# Results

Table 1 presents summary statistics of exposure and covariates for the full study population and for those diagnosed with NHL between 1985 and 2004. The cohort is predominantly white (66%) and male (87%). The median year of hire among those diagnosed with NHL was 1959 whereas the median year of hire in the full study population was almost a decade later. Age at hire was approximately the same among those with NHL and the full study population. Median lagged cumulative exposure to all three MWF types was higher among NHL cases. Soluble MWFs were the most widely used MWF type, with approximately 90% of workers ever exposed. Median cumulative exposure among the exposed was 6.5 times higher for soluble than for straight MWFs. Figure 2 shows median average annual exposure to the three MWF types among exposed workers over calendar time. Exposure to MWF generally followed a downward trend over time.

Table 1: Summary of population characteristics. Statistics shown above the horizontal line are count (%). Those shown below are median (quartile 1, quartile 3).

|  | Study population | |  | NHL cases | |
| --- | --- | --- | --- | --- | --- |
| N (person-years) | 34,734 | (596,698) |  | 231 | (2,777) |
| Race |  |  |  |  |  |
| White | 22,789 | (66%) |  | 173 | (75%) |
| Black | 6,304 | (18%) |  | 21 | (9%) |
| Unknown | 5,641 | (16%) |  | 37 | (16%) |
| Sex |  |  |  |  |  |
| Male | 30,235 | (87%) |  | 206 | (89%) |
| Female | 4,499 | (13%) |  | 25 | (11%) |
| Planta |  |  |  |  |  |
| Plant 1 | 8,721 | (25%) |  | 68 | (29%) |
| Plant 2 | 14,258 | (41%) |  | 90 | (39%) |
| Plant 3 | 11,755 | (34%) |  | 73 | (32%) |
| Ever exposed to MWFsb |  |  |  |  |  |
| Straight | 19,905 | (57%) |  | 133 | (58%) |
| Soluble | 31,044 | (89%) |  | 210 | (91%) |
| Synthetic | 12,262 | (35%) |  | 72 | (31%) |
| Deceased by end of follow-up | 10,384 | (30%) |  | 33 | (14%) |
| Year of birth | 1940 | (1925, 1950) |  | 1929 | (1919, 1940) |
| Year of hire | 1967 | (1953, 1976) |  | 1959 | (1951, 1969) |
| Age at hire (years) | 23.6 | (20.0, 30.1) |  | 25.4 | (21.1, 33.6) |
| Year of leaving workc | 1979 | (1968, 1989) |  | 1977 | (1964, 1987) |
| Age at leaving work (years)c | 45.0 | (31.9, 57.7) |  | 53.4 | (36.5, 61.2) |
| Years at workc | 15.3 | (7.3, 27.1) |  | 19.2 | (8.0, 29.9) |
| Year of death | 2000 | (1993, 2008) |  | 2001 | (1994, 2005) |
| Age at death (years) | 74.7 | (65.3, 82.5) |  | 73.8 | (66.2, 82.0) |
| Cumulative time off (years)b | 1.07 | (0.33, 1.87) |  | 0.68 | (0.17, 1.43) |
| Cumulative exposure to MWFs (mg/m3-years)d | | | | | |
| Straight | 0.70 | (0.22, 2.56) |  | 0.93 | (0.29, 3.30) |
| Soluble | 4.65 | (1.85, 12.13) |  | 7.16 | (2.86, 20.91) |
| Synthetic | 0.45 | (0.16, 1.64) |  | 0.89 | (0.29, 2.11) |
| NHL: non-Hodgkin lymphoma. | | | | | |
| a Plant of longest employment duration among those who worked at multiple plants; b Lagged 10 years; c Among those who left work by December 31, 1994; d Among ever-exposed individuals, lagged 10 years.; | | | | | |

