$PM_{2.5}$ levels and Chemical composition in 3 areas with Urban/ Rural difference in Prevalence of Respiratory diseases

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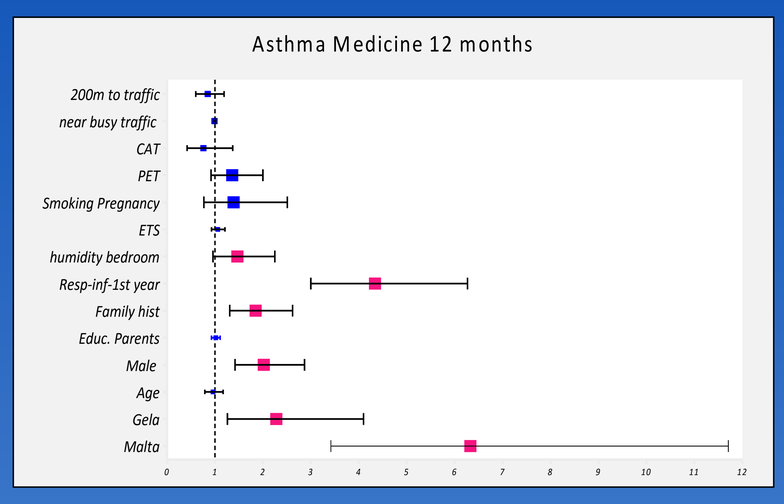
Intro: RESPIRA Study showed living in Malta (urban), Gela (industrial) is a risk for respiratory symptoms compared to rural south Sicily.

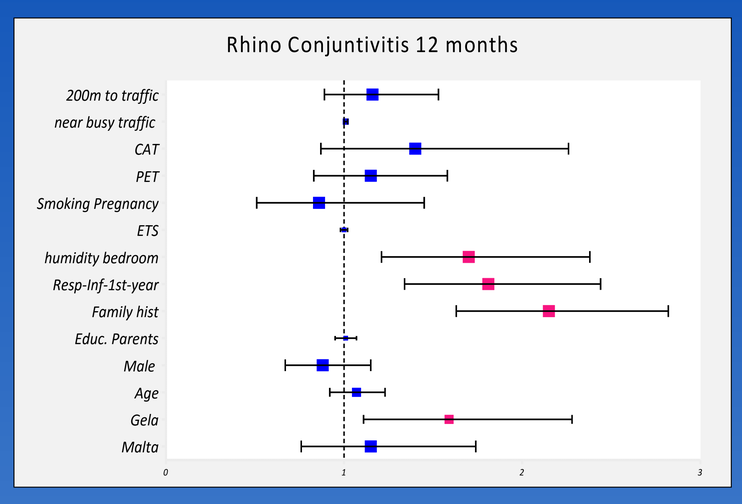
Aim: To chemically analyze outdoor $PM_{2.5}$ in these locations.

Method: FAI pumps at 10l/min and Teflon(Whatman) filters collected $PM_{2.5}$ for 48 hours, Malta(n=54), Gela(n=42) and rural areas (n=42), including schools and homes. The ionic component of ICP-MS extraction was measured at CNR Rome. Aeroqual IQM60 measured $PM_{2.5}$ levels in Malta. $PM_{2.5}$ in Sicily was calculated from filter weights.

Results: Outdoor $PM_{2.5}$ Malta(n=53) Mean41.1 µg/m³, Median29.7, Q1-13.9, Q3-57.7, p<0.001, Gela(n=34) MN 16 µg/m³, MD 15.1, Q1 12.1, Q3 19.1 P<0.01 and Rural (n=35) MN 12.36, MD 11.28, Q1 9.4, Q3 14.2. Chemical analysis showed higher metal levels in Malta and Gela compared to rural. (Malta, Gela, rural, mean and (Median) in ng/m³) of V 4.0(1.76), 2.3(1.50), 0.6(0.27), Ni 2.18(1.37), 0.98(0.82), 0.47(0.64), Cd 0.32(0.07), 0.11(0.072), 0.05(0.027), Pb 1.39(1.01), 0.91(0.81), 0.39(0.29), Fe 45.0(27.76), 3.5(3.05), 3.5(1.03), Cu 3.49(1.22), 1.44(1.07), 1.09(0.56), Sr 1.21(0.14), 0.18(0.075), 0.5(0.078), Ba 1.08(0.52), 0.36(0.25), 0.04(0.06), Sn 0.1(0.059), 0.053(0.032), 0.04(0.0035), Mn 1.01(0.8), 1.37(1.19), 0.66(0.41). Sulphur 460(209), 741(705) 342(202), and Antimony Sb 0.42(0.18), 0.72(0.85) 0.22(0.19) were higher in Gela. No difference noted for As 0.19(0.13), 0.19(0.19), 0.17(0.17), Rb 0.37(0.18), 0.45(0.37), 0.53(0.33).

