**Supplementary materials**

**Associations of co-exposure to metals with serum uric acid and hyperuricemia: A cross-sectional study**

Shunli Jiang1, 2, 3, Shuang Zhou2, Huimin Liu2, Cheng Peng2,Xu Zhang2, Hao Zhou2, Zhihong Wang1, \*, Qing Lu2, 3

1 The First Affiliated Hospital of Shenzhen University (The Second People's Hospital of Shenzhen); Guangdong Innovation Platform of Translational Research for Cerebrovascular Diseases, Shenzhen, Guangdong, China

2 Key Laboratory of Environment and Health, Ministry of Education & Ministry of Environmental Protection, and State Key Laboratory of Environmental Health (Incubating), School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, Hubei, China

3 State Key Laboratory of Transducer Technology, Chinese Academy of Sciences, Beijing, China

**Table of Contents**

Table S1. Metal concentrations and correlations between plasma, whole blood, and urine samples, and intra-class correlation coefficients (ICCs) of metals in repeated urine samples.

Table S2. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals.

Table S3. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals.

Table S4. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding patients with urine creatinine < 0.3 or > 3 g/L (N = 1547).

Table S5. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding patients with urine creatinine < 0.3 or > 3 g/L (N = 1547).

Table S6. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals, using urine specific gravity to adjust urine dilution (N = 1641).

Table S7. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals, using urine specific gravity to adjust urine dilution (N = 1641).

Table S8. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding elder (age ≥ 80) (N = 1923).

Table S9. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding elder (age ≥ 80) (N = 1923).

Table S10. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with BMI ≥ 30 kg/m2 (N = 1907).

Table S11. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with BMI ≥ 30 kg/m2 (N = 1907).

Table S12. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with eGFR ≤ 90 mL/min/1.73 m2 (N = 1374).

Table S13. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with eGFR ≤ 90 mL/min/1.73 m2 (N = 1374).

Table S14. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with hypertension and medications use (N = 1499).

Table S15. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with hypertension and medications use (N = 1499).

Table S16. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with hyperlipidemia (N = 1537).

Table S17. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with hyperlipidemia (N = 1537).

Table S18. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding patients with uric acid less than 2 mg/dL (N = 1947).

Table S19. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after further adjusted urinary lead concentrations (N = 1950).

Table S20. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after further adjusted urinary lead concentrations (N = 1950).

|  |
| --- |
| Table S1. Metal concentrations and correlations between plasma, whole blood, and urine samples, and intra-class correlation coefficients (ICCs) of metals in repeated urine samples.a |
| Metals | Plasma, μg/L | Whole blood, μg/L | Urine, μg/g | Plasma-whole bloodCorrelationb (p-Value) | Plasma-urineCorrelationb (p-Value) |  | First urine sample, μg/g | Second urine sample, μg/g | ICCs |
| Al | 128.68 | 103.35 | 6.98 | 0.73 (**< 0.001**) | -0.06 (0.6) |  | 23.32 | 16.13 | 0.321 |
| V | 0.98 | 0.62 | 0.32 | 0.23 (**0.03**) | 0.26 (**0.01**) |  | 0.39 | 0.73 | 0.402 |
| Cr | 3.20 | 4.59 | 0.28 | –0.09 (0.41) | 0.1 (0.36) |  | 1.11 | 1.24 | 0.456 |
| Mn | 6.13 | 11.89 | 0.33 | 0.38 (**< 0.001**) | –0.19 (**0.06**) |  | 1.75 | 0.72 | 0.329 |
| Fe | 1393.33 | 4.44×105 | 8.31 | 0.17 (0.11) | 0.02 (0.88) |  | 51.46 | 32.27 | 0.243 |
| Co | 0.17 | 0.14 | 0.08 | 0.45 (**< 0.001**) | 0.42 (**< 0.001**) |  | 0.19 | 0.24 | 0.442 |
| Ni | 1.54 | 3.50 | 0.53 | 0.18 (0.09) | –0.05 (0.61) |  | 1.69 | 2.01 | 0.262 |
| Cu | 954.34 | 752.93 | 2.25 | 0.75 (**< 0.001**) | 0.05 (0.64) |  | 5.53 | 6.81 | 0.448 |
| Zn | 909.94 | 5184.98 | 72.56 | 0.14 (0.19) | 0.23 (**0.03**) |  | 208.75 | 247.75 | 0.209 |
| As | 3.32 | 2.46 | 5.95 | 0.68 (**< 0.001**) | 0.34 (**< 0.001**) |  | 22.18 | 19.43 | 0.464 |
| Se | 83.64 | 83.26 | 3.78 | 0.52 (**< 0.001**) | 0.64 (**< 0.001**) |  | 6.37 | 6.54 | 0.518 |
| Rb | 309.43 | 2143.4 | 502.42 | 0.64 (**< 0.001**) | 0.03 (0.77) |  | 1534.04 | 1291.78 | 0.366 |
| Sr | 36.88 | 20.07 | 36.2 | 0.71 **(< 0.001**) | 0.29 (**0.005**) |  | 89.04 | 73.05 | 0.252 |
| Cd | 0.11 | 0.66 | 0.20 | 0.11 (0.28) | 0.07 (0.50) |  | 0.67 | 0.65 | 0.475 |
| Cs | NAc | NA | NA | NA | NA |  | NA | NA | NA |
| Ba | 39.27 | 20.46 | 2.16 | 0.59 (**< 0.001)** | 0.07 (0.52) |  | 2.86 | 2.19 | 0.321 |
| Hg | NA | NA | NA | NA | NA |  | NA | NA | NA |
| Tl | 0.29 | 0.18 | 0.16 | 0.73 (**< 0.001**) | 0.13 (0.22) |  | NA | NA | NA |
| Pb | 7.28 | 28.23 | 0.60 | 0.2 (**0.03**) | 0.03 (0.77) |  | 2.37 | 1.50 | 0.361 |
| U | NA | NA | NA | NA | NA |  | 0.02 | 0.02 | 0.327 |
| Abbreviations: Al, aluminum; V, vanadium; Cr, chromium; Mn, manganese; Fe, iron; Co, cobalt; Ni, nickel; Cu, copper; Zn, zinc; As, arsenic; Se, selenium; Rb, rubidium; Sr, strontium; Cd, cadmium; Cs, cesium; Ba, barium; Hg, mercury; Tl, thallium; Pb, lead; U, uranium.a data about metal concentrations and correlations between plasma, whole blood and urine samples derived from the article “*Plasma Metal Concentrations and Incident Coronary Heart Disease in Chinese Adults: The Dongfeng-Tongji Cohort*”; data about intra-class correlation coefficients (ICCs) of metals in repeated urine samples derived from the article “*Oxidative DNA Damage Mediates the Association between Urinary Metals and prevalence of Type 2 Diabetes Mellitus in Chinese adults*”. Metals concentrations were presented as median concentrations.b Spearman’s rank correlation coefficients.c NA, data not available. |

