Scholar Publishing Group
International Journal of World Medicine
https://doi.org/10.38007/IJWM.2023.040301
ISSN 2789-7133 Vol. 4, Issue 3: 1-10

# *Analysis of Prognosis, Survival Status, and Risk Factors of Occupational Pneumoconiosis Patients in Lanzhou Area*

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***Keywords:*** Occupational Pneumoconiosis, Prognostic Survival Status, Multiple Factors

***Abstract:*** Analyze the prognosis, survival status, and risk factors of occupational pneumoconiosis patients in Lanzhou area.Methods:100 pneumoconiosis patients hospitalized in our hospital from December 2022 to January 2023 were selected as the research subjects, including 67 male patients and 13 female patients; Initial diagnosis period: 77 cases in the first stage, 16 cases in the second stage, and 7 cases in the third stage. According to survival or not, they were divided into a survival group of 85 cases and a death group of 15 cases. A self-made survey questionnaire was used to collect patients' age, gender, occupational history, smoking history, past medical history, current medical history, complications, and other information. Patients were followed up for 1 year to understand their prognosis and survival status. They were divided into survival group and death group based on survival for comparative analysis. Logistic regression analysis was used to determine the risk factors for mortality after occupational pneumoconiosis. The prevalence rate was higher in the age group of 50-69, with 66 cases (66.00%), 23 cases (23.00%) aged 70-80, and 11 cases (11.00%) aged 30-49; 77 cases (77.00%) in the first stage, 16 cases (16.00%) in the second stage, and 7 cases (7.00%) in the third stage of the staging; Coal workers' pneumoconiosis was the main cause of pneumoconiosis in 87 cases (87.00%), followed by silicosis in 9 cases (9.00%), with a statistically significant difference (P<0. 05) 05) The results of univariate analysis showed that exposure to dust, smoking history, presence or absence of comorbidities, advanced stage of pneumoconiosis, initial diagnosis stage, and type of pneumoconiosis were the single factors affecting the prognosis and mortality of patients with chronic pneumoconiosis (P<0.05); Gender and age are not single factors that affect the prognosis and mortality of patients with chronic pneumoconiosis (P>0.05). The survival state variable is whether occupational pneumoconiosis patients die from pneumoconiosis or its complications during the observation period (0=no, 1=yes), and the observation time is the survival time variable. The time dependent variable is the length of work exposed to dust (≤ 10 years=1,>10 years=2), smoking history (yes=1, no=0), comorbidities (yes=1, no=0), and advanced stage of pneumoconiosis (yes=1, no=0). The time dependent variable is the initial diagnosis stage (first stage=1, second stage=2, third stage=3) The type of pneumoconiosis (silicosis=1, coal worker's pneumoconiosis=2, other pneumoconiosis=3), age (≤ 50 years of age=1,>50 years of age=2) are independent variables. Multiple categorical variable are transformed into dummy variables for analysis. The hazard ratio (HR) of variables and its 95% confidence interval are calculated using the forward method of non proportional risk Cox regression model. The results showed that exposure to dust, smoking history, presence or absence of comorbidities, advanced stage of pneumoconiosis, initial diagnosis stage, and type of pneumoconiosis were the influencing factors for the survival time of occupational pneumoconiosis patients ($P<0.05$). The prognosis and survival of patients with chronic pneumoconiosis are poor, and exposure to dust, smoking history, presence or absence of comorbidities, advanced stage of pneumoconiosis, initial diagnosis stage, and type of pneumoconiosis are independent risk factors that affect the prognosis and death of patients with chronic pneumoconiosis. Special attention should be paid to workers with risk factors, and timely health examinations should be conducted to achieve early detection and treatment; Actively treating comorbidities and quitting smoking can effectively improve patient prognosis.