Conclusion: Malta with risk for asthma symptoms, had higher PM2.5 level and most heavy metals. Gela with risk for rhinoconjuctivitis had higher level of sulphur content.



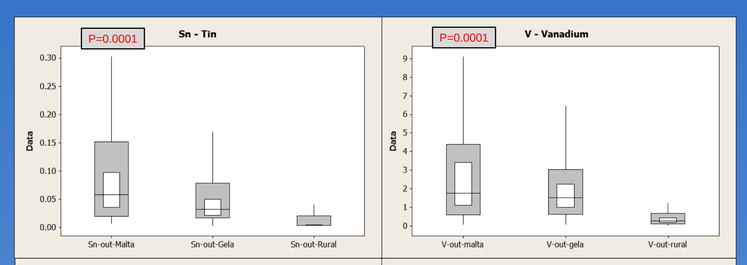


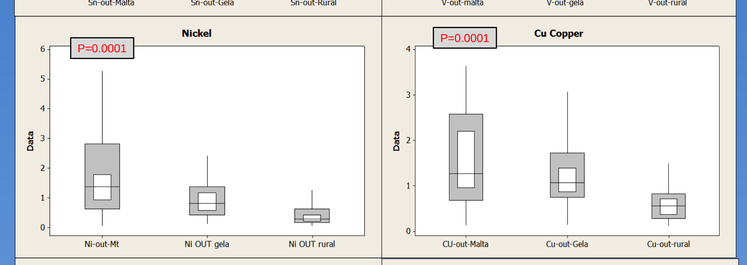
Outdoor $PM_{2.5}$

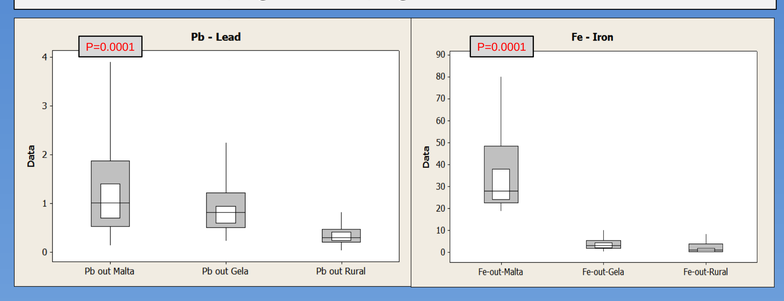
Malta (n=53)
Mean 41.10 µg/m³,
Median 29.70, Q1 13.9, Q3 57.7, p<0.001,

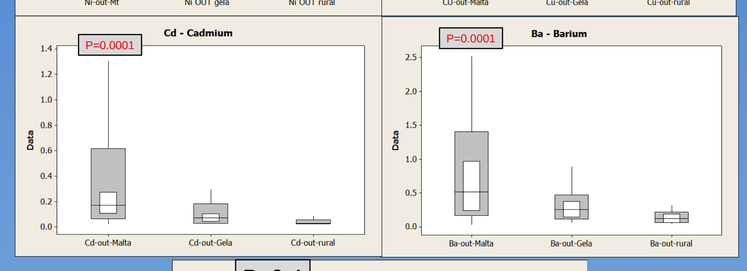
Gela (n=34)
Mean 16.00 µg/m³,
Median 15.10, Q1 12.1, Q3 19.1 p<0.01

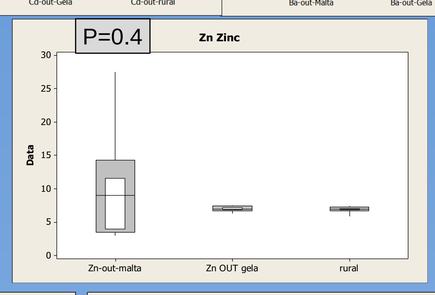
Rural (n=35)
Mean 12.36 µg/m³,
Median 11.28, Q1 9.40, Q3 14.2