|  |
| --- |
| Table S2. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals.a |
| Metals | Total |  | Male |  | Female |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| Al | **2.85 (1.51, 4.18)** | **< 0.001** |  | **5.11 (3.03, 7.20)** | **< 0.001** |  | 0.32 (–1.32, 1.95) | 0.704 |
| V | **4.07 (1.78, 6.36)** | **0.001** |  | **4.09 (0.54, 7.64)** | **0.024** |  | **3.45 (0.61, 6.28)** | **0.017** |
| Cr | –0.76 (–2.55, 1.04) | 0.408 |  | –0.94 (–3.92, 2.04) | 0.537 |  | –0.67 (–2.74, 1.41) | 0.528 |
| Mn | **2.20 (0.60, 3.79)** | **0.007** |  | **4.51 (1.86, 7.16)** | **0.001** |  | 0.30 (–1.54, 2.14) | 0.752 |
| Fe | 0.76 (–1.08, 2.60) | 0.417 |  | 1.58 (–1.52, 4.68) | 0.318 |  | 0.12 (–1.98, 2.23) | 0.910 |
| Co | –0.85 (–3.39, 1.69) | 0.513 |  | 0.48 (–3.78, 4.75) | 0.824 |  | –0.44 (–3.49, 2.62) | 0.780 |
| Ni | –1.88 (–4.78, 1.02) | 0.204 |  | –3.75 (–8.5, 1.00) | 0.122 |  | 0.02 (–3.38, 3.41) | 0.992 |
| Cu | –1.50 (–5.26, 2.26) | 0.435 |  | –2.42 (–8.67, 3.84) | 0.448 |  | –1.06 (–5.41, 3.29) | 0.634 |
| Zn | **3.74 (0.41, 7.07)** | **0.028** |  | 1.94 (–2.92, 6.81) | 0.433 |  | **6.78 (2.37, 11.19)** | **0.003** |
| As | **5.29 (1.77, 8.80)** | **0.003** |  | 5.48 (–0.06, 11.03) | 0.053 |  | **5.47 (1.23, 9.71)** | **0.012** |
| Se | –1.13 (–5.27, 3.01) | 0.593 |  | –5.79 (–13.09, 1.51) | 0.120 |  | 1.26 (–3.34, 5.87) | 0.590 |
| Rb | –0.73 (–5.63, 4.18) | 0.771 |  | –4.25 (–11.83, 3.33) | 0.271 |  | 2.74 (–3.30, 8.79) | 0.374 |
| Sr | –1.11 (–4.31, 2.10) | 0.498 |  | **–5.87 (–10.53, –1.20)** | **0.014** |  | **4.46 (0.24, 8.69)** | **0.038** |
| Cd | –1.14 (–3.72, 1.43) | 0.384 |  | –1.98 (–6.10, 2.15) | 0.347 |  | –0.21 (–3.30, 2.87) | 0.892 |
| Cs | –2.62 (–7.84, 2.60) | 0.325 |  | –5.88 (–13.96, 2.20) | 0.153 |  | 0.21 (–6.23, 6.64) | 0.950 |
| Ba | **2.07 (0.43, 3.71)** | **0.013** |  | **2.76 (0.20, 5.32)** | **0.035** |  | 1.12 (–0.89, 3.14) | 0.274 |
| Hg | –1.55 (–3.31, 0.22) | 0.087 |  | –1.39 (–4.41, 1.62) | 0.365 |  | –1.66 (–3.66, 0.34) | 0.104 |
| Tl | –0.29 (–4.15, 3.56) | 0.882 |  | –3.01 (–8.91, 2.90) | 0.318 |  | 1.82 (–3.00, 6.64) | 0.458 |
| Pb | 2.13 (–0.04, 4.30) | 0.054 |  | 3.06 (–0.61, 6.72) | 0.102 |  | 1.08 (–1.40, 3.57) | 0.392 |
| U | **3.53 (1.68, 5.39)** | **< 0.001** |  | **5.96 (2.94, 8.99)** | **< 0.001** |  | 1.03 (–1.16, 3.22) | 0.354 |
| Abbreviations: Al, aluminum; V, vanadium; Cr, chromium; Mn, manganese; Fe, iron; Co, cobalt; Ni, nickel; Cu, copper; Zn, zinc; As, arsenic; Se, selenium; Rb, rubidium; Sr, strontium; Cd, cadmium; Cs, cesium; Ba, barium; Hg, mercury; Tl, thallium; Pb, lead; U, uranium.a Model for the difference of uric acid with the increase of metals adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model for males and females did not adjust sex. Model for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the model. |

