IPP	2.89 ± 1.76	2.87 ± 1.90	3.08 ± 2.34	$F_{2;119} = 0.13$	0.88			
SAV	2.89 ± 2.08	3.55 ± 2.37	3.43 ± 2.75	$F_{2;119} = 0.67$	0.51			
SHY	2.96 ± 1.99	2.64 ± 2.35	2.05 ± 2.04	$F_{2;119} = 1.57$	0.21			
DSF	0.85 ± 1.03	0.87 ± 1.20	0.55 ± 1.09	$F_{2;119} = 1.06$	0.35			
AES	2.33 ± 1.66	3.16 ± 1.86	2.98 ± 1.70	$F_{2;119} = 2.03$	0.14			
MEC	2.41 ± 1.85	1.45 ± 1.41	1.43 ± 1.63	$F_{2;119} = 3.89$	0.02			
Personality Psychopathology Five (PSY-5) Scales								
AGGR-r	10.56 ± 2.59	10.07 ± 2.67	9.85 ± 3.26	$F_{2;119} = 0.50$	0.61			
PSYC-r	5.00 ± 3.89	4.24 ± 3.75	2.75 ± 3.21	$F_{2;119} = 3.51$	0.03			
DISC-r	5.19 ± 3.00	4.44 ± 2.62	5.45 ± 4.08	$F_{2;119} = 1.23$	0.30			
NEGE-r	8.30 ± 3.12	8.71 ± 3.78	6.90 ± 3.77	$F_{2;119} = 2.95$	0.06			
INTR-r	6.81 ± 2.94	7.36 ± 3.23	7.33 ± 3.61	$F_{2;119} = 0.28$	0.76			

Notes: Benjamini–Hochberg correction for multitest. *Significant for $P < 0.05$; **significant for $P < 0.01$. Tamhane's post hoc tests.

Abbreviations: ACT, Activation; AES, Aesthetic-Literary Interests; AGG, Aggression; AGGR-r, Aggressiveness-revised; ANP, Anger Proneness; AXY, Anxiety; BRF, Behavior-Restricting Fears; BXD, Behavioral/Externalizing Dysfunction; COG, Cognitive Complaints; DISC-r, Disconstraint-revised; DSF, Disaffiliativeness; EID, Emotional/Internalizing Dysfunction; FML, Family Problems; GIC, Gastrointestinal Complaints; HLP, Helplessness/Hopelessness; HPC, Head Pain Complaints; INTR-r, Introversion/Low Positive Emotionality-revised; IPP, Interpersonal Passivity; JCP, Juvenile Conduct Problems; MEC, Mechanical-Physical Interests; MLS, Malaise; MMPI, Minnesota Multiphasic Personality Inventory-2 Restructured Form; MSF, Multiple Specific Fears; NEGE-r, Negative Emotionality/Neuroticism-revised; NFC, Inefficiency; NUC, Neurological Complaints; PSYC-r, Psychoticism-revised; RC1, Somatic Complaints; RC2, Low Positive Emotions; RC3, Cynicism; RC4, Antisocial Behavior; RC6, Ideas of Persecution; RC7, Dysfunctional Negative Emotions; RC8, Aberrant Experiences; RC9, Hypomanic Activation; RCd, Demoralization; SAV, Social Avoidance; SFD, Self-Doubt; SHY, Shyness; STW, Stress/Worry; SUB, Substance Abuse; SUI, Suicidal/Death Ideation; THD, Thought Dysfunction.

Table 5 Partial multivariate models (criterion: groups)

Effect	Model fitting criteria	Likelihood ratio tests		
	-2 log likelihood	χ^2	df	P<
Likelihood ratio tests				
Model 1				
Sex	178.07	22.54	2	<0.001
Age	159.30	3.76	2	0.15
Living alone	165.83	10.29	2	0.01
School \leq 8 years	162.70	7.16	2	0.05
Physical comorbidities	169.60	14.07	2	0.001
Model 2				
TRIN-r	234.17	11.37	2	0.01
F-r	223.97	1.17	2	0.56
Fs	225.26	2.46	2	0.29
FBS-r	225.70	2.90	2	0.24
Model 3				
RC3	210.02	2.33	2	0.31
MLS	220.26	12.57	2	0.01
COG	211.51	3.82	2	0.15
HLP	212.69	5.00	2	0.08
NFC	208.91	1.22	2	0.54
BRF	217.20	9.51	2	0.01

Abbreviations: BRF, Behavior-Restricting Fears; COG, Cognitive Complaints; F-r, Infrequent Responses; FBS-r, Symptom Validity; Fs, Infrequent Somatic Responses; HLP, Helplessness/Hopelessness; MLS, Malaise; NFC, Inefficacy; RC3, Cynicism; TRIN-r, True Response Inconsistency.