## 1. Introduction

Occupational pneumoconiosis is an occupational disease that is caused by long-term inhalation of productive dust during occupational activities, resulting in diffuse fibrosis of lung tissue in the patient's lungs. It is a systemic disease. According to current occupational epidemiology, there are over 20 million township enterprises in China with over 200 million employees, of which 16% are engaged in dust exposure operations [1-2]. Due to the backwardness of the enterprise industry and the fact that the employees are mainly farmers, there is a lack of knowledge about the hazards of dust, and there are no guarantee measures in work. They are often severely affected households with pneumoconiosis[3]. In a large number of ore mining areas, especially small coal mines, cement industries, etc., are the main sources of pneumoconiosis. The clinical manifestation is long-term chronic cough, accompanied by excessive phlegm, showing a yellow dense shape, difficult to cough up, chest pain, and difficulty breathing, which are also inherent symptoms of sitting lung disease [4]. At present and in the future, pneumoconiosis is a major threat to the health of workers exposed to dust. Effective understanding of the prognosis, survival, and risk factors of chronic pneumoconiosis is of great significance for the prevention and control of chronic pneumoconiosis. Therefore, this article aims to analyze the prognosis, survival, and risk factors of occupational pneumoconiosis patients in Lanzhou area. The following report is presented.

## 2. Object and Method

### 2.1 Research Subjects

100 pneumoconiosis patients hospitalized in our hospital from December 2022 to January 2023 were selected as the research subjects, including 67 male patients and 13 female patients; The average age is (53.24 ±9.18) years old; Initial diagnosis period: 77 cases in the first stage, 16 cases in the second stage, and 7 cases in the third stage; Inclusion criteria: All patients met the diagnostic

criteria of "Diagnosis of Occupational Pneumoconiosis" [5] (GBZ 70-2015). (1) All patients were diagnosed as chronic pneumoconiosis patients through imaging, pathology, surgery, and other examinations; (2) No other serious illness patients; (3) The patient is aware of the purpose and content of this study and agrees to cooperate and sign a letter of understanding; (4) This study was approved by the hospital ethics committee. Exclusion criteria: (1) Patients with severe functional failure such as heart, liver, and kidney; (2) Failure to complete relevant inspections; (3) Those who are unwilling to cooperate during follow-up. Divided into a survival group of 85 cases and a death group of 15 cases based on survival or not.

### 2.2 Method

Refer to the "Pneumoconiosis Report Card" and the diagnosis records of pneumoconiosis, use a self-made survey questionnaire to collect patients' age, gender, occupational history, smoking history, past medical history, current medical history, complications, and other information. Follow up the patients for 1 year to understand their prognosis and survival status. Divide them into survival group and death group based on survival for comparative analysis. Logistic regression analysis was used to determine the risk factors for mortality after occupational pneumoconiosis.

### 2.3 Statistical Methods

Excel 2010 was used to organize the data, SPSS25.0 software was used for data processing, and counting data was compared and selected $\chi$ 2-test, multivariate analysis using logistic regression analysis, with $P<0.05$ indicating statistically significant differences.

## 3. Results

### 3.1 Age and Occupational Distribution of Occupational Pneumoconiosis Patients in Lanzhou Area

As shown in Table 1, 66 cases (66.00%), 23 cases (23.00%), and 11 cases (11.00%) had a higher prevalence rate in the age range of 50-69, 70-80, and 30-49 years, respectively; 77 cases (77.00%) in the first stage, 16 cases (16.00%) in the second stage, and 7 cases (7.00%) in the third stage of the staging; Coal worker pneumoconiosis was the main type of pneumoconiosis in 87 cases (87.00%), followed by silicosis in 9 cases (9.00%), with a statistically significant difference ($P<0.05$).