|  |
| --- |
| Table S3. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals.a |
| Metals | Total |  | Male |  | Female |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| Al | **1.07 (1.02, 1.13)** | **0.010** |  | **1.14 (1.06, 1.22)** | **< 0.001** |  | 0.97 (0.88, 1.06) | 0.486 |
| V | **1.14 (1.04, 1.25)** | **0.007** |  | **1.16 (1.03, 1.30)** | **0.011** |  | 1.10 (0.93, 1.29) | 0.269 |
| Cr | 0.99 (0.92, 1.07) | 0.840 |  | 1.01 (0.92, 1.12) | 0.763 |  | 0.97 (0.86, 1.10) | 0.652 |
| Mn | **1.08 (1.01, 1.15)** | **0.025** |  | **1.15 (1.06, 1.26)** | **0.001** |  | 0.99 (0.89, 1.10) | 0.853 |
| Fe | 1.03 (0.96, 1.11) | 0.431 |  | 1.07 (0.98, 1.18) | 0.146 |  | 0.98 (0.87, 1.11) | 0.790 |
| Co | 0.999 (0.90, 1.11) | 0.987 |  | 1.08 (0.95, 1.23) | 0.255 |  | 0.95 (0.80, 1.12) | 0.525 |
| Ni | 0.95 (0.85, 1.07) | 0.417 |  | 0.95 (0.82, 1.11) | 0.537 |  | 0.99 (0.82, 1.18) | 0.872 |
| Cu | 0.98 (0.84, 1.14) | 0.760 |  | 0.98 (0.80, 1.20) | 0.840 |  | 0.97 (0.76, 1.24) | 0.829 |
| Zn | 1.11 (0.97, 1.27) | 0.125 |  | 1.06 (0.90, 1.24) | 0.481 |  | 1.28 (0.99, 1.65) | 0.060 |
| As | **1.15 (1.001, 1.33)** | **0.049** |  | 1.17 (0.98, 1.39) | 0.083 |  | 1.16 (0.91, 1.48) | 0.228 |
| Se | 0.97 (0.82, 1.15) | 0.735 |  | 0.87 (0.69, 1.10) | 0.259 |  | 1.09 (0.83, 1.42) | 0.546 |
| Rb | 0.94 (0.77, 1.14) | 0.500 |  | 0.91 (0.72, 1.16) | 0.458 |  | 0.99 (0.70, 1.38) | 0.938 |
| Sr | 0.96 (0.85, 1.09) | 0.563 |  | 0.94 (0.81, 1.09) | 0.412 |  | 1.01 (0.80, 1.27) | 0.951 |
| Cd | 0.98 (0.89, 1.09) | 0.764 |  | 0.98 (0.86, 1.12) | 0.771 |  | 1.01 (0.86, 1.19) | 0.884 |
| Cs | 0.88 (0.72, 1.08) | 0.226 |  | 0.86 (0.67, 1.11) | 0.256 |  | 0.91 (0.63, 1.31) | 0.613 |
| Ba | 1.03 (0.96, 1.10) | 0.464 |  | **1.10 (1.01, 1.20)** | **0.033** |  | 0.92 (0.82, 1.03) | 0.147 |
| Hg | 1.02 (0.95, 1.10) | 0.613 |  | 1.03 (0.94, 1.14) | 0.529 |  | 1.00 (0.90, 1.12) | 0.994 |
| Tl | 0.97 (0.83, 1.13) | 0.723 |  | 0.99 (0.82, 1.19) | 0.907 |  | 0.94 (0.72, 1.23) | 0.677 |
| Pb | 1.07 (0.98, 1.16) | 0.134 |  | **1.13 (1.003, 1.27)** | **0.044** |  | 1.01 (0.89, 1.15) | 0.851 |
| U | **1.11 (1.03, 1.19)** | **0.007** |  | **1.17 (1.06, 1.28)** | **0.002** |  | 1.03 (0.91, 1.17) | 0.602 |
| Abbreviations: Al, aluminum; V, vanadium; Cr, chromium; Mn, manganese; Fe, iron; Co, cobalt; Ni, nickel; Cu, copper; Zn, zinc; As, arsenic; Se, selenium; Rb, rubidium; Sr, strontium; Cd, cadmium; Cs, cesium; Ba, barium; Hg, mercury; Tl, thallium; Pb, lead; U, uranium.a Model for the difference of uric acid with the increase of metals adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model for males and females did not adjust sex. Model for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the model. |

