

Recognized Occupational Diseases in Italy's Friuli-Venezia Giulia and Liguria Regions (2010-2021)

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ABSTRACT

Background: *The study of recognized occupational diseases trend is important to understand the preventive approach needed in the future, however, while numbers of occupational diseases are available on web, data on incidence are missing. The aim of our study was to analyze the trend and the incidence rate ratio (IRR) of recognized occupational diseases in Italy, in Friuli-Venezia Giulia region (FVG) and Liguria region from 2010 to 2021. Methods:* Numbers of recognized occupational diseases by the Italian National Insurance for Occupational Diseases (INAIL) were analyzed and incidence were calculated considering the total number of workforces in the area. A Poisson regression model was used to estimate incidence trends. **Results:** FVG region presented a higher incidence of all occupational diseases compared to Italy and to Liguria in the period considered. The overall incidence in 2019 was 175, 91.8 and 108 cases for 100,000 workers, for FVG, Liguria and Italy respectively. Musculoskeletal disorders (MSDs) were the majority of occupational diseases with 100, 51 and 82.8 cases per 100,000 workers, in FVG, Liguria and Italy, respectively. Incidence of occupational cancers was 16, 10 and 4.9 cases per 100,000 workers, in FVG, Liguria and Italy, respectively. The annual change of incidence from 2010 to 2019 was positive for MSDs (IRR 1.06; 95%CI 1.06 to 1.07) and decreasing for the other causes in Italy. In FVG region the trend was positive for MSDs (IRR 1.05; 95%CI 1.04 to 1.06), for respiratory diseases (IRR 1.03; 95%CI 1.00 to 1.05) and pleural plaques (IRR 1.03; 95%CI 1.00 to 1.06). In Liguria the trend was positive for MSDs (IRR 1.17; 95%CI 1.15-1.19) and for pleural plaques (IRR 1.07; 95%CI 1.03-1.12). Stable trends were found for cancers. Declining trend was shown for noise induced hearing loss and skin diseases. **Conclusions:** FVG region presented a higher incidence of recognized occupational diseases compared to Liguria region and Italian data. Results that can be explained by a higher propensity of claiming for occupational diseases in workers, mainly for MSDs disorders. For cancers and asbestos-related diseases the higher incidence can be attributable to high exposure to asbestos in FVG and Liguria workers mainly in shipyard and dock activities.

1. INTRODUCTION

The study of occupational diseases trend is needed to better define the preventive strategies to be applied to contrast or at least limit the onset of these

diseases. Trend in incidence data, reporting number of occupational diseases in relationship with workforce are limited in scientific literature.

Stocks et al. [1] studied noise-induced hearing loss, carpal tunnel syndrome, upper limb

musculoskeletal disorders, contact dermatitis and asthma in ten EU countries from 2000 to 2012 finding a general decrease in ODs with few exceptions. Noise-induced hearing loss was reported to increase only in some EU Countries (Belgium, Spain, Switzerland and the Netherlands). Trends in carpal tunnel syndrome and upper limb musculoskeletal disorders are completely different in different EU Countries, mainly due to different reporting and recognizing systems [1]. EURO-STAT [2] reported data from some EU Countries on ODs showing wide differences due to the reporting classification system.

The lack of precise data on ODs and the under-reporting phenomenon in official data determined the set-up of voluntary reporting schemes such as The Health and Occupational Reporting (THOR) Network in the UK; also, for that system, the under-reporting was recently studied by Gittins et al. [3] to suggest a statistical analysis to unjust for “zero” responders.

In Italy, van der Molen et al. [4] found, in agriculture, a significant increase in claims for musculoskeletal disorders (MSDs) from 2008, mainly due to a changeover of recognizing system applied by the Italian Insurance against occupational diseases (INAIL - Istituto Nazionale per l’Assicurazione contro gli Infortuni sul Lavoro). Recently Larese Filon et al. [5] performed the same analysis in industrial and services sectors from 2006 to 2019, finding a lower incidence of occupational diseases but with a similar increasing trend for MSDs and a decreasing trend for ear diseases.

To better analyze ODs in Italy, there is the need to evaluate recognized ODs and compare Italian to Regional data: local exposures and reporting attitudes can influence the difference in incidence of ODs that are interesting to discuss.