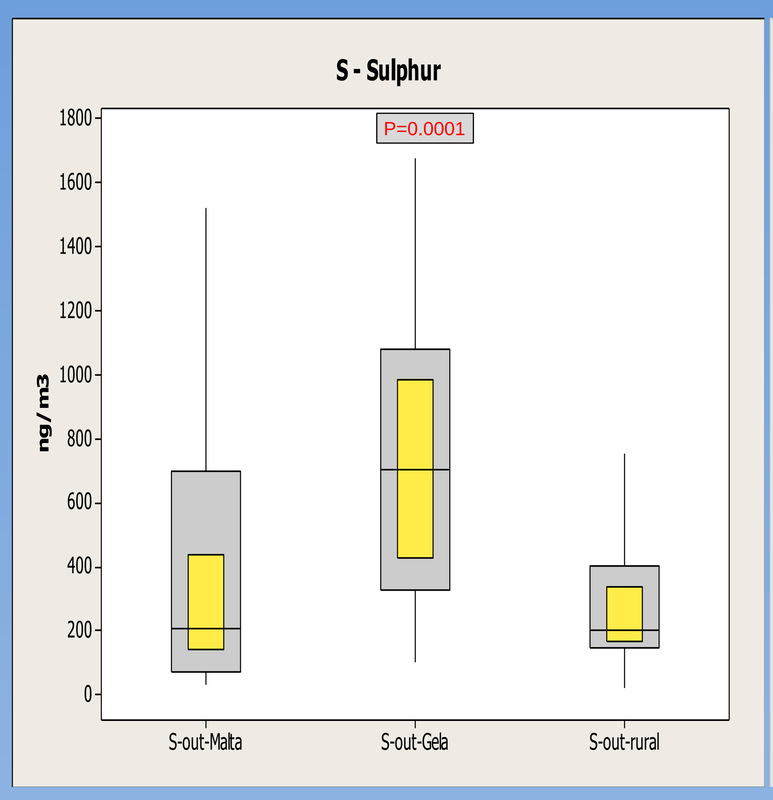


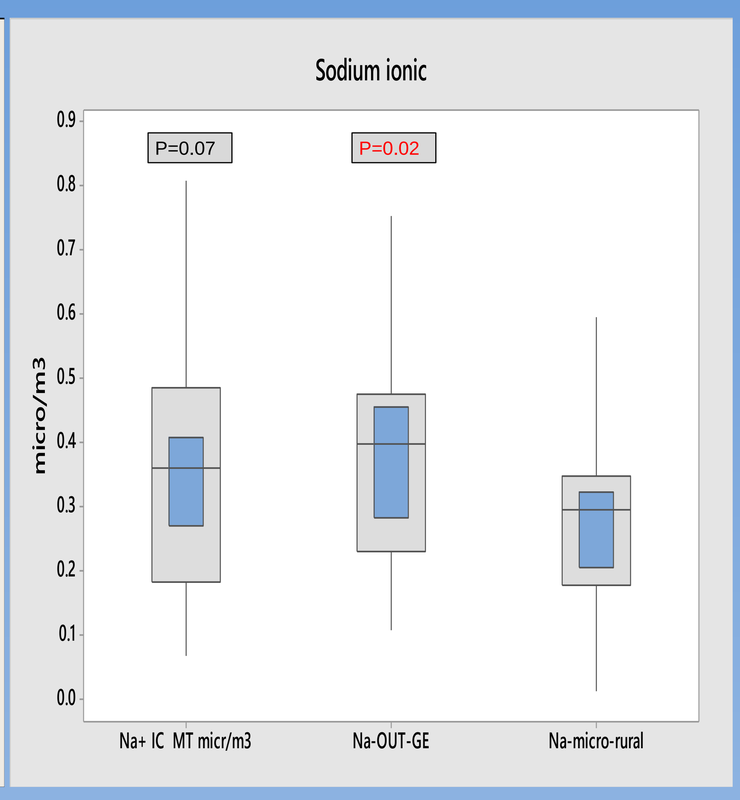


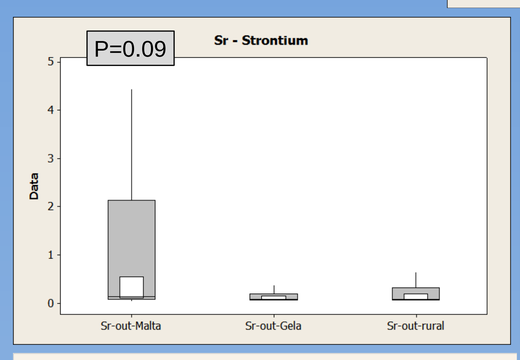


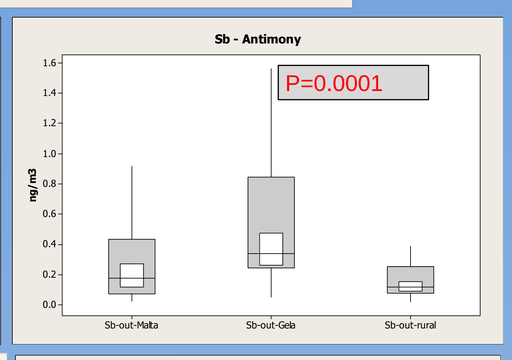


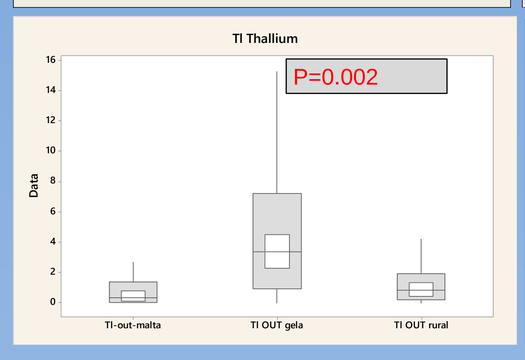


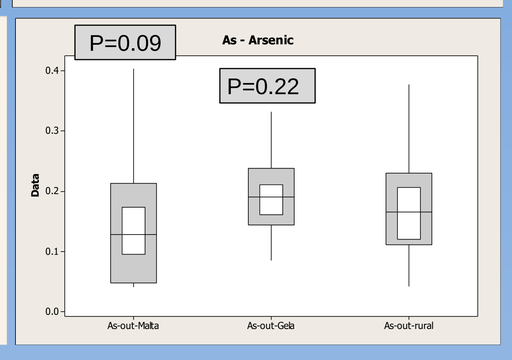


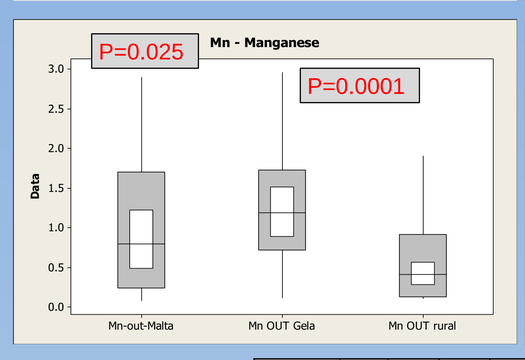


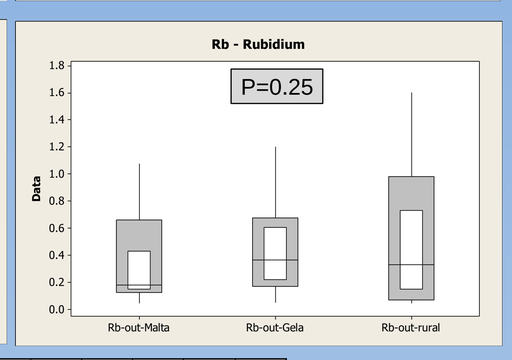


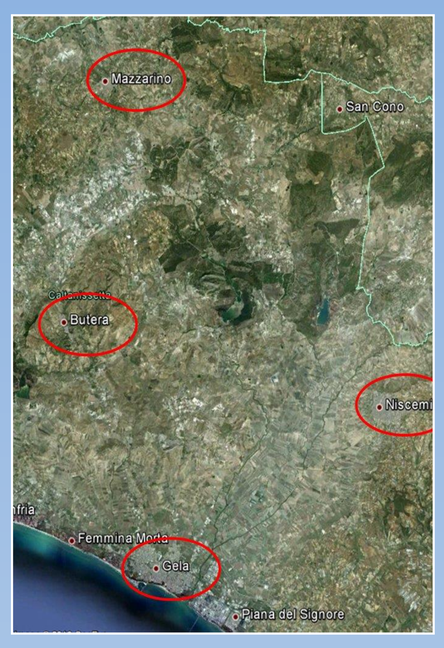












Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum	p value
Fe-out-Malta	33	45.01	41.08	18.74	22.58	27.76	48.41	194.19	<0.0001
Fe-out-Gela	40	3.50	2.33	0.18	1.67	3.05	5.48	10.249	0.0037
Fe OUT Rural	44	3.50	9.21	0.17	0.22	1.03	3.89	61.00	
V-out-Malta	54	3.973	4.969	0.05	0.592	1.766	4.404	19.063	<0.0001
V-out-Gela	40	2.28	2.476	0.056	0.628	1.505	3.025	12.6130	<0.0001
V-out-rural	44	0.584	0.817	0.003	0.098	0.271	0.686	3.301	
Cu-out-Malta	54	3.487	6.827	0.128	0.682	1.272	2.572	38.125	<0.0001
Cu-out-Gela	40	1.436	1.342	0.136	0.749	1.071	1.724	6.8690	0.0002
Cu-out-rural	44	1.089	2.225	0.118	0.28	0.56	0.824	13.9	
Ni-out-Malta	54	2.18	2.39	0.05	0.63	1.37	2.83	10.86	<0.0001
