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The psychological impact of asbestos exposure: risk perception and emotional distress among former workers in Tuscany

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Abstract

Background Exposure to asbestos continues to be a global health hazard, with significant mortality linked to asbestos-related diseases. Despite asbestos bans in many countries, including Italy (1992), former asbestos workers continue to experience health risks and psychological distress. This study examines the psychological impact of asbestos exposure among former workers enrolled in the Tuscany Region's health surveillance program, focusing on risk perception, emotional distress, and service evaluation.

Methods A cross-sectional study was conducted from October 2021 to September 2022, involving 362 former asbestos-exposed workers participating in the Tuscany Region's health surveillance program. Participants were interviewed via structured telephone surveys administered by trained psychologists. The questionnaire assessed asbestos-risk perception, self-perceived asbestos exposure, psychological distress (sadness, anxiety, anger, fear), and satisfaction with health services. Statistical analyses, including generalized logistic regression models, were performed to evaluate associations between risk perception and psychological symptoms.

Results Among participants, 77.9% believed they were at risk of developing an asbestos-related disease in the future, and 61.1% reported significant past exposure. Emotional distress was prevalent, with high self-perceived levels of sadness (mean: 5.1), anger (5.3), fear (4.9), and anxiety (4.0). Risk perception strongly correlated with psychological distress: those who believed they were at future risk exhibited higher levels of fear (OR: 2.86) and anger (OR: 2.56), while those who were uncertain about their past exposure showed increased anxiety (OR: 13.0) and anger (OR: 3.60). Additionally, knowing someone affected by an asbestos-related disease was associated with greater sadness (OR: 3.92) and fear (OR: 3.94). Despite psychological distress, health surveillance services were well-rated, particularly in staff availability (56.6%) and assistance quality (55.2%).

Conclusions This study emphasizes the psychological effects of asbestos exposure over the long term, underlining the need for integrated mental health support within health surveillance programs. The strong link between risk

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perception and emotional distress suggests that psychological interventions, like counselling and education ought to be used in conjunction with medical monitoring. Addressing these needs can enhance the well-being of former asbestos-exposed workers, mitigating the lasting effects of exposure-related uncertainty and fear. Future research should focus on developing targeted interventions to support this vulnerable population.

Keywords Asbestos exposure, Health surveillance, Psychological distress, Risk perception, Emotional impact, Occupational health

Background

Asbestos exposure remains a significant global health challenge and asbestos-related diseases continue to pose a public health issue worldwide. It is estimated that approximately 255,000 people die annually from asbestos-related diseases, with 233,000 of these deaths linked to occupational exposure [1, 2]. While numerous countries, including Japan, Australia, and the European Union, have banned the industrial production and processing of asbestos, the mineral continues to be mined, used, imported and exported in several countries. Russia, China, Kazakhstan, and Brazil are nowadays the major producers [3, 4].

Asbestos related diseases include asbestosis, pleural plaques, laryngeal, lung and ovary cancer, and mesothelioma [5, 6]. Mesothelioma, the most aggressive and prognostically unfavourable form of asbestos-related disease [7], is a rare cancer and its prevalence is notably high in regions historically marked by industrial asbestos use, leading to increased occupational and environmental exposure [8]. Incidence rates are expected to rise in nations where asbestos production and use persist [9–11]. Survival rates for mesothelioma are alarmingly low compared to other cancers, with median survival estimates ranging from 4 to 13 months without treatment and from 6 to 18 months with chemotherapy [12]. Furthermore, the latency period between asbestos exposure and disease onset can range from 20 to 45 years [8, 13], making diagnoses relevant even in countries that have stopped producing asbestos decades ago.

In Italy, despite a nationwide ban on asbestos since 1992, an average of 1,600 mesothelioma deaths have been recognized annually between 2010 and 2020 [14] and since 1993 a permanent surveillance system for mesothelioma incidence with a regional structure has been operating [15].

For residents in Italian areas where asbestos was used, the risk of contamination of their life environment profoundly impacts their psychological well-being. The anxiety and fear of developing asbestos-related diseases can disrupt individuals' somatopsychic equilibrium, both intrapsychically and interpersonally. This emotional strain may manifest as depression, anxiety, guilt, shame, irritability, and low self-efficacy, often accompanied by social withdrawal and diminished feelings of belonging [16–19]. Furthermore, risk perception extends beyond

the individual, influencing the social fabric of communities. It shapes collective experiences of distrust and helplessness in the face of survival's unpredictability, particularly in areas still grappling with asbestos-related risks [20]–[21].

Similar psychological distress might be relevant in workers with former occupational exposure. This dimension of risk perception among individuals formerly exposed to asbestos was explored by Mouchetrou Njoya and colleagues [22] in a study of 2,225 retired French workers. Analyzing 2,210 completed questionnaires, the researchers found significant levels of anxiety (19.7%) and depression (9.9%), alongside correlations between the perceived intensity of asbestos exposure, risk perception, and the likelihood of developing depressive and anxiety symptoms.

In view of these considerations, this study aims to examine the psychological needs of former asbestos-exposed workers participating in the health surveillance program of the Tuscany Region (Central Italy) [23, 24]. In Tuscany, there are also three sites where a contamination of asbestos or containing asbestos materials has been documented, that have been defined as “National Priority Contaminated Sites” (NPCSS) - namely Massa Carrara, Livorno, Piombino. Particularly, the relative risk of mesothelioma incidence has been investigated in such sites [25]. Our primary objectives are to assess these individuals' perceptions of asbestos-related risks, evaluate the quality and accessibility of information and health surveillance services they receive, and develop a tailored approach to addressing the psychological needs identified in this population.