This study analyzed the incidence and trend of recognized ODs in Italy compared to the Friuli-Venezia Giulia and Liguria regions. We chose these two regions because both have a similar number of workers and are characterized by high past exposure to asbestos in shipyard and dock sectors [6, 7].

2. METHODS

2.1. Study Design and Procedures

ODs recognized by national insurance INAIL in Italy, Friuli-Venezia Giulia, and Liguria regions in all sectors from 2010 to 2021 were considered. Incidence of ODs was determined for all diseases and for six groups of diseases present in the Italian list: Cancers (C00-D48); mesothelioma (C45); asbestosis (J61); pleural plaques (J92); noise induced hearing loss (H83.3); musculoskeletal and connective tissue diseases (M00-M99); respiratory diseases (J00-J99); skin diseases (L00-L99). The number of recognized ODs for industrial and services sectors was taken from the INAIL website available for FVG region (Flussi Informativi INAIL - Regioni) [8].

The number of total workers in the Industrial and services sectors was taken from a database provided by the Italian National Institute of Statistics (ISTAT) [9].

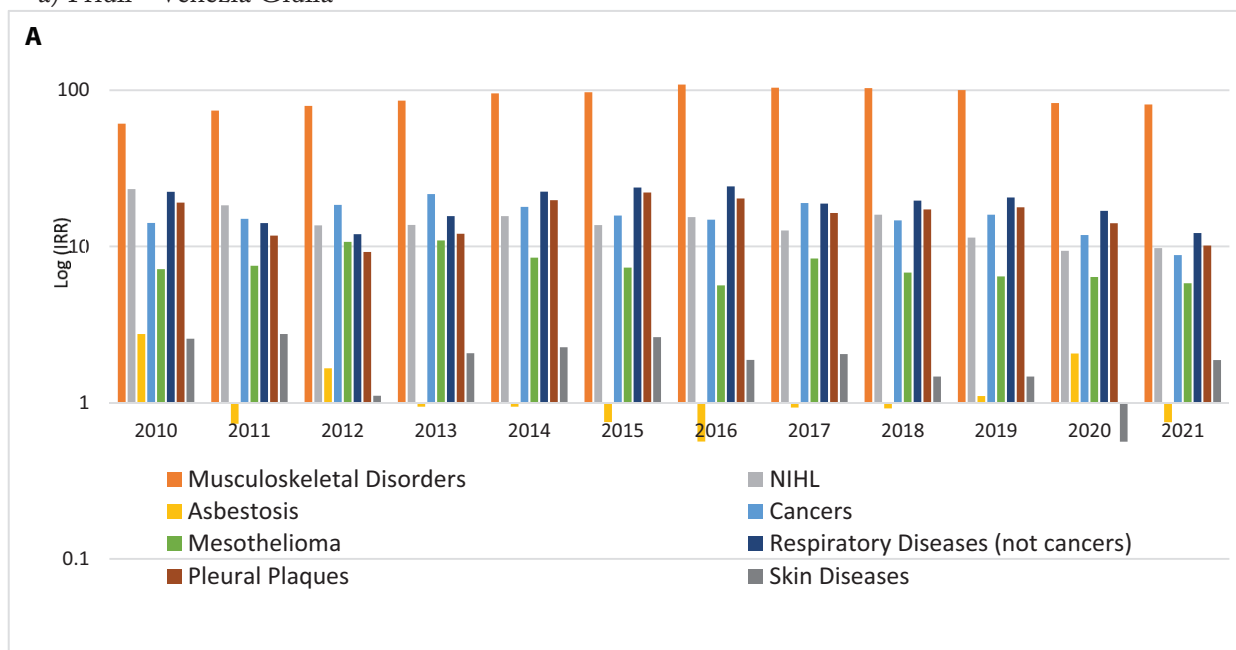
2.2. Statistics

The annual incidence of occupational diseases was calculated by dividing the number of reported ODs per year provided by INAIL [8] by the total workforce in the areas (provided by ISTAT). [8] To estimate incidence trends, the annual case numbers were analyzed using a Poisson regression model using the time (year) as a continuous variable and the estimate of the annual population of occupied workers in all sectors. Due to potential “non-consolidated numbers” of recognized ODs for the last two years considered, the model was fitted for data from 2010 to 2019. Statistical analyses were performed with StataCorp V.15. Texas, USA. A p-value for $p < 0.05$ was considered significant.