Ni-out-Gela	40	0.98	0.77	0.12	0.43	0.82	1.38	3.9230	0.0001
Ni-out-rural	44	0.47	0.47	0.05	0.17	0.29	0.64	2.09	
Pb-out-Malta	53	1.39	1.21	0.14	0.525	1.009	1.8780	4.796	<0.0001
Pb-out-Gela	40	0.9123	0.5441	0.2295	0.5027	0.8101	1.2154	2.2514	<0.0001
Pb-out-Rural	44	0.3878	0.2786	0.034	0.208	0.2914	0.4652	1.5	
Cd-out-Malta	54	0.3212	0.0481	0.3531	0.0224	0.0662	0.1712	0.6154	<0.0001
Cd-out-Gela	40	0.1047	0.0846	0.0252	0.028	0.0724	0.1835	0.2987	0.0001
Cd-out-rural	44	0.04257	0.03309	0.02	0.02676	0.02789	0.05527	0.2078	
Sr-out-Malta	54	1.214	1.974	0.033	0.082	0.139	2.136	9.566	0.09
Sr-out-Gela	37	0.1834	0.2382	0.0588	0.0688	0.0751	0.198	1.3102	0.29
Sr-out-rural	44	0.5010	1.2290	0.0590	0.0710	0.0780	0.3260	7.6180	
Ba-out-Malta	54	1.08	1.77	0.03	0.17	0.52	1.41	11.86	<0.0001
Ba-out-GE	40	0.36	0.35	0.06	0.11	0.25	0.47	1.4423	0.0017
Ba OUT Rural	44	0.04	0.03	0.02	0.03	0.03	0.06	0.21	
Sn-out-Malta	54	0.1	0.1002	0.0067	0.0193	0.0585	0.1514	0.3798	<0.0001
Sn-out-Gela	40	0.05247	0.0535	0.00315	0.01687	0.03187	0.07899	0.2111	<0.0001
Sn-out-rural	44	0.0404	0.1007	0.0029	0.0034	0.0035	0.0208	0.4443	