|  |
| --- |
| Table S4. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding patients with urine creatinine < 0.3 or > 3 g/L (N = 1547). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **5.79 (3.04, 8.54)** | **< 0.001** |  | **6.62 (2.22, 11.02)** | **0.003** |  | **4.22 (0.97, 7.47)** | **0.011** |
| Model 2b | **5.98 (3.02, 8.94)** | **< 0.001** |  | **7.48 (2.69, 12.27)** | **0.002** |  | **3.64 (0.17, 7.10)** | **0.040** |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –0.87 (–3.75, 2.01) | 0.555 |  | 1.03 (–3.74, 5.79) | 0.673 |  | –1.07 (–4.49, 2.35) | 0.539 |
| Model 2 | –1.67 (–4.63, 1.29) | 0.269 |  | 0.90 (–4.21, 6.01) | 0.729 |  | –1.84 (–5.31, 1.62) | 0.297 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **6.33 (2.41, 10.25)** | **0.002** |  | **7.70 (1.29, 14.10)** | **0.019** |  | **5.18 (0.68, 9.67)** | **0.024** |
| Model 2 | **6.36 (2.04, 10.69)** | **0.004** |  | **10.15 (2.85, 17.45)** | **0.006** |  | 4.11 (–0.74, 8.96) | 0.096 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –0.82 (–5.79, 4.14) | 0.745 |  | –6.70 (–15.22, 1.83) | 0.123 |  | 3.13 (–2.37, 8.62) | 0.265 |
| Model 2 | **–6.81 (–12.42, –1.21)** | **0.017** |  | **–18.49 (–28.57, –8.41)** | **< 0.001** |  | 0.10 (–5.94, 6.15) | 0.974 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S5. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding patients with urine creatinine < 0.3 or > 3 g/L (N = 1547). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **1.27 (1.14, 1.43)** | **< 0.001** |  | **1.25 (1.08, 1.44)** | **0.002** |  | **1.31 (1.08, 1.6)** | **0.007** |
| Model 2b | **1.29 (1.14, 1.45)** | **< 0.001** |  | **1.25 (1.07, 1.46)** | **0.004** |  | **1.33 (1.07, 1.65)** | **0.010** |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 1.02 (0.91, 1.14) | 0.707 |  | 1.09 (0.94, 1.26) | 0.238 |  | 0.97 (0.8, 1.17) | 0.725 |
| Model 2 | 0.99 (0.88, 1.12) | 0.905 |  | 1.07 (0.92, 1.26) | 0.367 |  | 0.94 (0.77, 1.14) | 0.531 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **1.2 (1.02, 1.4)** | **0.025** |  | **1.26 (1.03, 1.53)** | **0.025** |  | 1.13 (0.86, 1.48) | 0.381 |
| Model 2 | 1.16 (0.97, 1.38) | 0.106 |  | **1.27 (1.01, 1.60)** | **0.041** |  | 1.03 (0.76, 1.39) | 0.856 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 1.01 (0.82, 1.23) | 0.957 |  | 0.95 (0.73, 1.24) | 0.701 |  | 1.1 (0.79, 1.52) | 0.568 |
| Model 2 | 0.81 (0.64, 1.02) | 0.069 |  | **0.68 (0.49, 0.93)** | **0.018** |  | 0.95 (0.66, 1.37) | 0.789 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S6. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals, using urine specific gravity to adjust urine dilution (N = 1641). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **6.38 (3.82, 8.94)** | **< 0.001** |  | **8.87 (4.91, 12.82)** | **< 0.001** |  | **3.27 (0.12, 6.41)** | **0.042** |
| Model 2b | **6.55 (3.79, 9.31)** | **< 0.001** |  | **8.29 (4.00, 12.58)** | **< 0.001** |  | **3.77 (0.38, 7.17)** | **0.030** |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 0.54 (–1.89, 2.98) | 0.661 |  | 3.90 (–0.04, 7.85) | 0.052 |  | –1.45 (–4.39, 1.49) | 0.333 |
| Model 2 | –1.09 (–3.89, 1.71) | 0.446 |  | 1.95 (–2.82, 6.72) | 0.423 |  | –2.49 (–5.84, 0.86) | 0.145 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **4.35 (1.25, 7.45)** | **0.006** |  | **6.99 (1.92, 12.06)** | **0.007** |  | 2.55 (–1.04, 6.15) | 0.164 |
| Model 2 | **5.42 (1.30, 9.54)** | **0.010** |  | **7.03 (0.07, 13.98)** | **0.048** |  | **4.74 (0.06, 9.42)** | **0.047** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 0.76 (–2.49, 4.00) | 0.648 |  | 3.09 (–2.49, 8.66) | 0.278 |  | –0.88 (–4.5, 2.74) | 0.634 |
| Model 2 | **–4.98 (–9.45, –0.51)** | **0.029** |  | –7.64 (–15.79, 0.51) | 0.066 |  | –3.88 (–8.75, 0.98) | 0.117 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S7. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals, using urine specific gravity to adjust urine dilution (N = 1641). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **1.21 (1.09, 1.35)** | **0.001** |  | **1.28 (1.12, 1.47)** | **< 0.001** |  | 1.07 (0.9, 1.29) | 0.441 |
| Model 2b | **1.22 (1.08, 1.37)** | **0.001** |  | **1.27 (1.10, 1.47)** | **0.001** |  | 1.09 (0.89, 1.33) | 0.424 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 1.05 (0.94, 1.16) | 0.391 |  | 1.13 (0.995 1.29) | 0.057 |  | 0.94 (0.79, 1.12) | 0.497 |
| Model 2 | 1.01 (0.89, 1.13) | 0.926 |  | 1.11 (0.95, 1.30) | 0.169 |  | 0.90 (0.74, 1.10) | 0.325 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | 1.13 (0.99, 1.29) | 0.060 |  | **1.20 (1.01, 1.41)** | **0.035** |  | 1.06 (0.85, 1.31) | 0.610 |
| Model 2 | 0.84 (0.70, 1.02) | 0.076 |  | 1.26 (0.99, 1.59) | 0.056 |  | 1.09 (0.83, 1.44) | 0.535 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 1.02 (0.89, 1.17) | 0.735 |  | 1.04 (0.86, 1.24) | 0.704 |  | 1.01 (0.81, 1.24) | 0.963 |