3. RESULTS

In the period considered 10,615 ODs were recognized in Friuli-Venezia Region (Figure 1a), 6,568 in Liguria region (Figure 1b) and 257,715 in Italy (Figure 2), while the overall workforce was in mean

a) Friuli - Venezia Giulia



b) Liguria

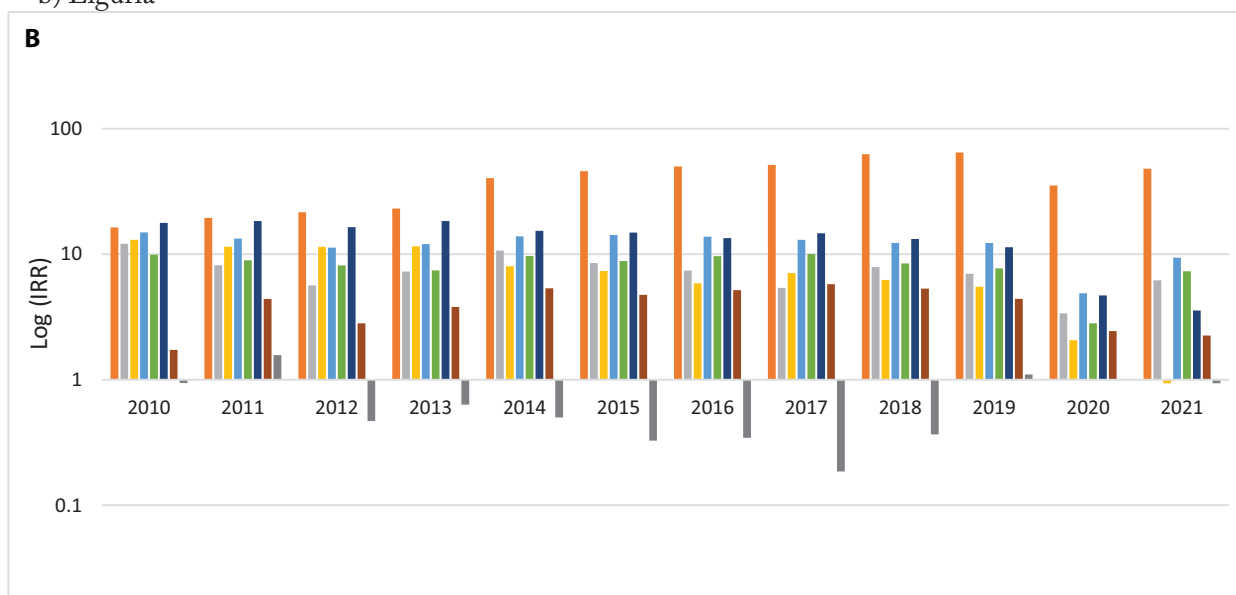


Figure 1. Incidence cases per 100,000 workers of Occupational diseases in Friuli-Venezia Giulia (a) and Liguria (b) regions from 2010 to 2021 on a semi-logarithmic scale to keep on the same graph incidences differing by orders of magnitude.

537,967, 669,433 and 22,428,333 workers in FVG, Liguria and Italy, respectively. Both Figures 1 and 2 showed an increase of incidence for MSDs from 2010 to 2016 and then a slow decrease in more

recent years. To note that data on ODs in the last two years are non-completely consolidated, thou it is possible an increase of numbers due to late recognizing for more recent ODs. In 2016 the incidence

