

# ELEMENTAL PROFILE OF RECORDED AND UNRECORDED FRUIT SPIRITS AND HEALTH RISK ASSESSMENT

Ljilja, D, Torović<sup>1,2</sup>, Branislava, U, Srdjenović-Čonić<sup>1,3</sup>, Nebojša, V, Kladar<sup>1,3</sup>, Nebojša, Salaj<sup>1</sup>, Milan, Lj, Jovanović<sup>2</sup>, Danijela, R, Lukić<sup>2</sup>, Sanja, V, Bijelović<sup>1,2</sup>

<sup>1</sup>University of Novi Sad, Faculty of Medicine, Novi Sad, Serbia

<sup>2</sup>Institute of Public Health of Vojvodina, Novi Sad, Serbia

<sup>3</sup>University of Novi Sad, Faculty of Medicine, Center for Medical and Pharmaceutical Investigations and Quality Control



Table 1. Elemental profile of recorded and unrecorded fruit spirits

**INTRODUCTION**  
Home production of spirits from fruits such as plums, grapes, pears, and apricots, has a very long tradition in Serbia. Such spirits are often not being taxed nor captured by official sale statistics, and therefore are termed “unrecorded alcohol”. Unrecorded alcohols also escape safety control but reach numerous consumers, thus raising health risk concerns.

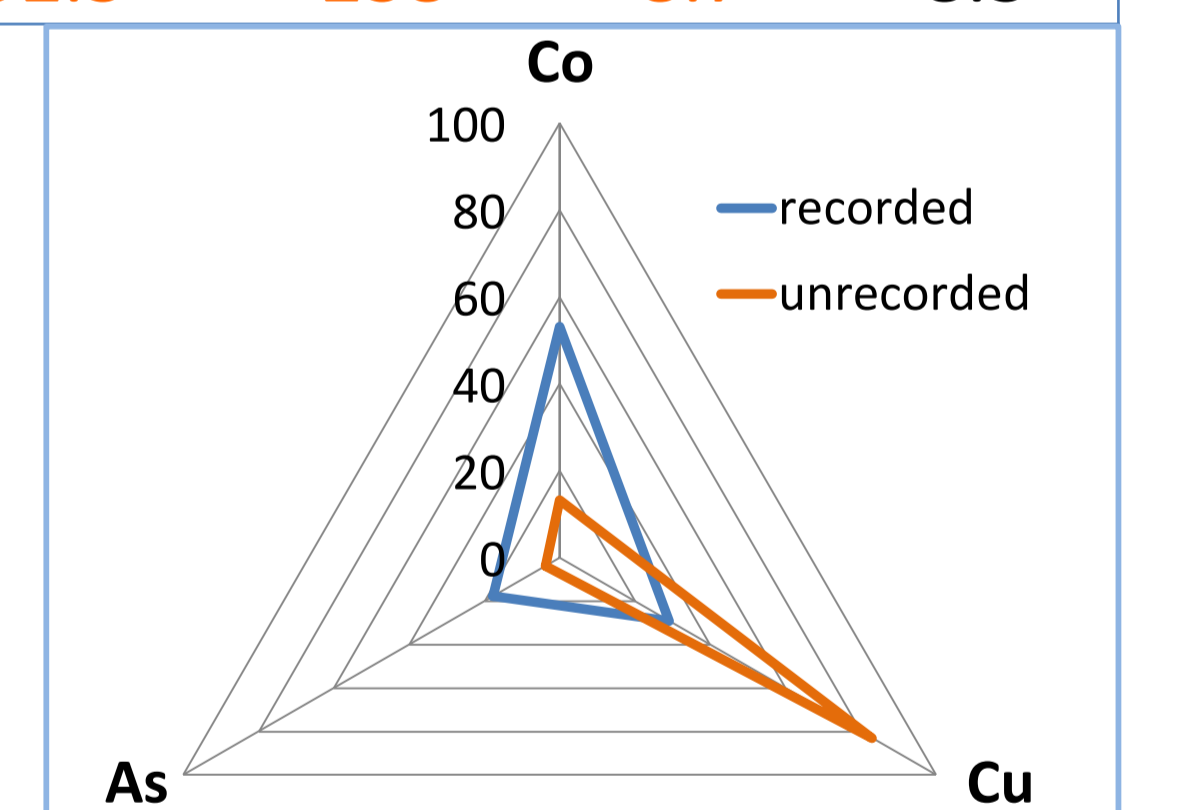
**MATERIALS**  
Out of 153 samples of fruit spirits collected during 2020 in Vojvodina, 26 with tax stamp were marked as recorded, whereas 127 produced in private homes or small scale distilleries and obtained mainly directly from the producers were marked as unrecorded.