The factors enlisted as causes of distress in patients with MPM (eg, legal battles for financial compensation and anger toward employers) may cause disappointment and lack of trust among caregivers and patients. Furthermore, feelings of helplessness/hopelessness and behavior-restricting fears are other common features among caregivers who look after patients with MPM. Some studies have supported the concept that younger, relatively poor caregivers who are actively providing care to their relatives for several years may benefit from interventions to improve their QoL.^{17,21}

Now we have to consider some limitations to the generalizability of the results. First, the number of patients with MPM was quite low, due to the short survival times. Moreover, some contrasts could not be significant due to the low power of the analyses. Furthermore, the low number of subjects in some groups may have caused wider confidence intervals in the multivariate analysis. Second, despite the fact that we excluded patients with any DSM-IV-TR Axis I or Axis II diagnosis, we did not use well-accepted measures to screen for depressive and anxiety symptomatology. Third, we only used self-report measures that were potentially

Table 6 Multinomial logistic regression analysis: final model (criterion: group differences)

Effect	Model fitting criteria	Likelihood ratio tests				95% CI of odds ratio			
	−2 log likelihood of reduced model	χ^2	df	P<		OR	Lower bound	Upper bound	P<
Likelihood ratio tests									
Final model									
Women	165.31	21.34	2	<0.001	Patients	0.12	0.02	0.78	0.05
	—	—	—	—	First-degree relatives	3.35	0.92	12.13	0.07
Living alone	153.31	9.35	2	0.01	Patients	0.08	0.01	0.51	0.01
	—	—	—	—	First-degree relatives	0.20	0.05	0.80	0.05
School ≤8 years	150.64	6.67	2	0.05	Patients	1.26	0.18	8.93	0.82
	—	—	—	—	First-degree relatives	5.16	1.12	23.82	0.05
Physical comorbidities	157.36	13.39	2	0.001	Patients	27.43	3.17	237.50	0.01
	—	—	—	—	First-degree relatives	1.25	0.40	3.89	0.70
TRIN-r	153.39	9.42	2	0.01	Patients	1.99	1.22	3.22	0.01
	—	—	—	—	First-degree relatives	1.23	0.87	1.74	0.24
MLS	156.75	12.78	2	0.01	Patients	1.88	1.15	3.08	0.05
	—	—	—	—	First-degree relatives	0.90	0.64	1.27	0.55
BRF	149.26	5.29	2	0.07	Patients	0.73	0.41	1.31	0.29
	—	—	—	—	First-degree relatives	1.22	0.84	1.76	0.30
Physical health	147.24	3.27	2	0.20	Patients	0.98	0.92	1.05	0.60
	—	—	—	—	First-degree relatives	0.96	0.91	1.01	0.10
						Pearson		Nagelkerke R ²	
−2 log likelihood						χ^2	df	P<	
Final model fitting statistics									
101.27						342.46	216	<0.001	0.66

Abbreviations: BRF, Behavior-Restricting Fears; CI, confidence interval; MLS, Malaise; OR, odds ratio; TRIN-r, True Response Inconsistency.

affected by social desirability bias, and – despite the validity of all the MMPI protocols – our results have shown some differences between groups for scales of validity, with patients and caregivers having higher scores than controls. Fourth, controls differed between patients and their relatives for several socio-demographic variables, even after controlling for other variables. Nevertheless, our research is the first systematic study investigating personality traits and QoL in MPM patients and their relatives who provide direct care.

Conclusion

Patients with MPM have poorer physical health, and they report a general feeling of malaise, cognitive symptoms, inefficacy, helplessness, and hopelessness. Caregivers, meanwhile, often report feelings of inefficacy and helplessness, and they lack trust in people. Due to the fact that the QoL of family caregivers and patients with cancer can vary along the illness trajectory,²² health care providers should assess the ongoing adjustment and emotional wellbeing of people with MPM and their relatives. After all, poorly recognized distress could lead to difficulties in making decisions about treatment, and poor adherence to medical treatment, and among family caregivers, lower engagement in health behaviors, such as cancer screening. Family-based psychoeducational programs and support groups for people affected by MPM and their family members may help to reduce the distress in patients and caregivers, improving their quality of life and lowering levels of caregiver burden.^{23,24} Nevertheless, to date, we have no controlled studies investigating the effectiveness of psychological interventions aimed to reduce emotional distress in MDM patients and their caregivers. Thus, future research is needed to identify guidelines for psychological best practices (through process and outcome studies). In this perspective, the assessment of personality traits in MDM patients and their caregivers could orient the intervention, with the aims of activating and reinforcing adherence to treatment and improving QoL.

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Disclosure

The authors report no conflicts of interest in this work.

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