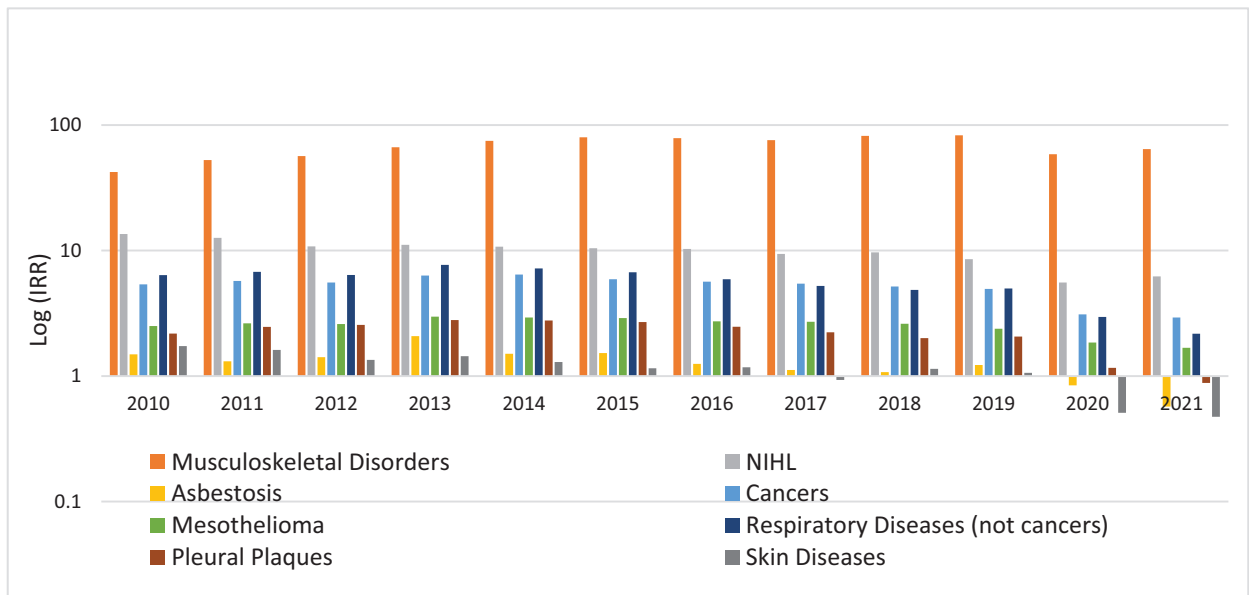


Figure 2. Incidence cases per 100,000 workers of Occupational diseases in Italy (2010-2021).

of MSDs was 109, and 78.6 cases per 100,000 workers in FVG and Italy, respectively with a decrease to 100 and 82.8 cases per 100,000 workers in 2019 and 81 and 64 cases per 100,000 workers in 2021, in FVG and Italy, respectively. In Liguria, instead, MSDs increased from 43.2 to 52 cases per 100,000 workers from 2016 to 2019. MSDs represent the 54.3% of the overall recognized ODs in FVG, the 41.7% in Liguria and the 70.9% in Italy.

Non-neoplastic respiratory diseases (that comprises pleural plaques and asbestosis) ranked second after MSDs in FVG region with a maximum in 2010 with an incidence of 22.4 cases per 100,000 workers, declining slowly to 20.6 in 2019 and to 12.2 in 2021. In Liguria the incidence was 16.9 cases per 100,000 workers in 2010, a maximum of 17.5 cases per 100,000 workers in 2013 and a declining trend until 2.87 cases per 100,000 cases in 2021. In Italy, the maximum incidence was 7.7 cases in 2013, declining to 2.2 case in 2021, well below FVG incidence.

Pleural plaques incidence ranked 3rd in FVG with 19.1 cases per 100,000 workers in 2010, 22.1 cases per 100,000 workers in 2015, 17.9 cases per 100,000 workers in 2019, declining to 10.1 cases per 100,000 workers in 2021. In Liguria incidence was ranging between 1.7 cases per 100,000 workers in 2010 to

5.7 cases per 100,000 workers in 2020. Incidence of pleural plaques in Italy was ranging around 2-2.8 cases per 100,000 workers from 2011 to 2019, declining to 0.88 cases in 2021 (Figure 3). The 12 years' incidence was 189.8, 41.9 and 16.2 cases for 100,000 workers in FVG, Liguria and Italy, respectively (11.7 times more in FVG compared to Italy).