**METHODS**  
Profiles of 22 elements were provided using ICP-MS and direct mercury analyzer. Daily intake of elements was estimated separately for adult men and women, at different consumption levels, taken from the WHO Global status report on alcohol and health, considering the share of recorded and unrecorded alcohol consumption. Hazard quotient (HQ)/hazard index (HI) method was used to estimate health risk, as well as comparison with benchmark doses (BMDLs) for lead and arsenic.

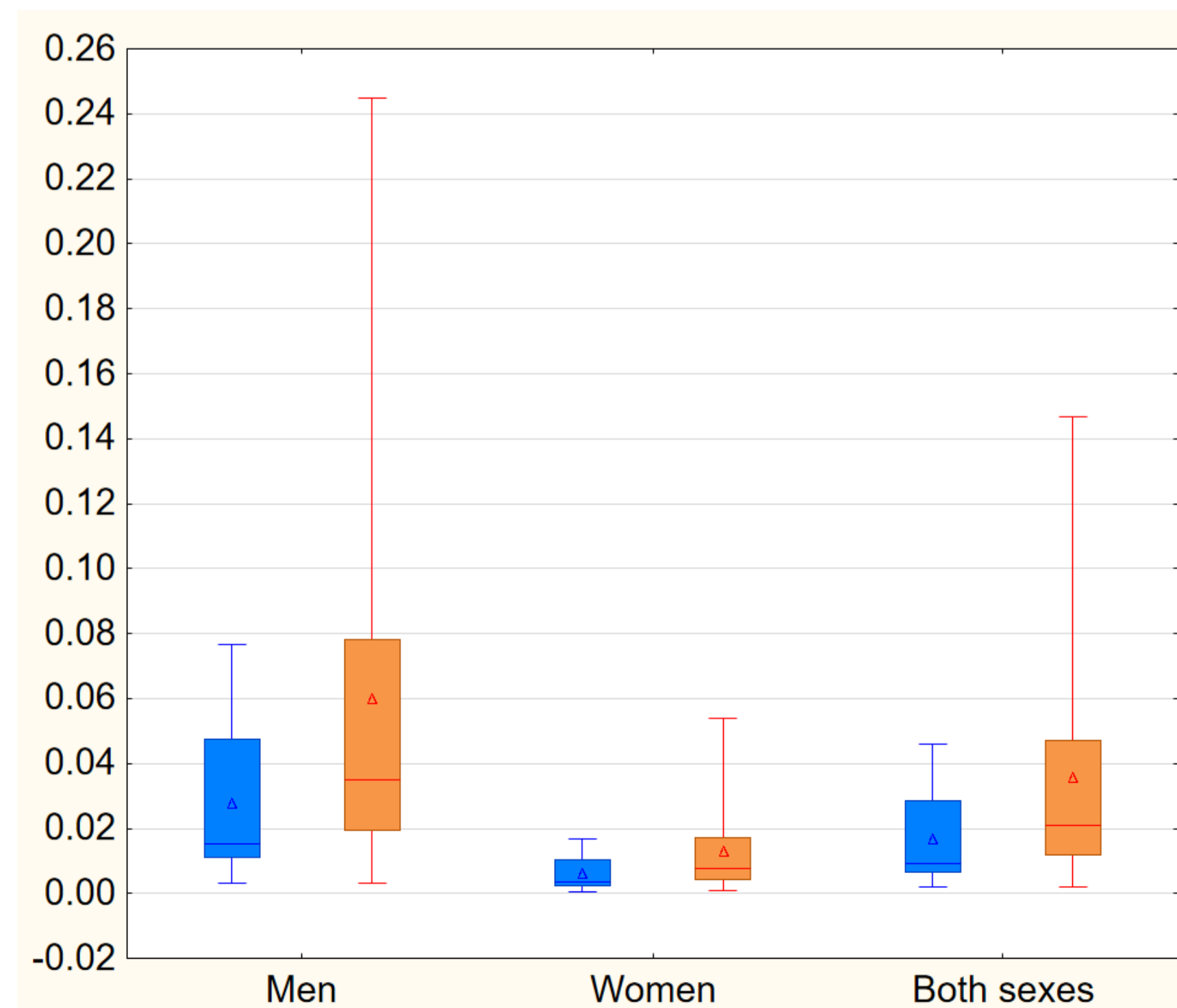
**RESULTS**  
**Elemental profile:** Only Cu and Pb concentrations exceeded toxicological thresholds proposed by the AMPHORA project (Alcohol Measures for Public Health Research Alliance) (73.2 and 8.5% of all samples, respectively, Table 1). The mean Cu content of unrecorded spirits was substantially higher than that of recorded ones (8.2 vs 1.5 mg/L), probably due to the different materials used for processing equipment.