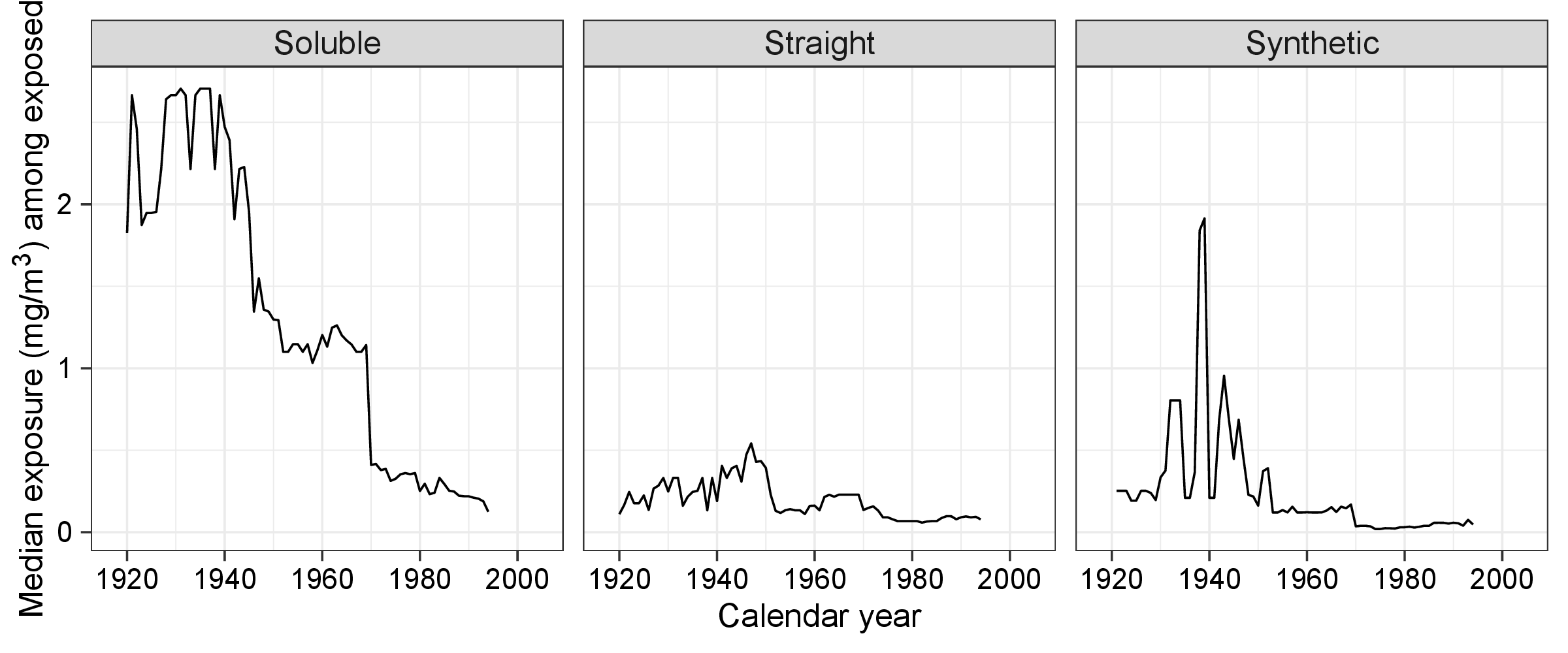


Figure 2. Median average annual exposure to soluble, straight, and synthetic metalworking fluids among exposed workers over time.

The observed risk of NHL over the 20-year follow-up period was 231 per 34,734 (6.65 per 1000). Table 2 presents the hazard-extended ICE parametric g-formula estimates of the counterfactual risk, risk difference, and risk ratios contrasting hypothetical limits on exposure to soluble MWF to no limit, after elimination of competing risks. Under an intervention eliminating competing risks, the estimated risk under no limit on MWF exposure was 332 (285, 380) per 34,734. Stronger limits on average annual exposure to soluble MWFs resulted in monotonically stronger reductions in the risk of NHL. Capping average annual exposure to soluble MWFs at 0.5 mg/m3, 0.25 mg/m3, and 0.05 mg/m3 resulted in 44 (-6, 91), 52 (-5, 106), and 71 (12, 129) fewer NHL cases, respectively. These correspond to risk ratios 0.87 (0.73, 1.02), 0.84 (0.68, 1.01), and 0.79 (0.61, 0.97).

Table 2: Counterfactual risk, risk difference, and risk ratio estimates contrasting interventions on soluble MWF to the observed course.

| Exposure limit (mg/m3) | Person-years intervened (%) | Risk | (95% CI) | RD | (RD 95% CI) | RR | (95% CI) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| None | 0.0 | 332 | (285, 380) |  |  |  |  |
| 0.5 | 23.8 | 288 | (224, 351) | 44 | (-6, 91) | 0.87 | (0.73, 1.02) |
| 0.25 | 36.2 | 280 | (209, 348) | 52 | (-5, 106) | 0.84 | (0.68, 1.01) |
| 0.05 | 43.9 | 261 | (193, 325) | 71 | (12, 129) | 0.79 | (0.61, 0.96) |
| Note. Counterfactual risk and risk difference estimates were expressed per 34,734. MWF: metalworking fluid | | | | | | | |