Asbestosis incidence in FVG was ranging between 2.7 cases per 100,000 workers in 2010 (15 cases) declining to 1.9 cases per 100,000 in 2019 (6 cases). In Liguria the number of cases was much higher with an incidence of 13.1 cases per 100,000 workers in 2010 (83 cases) declining to 5.5 cases per 100,000 workers in 2019 (30 cases). In Italy asbestosis incidence was 1.5 and 1.2 cases per 100,000 workers in 2010 and 2019, respectively.

Considered the year 2019, in which INAIL data are considered completely consolidated, cancers (including mesothelioma) ranked 4th in FVG with 16 cases per 100,000 workers, with an increasing trend. In Liguria cancers ranked 3rd with 12 case per 100,000 workers. By contrast, incidence data were significantly lower in Italy with 5.2 cases per 100,000 workers in the same year.

During the period considered, 492 mesothelioma cases were recognized in the FVG region, ranging between 39 in 2010 and 58 in 2013, declining

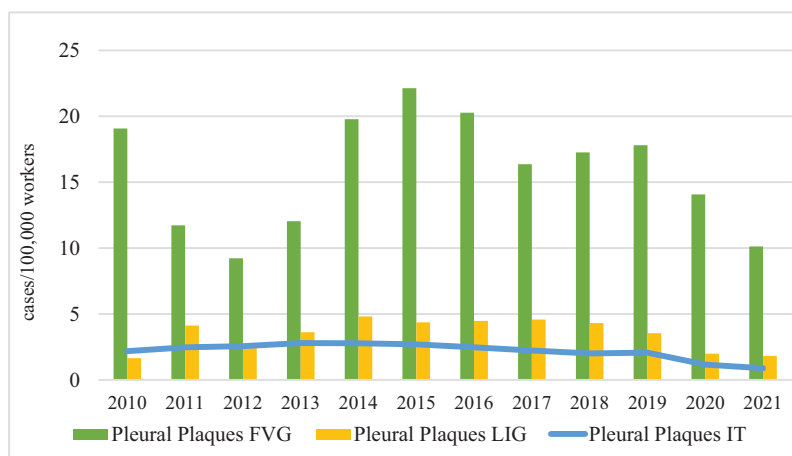


Figure 3. Incidence of Pleural Plaques in FVG Region, Liguria region and Italy (line).

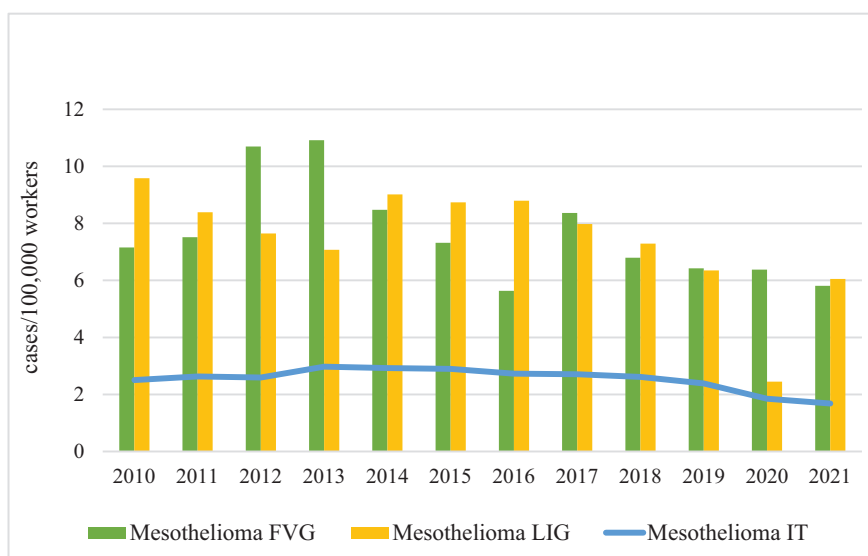


Figure 4. Incidence of Mesothelioma in FVG Region, Liguria region, and Italy (line).

progressively in recent years. Incidence was 7.1 cases per 100,000 workers in 2010 and 10.9 in 2012, declining progressively until 5.8 cases in 2021. In Liguria, 583 mesotheliomas were recognized in the period considered, with an incidence ranging from 9.9 cases per 100,000 workers in 2010 to 7.3 cases per 100,000 workers in 2021. In Italy, 6833 cases were recognized, the maximum in 2013 (650 cases) and the minimum in 2021 with 379 cases (non-consolidated data). Incidence ranged between 3.0 cases per 100,000 workers in 2013 to 1.7 cases per 100,000 workers in 2021. Figure that represents

1/3 of those registered in FVG and Liguria regions (Figure 4).