Methods

Study participants

A health surveillance programme for former asbestos-exposed workers was organised in Tuscany Region since 2016 with the Deliberation of the Regional Administration of Tuscany (No. 396/2016) [23, 24]. The activities of the program, which are defined, revised and updated by a regional group of experts, also define the public health services in which the program must be implemented. The last program approved by the Tuscany Region and the regional group is divided into three stages: a first stage for a basic health assessment and a second and third stage for in-depth analyses [26].

The Regional Administration of Tuscany offers and guarantees a homogeneous program throughout the region. The former asbestos workers invited to participate in the program were people who lived in the Tuscany Region, aged less than 80 years, had been exposed to occupational asbestos in the last 30 years, retired or still employed at a facility distinct from the one where the exposure occurred and whose exposure is certified by a public Occupational Health Physician (OHP) [27]. The services provided to users as part of the health surveillance program were free of charge. Throughout the duration of the program, subjects who participated into the program, identified through data plant records, were invited to participate in this study aimed at examining their psychological needs. The survey was conducted through interviews with people attending the first and second level clinics of the health surveillance program, as well as with people attending the clinic for the first time and was conducted from October 2021 to September 2022. A structured questionnaire was administered via phone by two psychologists specifically trained for this type of service and on the psychological assessment of former asbestos-exposed individuals. The study protocol was approved by the Regional Ethics Committee for Clinical Research of the Tuscany Region (N. 17347_oss). Of the 495 people invited, 272 participated in the study, including 152 and 120 people attending first- and second-level clinics, respectively, and 90 people attending the clinic for the first time. Sixty-seven people refused to participate, and 67 individuals were unreachable.

Instruments and assessment

The questionnaire administered in this study (see Supplementary Materials) was developed ad hoc, based on a review of the relevant literature on the topic [17, 22, 28]. A preliminary pre-test conducted on a random sample allowed for the refinement of the instrument and the determination of the time required to complete the tool.

The questionnaire consists of the following sections:

- Accessibility and waiting times for the completion of the health surveillance visit (from the first access to the final delivering), scored on a scale from 1 (totally disagreement) to 5 (fully agreement).
- Customer satisfaction and relationship in connection to the quality of service, scored on a scale from 1 (very unsatisfied) to 5 (very satisfied).
- Quality of communication, scored on a scale from 1 (very unsatisfied) to 5 (very satisfied).
- Psychological needs and emotions associated with asbestos exposure (sadness, feeling depleted of energy, anxiety, shame, anger, deep spiritual suffering, disorientation, guilt, irritability, freezing of emotions, fear) experienced over the last 3 months,

scored on a scale from 0 (absence) to 10 (constant presence).

- Asbestos-exposure (self-assessment) scored with 1 (low), 2 (moderate), 3 (high), 4 (don't know).
- Asbestos-risk perception, with the following questions scored on a scale from 0 (totally disagreement) to 10 (fully agreement):

"All subjects exposed to asbestos will develop a disease"

"Cancer is the most frequent asbestos-related disease"

"There are effective treatments against all asbestos-related disease"

"For subjects exposed to asbestos, smoking cessation decrease the risk of developing cancer"

and the following questions with binary response:

"I think I'm at risk of developing an asbestos-related disease in the future" (yes, no).

"I think I'm currently suffering from an asbestos-related disease" (yes, no, don't know).

"Do you know someone who has developed an asbestos-related disease?" (yes, no).

All participants received information about the study and provided their informed consent.

Statistical analysis

Socio-demographic indicators and other general characteristics of the study population were first examined using frequencies. Secondly, the mean and standard deviation of the scores reflecting the states of mind associated with asbestos exposure were calculated. Generalised logistic regression models, adjusted by age-class and NPCCs, were used to estimate the association between each risk factor previously selected and the developing of sadness, anxiety, anger or fear, where a score ranging from 0 to 4 indicated a low self-perceived level of sadness, anxiety, anger, or fear, whereas a score from 5 to 10 indicated a high level. Odds Ratios (ORs) and their 95% Confidence Intervals (95% CI) were calculated for the whole group of participants, without considering gender due to the small number of females ($n = 5$). Mean differences of developing sadness, anxiety, anger or fear symptoms by asbestos-risk perception were evaluated through independent Samples t-Test. The significance level was set at $p < 0.05$. All analyses were conducted with STATA ver.13 software (StataCorp Release 13. College Station, TX) and IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp.

Table 1 Number and percentage of characteristics of study participants

Variable	No. (%)
Gender	
Female	5 (1.4)
Male	356 (98.3)
Missing	1 (0.3)
Age class	
< 68	111 (30.7)
68–77	189 (52.2)
> 77	59 (16.3)
Missing	3 (0.8)
Region of residence	
Lazio	1 (0.3)
Liguria	17 (4.7)
Toscana	313 (86.5)
Missing	31 (8.5)
Local Health Administration	
Local Health Authority 5 Spezzino ^a	17 (4.7)
Local Health Authority Rome 4	1 (0.3)
Local Health Unit Tuscany Centre and University Hospital of Florence	21 (5.8)
Local Health Unit Tuscany Northwest and University Hospital of Pisa ^a	265 (73.2)
Local Health Unit Tuscany Southeast and University Hospital of Siena	27 (7.5)
Missing	31 (7.5)
National Priority Contaminated Sites resident	
No	204 (56.4)
Yes	127 (35.1)
Missing	31 (8.5)
Total	362 (100.0)

^apresence of National Priority Contaminated Sites

Results

A total of 362 interviews were completed. Characteristics of study participants are shown in Table 1. The most were in the age-class 68–77 years (52.2%) and 98.3% ($n=356$) were males. Local Health Unit Tuscany Northwest (73.2%) was the most represented area. Originating from NPCSSs was found in 35.1% of participants.