*Table 1. Age and occupational distribution of occupational pneumoconiosis patients in Lanzhou area*

| index | | number (n=100) | $x^2$ | $P$ |
|---|---|---|---|---|
| Age (years) | 30-49 | 11(11.00) | 0.253 | >0.05 |
| | 50-69 | 66(66.00) | | |
| | 70-80 | 23(23.00) | | |
| occupation | Coal worker's pneumoconiosis | 87(87.00) | 5.563 | <0.05 |
| | silicosis | 9(9.00) | | |
| | other | 4(4.00) | | |
| by stages | Phase I | 77(77.00) | 6.453 | <0.05 |
| | Phase II | 16(16.00) | | |
| | Phase III | 7(7.00) | | |

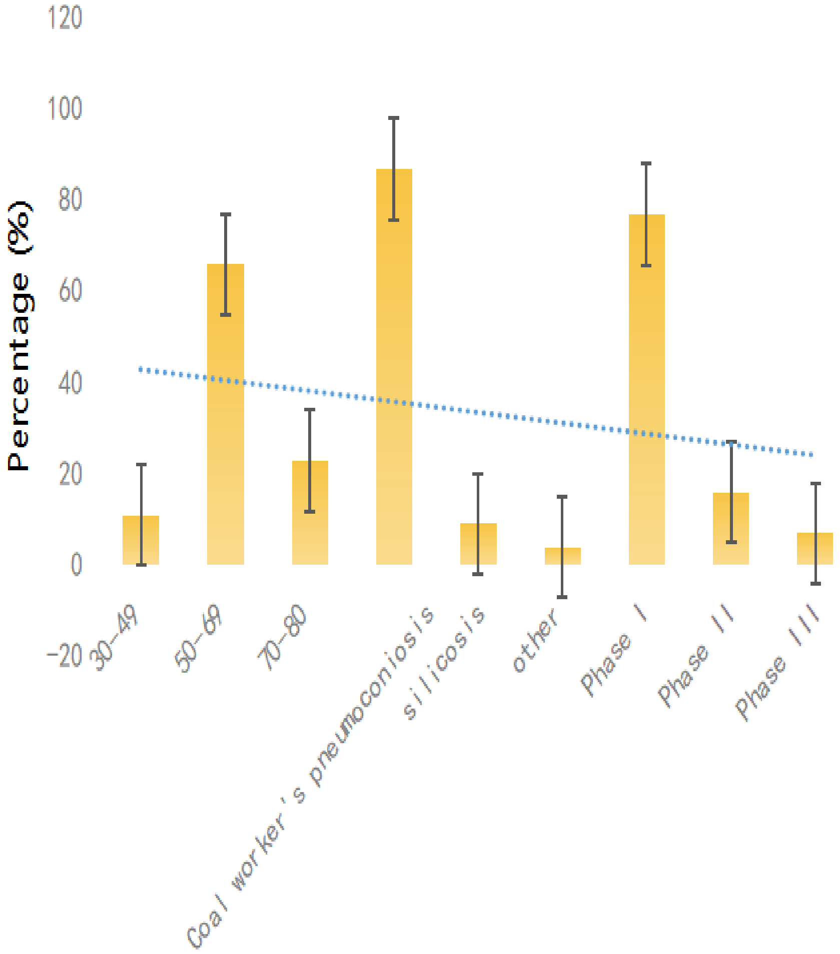


*Figure 1. Age and occupational distribution of occupational pneumoconiosis patients in Lanzhou area*

## 3.2 Analysis of Influencing Factors on Prognosis and Death of Patients with Chronic Pneumoconiosis

As shown in Table 2, the results of univariate analysis showed that exposure to dust, smoking history, presence or absence of comorbidities, advanced stage of pneumoconiosis, initial diagnosis stage, and type of pneumoconiosis were the single factors affecting the prognosis and mortality of patients with chronic pneumoconiosis ($P<0.05$); Gender and age are not single factors that affect the prognosis and mortality of patients with chronic pneumoconiosis ($P>0.05$).