Mn-out-Malta	54	1.01	0.847	0.08	0.245	0.795	1.703	4.263	0.0250
Mn-out-Gela	40	1.373	1.022	0.115	0.722	1.194	1.734	5.1930	<0.0001
Mn-out-rural	44	0.661	0.732	0.103	0.126	0.409	0.913	3.619	

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum	
Sb-out-Malta	54	0.419	0.909	0.024	0.077	0.179	0.434	6.502	0.1700
Sb-out-Gela	40	0.712	0.852	0.051	0.246	0.341	0.847	3.1100	<0.0001
Sb-out-rural	44	0.2229	0.2801	0.0231	0.0779	0.1188	0.255	1.2241	
As-out-Malta	54	0.1905	0.261	0.0417	0.0481	0.1283	0.2134	1.4684	0.0930
As-out-Gela	40	0.1943	0.0712	0.0851	0.1445	0.1906	0.2384	0.4256	0.2200
As-out-rural	44	0.1742	0.0804	0.042	0.1114	0.1664	0.2301	0.3777	
Rb-out-Malta	54	0.3692	0.3377	0.0481	0.1249	0.1829	0.6603	1.5019	0.2500
Rb-out-Gela	40	0.4519	0.3358	0.0497	0.1698	0.368	0.6753	1.2027	0.93
Rb-out-rural	44	0.5306	0.4764	0.0441	0.0718	0.333	0.9799	1.6034	
S-out-Malta	54	460.2	483.8	33.2	73.1	209.6	699.2	1671.3	0.9500
S-out-Gela	34	741.2	454.3	106.1	331.9	705	1081	1677.9	0.0001
S-out-rural	37	342	343.5	22.9	147.7	202.8	406.3	1667.1	

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