There were no gender or geographic differences between those who declined to participate ($N=67$) and those who did. Conversely, the distribution by age classes was different in the two groups: 19.4% non-participants vs. 30.7% participants in the group < 68 years; 46.3% non-participants vs. 52.2% participants in the group 68–77 years; 32.8% non-participants vs. 16.3% participants in the group > 77 years. Regarding residents in NPCSS, the percentages were slightly higher for non-participants (37.3% non-participants vs. 35.1% participants) (Table SM1).

The states of mind over the last 3 months linked to having been formerly exposed to asbestos are reported in

Table 2 Mean and standard deviation (SD) of the scores relating to States of mind referred over the last 3 months

Over the last 3 months, have you experienced one or more of the following states of mind linked to having been exposed to asbestos ^a ?	mean $\pm$ SD
Sadness	5.1 $\pm$ 3.5
Feeling depleted of energy	1.8 $\pm$ 2.7
Anxiety	4.0 $\pm$ 3.1
Shame	0.5 $\pm$ 1.8
Anger	5.3 $\pm$ 3.7
Deep spiritual suffering	0.9 $\pm$ 2.1
Disorientation	0.9 $\pm$ 2.1
Guilt	0.9 $\pm$ 2.3
Irritability	3.3 $\pm$ 3.3
Freezing of emotions (not being able to feel your own)	1.3 $\pm$ 2.4
Fear	4.9 $\pm$ 3.4

^awe ask to respond by scoring from 0 to 10, where 0 means absence and 10 the constant presence of that state of mind

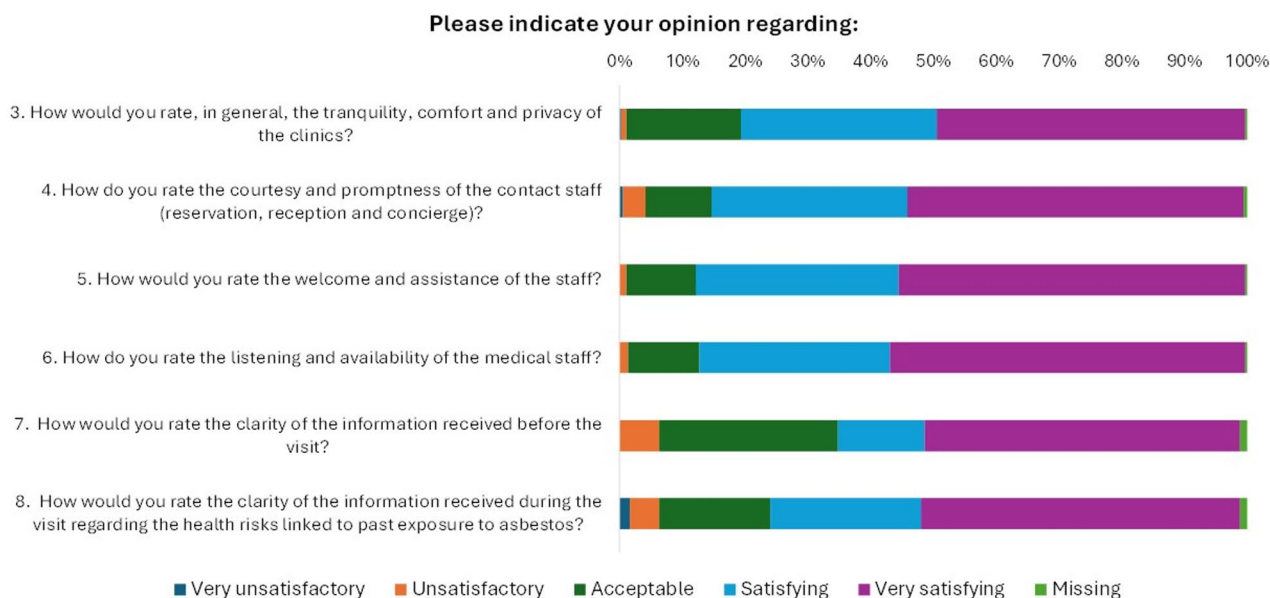
Table 2. The most frequent were sadness (mean: 5.1; SD: $\pm$ 3.5), anger (mean: 5.3; SD: $\pm$ 3.7), fear (mean: 4.9; SD: $\pm$ 3.4) and anxiety (mean: 4.0; SD: $\pm$ 3.1).

More than half of the responses regarding service quality were rated as ‘satisfactory’ and ‘very satisfactory’ (Fig. 1), particularly about the following questions: ‘How would you rate the welcome and assistance of the staff?’ (87.6%), ‘How do you rate the listening and availability of the medical staff?’ (87%) and ‘How do you rate the courtesy and promptness of the contact staff (reservation, reception and concierge)?’ (85%).

The frequencies of responses on ‘asbestos exposure’, ‘asbestos-risk perception’, ‘self-perception of current’ and ‘future asbestos-related diseases’ are reported in Fig. 2: 66.6% of participants think they are currently not suffering from an asbestos-related disease, while 77.9% think they are at risk of developing an asbestos-related disease in the future; 61.1% estimate a significant history of past asbestos exposure, and 86.4% know someone who has developed an asbestos-related disease.

The average agreement scores on asbestos-risk perception are summarized in Fig. 3. Most participants concur that for individuals exposed to asbestos, quitting smoking reduces the risk of developing cancer (mean: 7.7; SD: $\pm$ 2.2), that cancer is the most frequent asbestos-related disease (mean: 7.1; SD: $\pm$ 2.2) and that all subjects exposed to asbestos will develop a disease (mean: 6.3; SD: $\pm$ 2.5), while a minority reports that there are effective treatments against all asbestos related diseases (mean: 2.6; SD: 2.2).