*Table 2. Analysis of influencing factors on prognosis and mortality in patients with chronic pneumoconiosis*

| factor | | Number of cases | death group(n=15) | Survival group(n=85) | $x^2$ | *P* |
|---|---|---|---|---|---|---|
| Gender | male | 67 | 14(93.33) | 53(62.23) | 0.121 | >0.05 |
| | female | 33 | 1(6.67) | 32(14.12) | | |
| Age | ≤50 years old | 20 | 6(40.00) | 14(16.47) | 6.561 | <0.05 |
| | >50 years old | 80 | 9(60.00) | 71(83.53) | | |
| Dust exposure experience | ≤10 years | 22 | 1(6.67) | 21(24.71) | 5.542 | <0.05 |
| | >10 years | 78 | 14(93.33) | 64(75.29) | | |
| Smoking history | have | 55 | 12(80.00) | 43(50.59) | 5.556 | <0.05 |
| | nothing | 45 | 3(20.00) | 42(49.41) | | |
| Comorbidities | have | 60 | 13(86.67) | 47(55.29) | 7.787 | <0.05 |
| | nothing | 40 | 2(13.33) | 38(44.71) | | |
| Jin stage of pneumoconiosis | have | 30 | 1(6.67) | 29(34.12) | 8.976 | <0.05 |
| | nothing | 70 | 14(93.33) | 56(65.88) | | |
| Initial diagnosis period | Phase I | 77 | 10(66.67) | 67(78.82) | 5.563 | <0.05 |
| | Phase II | 16 | 4(26.67) | 12(14.12) | | |
| | Phase III | 7 | 1(6.67) | 6(7.06) | | |
| Types of pneumoconiosis | Coal worker's pneumoconiosis | 87 | 8(53.33) | 79(92.94) | 6.453 | <0.05 |
| | silicosis | 9 | 4(26.67) | 5(5.88) | | |
| | other | 4 | 3(20.00) | 1(1.18) | | |

