World Health Organization

20, AVENUE APPIA – CH-1211 GENEVA 27 – SWITZERLAND – TEL CENTRAL +41 22 791 2111 – FAX CENTRAL +41 22 791 3111 – WWW.WHO.INT

Ref.: C.L.2.2026

The World Health Organization (WHO) presents its compliments to Member States and has the honour to consult them on joint estimates of WHO and the International Labour Organization (ILO) of the work-related burden of disease and injury (WHO/ILO Joint Estimates).

In the spirit of the Sustainable Development Goals,[1] WHO and ILO produce the WHO/ILO Joint Estimates.[2] The organizations have systematically selected pairs of occupational risk factors and health outcomes. For each pair, the existing evidence has been systematically reviewed and synthesized. Databases have been established on exposure to the risk factors and their health effects. For pairs with the required evidence and data, estimates have been produced. ... The attached guidance note details the data sources and methods used.

Prior to publication planned for the second quarter of 2026, WHO would like to share the following WHO/ILO Joint Estimates that were developed and compiled globally: (1) proportion of the population occupationally exposed to welding fumes; (2) number of deaths due to trachea, bronchus, and lung cancer attributable to occupational exposure to welding fumes; and (3) number of disability-adjusted life years due to trachea, bronchus, and lung cancer attributable to occupational exposure to welding fumes.

WHO will share with each Member State a data sheet with the WHO/ILO Joint Estimates for the country on request.

Member States are invited to provide feedback to the finalization of these WHO/ILO Joint Estimates. Focal points designated by the Ministries of Health and/or Labour in 2020 (following C.L.8.2020) may want to comment.

Requests for information on these estimates can be sent to Dr Frank Pega, jointestimates@who.int, Department of Environment, Climate Change, One Health and Migration, no later than 4 March 2026.

The World Health Organization avails itself of this opportunity to renew to Member States the assurance of its highest consideration.

GENEVA, 21 January 2026

[1] 70th UNGA (2015). Transforming our world: the 2030 Agenda for Sustainable Development. New York, NY: UN.

[2] WHO, ILO (2021). WHO/ILO joint estimates of the work-related burden of disease and injury, 2000–2016: global monitoring report. Geneva: WHO, ILO.

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Guidance note to facilitate country consultation on WHO/ILO Joint Estimates of the burden of trachea, bronchus, and lung cancer attributable to occupational exposure to welding fumes, for the years 2000, 2010, and 2021

December 2025

Department of Environment, Climate Change, One Health and Migration, WHO Headquarters

Background

The World Health Organization (WHO) and the International Labour Organization (ILO) produce joint estimates of the work-related burden of disease and injury (WHO/ILO Joint Estimates) (WHO, ILO 2021). To establish the evidence base, WHO and ILO conducted systematic reviews and compiled input data in databases.

Objectives

We aimed to estimate the proportion of the population with occupational exposure to welding fumes (OEWF) at the levels of (i) regular exposure and (ii) occasional exposure, and the burden of trachea, bronchus, and lung cancer (TBLC) attributable to such OEWF.

Objectives of the country consultation

Through this country consultation WHO invites feedback from countries on its estimates.

Results

Feedback is invited on the following WHO/ILO Joint Estimates:

1. Proportion of the population with OEWF (by exposure level);
2. Number of deaths due to TBLC attributable to OEWF; and
3. Number of disability-adjusted life years (DALYs) due to TBLC attributable to OEWF.

These estimates are produced for three years (2000, 2010, 2021), disaggregated by sex (3 categories: both sexes, female, male) and age group (18 categories: ≥15, 15-19, … , 90-94, ≥95 years).

Data sources

The estimates were produced using six input data sets described below.

Input Data 1: Cross-sectional data on proportion of survey participants in occupations classified as either regularly or occasionally exposed to welding fumes

The WHO/ILO Global Cross-sectional Occupations Database (Pega 2023) comprises 166 million observations on occupation using 4-digit International Classification of Occupation (ISCO) codes (ILO 2012), from 763 Labour Force Surveys collected by statistical offices in 96 countries/areas between 1996 and 2021 (*Table 1*). Each participant's exposure was assigned via proxy of occupation (i.e., ISCO code) into three levels of OEWF: (1) regular, (2) occasional or (3) no (or very rare) OEWF. The occupation-exposure matrices are available in Tables 3 and 4 (pages 7–8) of Momen (2025). To protect confidentiality the database is unpublished.

Table 1: Coverage of surveys and countries/areas in the WHO/ILO Global Cross-sectional Occupations Database

	Region (defined as per WHO classification)						**World**
	Africa	**Americas**	**South-East Asia**	**Europe**	**Eastern Mediterranean**	**Western Pacific**	
Number of countries/areas	50	53	11	60	22	37	234
Surveys (N)	69	168	49	391	41	45	763
Countries/areas with ≥1 survey (N) (% of countries/areas)	18 (36.0%)	15 (28.3%)	8 (72.7%)	33 (55.0%)	9 (40.9%)	13 (35.1%)	96 (41.0%)

Footnote: The programmatic allocation of areas to regions follows the WHO Coronavirus (COVID-19) Dashboard (WHO n.d.).

Input Data 2: Longitudinal data on proportion of survey participants in occupations classified as exposed to welding fumes

The WHO/ILO Global Longitudinal Occupations Database (Pega 2023) comprises repeated measures of 4-digit ISCO codes on 289 year-on-year transitions from quarterly Labour Force Surveys collected by national statistical offices in 31 countries within the WHO European Region between 2000 and 2024 and shared by Eurostat. The microdata on occupations were extracted; harmonized into the exposure level categories using the occupation-exposure matrices; weighted; and aggregated by population defined by country, year, sex, and age group. Raw data were not modified. For confidentiality the database is unpublished.