The association between different levels of developing symptoms of sadness, anxiety, anger and fear and self-perception of current or future asbestos-related diseases, self-assessment of asbestos exposure, and asbestos-risk perception is shown in Table 3. Regarding *Self-perception of asbestos-related disease*, the opinion ‘I think I’m at risk



Note: the numbering of questions (from 3 to 8) refers to the questionnaire sections of “COMFORT AND RELATIONSHIP” and “QUALITY OF COMMUNICATION” (see the questionnaire in supplemental materials)

Fig. 1 Percentage of responses regarding service quality

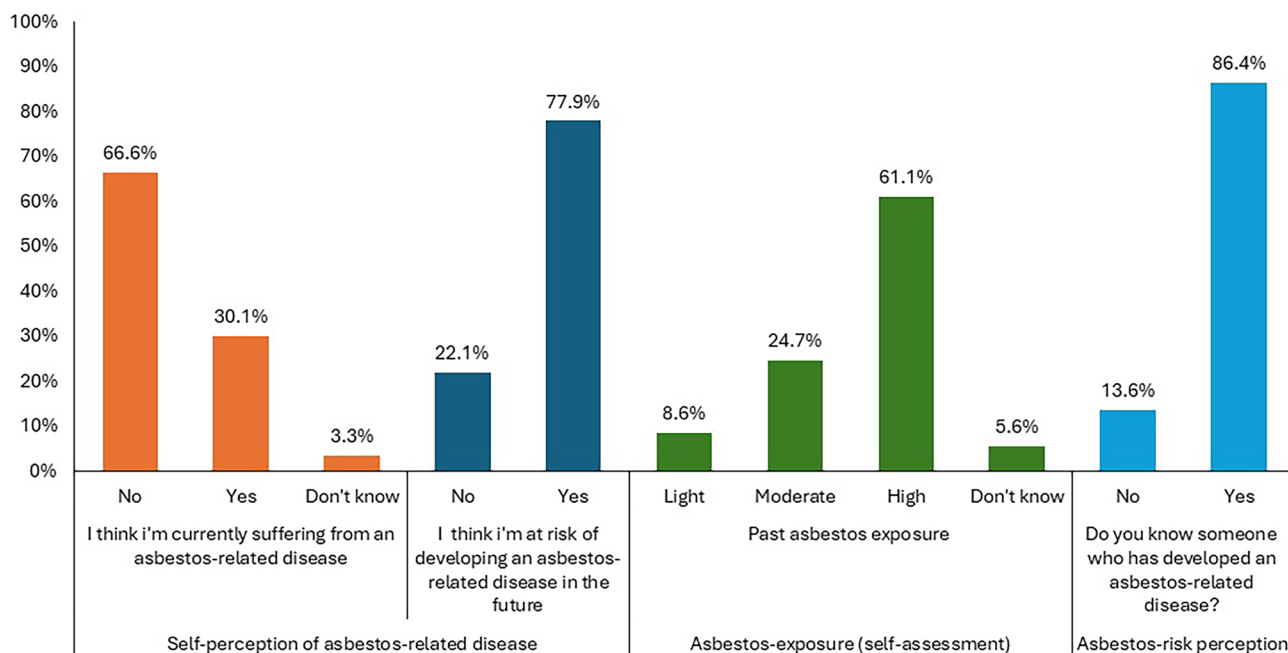


Fig. 2 Percentage of responses on self-perception of current and future asbestos-related diseases, past asbestos exposure, and asbestos-risk perception

of developing an asbestos-related disease in the future’ was significantly associated with developing symptoms of high self-perceived level of anger (OR: 2.56, 95% CI: 1.08–6.08) and fear (OR: 2.86, 95% CI: 1.19–6.83). Concerning *self-assessment of asbestos-exposure*, either estimating to have experienced a high past exposure

to asbestos either not knowing about their past exposure to asbestos were both significantly associated with increased symptoms of high self-perceived level of anxiety (OR: 17.0, 95% CI: 2.03–142.3 and OR: 13.0, 95% CI: 1.61–106.4 respectively). Not knowing about past exposure to asbestos was also significantly associated with the

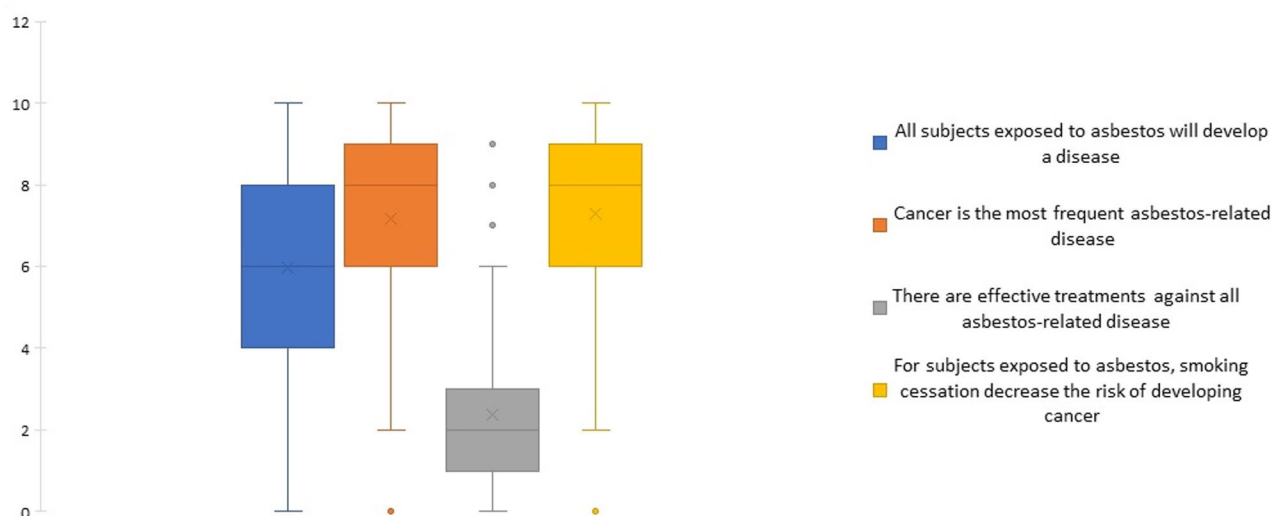


Fig. 3 Mean and standard deviation (SD) of the scores relating to questions on asbestos-risk perception (0=complete disagreement, 10=complete agreement)

increased symptoms of high self-perceived level of anger (OR: 3.60, 95% CI: 1.01–12.8) and fear (OR: 6.42, 95% CI: 1.69–24.3). Considering the answers regarding *Asbestos-risk perception*, knowing someone who has developed an asbestos-related disease was significantly associated with increased symptoms of high self-perceived level of sadness (OR:

3.92, 95% CI: 1.65–9.31), anger (OR: 2.45, 95% CI: 1.06–5.69) and fear (OR: 3.94, 95% CI: 1.65–9.36). Separated analyses for the two groups (residents and non-residents of a NPCS) were performed, but no statistically significant differences were found, except for “knowing someone who has developed an asbestos-related disease” ($p=0.027$), with a slightly higher percentage of cases reporting such knowledge among residents in NPCS (91.3%) than in non-residents in NPCS (82.7%) (Tables SM2).

The mean differences of developing different levels of sadness, anxiety, anger or fear by asbestos risk perception are reported in Table 4. People highly self-perceiving symptoms of sadness, anxiety, anger or fear (high score) were on average more in agreement than people characterised by low score with the following statements ($p<0.05$): “All subjects exposed to asbestos will develop a disease” and that “Cancer is the most frequent asbestos-related disease”. No differences between the two groups were observed about the statements “There are effective treatments against all asbestos-related disease” and “For subjects exposed to asbestos, smoking cessation decrease the risk of developing cancer”.

Discussion

Previous studies have shown that asbestos exposure, whether occupational or environmental, is associated with significant levels of psychological stress, anxiety, and

depression, and this applies not only to mesothelioma patients but also to others who have been exposed to asbestos [17, 29]. The persistent psychological impact of asbestos exposure among former workers, even decades after the cessation of occupational exposure, is a significant finding of this study. In fact, almost 78% of participants in this study thinks to be at risk of developing an asbestos-related disease in the future and the most are aware that cancer is the most frequent asbestos-related disease. This study highlights the prevalence of emotional distress, including sadness, anger, fear, and anxiety, among the participants, which underscores the long-term consequences of asbestos exposure on mental health.

Widespread knowledge on long latency of asbestos related cancers as well as their poor prognosis [6] are factors contributing to the high levels of psychological distress observed in the study population. The latency period, which can span 20 to 45 years, creates a prolonged period of uncertainty and anxiety for exposed individuals. The awareness that asbestos-related

diseases, such as mesothelioma, have poor prognoses and limited treatment options further exacerbates these feelings of helplessness and fear.

The study reveals that risk perception plays a crucial role in the psychological well-being of former asbestos workers: participants who perceived a higher risk of developing asbestos-related diseases or who knew someone affected by such diseases reported higher levels of sadness, anger, and fear. It should be noted, however, that responders were those who agreed to receive health care for their previous exposure to asbestos, presenting themselves spontaneously to the public health surveillance services specifically dedicated to them. This finding aligns with previous research indicating that perceived

Table 3 Frequencies (No. And %) And odds ratios with 95%CI of developing different levels (score) of sadness, anxiety, anger or fear symptoms, by self-perception of current or future asbestos-related diseases, self-assessment of asbestos exposure, and asbestos-risk perception

Score	Sadness			Anxiety			Anger			Fear		
	0-4 ^a	No. (%)	5-10 ^b	0-4 ^a	No. (%)	5-10 ^b	0-4 ^a	No. (%)	5-10 ^b	0-4 ^a	No. (%)	5-10 ^b
Self-perception of asbestos-related disease												
<i>I think I'm currently suffering from an asbestos-related disease</i>												
No	66 (75)	103 (65.6)	1.00	84 (74.3)	86 (64.7)	1.00	69 (76.7)	101 (64.7)	1.00	72 (78.3)	98 (63.6)	1.00
Yes	19 (21.6)	48 (30.6)	1.12 (0.25–4.99)	27 (23.9)	40 (30.1)	0.34 (0.06–1.76)	18 (20)	49 (31.4)	1.15 (0.26–5.09)	17 (18.5)	50 (32.5)	1.05 (0.24–4.64)
Don't know	3 (3.4)	6 (3.8)	1.50 (0.32–7.05)	2 (1.8)	7 (5.3)	0.53 (0.09–2.86)	3 (3.3)	6 (3.8)	1.74 (0.37–8.20)	3 (3.3)	6 (3.9)	2.16 (0.45–10.2)
<i>I think I'm at risk of developing an asbestos-related disease in the future</i>												
No	19 (21.6)	21 (13.4)	1.00	22 (19.5)	18 (13.5)	1.00	19 (21.1)	21 (13.5)	1.00	21 (22.8)	19 (12.3)	1.00
Yes	35 (39.8)	53 (33.8)	1.73 (0.75–3.98)	40 (35.4)	48 (36.1)	1.66 (0.71–3.87)	32 (35.6)	56 (35.9)	2.56 (1.08–6.08)	33 (35.9)	55 (35.7)	2.86 (1.19–6.83)
Asbestos-exposure (self-assessment)												
<i>Past asbestos exposure</i>												
Light	13 (14.8)	15 (9.6)	1.00	16 (14.2)	12 (9)	1.00	14 (15.6)	14 (9)	1.00	16 (17.4)	12 (7.8)	1.00
Moderate	23 (26.1)	48 (30.6)	0.93 (0.21–3.98)	28 (24.8)	44 (33.1)	6.41 (0.69–59.46)	31 (34.4)	41 (26.3)	1.30 (0.30–5.58)	29 (31.5)	43 (27.9)	1.06 (0.23–4.82)
High	46 (52.3)	88 (56.1)	1.73 (0.46–6.40)	59 (52.2)	75 (56.4)	17.0 (2.03–142.3)	38 (42.2)	96 (61.5)	1.75 (0.48–6.43)	39 (42.4)	95 (61.7)	2.91 (0.75–11.2)
Don't know	6 (6.8)	6 (3.8)	1.76 (0.5–6.22)	10 (8.8)	2 (1.5)	13.0 (1.61–106.4)	7 (7.8)	5 (3.2)	3.60 (1.01–12.8)	8 (8.7)	4 (2.6)	6.42 (1.69–24.3)
Asbestos-risk perception												
<i>Do you know someone who has developed an asbestos-related disease?</i>												
No	18 (20.5)	12 (7.6)	1.00	17 (15)	13 (9.8)	1.00	17 (18.9)	13 (8.3)	1.00	18 (19.6)	12 (7.8)	1.00
Yes	70 (79.5)	145 (92.4)	3.92 (1.65–9.31)	96 (85)	120 (90.2)	1.56 (0.68–3.58)	73 (81.1)	143 (91.7)	2.45 (1.06–5.69)	74 (80.4)	142 (92.2)	3.94 (1.65–9.36)