Element	AMPHORA maximum (µg/L)	Recorded fruit spirits (c µg/L)						Unrecorded fruit spirit (c µg/L)						Total
		% pos	min	max	average	STD	%>max	% pos	min	max	average	STD	%>max	
Be	-	0.0	0.0	0.0	0.0	0.0	-	9.4	0.0	0.1	0.0	0.0	-	
B	5000	100	3.7	165	40.1	32.7	0	96.9	0.0	206	29.6	39.6	0	
Al	2000	65.4	0.0	671	67.8	154	0	83.5	0.0	384	31.8	47.8	0	
Cr	500	69.2	0.0	74.2	26.2	24.8	0	44.1	0.0	163	24.1	36.7	0	
Mn	500	96.2	0.0	23.4	3.9	6.0	0	100	0.3	416	9.2	39.4	0	
Fe	2000	84.6	0.0	190	39.4	48.1	0	63.8	0.0	1202	35.4	111	0	
Co	-	100	1.5	56.3	9.6	11.3	-	81.9	0.0	101	7.1	14.2	-	
Ni	200	100	0.4	20.1	5.5	5.5	0	79.5	0.0	51.4	2.9	7.8	0	
Cu	2000	76.9	0.0	6990	1520	2230	30.8	100	44.0	43300	8175	8371	81.9	73.2
Zn	5000	88.5	0.0	1195	127	250	0	100	2.9	4984	285	843	0	
As	100	96.2	0.0	18.5	2.7	4.4	0	92.1	0.0	26.2	2.4	5.0	0	
Se	100	53.8	0.0	2.1	1.0	1.0	0	40.9	0.0	17.8	1.5	3.3	0	
Sr	-	88.5	0.0	101	17.5	31.0	-	92.9	0.0	70.2	7.4	12.2	-	
Mo	-	46.2	0.0	0.8	0.2	0.3	-	17.3	0.0	1.2	0.1	0.2	-	
Cd	10	23.1	0.00	0.48	0.04	0.11	0	38.6	0.00	1.60	0.08	0.20	0	
Sn	1000	100	0.1	24.1	2.4	4.8	0	66.9	0.0	72.8	0.9	6.8	0	
Sb	50	92.3	0.00	3.41	0.52	0.90	0	82.7	0.00	4.20	0.42	0.76	0	
Te	-	0	0.0	0.0	0.0	0.0	-	7.9	0.0	0.1	0.0	0.0	-	
Ba	-	73.1	0.0	15.4	2.7	3.2	-	70.1	0.0	11.0	2.0	2.1	-	
Hg	10	15.4	0.00	0.62	0.07	0.18	0	19.7	0.00	1.07	0.10	0.22	0	
Tl	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	-	
Pb	200	14.4	0.0	384	35.7	90.4	7.7	97.6	0.0	1873	92.5	238	8.7	8.5