Input Data 3: Estimates of the total number of population

Estimates of the total number of population by country/area, year, sex, and age group for the years 1950-2021 were sourced from the United Nations global population estimates (UN 2024).

Input Data 4: Estimates of probability of death

Estimates of probability of death by country/area, year, sex, and age group were sourced from the United Nations life tables (UN 2022).

Input Data 5: Estimates of total number of deaths and disability-adjusted life years

Estimates of total number of deaths and DALYs for TBLC for the years 2000, 2010 and 2021 were sourced from the WHO Global Health Estimates (WHO 2024).

Input Data 6: Estimate of risk ratios

A specifically conducted WHO/ILO systematic review and meta-analysis, with supplementary analysis, reported a risk ratio of 1.39 for incident TBLC among persons with regular OEWF (95% CI 1.15-1.67, “high quality of evidence”) and a risk ratio of 1.16 among persons with occasional OEWF (95% CI 1.06-1.77, “moderate quality of evidence”) compared with those with no (or very rare) OEWF (Momen 2025). It concluded “sufficient evidence of harmfulness” of both regular and occasional OEWF for TBLC.

Methods

The estimation comprised modelling the input data (i.e., Input Data 1–6) described above in four models that consecutively built on each other (Models 1–4), as described below.

Model 1: Multilevel model to estimate proportion of exposed population at each year

For each year between 1950–2021 for each population cohort defined by country/area, sex and age group, we produced estimates of the proportion (P_i) for each of the three exposure categories (*i)*. We modelled Input Data 1 using a multilevel model (Model 1), as previously described in Table 3 (pages 6–7) of Pega (2023).

Model 2: Model of transition probabilities between exposure status categories

For each population cohort, we, along with Eurostat, estimated the probability (T_j) of transitioning between the categories of regular exposure, occasional exposure and unexposed from year^t to year$_{t+1}$ (Eurostat 2020). The *j* denotes one of nine possible transitions from one exposure category in year$_t$ to another in year$_{t+1}$.

Using Input Data 2, the survey weights for the target year (year$_{t+1}$) were scaled to represent the exposure level by population cohort for the initial year (year$_t$) and the target year. We modelled Input Data 2 using a multinomial logit regression model (Model 2), as previously described (Table 3, pages 6–7, Pega (2023)).

With Model 2, Eurostat derived and shared with WHO/ILO transition probabilities covering 31 countries based on sub-samples of the European Union Labour Force Surveys. For population cohorts for whom required input data were unavailable, the transition probability was imputed, as described elsewhere (Table 3, pages 6–7), Pega (2023)).

Model 3: Microflow model to estimate exposed population over time window

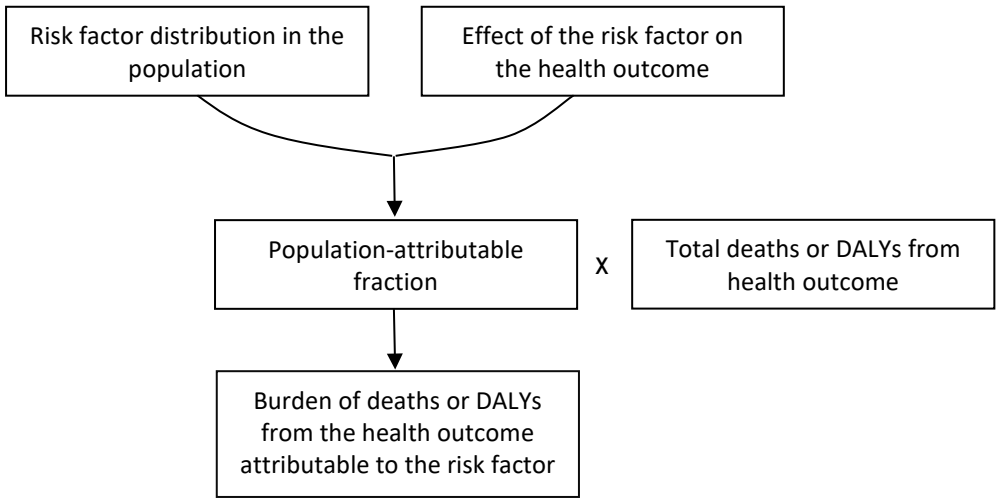
For each population cohort, we estimated the proportion (P_k) of the population in each exposure category (*k*) over the time window of exposure. We defined *k* as the exposure category *i* in any year in the time window. The approach assumed a 20-year latency between exposure and occurrence of clinical disease, and a 40-year exposure time window (spaced 30 years before and 10 years after the lag year).

The model, which used Input Data 4 and outputs from Models 1 and 2, has been previously described (Table 3, pages 6–7, Pega (2023)).

Model 4: Burden of disease estimation model

Using the Comparative Risk Assessment framework (Ezzati 2002), we estimated the proportional reduction in death or disease that would occur if exposure was reduced to a level with a minimum risk (i.e., no or very rare OEWF), while other conditions remain unchanged. Information on the population distribution of exposure to the risk factor was combined with information on the increased risk of incident disease caused by exposure to the risk factor (Figure 1).

Figure 1: Comparative Risk Assessment method for burden of disease estimation



Using estimates outputted from Model 3 and Input Data 5 and 6, we calculated the population-attributable fraction, the proportion of health outcome from the disease seen in each population that can be attributed to exposure to the specific occupational risk factor, using Model 4. The model has been previously described in Table 3 (pages 6–7) of Pega (2023).

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