In the period considered, 76 cases of asbestosis were recognized in the FVG Region and 3447 cases in Italy, with an incidence of 2.75 and 2.06 cases per 100,000 workers in 2010 and 2020, respectively, with a fluctuation trend. In Liguria, 547 cases of asbestosis were recognized, with an incidence of 12.4 and 4.4 cases per 100,000 workers in 2010 and 2019, respectively.

Conversely, in Italy, the incidence was more constant, around 1.5 cases per 100,000 workers, with a minimum of 0.6 cases per 100,000 workers in 2021.

Noise-induced hearing loss incidence ranked 5th in the FVG region with a progressive decline to 11.4 cases per 100,000 workers in 2019 compared to 8.5 cases per 100,000 workers in Italy in the same year. In Liguria, the decline was similar, with 11.5 cases per 100,000 workers in 2010 to 5.6 cases in 2019.

The number of occupational skin diseases was low in the FVG region, Liguria, and Italy, with numbers below 3, below 1, and below 1.7 cases per 100,000 workers, respectively.

Table 1 shows the absolute number of ODs in 2010-2019 and the trend over the ten years (2010-2019) evaluated using the Poisson regression. For the FVG region, the annual change in incidence (IRR) was 1.02 (95%CI 1.01-1.03) for all diseases with a significant positive trend, maximum for MSDs 1.05 (95%CI 1.04-1.06), lower for respiratory diseases 1.03 (95%CI 1.00-1.05) and pleural plaques 1.02 (95%CI 1.00-1.06). A decreasing trend that did not reach statistical significance was demonstrated for cancers, including mesothelioma and skin diseases. The trend was significantly negative for noise-induced ear loss [0.95 (95%CI 0.93-0.97)] and asbestosis [0.90 (95%CI 0.83-0.99)]. For Liguria, an increasing trend was demonstrated for all ODs [IRR 1.07 (95%CI 1.06-1.08)], maximum for MSDs [IRR 1.17 (95%CI 1.15-1.19)], lower for pleural plaques [IRR 1.07 (95%CI 1.03-1.12)]. A decreasing trend was demonstrated for NIHL, respiratory diseases, and asbestosis.

For Italy, the annual IRR was 1.03 (95%CI 1.02-1.04) for all ODs, significantly increasing for MSDs [1.06 (95%CI 1.03-1.07)]. A stable trend was shown for mesothelioma, while all other ODs are significantly decreasing, mainly skin diseases [IRR 0.94 (0.93-0.95)] and NIHL [IRR 0.96 (95%CI 0.96 to 0.97)] but also for respiratory diseases and cancers.

4. DISCUSSION

In the present study, recognized ODs in Friuli-Venezia Giulia and Liguria regions and Italy were analyzed from 2010 to 2021, finding a significant increase in numbers mainly due to MSDs that accounted for 71% of ODs in Italy, 54% in FVG and 47.5% in Liguria. Moreover, the incidence of all analyzed ODs, was higher in the FVG region compared to Liguria and Italian data, showing important differences in ODs trends and incidence. The statistical analysis was performed from 2010 to 2019 because data are not considered stabilized for the last two years, though it is still possible to have some missing cases.

Considering ODs recognized in 2019, FVG region workers had 8.6 times more incidence of pleural plaques, 4.1 times more incidence of lung diseases, 3.2 times more incidence of cancers, 2.7 times more incidence of mesothelioma, while the overall incidence of ODs was 1.6 times more than Italian data. In Liguria, the overall incidence of ODs was lower

Table 1. Incidence of occupational diseases in Friuli-Venezia Giulia, Liguria regions and in Italy. IRR is the annual change in incidence from 2010 to 2019, assuming a linear trend. ICD-10, International Classification of Diseases; ODs, Occupational Disease; IRR, incidence rate ratio. NIHL, noise-induced hearing loss. In bold are reported significant values.