| Model 2 | 0.84 (0.70, 1.02) | 0.076 |  | **0.71 (0.54, 0.94)** | **0.015** |  | 0.97 (0.73, 1.29) | 0.831 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S8. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding elder (age ≥ 80) (N = 1923). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **4.24 (1.94, 6.54)** | **< 0.001** |  | **4.20 (0.63, 7.77)** | **0.021** |  | **3.65 (0.80, 6.51)** | **0.012** |
| Model 2b | **4.42 (1.92, 6.91)** | **0.001** |  | **4.93 (0.99, 8.86)** | **0.014** |  | **3.22 (0.15, 6.28)** | **0.040** |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –0.94 (–3.49, 1.60) | 0.468 |  | 0.30 (–3.97, 4.58) | 0.889 |  | –0.54 (–3.60, 2.52) | 0.729 |
| Model 2 | –2.23 (–4.88, 0.43) | 0.101 |  | –0.22 (–4.87, 4.44) | 0.928 |  | –1.71 (–4.87, 1.45) | 0.289 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **5.30 (1.77, 8.83)** | **0.003** |  | 5.37 (–0.23, 10.97) | 0.060 |  | **5.62 (1.37, 9.87)** | **0.010** |
| Model 2 | **5.47 (1.53, 9.40)** | **0.006** |  | **8.06 (1.56, 14.56)** | **0.015** |  | **4.88 (0.25, 9.51)** | **0.039** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –0.92 (–5.09, 3.24) | 0.663 |  | –5.91 (–13.28, 1.47) | 0.116 |  | 1.58 (–3.05, 6.21) | 0.502 |
| Model 2 | **–4.88 (–9.51, –0.25)** | **0.039** |  | **–14.31 (–23.09, –5.54)** | **0.001** |  | –0.95 (–5.93, 4.04) | 0.710 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S9. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding elder (age ≥ 80) (N = 1923). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **1.16 (1.05, 1.27)** | **0.003** |  | **1.18 (1.05, 1.33)** | **0.006** |  | 1.10 (0.94, 1.30) | 0.238 |
| Model 2b | **1.16 (1.05, 1.29)** | **0.004** |  | **1.19 (1.05, 1.36)** | **0.007** |  | 1.09 (0.91, 1.30) | 0.361 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 0.997 (0.90, 1.10) | 0.953 |  | 1.08 (0.95, 1.24) | 0.244 |  | 0.94 (0.79, 1.11) | 0.449 |
| Model 2 | 0.96 (0.86, 1.07) | 0.454 |  | 1.07 (0.93, 1.24) | 0.352 |  | 0.90 (0.76, 1.07) | 0.246 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **1.16 (1.01, 1.34)** | **0.042** |  | 1.18 (0.98, 1.41) | 0.076 |  | 1.17 (0.91, 1.49) | 0.214 |
| Model 2 | 1.15 (0.98, 1.36) | 0.081 |  | **1.24 (1.003, 1.52)** | **0.047** |  | 1.13 (0.86, 1.47) | 0.387 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 0.98 (0.83, 1.17) | 0.844 |  | 0.87 (0.68, 1.10) | 0.237 |  | 1.11 (0.85, 1.46) | 0.439 |
| Model 2 | 0.86 (0.71, 1.04) | 0.129 |  | **0.65 (0.49, 0.86)** | **0.003** |  | 1.07 (0.79, 1.43) | 0.676 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S10. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with BMI ≥ 30 kg/m2 (N = 1907). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **4.27 (1.95, 6.59)** | **< 0.001** |  | **4.38 (0.76, 7.99)** | **0.018** |  | **3.62 (0.77, 6.48)** | **0.013** |
| Model 2b | **4.37 (1.85, 6.88)** | **0.001** |  | **5.05 (1.06, 9.05)** | **0.013** |  | **3.10 (0.04, 6.17)** | **0.047** |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –0.63 (–3.20, 1.93) | 0.628 |  | 0.63 (–3.72, 4.99) | 0.776 |  | –0.19 (–3.25, 2.87) | 0.902 |
| Model 2 | –1.91 (–4.59, 0.77) | 0.162 |  | –0.04 (–4.75, 4.67) | 0.986 |  | –1.36 (–4.52, 1.80) | 0.400 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **5.28 (1.73, 8.82)** | **0.004** |  | 5.52 (–0.13, 11.17) | 0.056 |  | **5.52 (1.27, 9.76)** | **0.011** |
| Model 2 | **5.27 (1.32, 9.22)** | **0.009** |  | **7.70 (1.17, 14.23)** | **0.021** |  | **4.67 (0.05, 9.29)** | **0.048** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –0.61 (–4.80, 3.58) | 0.775 |  | –5.25 (–12.71, 2.20) | 0.167 |  | 1.90 (–2.72, 6.53) | 0.419 |
| Model 2 | –4.61 (–9.26, 0.04) | 0.052 |  | **–13.65 (–22.47, –4.83)** | **0.002** |  | –0.63 (–5.61, 4.36) | 0.805 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S11. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with BMI ≥ 30 kg/m2 (N = 1907). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **1.13 (1.03, 1.24)** | **0.011** |  | **1.16 (1.03, 1.30)** | **0.014** |  | 1.08 (0.92, 1.28) | 0.338 |
| Model 2b | **1.13 (1.02, 1.25)** | **0.020** |  | **1.16 (1.02, 1.32)** | **0.019** |  | 1.06 (0.89, 1.27) | 0.515 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 1.01 (0.91, 1.11) | 0.920 |  | 1.09 (0.95, 1.24) | 0.236 |  | 0.96 (0.81, 1.13) | 0.608 |
| Model 2 | 0.97 (0.87, 1.08) | 0.602 |  | 1.07 (0.93, 1.24) | 0.361 |  | 0.92 (0.77, 1.10) | 0.378 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **1.16 (1.002, 1.33)** | **0.047** |  | 1.17 (0.98, 1.40) | 0.078 |  | 1.16 (0.91, 1.49) | 0.229 |
| Model 2 | 1.15 (0.98, 1.35) | 0.087 |  | 1.21 (0.99, 1.49) | 0.066 |  | 1.13 (0.86, 1.48) | 0.374 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 0.99 (0.84, 1.18) | 0.955 |  | 0.90 (0.71, 1.14) | 0.395 |  | 1.12 (0.85, 1.47) | 0.433 |
| Model 2 | 0.88 (0.73, 1.07) | 0.196 |  | **0.69 (0.52, 0.92)** | **0.011** |  | 1.07 (0.79, 1.44) | 0.670 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S12. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with eGFR ≤ 90 mL/min/1.73 m2 (N = 1374). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **3.28 (0.65, 5.92)** | **0.015** |  | 3.88 (–0.39, 8.14) | 0.075 |  | 2.05 (–1.19, 5.29) | 0.214 |