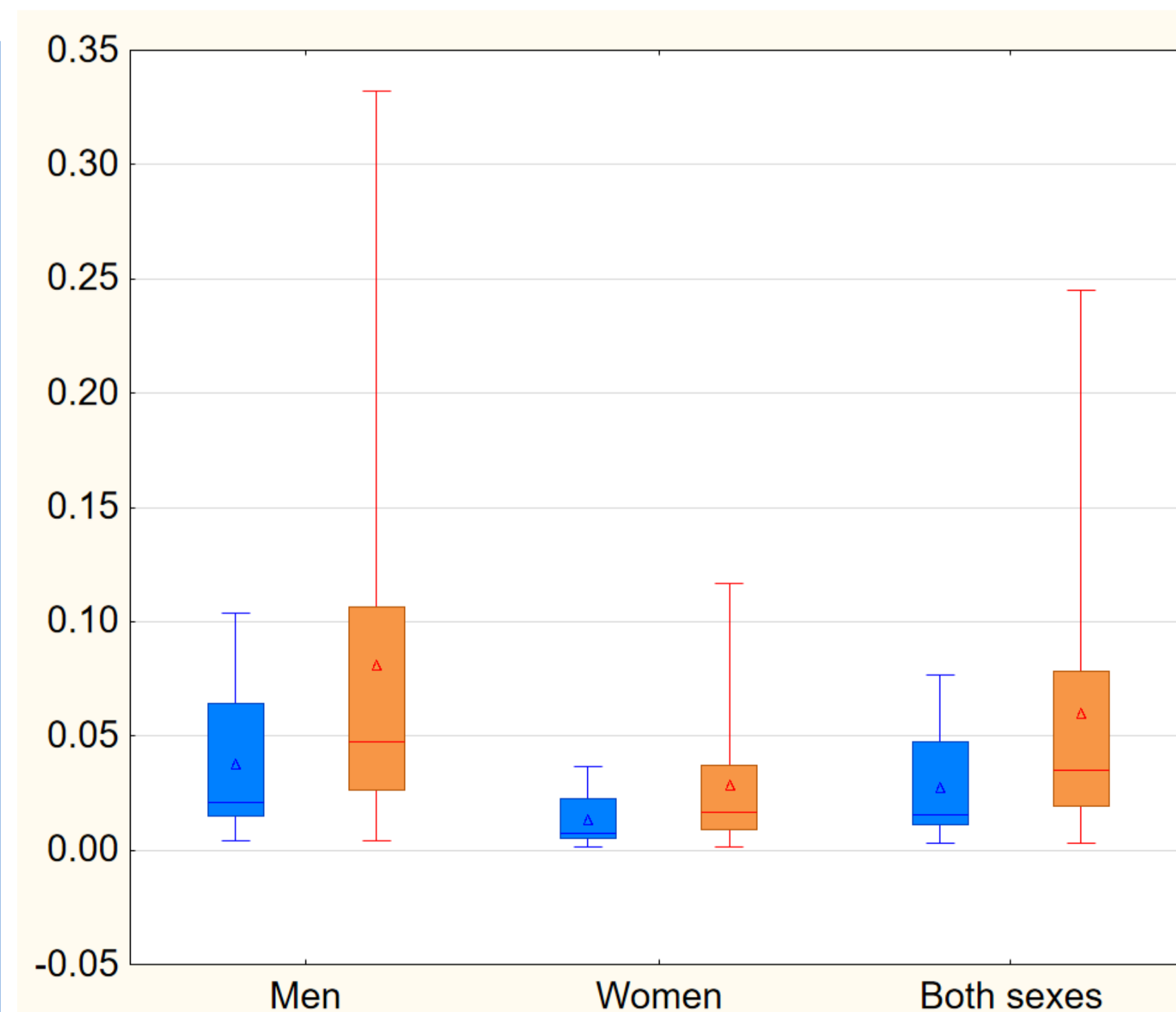
**Risk assessment:** Exposure assessed in average and regular drinker scenarios translated into HQs was well below limit level of 1, for both men and women, regardless of recorded / unrecorded spirit consumed. Furthermore, HI, a sum of individual elements' HQs for a sample, also remained low (Graphs 1,2). Cu, Co and As were the main contributors to HI (Graph 5). In chronic heavy drinker scenarios (Graph 3 – shared consumption), only if total alcohol consumption was considered attributable to unrecorded spirits (Graph 4), HIs exceeded 1 for 15% of the samples for men and 9.4% for women. In the same scenario, exposure to Pb at high percentiles exceeded BMDL for nephrotoxicity (0.63 µg/kg bw), whereas As exposure was below BMDL (0.3-8 µg/kg bw) in all exposure scenarios.