^aSymptoms of low self-perceived level of sadness, anxiety, anger or fear^bSymptoms of high self-perceived level of sadness, anxiety, anger or fear^cAdjusted by age class and National Priority Contaminated Sites

Table 4 Mean and standard deviation ($\pm$ SD) of developing sadness, anxiety, anger or fear symptoms by asbestos-risk perception

Agreement Score	Sadness			Anxiety			Anger			Fear		
	0-4 ^a	5-10 ^b	p-value	0-4 ^a	5-10 ^b	p-value	0-4 ^a	5-10 ^b	p-value	0-4 ^a	5-10 ^b	p-value
All subjects exposed to asbestos will develop a disease	5.1 $\pm$ 2.8	6.4 $\pm$ 2.6	<0.001	5.4 $\pm$ 2.9	6.4 $\pm$ 2.6	0.007	4.9 $\pm$ 2.6	6.5 $\pm$ 2.7	<0.001	4.9 $\pm$ 2.7	6.5 $\pm$ 2.7	<0.001
Cancer is the most frequent asbestos-related disease	6.6 $\pm$ 2.6	7.6 $\pm$ 2.1	0.005	6.9 $\pm$ 2.5	7.5 $\pm$ 2.2	0.030	6.6 $\pm$ 2.4	7.6 $\pm$ 2.2	0.003	6.4 $\pm$ 2.6	7.7 $\pm$ 2	<0.001
There are effective treatments against all asbestos-related disease	2.3 $\pm$ 2.3	2.5 $\pm$ 2.3	0.625	2.5 $\pm$ 2.2	2.4 $\pm$ 2.3	0.769	2.6 $\pm$ 2.3	2.4 $\pm$ 2.3	0.514	2.3 $\pm$ 2.3	2.5 $\pm$ 2.2	0.446
For subjects exposed to asbestos, smoking cessation decrease the risk of developing cancer	7.1 $\pm$ 2.5	7.5 $\pm$ 2.2	0.153	7.4 $\pm$ 2.1	7.3 $\pm$ 2.4	0.780	7.2 $\pm$ 2.5	7.5 $\pm$ 2.1	0.335	7.2 $\pm$ 2	7.4 $\pm$ 2.4	0.597

^aSymptoms of low self-perceived level of sadness, anxiety, anger or fear^bSymptoms of high self-perceived level of sadness, anxiety, anger or fear

health risks might significantly influence mental health outcomes [17, 22, 28, 29]. From these studies, it emerges that people who perceive a high risk of developing asbestos-related diseases, or who believe that “all individuals exposed to asbestos will get sick,” exhibit higher levels of anxiety and depression.

Previous studies [22, 28] show that self-assessment of past asbestos exposure intensity is significantly correlated with symptoms of anxiety and depression. This suggests that the subjective perception of exposure plays a key role in determining the psychological impact. In this study, 61% of the participants believe they had a high level of past asbestos exposure, and this perception is associated with a higher risk of reported anxiety states. The self-assessment of the intensity of past asbestos exposure, without an objective comparison of the evaluation made by experts, represents one of the main limitations of the study.

The use of non-validated psychological measures for assessing anxiety and depression, along with the development of an ad hoc questionnaire based on the study by Mouchetrou et al. 2017 [22], represent additional limitations of our work. In fact, there are no measures of the questionnaire’s reliability and statistical validity, which could be evaluated in the development of the study. This constitutes a limitation for the generalizability of the results. Moreover, another limitation is the use of telephone interviews, although these were conducted by professional psychologists adequately trained on the topic.

The perception of risk is not only influenced by personal knowledge and health concerns but also by the broader social context, including the experiences of peers and community members. This study, consistently with previous research [22, 28], highlights that knowing someone who has developed an asbestos-related disease can heighten the perception of threat and contribute to greater psychological distress.

The positive evaluation of the health surveillance services provided by the Tuscany Region is an encouraging aspect of this study. High satisfaction levels with the accessibility and overall service quality perception suggest that these programs are well-received by the participants, despite a higher clarity of the information received need more attention. The structured and comprehensive nature of the health surveillance program, which includes first-level basic health evaluations and second- and third-level in-depth analyses, ensures that former asbestos workers receive thorough and consistent care. The program’s design, which guarantees homogeneity across the region, is a critical factor in its success [23, 24].