| Model 2b | **3.41 (0.59, 6.23)** | **0.018** |  | **5.02 (0.38, 9.67)** | **0.034** |  | 1.47 (–1.99, 4.93) | 0.404 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | **–2.88 (–5.71, –0.04)** | **0.046** |  | –2.40 (–7.54, 2.75) | 0.361 |  | –1.64 (–4.98, 1.70) | 0.336 |
| Model 2 | **–3.89 (–6.84, –0.95)** | **0.010** |  | –2.67 (–8.19, 2.86) | 0.343 |  | –2.43 (–5.88, 1.03) | 0.169 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **6.04 (2.12, 9.97)** | **0.003** |  | 6.25 (–0.32, 12.83) | 0.062 |  | **6.03 (1.36, 10.71)** | **0.012** |
| Model 2 | **6.96 (2.59, 11.34)** | **0.002** |  | **10.66 (3.10, 18.22)** | **0.006** |  | **5.86 (0.72, 11.00)** | **0.025** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –1.24 (–5.91, 3.43) | 0.603 |  | **–8.75 (–17.5, –0.002)** | **0.049** |  | 1.98 (–3.21, 7.17) | 0.455 |
| Model 2 | –4.67 (–9.85, 0.52) | 0.078 |  | **–17.30 (–27.63, –6.97)** | **0.001** |  | –0.16 (–5.8, 5.48) | 0.956 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S13. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with eGFR ≤ 90 mL/min/1.73 m2 (N = 1374). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **1.15 (1.02, 1.30)** | **0.028** |  | **1.18 (1.01, 1.38)** | **0.038** |  | 1.06 (0.86, 1.30) | 0.613 |
| Model 2b | **1.16 (1.02, 1.33)** | **0.025** |  | **1.21 (1.02, 1.44)** | **0.026** |  | 1.05 (0.84, 1.32) | 0.657 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 0.91 (0.80, 1.03) | 0.128 |  | 1.04 (0.87, 1.24) | 0.642 |  | **0.80 (0.66, 0.98)** | **0.029** |
| Model 2 | 0.89 (0.78, 1.01) | 0.072 |  | 1.06 (0.88, 1.28) | 0.549 |  | **0.79 (0.64, 0.96)** | **0.020** |
| As |  |  |  |  |  |  |  |  |
| Model 1 | 1.19 (0.996, 1.43) | 0.056 |  | 1.19 (0.94, 1.50) | 0.154 |  | 1.22 (0.91, 1.63) | 0.178 |
| Model 2 | **1.23 (1.003, 1.50)** | **0.046** |  | 1.31 (0.996, 1.72) | 0.053 |  | 1.22 (0.88, 1.68) | 0.229 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 0.92 (0.74, 1.15) | 0.486 |  | 0.79 (0.58, 1.08) | 0.146 |  | 1.04 (0.74, 1.48) | 0.804 |
| Model 2 | 0.82 (0.64, 1.05) | 0.118 |  | **0.57 (0.39, 0.84)** | **0.004** |  | 1.03 (0.70, 1.53) | 0.868 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S14. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with hypertension and medications use (N = 1499). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **3.26 (0.74, 5.78)** | **0.011** |  | 3.19 (–0.93, 7.31) | 0.129 |  | 2.67 (–0.4, 5.74) | 0.088 |
| Model 2b | **3.46 (0.72, 6.20)** | **0.013** |  | 4.24 (–0.31, 8.79) | 0.068 |  | 1.90 (–1.43, 5.23) | 0.262 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –0.76 (–3.68, 2.17) | 0.613 |  | –0.47 (–5.76, 4.81) | 0.860 |  | 0.31 (–3.11, 3.72) | 0.860 |
| Model 2 | –1.75 (–4.81, 1.31) | 0.262 |  | –0.18 (–5.93, 5.56) | 0.950 |  | –0.64 (–4.18, 2.89) | 0.721 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **5.10 (1.18, 9.02)** | **0.011** |  | 4.79 (–1.78, 11.36) | 0.153 |  | **5.81 (1.18, 10.43)** | **0.014** |
| Model 2 | **6.02 (1.67, 10.38)** | **0.007** |  | **10.08 (2.51, 17.65)** | **0.009** |  | **5.44 (0.38, 10.50)** | **0.035** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –2.74 (–7.24, 1.75) | 0.232 |  | **–11.33 (–19.77, –2.89)** | **0.009** |  | 1.23 (–3.72, 6.17) | 0.626 |
| Model 2 | **–6.50 (–11.45, –1.55)** | **0.010** |  | **–20.13 (–30.05, –10.21)** | **< 0.001** |  | –1.26 (–6.57, 4.06) | 0.643 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, and hyperlipidemia. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S15. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with hypertension and medications use (N = 1499). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | 1.10 (0.98, 1.23) | 0.094 |  | 1.11 (0.97, 1.28) | 0.136 |  | 1.06 (0.88, 1.27) | 0.529 |
| Model 2b | 1.10 (0.98, 1.24) | 0.104 |  | 1.13 (0.97, 1.32) | 0.115 |  | 1.02 (0.83, 1.25) | 0.853 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 1.00 (0.88, 1.14) | 0.999 |  | 1.05 (0.88, 1.26) | 0.591 |  | 1.02 (0.82, 1.27) | 0.841 |
| Model 2 | 0.98 (0.85, 1.12) | 0.735 |  | 1.07 (0.88, 1.30) | 0.501 |  | 0.99 (0.80, 1.24) | 0.957 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | 1.15 (0.97, 1.37) | 0.100 |  | 1.15 (0.92, 1.43) | 0.231 |  | 1.21 (0.91, 1.60) | 0.186 |
| Model 2 | 1.20 (0.99, 1.46) | 0.062 |  | **1.32 (1.02, 1.71)** | **0.035** |  | 1.20 (0.88, 1.64) | 0.247 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 0.90 (0.74, 1.10) | 0.289 |  | **0.73 (0.55, 0.97)** | **0.032** |  | 1.07 (0.78, 1.45) | 0.688 |
| Model 2 | **0.79 (0.64, 0.99)** | **0.037** |  | **0.55 (0.39, 0.78)** | **0.001** |  | 0.99 (0.71, 1.38) | 0.949 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, and hyperlipidemia. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S16. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding participants with hyperlipidemia (N = 1537). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **3.45 (0.99, 5.92)** | **0.006** |  | 2.86 (–1.06, 6.79) | 0.153 |  | **3.39 (0.34, 6.44)** | **0.029** |
