

Environmental epidemiological study and estimation of benchmark dose on renal dysfunction in a cadmium polluted area in China

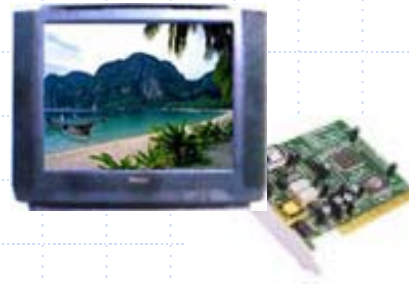
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Cd



17000 Tons / year

Cd





Critical concentration

Critical concentration
Critical concentration
Critical concentration
Critical concentration
Critical concentration
Critical concentration



BenchMark Dose Software

Version 1.2.1



United States
Environmental Protection
Agency

Office of Research
and Development

NCEA

National Center For Environmental Assessment

BenchMark Dose Software

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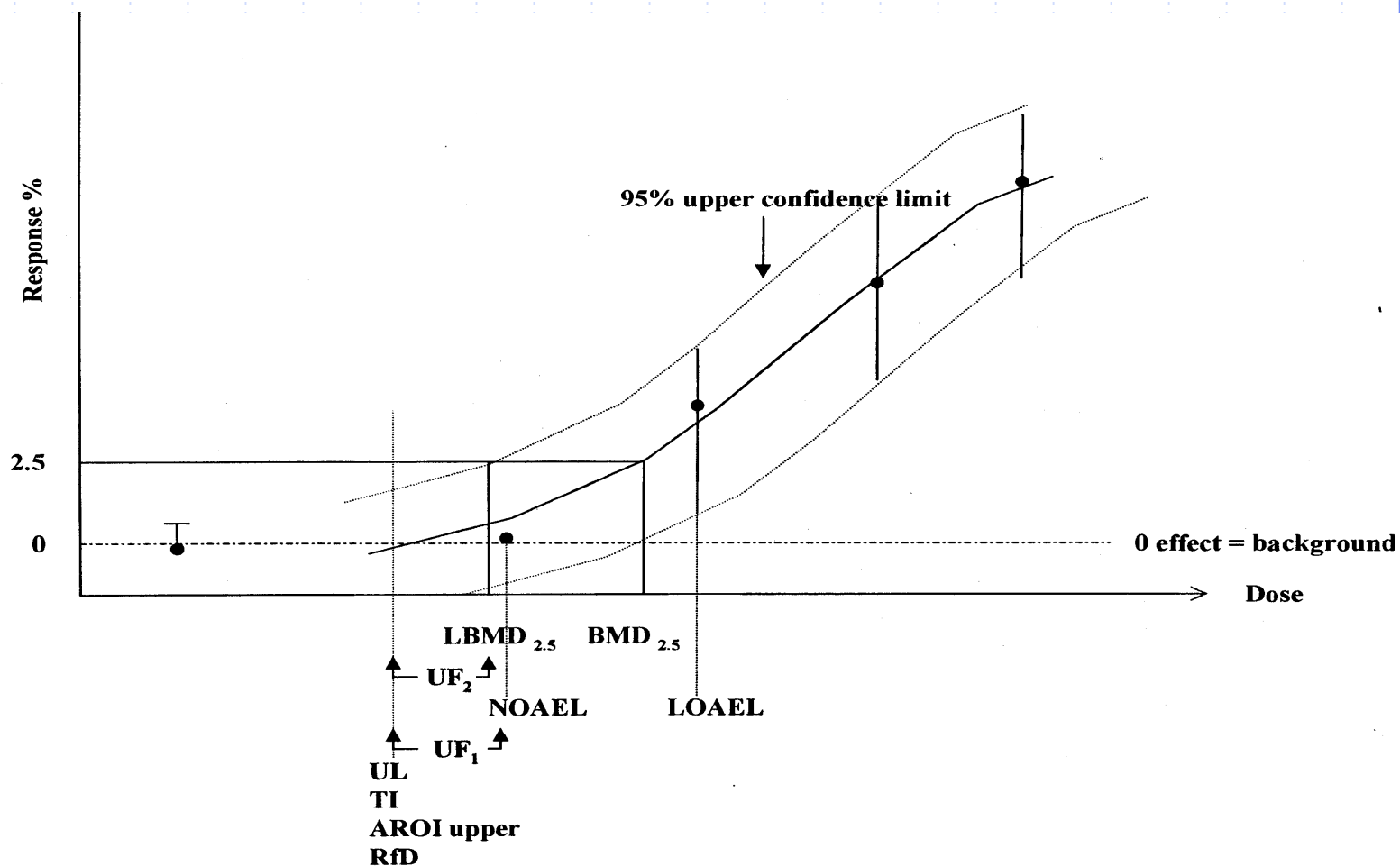
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This software has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for use. Mention of trade names or commercial products does not constitute endorsement.