However, the results of the study, aimed to evaluate the necessity for a tailored psychological support within this program, confirmed this need. While the health surveillance services are highly valued, addressing the

specific emotional and psychological needs of former asbestos-exposed workers could further enhance their overall well-being. The anxiety and fear associated with the risk of developing asbestos-related diseases can disrupt individuals' somato-psychic equilibrium, leading to depression, anxiety, guilt, shame, irritability, and low self-efficacy. These emotional strains often manifest as social withdrawal and diminished feelings of belonging, which can further exacerbate the psychological burden [30].

Developing a tailored approach for addressing the psychological needs identified in this population is essential. This could include providing targeted psychological counselling, support groups, and educational programs to help individuals manage their anxiety and fear. Additionally, improving the quality and accessibility of information about asbestos-related risks and health surveillance services can empower individuals and reduce feelings of helplessness. Ensuring that former asbestos workers have access to accurate and comprehensive information about their health risks and the available support services is crucial in mitigating the psychological impact of asbestos exposure.

Conclusion

Despite the ban on asbestos use in Italy since 1992, the psychological burden on individuals previously exposed remains substantial. This study emphasizes the importance of comprehensive health surveillance programs that should provide a robust psychological support for individuals who have suffered an asbestos exposure and not only monitor their physical health. The findings highlight the need for a holistic approach to health care that addresses both the physical and psychological aspects of asbestos-related diseases. Future research should focus on developing and evaluating interventions aimed at reducing psychological distress and improving mental health outcomes in this vulnerable population. By addressing the psychological needs of former asbestos-exposed workers, health care providers might significantly enhance their quality of life and overall well-being.

Abbreviations

NPCS	National Priority Contaminated Site
OR	Odds Ratio
CI	Confidence Interval
SD	Standard Deviation

Supplementary information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-025-24334-3>.

Supplementary Material 1. Questionnaire administered; tables SM1 and SM2

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Authors' contributions

*MBo and EC designed the study; ABa, VC, RC, FD, SF, GG, AMe, EP, AR, GSi, GSp, LT carried out the activities of the health surveillance programme for former asbestos-exposed workers; MBo, MBu, AG, IGF, MDS and ABi wrote the main manuscript text; MBu and ABi analyzed the data; MBo, MBu, AMa, LM, SP, AG, IGF, MDS and ABi interpreted the data. All authors read and approved the final manuscript."

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Data availability

The dataset analysed during the current study is not publicly available due to privacy concerns but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The questionnaire and methodology for this study was approved by the Regional Ethics Committee for Clinical Research of the Tuscany Region (N. 17347_oss). The study adhered to the Declaration of Helsinki. All participants received information about the study and provided their informed consent.

Consent for publication

Not applicable (the manuscript does not contain data from any individual person).

Competing interests

The authors declare no competing interests.

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References

1. Furuya S, Chimed-Ochir O, Takahashi K, David A, Takala J. Global asbestos disaster. *Int J Environ Res Public Health*. 2018;15(5): 1000. <https://doi.org/10.3390/ijerph15051000>.
2. Wilk E, Króćczyńska M. Malignant mesothelioma and asbestos exposure in Europe. *Geospat Health*. 2021;16(1). <https://doi.org/10.4081/gh.2021.951>.
3. Berry T-A, Belluso E, Vigliaturo R, Gieré R, Emmett EA, Testa JR, et al. Asbestos and other hazardous fibrous minerals: potential exposure pathways and associated health risks. *Int J Environ Res Public Health*. 2022;19(7): 4031. <https://doi.org/10.3390/ijerph19074031>.