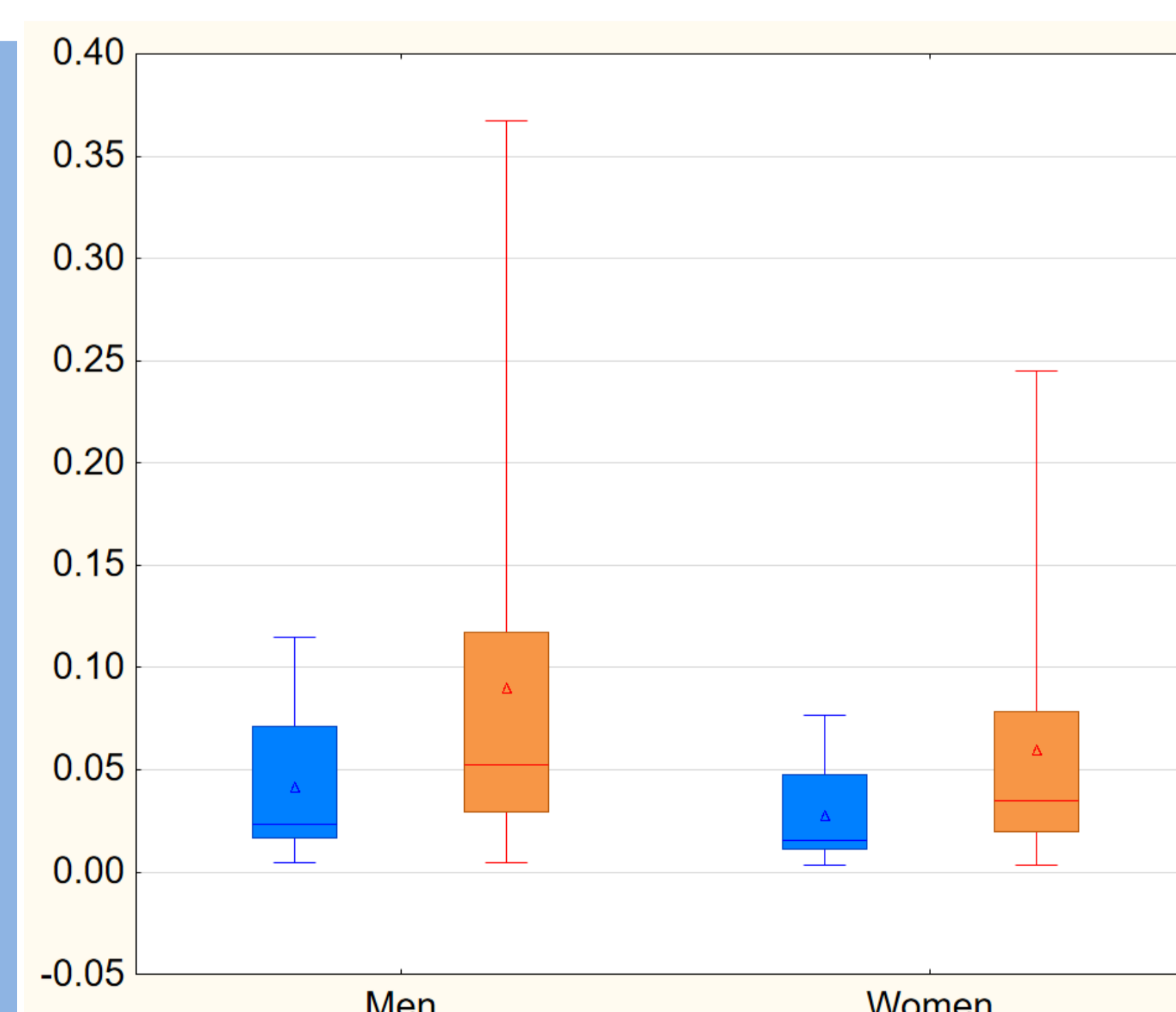
Graph 5. Cu, Co and As contribution to HI