Diagnosis (ICD-10)	FVG		Liguria		Italy	
	ODs	IRR (95%CI)	ODs	IRR (95%CI)	ODs	IRR (95%CI)
Total	9 153	1.02 (1.01-1.03)	5070	1.07 (1.06-1.08)	223 201	1.03 (1.03-1.04)
MSDs (M00-M99)	4 892	1.05 (1.04-1.06)	2295	1.17 (1.15-1.19)	155 186	1.06 (1.06-1.07)
NIHL (H83.3)	829	0.95 (0.93-0.97)	480	0.96 (0.93-0.99)	23 987	0.96 (0.95-0.96)
Respiratory disease (J00-J99)	1 042	1.03 (1.00-1.05)	782	0.95 (0.93-0.98)	13 889	0.96 (0.96-0.97)
Cancers (C00-D48)	901	0.99 (0.97-1.02)	925	0.99 (0.97-1.02)	12 660	0.99 (0.98-0.99)
Mesothelioma (C45)	427	0.97 (0.94-1.002)	529	0.99 (0.96-1.02)	6 040	0.997 (0.99-1.01)
Asbestosis (J61)	61	0.90 (0.83-0.99)	531	0.90 (0.87-0.93)	3 129	0.96 (0.95-0.96)
Pleural plaques (J92)	892	1.03 (1.00-1.06)	256	1.07 (1.03-1.12)	5 424	0.98 (0.97-0.99)
Skin diseases (L00-L99)	109	0.96 (0.90-1.02)	39	0.91 (0.81-1.02)	2 886	0.94 (0.93-0.95)

than in Italy, except for asbestosis, which had a higher incidence than in Italy and the FVG region, confirming the high previous exposure to asbestos in the Liguria workforce [7].

The change in Italian legislation in 2008, the reduction of the underreporting phenomenon, and the increasing age of the workforce related to the change in retirement law in Italy caused an increase in MSDs, as already demonstrated by previous studies on claimed ODs in Italy [4, 5]. In our study, more than half of ODs are MSDs, in line with European data [1, 2], except for Scotland [10] and the Netherlands [11], in which mental diseases are the most frequent ODs. Note that for MSDs, there are differences between countries in compensation criteria, as the results trends varied widely between countries [1, 12-14].

Looking to overall incidence data of ODs (164.4, 82 and 95.7 cases per 100,000 workers in FVG, Liguria and Italy), results are lower than those reported in The Netherlands [11] in which Van der Molen found an annual incidence for claimed ODs of 346 cases (95%CI 330 to 362) per 100 000 worker-years in 2009. Oksa et al. [15] reported an incidence of recognized ODs in Finland in the period 2005-2013 of 117 cases for 100,000 with a decreasing trend. A similar incidence was reported in Poland in 1998 (117 cases per 100,000 workers) [16], decreasing to 23 cases per 100,000 workers in 2012 [17] and to 11.5 cases per 100,000 occupied workers in 2020 [18]. In the Czech Republic, Jarolímek et al. [19] reported regional differences in the incidence of ODs with a decreasing trend from 41 to 14 cases per 100,000 economically active populations in 1994 and 2013, respectively.

Compared to Italian data, our study showed a wide difference in recognized ODs in Friuli-Venezia Giulia and Liguria. This is probably due to the increased knowledge of the potential occupational causation of MSDs and asbestos-related diseases and the improvement of medical surveillance for workers linked to the Italian Law on prevention of injuries and ODs 81/2008 [20] and, for FVG, to the regional law for workers exposed to asbestos, which provides regular screening for them. The high previous exposure to asbestos in FVG and Liguria [6, 21] caused the high incidence of all asbestos

related diseases included pleural plaques with an incidence increasing until 2019 (OR 1.03, 95%CI 1.00-1.06 in FVG and 1.07, 95%CI 1.03-1.12) in Liguria. On the contrary, in Italy, the incidence of pleural plaques significantly declined in the same period (OR 0.98; 95%CI 0.97-0.99).