4. World Integrated Trade Solution (WITS). Asbestos exports by country in 2021. <https://wits.worldbank.org/trade/comtrade/en/country/ALL/year/2021/trade-flow/Exports/partner/WLD/product/252400>. Accessed 10 Mar 2025.
5. IARC. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Arsenic, Metals, Fibres, and Dusts. Volume 100 C. Lyon, France. 2012. <https://publications.iarc.fr/120>. Accessed 10 Mar 2025.
6. Oksa P, Wolff H, Vehmas T, Pallasaho P, Frilander H. Asbestos, asbestosis, and cancer. Helsinki criteria for diagnosis and attribution. Helsinki: Finnish Institute of Occupational Health; 2014.
7. Ulla-Mari T. Mar. Protection of workers from the risks related to exposure to asbestos at work. [https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI\(2023\)734709](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2023)734709). Accessed 10 2025.
8. Marinaccio A, Binazzi A, Bonafede M, Di Marzio D, Scarselli A. Regional operating centres. Epidemiology of malignant mesothelioma in Italy: surveillance systems, territorial clusters and occupations involved. *J Thorac Dis*. 2018;Suppl 2S221–7. <https://doi.org/10.21037/jtd.2017.12.146>.
9. Carbone M, Adusumilli PS, Alexander HR Jr, Baas P, Bardelli F, Bononi A, et al. Mesothelioma: scientific clues for prevention, diagnosis, and therapy. *CA Cancer J Clin*. 2019;69(5):402–29. <https://doi.org/10.3322/caac.21572>.
10. Gariazzo C, Gasparrini A, Marinaccio A. Asbestos consumption and malignant mesothelioma mortality trends in the major user countries. *Ann Glob Health*. 2023;89(1): 11. <https://doi.org/10.5334/aogh.4012>.
11. Miao X, Yao T, Dong D, Chen Z, Wei W, Shi Z, et al. Global, regional, and National burden of non-communicable diseases attributable to occupational asbestos exposure 1990–2019 and prediction to 2035: worsening or improving? *BMC Public Health*. 2024;24(1):832. <https://doi.org/10.1186/s12889-024-18099-4>.
12. Demirjian CC, Saracino RM, Napolitano S, Schofield E, Walsh LE, Key RG, et al. Psychosocial well-being among patients with malignant pleural mesothelioma. *Palliat Support Care*. 2024;22(1):57–61. <https://doi.org/10.1017/S1478951522001596>.
13. Huang J, Chan SC, Pang WS, Chow SH, Lok V, Zhang L, et al. Global incidence, risk factors, and temporal trends of mesothelioma: a population-based study. *J Thorac Oncol*. 2023;18(6):792–802. <https://doi.org/10.1016/j.jtho.2023.01.095>.
14. Istituto Superiore di Sanità. Impact of asbestos on mortality. Italy, 2010–2020. Fazzo L, De Santis M, Minelli G, Zona A, editors. Rapporti ISTISAN 24/18; 2024, iii, p. 84 (in Italian). <https://www.iss.it/-/rapporto-istisan-24/18-impatto-dell-amianto-sulla-mortalita-italia-2010-2020-a-cura-di-lucia-fazzo-marco-de-santi-s-giada-minelli-amerigo-zona>. Accessed 10 Mar 2025.
15. National Institute for Accident Insurance at Work (INAIL). Italian national mesothelioma registry – ReNaM, VIII Report. 2024 (in Italian). <https://www.inail.it/portale/it/inail-comunica/pubblicazioni/catalogo-generale/catalogo-generale-dettaglio.2025.02.registro-nazionale-dei-mesoteliomi--ottavo-rapporto.html>. Accessed 10 Mar 2025.
16. Granieri A, Borgogno FV, Franzoi IG, Gonella M, Guglielmucci F. Development of a brief psychoanalytic group therapy (BPG) and its application in an asbestos National priority contaminated site. *Ann Ist Super Sanita*. 2018;54(2):160–6. https://doi.org/10.4415/ANN_18_02_12.
17. Bonafede M, Ghelli M, Corfiati M, Rosa V, Guglielmucci F, Granieri A, et al. The psychological distress and care needs of mesothelioma patients and asbestos-exposed subjects: a systematic review of published studies. *Am J Ind Med*. 2018;61(5):400–12. <https://doi.org/10.1002/ajim.22831>.
18. Bonafede M, Granieri A, Binazzi A, Mensi C, Grosso F, Santoro G, et al. Psychological distress after a diagnosis of malignant mesothelioma in a group of patients and caregivers at the National priority contaminated site of Casale Monferrato. *Int J Environ Res Public Health*. 2020;17(12):4353. <https://doi.org/10.3390/ijerph17124353>.
19. Franzoi IG, Sauta MD, Bonafede M, Francioso G, De Luca A, Barbagli F, et al. Psychological distress in patients with asbestos-related diseases and their families: a systematic literature review. *Psychooncology*. 2025;34(1): e70051. <https://doi.org/10.1002/pon.70051>.
20. Legg R, Prior J, Adams J, McIntyre E. The relations between mental health and psychological wellbeing and living with environmental contamination: a systematic review and conceptual framework. *J Environ Psychol*. 2023;87: 101994. <https://doi.org/10.1016/j.jenvp.2023.101994>.
21. Granieri A. The drive for Self-Assertion and the reality principle in a patient with malignant pleural mesothelioma: the history of Giulia. *Am J Psychoanal*. 2017;77(3):285–94. <https://doi.org/10.1057/s11231-017-9099-0>.
22. Mouchetrou Njoia I, Paris C, Dinot J, Luc A, Lighezzolo-Alnot J, Pairon JC, et al. Anxious and depressive symptoms in the French Asbestos-Related diseases cohort. *Eur J Public Health*. 2017;27(2):359–66. <https://doi.org/10.1093/eurpub/ckw106>.
23. Chellini E, Battisti F, Pellegrini M, Baldacci M, Sallase D, Cristaudo A, et al. Health surveillance programme for workers with past asbestos exposure in Tuscany region (Central Italy). *Epidemiol Prev*. 2018;42(2):171–7. <https://doi.org/10.19191/EP18.2.P171.047>.
24. Chellini E, Battisti F, Cristaudo A, Sartorelli P, Calà P. Health surveillance for former asbestos exposed worker: a specific programme developed in an Italian region. *J Thorac Dis*. 2018;10(Suppl 2):S383–9.
25. Binazzi A, Marinaccio A, Corfiati M, Bruno C, Fazzo L, Pasetto R, et al. Mesothelioma incidence and asbestos exposure in Italian National priority contaminated sites. *Scand J Work Environ Health*. 2017;43(6):550–9. <https://doi.org/10.5271/sjweh.3676>.
26. Sorveglianza sanitaria dei lavoratori ex-esposti ad amianto. Vademecum per gli operatori degli ambulatori. Versione IV (in Italian). https://www301.regione.toscana.it/bancadati/atti/Contenuto.xml?id=5409103&nomeFile=Delibera_n.193_del_26-02-2024-Allegato-A. Accessed 10 Mar 2025.
27. Chellini E, Lippi G, Festa G, Fani S, Capacci F, Martini A, et al. Identification of workers with past asbestos exposure in Tuscany eligible to health surveillance programme. *Med Lav*. 2019;110(1):46–55. <https://doi.org/10.23749/mdl.v110i1.7739>.
28. Maurel M, Stoufflet A, Thorel L, Berna V, Gislar D, Letourneux M, et al. National network of asbestos Post-Exposure survey; Paris C. Factors associated with cancer distress in the asbestos Post-Exposure survey (APEXS). *Am J Ind Med*. 2009;52(4):288–96. <https://doi.org/10.1002/ajim.20672>.
29. Siefert E, Delva F, Paris C, Pairon J-C, Thaon I. Quality of life in retired workers with past exposure to asbestos. *Am J Ind Med*. 2024;67(7):610–23. <https://doi.org/10.1002/ajim.23592>.
30. Franzoi IG, Sauta MD, De Luca A, Barbagli F, Granieri A. Psychological interventions for mesothelioma patients and their caregivers: A systematic literature review. *J Pain Symptom Manage*. 2024;68(5):e347–55. <https://doi.org/10.1016/j.jpainsymman.2024.07.004>.

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