| Model 2b | **3.76 (1.09, 6.42)** | **0.006** |  | 3.88 (–0.49, 8.25) | 0.081 |  | 3.13 (–0.13, 6.38) | 0.060 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –1.18 (–3.97, 1.61) | 0.407 |  | 1.21 (–3.84, 6.26) | 0.637 |  | –1.36 (–4.62, 1.91) | 0.415 |
| Model 2 | –2.19 (–5.10, 0.72) | 0.140 |  | 1.67 (–3.85, 7.20) | 0.552 |  | –2.49 (–5.87, 0.88) | 0.147 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **4.69 (0.88, 8.50)** | **0.016** |  | 3.71 (–2.43, 9.84) | 0.236 |  | **5.31 (0.68, 9.94)** | **0.025** |
| Model 2 | **5.43 (1.17, 9.70)** | **0.013** |  | **8.01 (0.86, 15.16)** | **0.028** |  | 4.56 (–0.50, 9.62) | 0.077 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –1.97 (–6.43, 2.49) | 0.387 |  | **–10.29 (–18.29, –2.29)** | **0.012** |  | 1.89 (–3.14, 6.91) | 0.461 |
| Model 2 | **–5.68 (–10.65, –0.7)** | **0.025** |  | **–19.00 (–28.48, –9.52)** | **< 0.001** |  | –0.28 (–5.73, 5.17) | 0.919 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S17. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after excluding participants with hyperlipidemia (N = 1537). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | 1.08 (0.97, 1.21) | 0.159 |  | 1.09 (0.95, 1.24) | 0.240 |  | 1.08 (0.89, 1.30) | 0.434 |
| Model 2b | 1.11 (0.99, 1.25) | 0.074 |  | 1.14 (0.98, 1.33) | 0.089 |  | 1.07 (0.88, 1.31) | 0.506 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 0.95 (0.84, 1.08) | 0.457 |  | 1.06 (0.89, 1.26) | 0.483 |  | 0.91 (0.76, 1.10) | 0.329 |
| Model 2 | 0.95 (0.84, 1.08) | 0.417 |  | 1.12 (0.93, 1.35) | 0.244 |  | 0.89 (0.73, 1.08) | 0.230 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | 1.09 (0.92, 1.29) | 0.334 |  | 1.05 (0.85, 1.30) | 0.632 |  | 1.14 (0.86, 1.52) | 0.359 |
| Model 2 | 1.17 (0.97, 1.42) | 0.098 |  | 1.26 (0.98, 1.61) | 0.075 |  | 1.13 (0.82, 1.54) | 0.456 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | **0.81 (0.67, 0.99)** | **0.042** |  | **0.62 (0.47, 0.83)** | **0.001** |  | 1.05 (0.76, 1.46) | 0.765 |
| Model 2 | **0.73 (0.58, 0.91)** | **0.004** |  | **0.46 (0.33, 0.65)** | **< 0.001** |  | 1.02 (0.71, 1.46) | 0.927 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S18. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after excluding patients with uric acid less than 2 mg/dL (N = 1947). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **3.74 (1.46, 6.03)** | **0.001** |  | **3.75 (0.21, 7.29)** | **0.038** |  | **3.11 (0.29, 5.93)** | **0.031** |
| Model 2b | **3.94 (1.47, 6.42)** | **0.002** |  | **4.44 (0.53, 8.34)** | **0.026** |  | 2.73 (–0.30, 5.75) | 0.077 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –0.93 (–3.45, 1.60) | 0.473 |  | 0.41 (–3.83, 4.65) | 0.849 |  | –0.52 (–3.55, 2.51) | 0.736 |
| Model 2 | –1.99 (–4.62, 0.65) | 0.140 |  | 0.08 (–4.53, 4.69) | 0.973 |  | –1.44 (–4.57, 1.68) | 0.365 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **5.12 (1.61, 8.62)** | **0.004** |  | 5.21 (–0.31, 10.73) | 0.065 |  | **5.31 (1.09, 9.54)** | **0.014** |
| Model 2 | **5.65 (1.75, 9.55)** | **0.005** |  | **7.90 (1.53, 14.26)** | **0.015** |  | **5.01 (0.40, 9.63)** | **0.033** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –1.67 (–5.79, 2.45) | 0.427 |  | –6.15 (–13.41, 1.11) | 0.097 |  | 0.59 (–3.99, 5.17) | 0.800 |
| Model 2 | –5.58 (–10.16, –0.99) | **0.017** |  | **–14.17 (–22.76, –5.57)** | **0.001** |  | –1.92 (–6.86, 3.03) | 0.447 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, and hypertension. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S19. The difference [95% confidence interval (CI)] in uric acid (μmol/L) with a 2-fold increase in urinary metals after further adjusted urinary lead concentrations (N = 1950). |
| Metals | Total |  | Male |  | Femalec |
| Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |  | Coefficient (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **3.90 (1.27, 6.52)** | **0.004** |  | 3.46 (–0.58, 7.50) | 0.093 |  | **3.77 (0.50, 7.05)** | **0.024** |
| Model 2b | **4.00 (1.27, 6.74)** | **0.004** |  | 4.16 (–0.10, 8.42) | 0.056 |  | 3.35 (–0.25, 6.73) | 0.052 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | –1.66 (–4.31, 0.98) | 0.217 |  | –0.63 (–5.09, 3.84) | 0.782 |  | –0.88 (–4.06, 2.30) | 0.588 |
| Model 2 | –2.14 (–4.83, 0.56) | 0.120 |  | –0.29 (–4.98, 4.41) | 0.905 |  | –1.34 (–4.55, 1.87) | 0.412 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | **5.38 (1.86, 8.89)** | **0.003** |  | 4.65 (–1.06, 10.36) | 0.110 |  | **5.34 (0.95, 9.73)** | **0.017** |
| Model 2 | **5.48 (1.55, 9.40)** | **0.006** |  | **7.87 (1.47, 14.28)** | **0.016** |  | **4.97 (0.32, 9.63)** | **0.036** |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | –2.01 (–6.23, 2.21) | 0.351 |  | **–7.65 (–15.15, –0.15)** | **0.046** |  | 0.95 (–3.72, 5.63) | 0.689 |
| Model 2 | **–5.13 (–9.74, –0.57)** | **0.029** |  | **–14.12 (–22.76, –5.48)** | **0.001** |  | –1.30 (–6.27, 3.68) | 0.609 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, hypertension, and urinary lead concentrations. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |