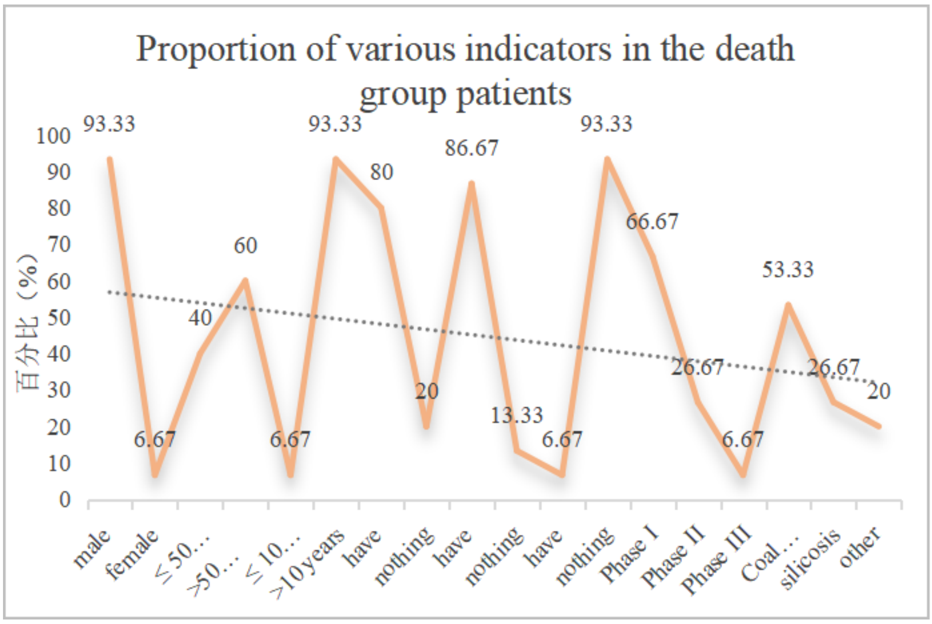


*Figure 2. Proportion of various indicators in the death group patients*

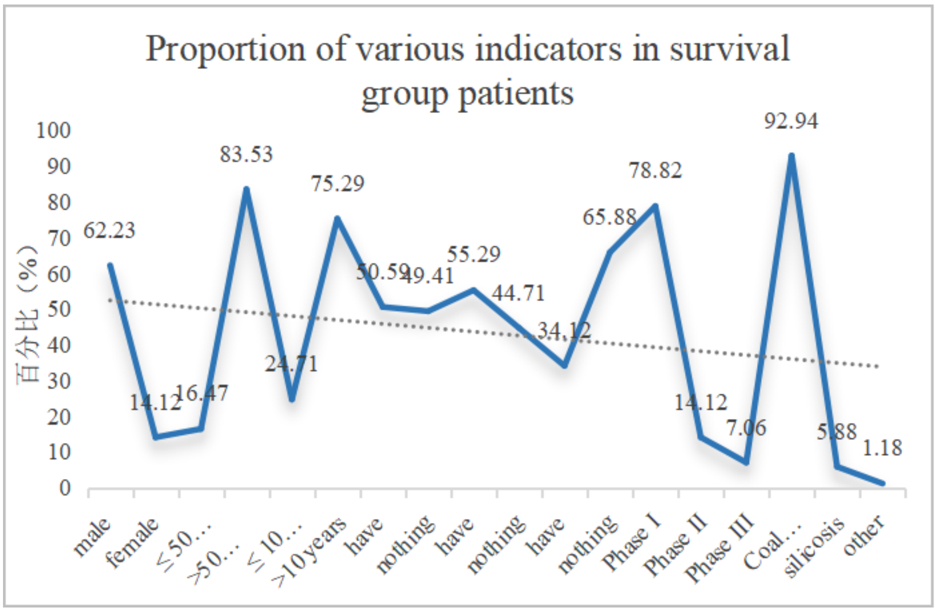


*Figure 3. Proportion of various indicators in survival group patients*

## 2.3 Multivariate Logistic Regression Analysis Affecting the Prognosis and Mortality of Patients with Chronic Pneumoconiosis

The survival state variable is whether occupational pneumoconiosis patients died from pneumoconiosis or its complications during the observation period (0=no, 1=yes), the observation time is the survival time variable, and the dust exposure service experience (≤ 10 years=1,>10 years=2), smoking history (yes=1, no=0), comorbidities (yes=1, no=0) The advanced stage of pneumoconiosis (with=1, without=0) is a time-dependent variable. The initial diagnosis stage (with=1, with=2, with=3), the type of pneumoconiosis (silicosis=1, coal worker's pneumoconiosis=2, with other pneumoconiosis=3), and age (≤ 50 years old=1,>50 years old=2) are independent variables. Multiple categorical variable are converted into dummy variables for analysis. The hazard ratio (HR) and its 95% confidence interval are calculated using the forward method of the nonproportional risk Cox regression model. The results showed that exposure to dust, smoking history, presence or absence of comorbidities, advanced stage of pneumoconiosis, initial diagnosis stage, and type of pneumoconiosis were the influencing factors for the survival time of occupational pneumoconiosis patients ($P$<0.05).

Compared with dust exposed workers ≤ 10 years, patients with dust exposed workers>10 years (HR=1.376, 95% CI: 1.079~1.755) had an increased risk of reduced survival time ($P$<0.05); Compared with patients without smoking history, patients with smoking history (HR=1.839, 95% CI: 1.15-3.034) had an increased risk of reduced survival time ($P$<0.05); Compared with patients without comorbidities, patients with comorbidities (HR=1.334, 95% CI: 1.143-3.082) had an increased risk of reduced survival time ($P$<0.05); Compared with patients with advanced stage of pneumoconiosis during the observation period, patients with advanced stage of pneumoconiosis during the observation period have an increased risk of reduced survival time (HR=1.006, 95% CI: 1.001-1.011, $P$<0.05); Compared with the first stage of diagnosis, patients with the second stage (HR=1.385, 95% CI: 1.185-1.618) and the third stage (HR=2.593, 95% CI: 0.010-3.344) had an increased risk of reduced survival time ($P$<0.001); Compared with silicosis, coal worker pneumoconiosis patients have an increased risk of reduced survival time (HR=1.423, 95% CI: 1.157-1.749, $P$=0.001); The risk of reduced survival time for patients in other industries (HR=2.334, 95% CI: 1.243~4.382) increases ($P$<0.05); Compared with diagnosis age ⩽ 50 years old, diagnosis age>50 years old (HR=3.764, 95% CI: 3.111~4.554) increases the risk of reduced survival time for patients ($P$<0.001).