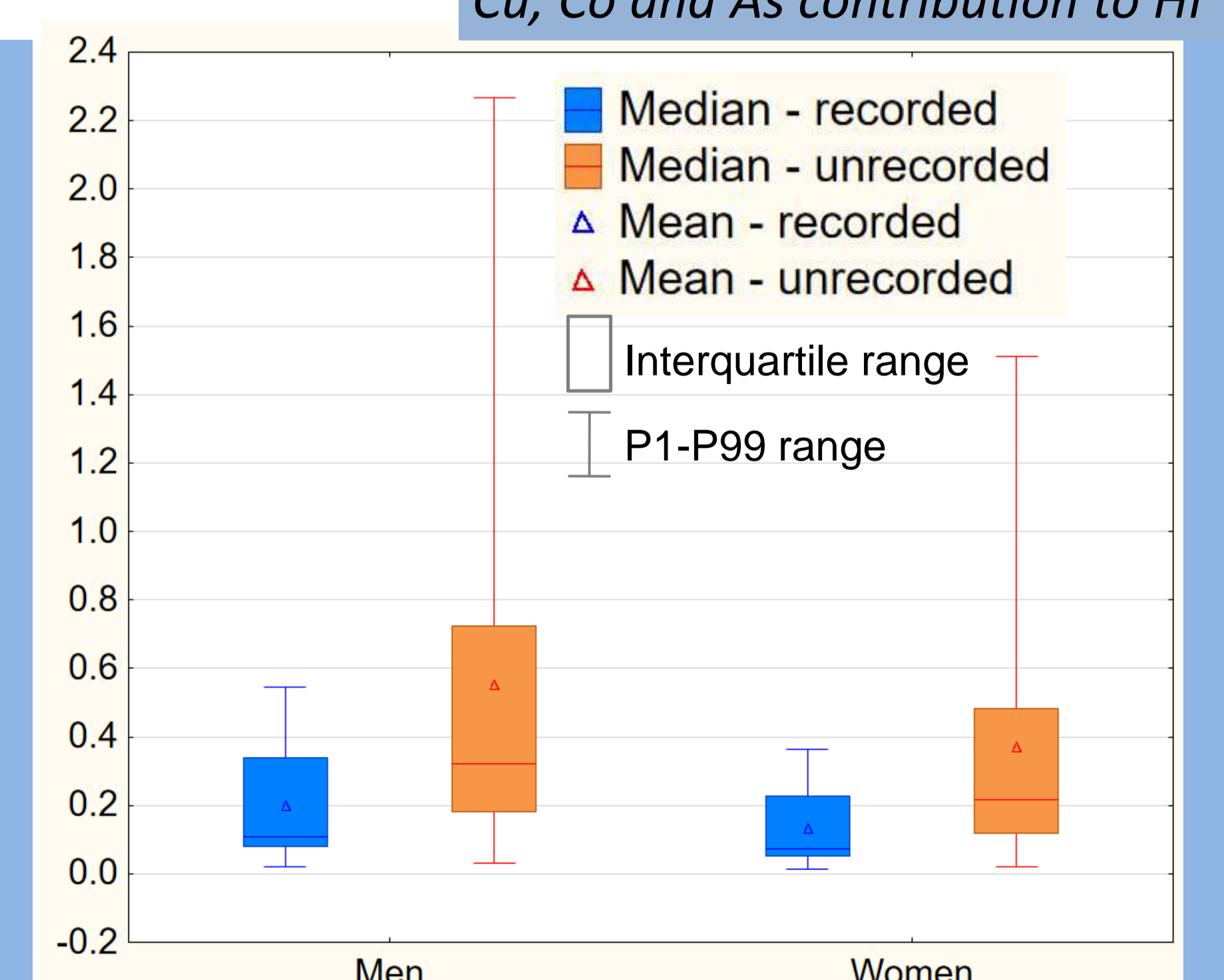
Graph 1. Hazard index – average drinker scenario



Graph 2. Hazard index – regular drinker scenario



Graph 3. Hazard index – chronic heavy drinker scenario



Graph 4. Hazard index – chronic heavy drinker scenario