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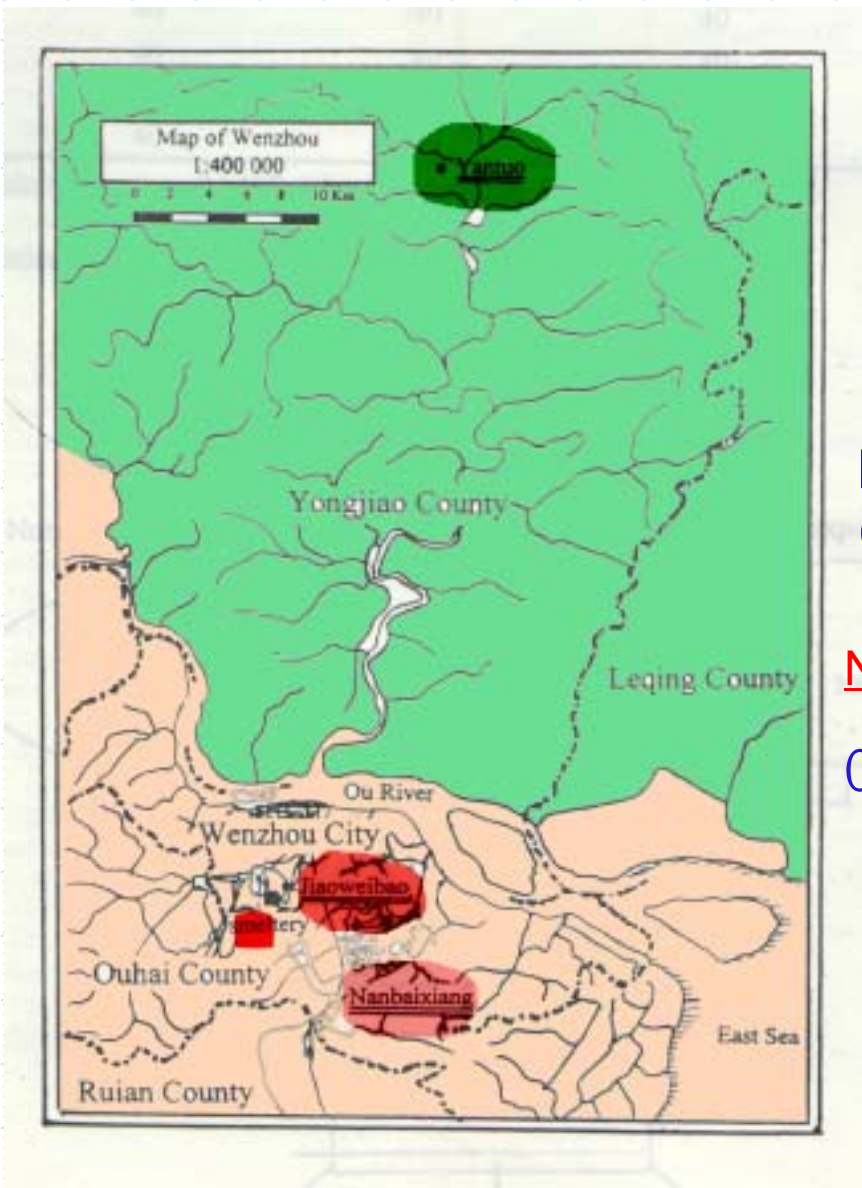
Benchmark Dose (BMD)