*Table 3. Multivariate logistic regression analysis on the prognosis and mortality of patients with chronic pneumoconiosis*

| influence factor | *B* price | *SE* | *Wald* $\chi^2$ | *HR* price | 95%CI | P |
|---|---|---|---|---|---|---|
| Dust exposure experience ⩽ 10 years | - | - | - | 1.000 | - | - |
| Dust exposure experience>10 years | 0.319 | 0.124 | 6.60 | 1.376 | 1.079 ~1.755 | 0.010 |
| No smoking history | - | - | - | 1.000 | - | - |
| Have a history of smoking | 0.609 | 0.255 | 5.69 | 1.839 | 1.115~3.034 | 0.017 |
| No comorbidities | - | - | - | 1.000 | - | - |
| With concomitant diseases | 0.332 | 0.119 | 6.296 | 1.334 | 1.143~3.082 | <0.001 |
| Dust free lung Jin stage | - | - | - | 1.000 | - | - |
| Having advanced stage of pneumoconiosis | 0.006 | 0.003 | 5.69 | 1.006 | 1.001~1.011 | 0.017 |
| Phase I | - | - | - | 1.000 | - | - |
| Phase II | 0.326 | 0.079 | 16.83 | 1.385 | 1.185~1.618 | <0.001 |
| Phase III | 0.953 | 0.130 | 53.85 | 2.593 | 2.010~3.344 | <0.001 |
| Coal worker's pneumoconiosis | - | - | - | 1.000 | - | - |
| silicosis | 0.353 | 0.105 | 11.20 | 1.423 | 1.157~1.749 | 0.001 |
| other | 0.126 | 0.153 | 0.68 | 2.334 | 1.243~4.382 | 0.411 |
| Age ⩽ 50 years old | - | - | - | 1.000 | - | - |
| Age>50 years old | 1.326 | 0.097 | 186.04 | 3.764 | 3.111~4.554 | <0.001 |

## 4. Discussion

As a major country with pneumoconiosis, China has the highest number of patients in the world. In some professions, due to workers inhaling dust particles during work, the number of patients directly exceeds 10 μ The particles of m will block the mucosa of the nasal and pharyngeal organs by 10% μ Dust below m will directly enter the bronchioles, causing sedimentation and attachment; five μ Dust below m can directly enter the alveoli [6-7]. Most of these dust particles are expelled from the body through coughing and breathing, but the particle diameter is 0.2 μ Dust below m enters the human body and is directly engulfed by macrophages, which settle in the bronchioles and alveoli, causing damage and fibrosis of the alveoli, further damaging the patient's lung function [8-9]. This disease occurs slowly and has a latent period of 5-10 years; If a high amount of dust is continuously absorbed, the disease can occur within 1-2 years. At present, there is no effective treatment measure in clinical practice, and the key to prevention and treatment is prevention [10-11].