Looking to the overall trend of ODs in Italy, MSDs are significantly increasing, as is happening in FVG and Liguria regions, mainly due to the increase in MSD recognition, while we calculated a significant decrease for NIHL, skin diseases, cancers, pleural plaques, asbestosis, and respiratory diseases. A stable trend was found for mesothelioma in Italy until 2019, with declining numbers for the last two years considered, which need to be confirmed. On the contrary, respiratory diseases (that included pleural plaques) increased until 2019 in FVG. This trend is again explained by the high former exposure to asbestos in FVG workers.

Regarding mesothelioma row incidence, FVG had 6.4 cases per 100,000 workers (2.88 cases per 100,000 inhabitants), while Italy had 2.38 cases per 100,000 workers (0.92 cases per 100,000 inhabitants). In the USA, the incidence ranges between 0.5 and 1.3 per 100,000 people [22] in northern Europe, the incidence is around 1.4 cases per 100,000 inhabitants, in Australia and New Zealand, the incidence is around 1.3 cases per 100,000 inhabitants [23-24]. In areas without asbestos exposure, the incidence of mesothelioma is estimated to be around 0.3 cases per 100,000 inhabitants [24]. Our data confirmed a higher incidence of asbestos-related diseases in the two regions considered. The numbers of mesotheliomas recognized by INAIL were lower than cases reported in RENAM (Registro Nazionale dei Mesoteliomi) [25] as expected, because not all cases of mesothelioma occurred have to be considered occupational.

Cases of asbestosis are still reported in Italy, with a declining trend from 2010 to 2019, despite the asbestos ban since 1996. Considering occupied workers in the shipyard sector (ATECO 301 from ISTAT) in 2019, the incidence of asbestosis was 6/4297 (139 cases x 100,000 workers) and 30/4985 (601 cases x 100,000 workers) in FVG and Liguria, respectively, showing wide differences. However, it is well known that asbestosis is related mainly to previous exposure to asbestos.

Moreover, the differential diagnosis between asbestosis and idiopathic pulmonary fibrosis is difficult due to similar clinical, radiological, and histopathological findings, and there is a debate in the scientific literature on the role of previous asbestos exposure and idiopathic pulmonary fibrosis, occurring many years after exposure [26]. Recently, in a case-control study performed in the UK, Reynolds et al. [26] evaluated asbestos exposure in 494 cases of idiopathic pulmonary fibrosis and 466 controls, failing to find an association with asbestos exposure.

Incidence of skin diseases decreased in the period with an overall lower incidences of skin diseases compared to international data [27-29]. Recently, Aalto-Korte et al [30] analyzing the Finnish register of occupational diseases, reported an overall incidence of 18.8 cases per 100,000 workers, much higher than our data (3 and 1.7 cases per 100,000 workers in the FVG region and Italy, respectively). It is already shown [29] that skin diseases in Italy are less reported, and incidence data are probably underestimated. Moreover, Mediterranean skin, frequently exposed to the sun, presented a lower prevalence of atopic eczema, one of the most important risk factors for contact dermatitis [29]. The decreasing trend for occupational skin diseases aligns with a European registry study [1] and EUROSTAT data [2].

NIHL decreased significantly in the FVG and Liguria regions and Italy, in accord with what is happening in other EU countries, due to better preventive actions to protect workers from noise [1].

5. STRENGTHS AND LIMITATIONS

To our knowledge, data on the incidence of ODs in Italy are limited. The comparison between two regions with a high past exposure to asbestos permitted us to highlight interesting associations. However, our study has some limitations. The first one is that available data did not allow for standardized incidence of ODs by age classes. The second limitation is the difference between reporting and recognizing ODs in Italian regions, which was expected. However, we think the apparent increase in ODs in Italy is mainly due to the decrease in the “under-reporting phenomenon” and an improved insurance system against ODs.

6. CONCLUSION

Our study reported the incidence of recognized ODs in Italy and the FVG and Liguria regions from 2010 to 2021, showing an increasing trend due mainly to MSDs in Italy and to MSDs, pleural plaques, and respiratory diseases in FVG. A decreasing trend was demonstrated for NIHL and dermatitis, while the incidence of mesothelioma and cancers was declining only in Italy. Wide differences in incidence were shown between FVG, Liguria, and Italy, mainly due to past asbestos exposure in the FVG region.

DECLARATION OF INTERESTS: The Authors declare no conflict of interest.

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