|  |
| --- |
| Table S20. Odds ratios [95% confidence interval (CI)] for hyperuricemia with a 2-fold increase in urinary metals after further adjusted urinary lead concentrations (N = 1950). |
| Metals | Total |  | Male |  | Femalec |
| OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |  | OR (95% CI) | *p*-value |
| V |  |  |  |  |  |  |  |  |
| Model 1a | **1.13 (1.02, 1.25)** | **0.022** |  | 1.13 (0.99, 1.28) | 0.070 |  | 1.11 (0.93, 1.34) | 0.250 |
| Model 2b | **1.14 (1.02, 1.26)** | **0.024** |  | 1.15 (0.999, 1.31) | 0.052 |  | 1.09 (0.90, 1.32) | 0.367 |
| Co |  |  |  |  |  |  |  |  |
| Model 1 | 0.98 (0.88, 1.08) | 0.656 |  | 1.04 (0.91, 1.20) | 0.555 |  | 0.94 (0.79, 1.12) | 0.476 |
| Model 2 | 0.97 (0.87, 1.07) | 0.511 |  | 1.06 (0.92, 1.22) | 0.434 |  | 0.92 (0.77, 1.10) | 0.369 |
| As |  |  |  |  |  |  |  |  |
| Model 1 | 1.13 (0.98, 1.31) | 0.096 |  | 1.13 (0.94, 1.35) | 0.187 |  | 1.17 (0.91, 1.50) | 0.230 |
| Model 2 | 1.15 (0.98, 1.35) | 0.082 |  | 1.22 (0.99, 1.49) | 0.059 |  | 1.13 (0.87, 1.49) | 0.360 |
| Se |  |  |  |  |  |  |  |  |
| Model 1 | 0.94 (0.79, 1.12) | 0.504 |  | 0.82 (0.65, 1.04) | 0.101 |  | 1.08 (0.82, 1.43) | 0.563 |
| Model 2 | 0.86 (0.71, 1.03) | 0.104 |  | **0.67 (0.50, 0.88)** | **0.004** |  | 1.03 (0.77, 1.39) | 0.830 |
| Abbreviations: V, vanadium; Co, cobalt; As, arsenic; Se, selenium.a Model 1 adjusted age, sex, BMI, smoking status, pack-years of smoking, alcohol consumption, exercise frequency, education attainment, income level, eGFR, hyperlipidemia, hypertension, and urinary lead concentrations. Model 1 for males and females did not adjust sex.b Model 2 adjusted all covariates in model 1 and other metals levels. Model 2 for males and females did not adjust sex.c Model 1 and 2 for females did not adjust smoking status and pack-years of smoking owing to the few numbers of smokers, and alcohol consumption was dichotomized into non-drinker and drinker (current and former drinker) in the models. |