The results of univariate analysis in this study showed that age, length of work exposed to dust, smoking history, and presence or absence of comorbidities were the univariate factors affecting the prognosis and mortality of patients with chronic pneumoconiosis ($P$<0.05); The results of multivariate logistic regression analysis showed that the type of pneumoconiosis, industry, diagnosis age, exposure to dust, initial diagnosis period, and promotion are influencing factors for the survival time of occupational pneumoconiosis patients. Specific analysis: (1) The risk of death for coal workers' pneumoconiosis and mining industry patients is relatively high, mainly because coal workers' pneumoconiosis patients are mainly concentrated in the mining industry, and they are mostly exposed to mixed dust containing silica and coal dust, making their condition more severe. This indicates that coal workers' pneumoconiosis will still be the focus of occupational pneumoconiosis prevention and control in Shizuishan City in the future, and the mining industry is the key industry for prevention and control; (2) As the age of diagnosis and the length of exposure to dust increase, the risk of death for occupational pneumoconiosis patients increases, which is consistent with the results reported in other regions in China [12-13]. On the one hand, with the extension of workers' exposure to dust, the accumulation of dust in the lungs increases, and its harm and severity to the lungs also increase. On the other hand, as age increases, workers' own immunity and resistance gradually decrease; (3) The higher the initial diagnosis stage and the higher the risk of death for those who advance during the observation period, the stage of pneumoconiosis reflects the degree of progression of pulmonary fibrosis. As pulmonary fibrosis progresses, the stage of pneumoconiosis increases, and the damage to lung ventilation and diffusion function worsens, directly affecting the quality of life and lifespan of patients. Previous studies have suggested that smokers have a 10 times higher risk of developing lung diseases than non-smokers [14-15]. Based on the above results, it can be seen that chronic pneumoconiosis is caused by a combination of multiple factors, and for workers with related risk factors, it is necessary to strengthen prevention of the occurrence of chronic pneumoconiosis and regularly check their bodies. Age is an independent risk factor for the occurrence of occupational pneumoconiosis. As workers age, lung ventilation function decreases significantly, and dust or debris from processed materials can be inhaled by workers. Long term work can lead to the occurrence of occupational pneumoconiosis [16-17]. The length of service exposed to dust is an independent risk factor for the occurrence of occupational pneumoconiosis. With the increase of the length of service exposed to dust, the incidence rate of occupational pneumoconiosis increases significantly, and the disease becomes more serious. Therefore, publicity and education on the Law on the Prevention and Control of Occupational Diseases should be strengthened, and occupational health examination should be carried out for workers with higher length of service exposed to dust, so as to find pneumoconiosis patients as early as possible [18-19]. Comorbidities are independent risk factors for the occurrence of occupational pneumoconiosis. Patients with occupational pneumoconiosis are prone to developing pulmonary tuberculosis, which is one of the causes of death. Complications such as tuberculosis and pneumoconiosis can promote each other, leading to a significant decrease in quality of life, exacerbating the progression of the disease, and even leading to death. Targeted measures should be taken to prevent and cure pulmonary diseases and improve the quality of life of workers, Thus extending its lifespan [20-21].

To sum up, the results of this study found that patients with occupational pneumoconiosis in the region have a higher mortality rate, a shorter median survival time, and a higher risk of death among coal workers with pneumoconiosis, mining workers, older diagnosed individuals, and those with longer exposure to dust. Therefore, this study suggests that the construction of a health management system for occupational pneumoconiosis should be strengthened first, and health monitoring and tracking of occupational pneumoconiosis patients should be carried out. For key groups such as retired people and people with complications, occupational pneumoconiosis patients should be regularly arranged for physical examination. It is suggested to establish electronic health records of occupational disease patients through the information platform, and gradually realize the whole life cycle, whole process and personalized health management of patients. Secondly, regular health assessments should be conducted on patients with occupational pneumoconiosis, and doctors should adjust treatment plans in a timely manner based on the assessment results, and conduct graded diagnosis and treatment. At the same time, health education and health behavior promotion should be strengthened. Occupational pneumoconiosis patients can improve their self-health management ability by quitting smoking and avoiding daily dust exposure. Finally, while early detection, diagnosis, and treatment of occupational pneumoconiosis patients should be achieved, engineering protection should be strengthened, production process reform should be promoted, and personal protection and health monitoring should be carried out to effectively protect the health of workers, prevent the occurrence of occupational pneumoconiosis, and reduce the burden of disease.

## Funding

Lanzhou City Science and Technology Plan Project (2021-1-132)

## Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Conflict of Interest

The author states that this article has no conflict of interest.

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