Cadmium polluted areas in China





Heavy polluted area : 253
 Moderated : 243
 Control : 294

Cd in rice

Heavy polluted area : 3.75 mg/kg
 Moderated : 0.70 mg/kg
 Control : 0.05 mg/kg

National hygienic standard

Cd in rice : 0.2mg/kg

Cd in cigarette : 1.6µg/stick

Geometric mean (G) of urinary cadmium in different areas and genders

Indicator/Area	Total		Female		Male	
	n	G	n	G	n	G
UCd ($\mu\text{g/g}$ creatinine)						
Control area	253	1.83	155	1.79	98	1.58
Medium polluted area	243	3.55*	162	4.45*	81	2.27*
Highly polluted area	294	11.18*	171	12.86*	123	9.20*

* Compared with control area: $p < 0.05$
compared with medium exposed area: $P < 0.05$

Fig 3. Distribution of UCd in different areas

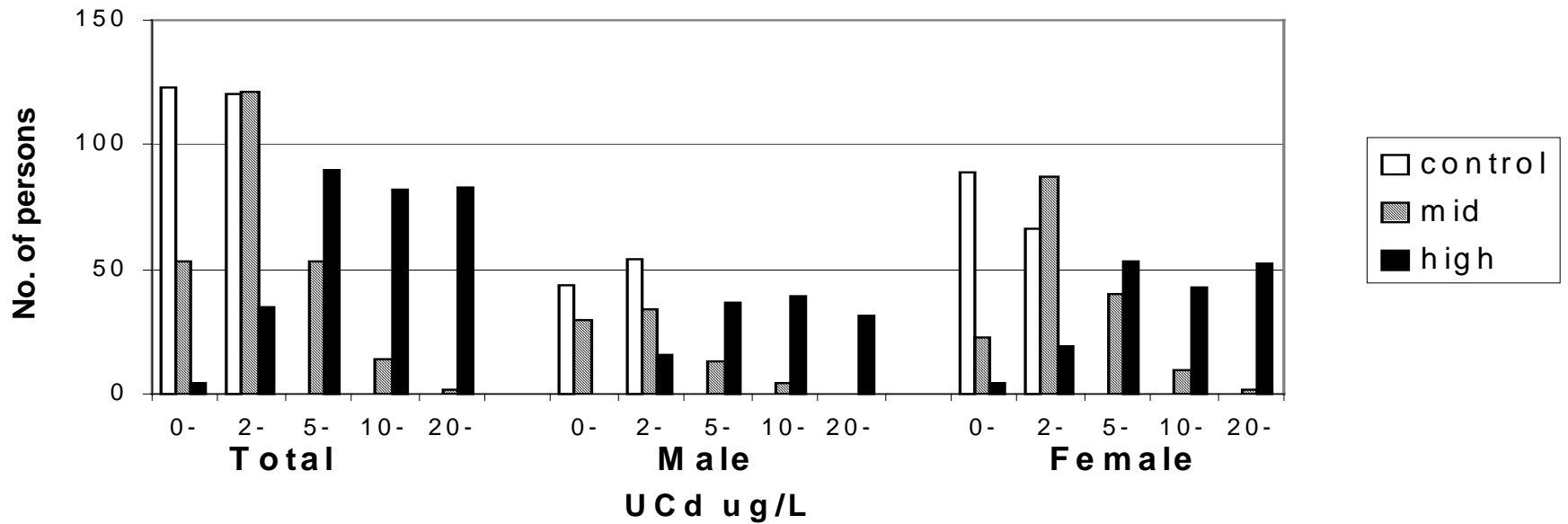
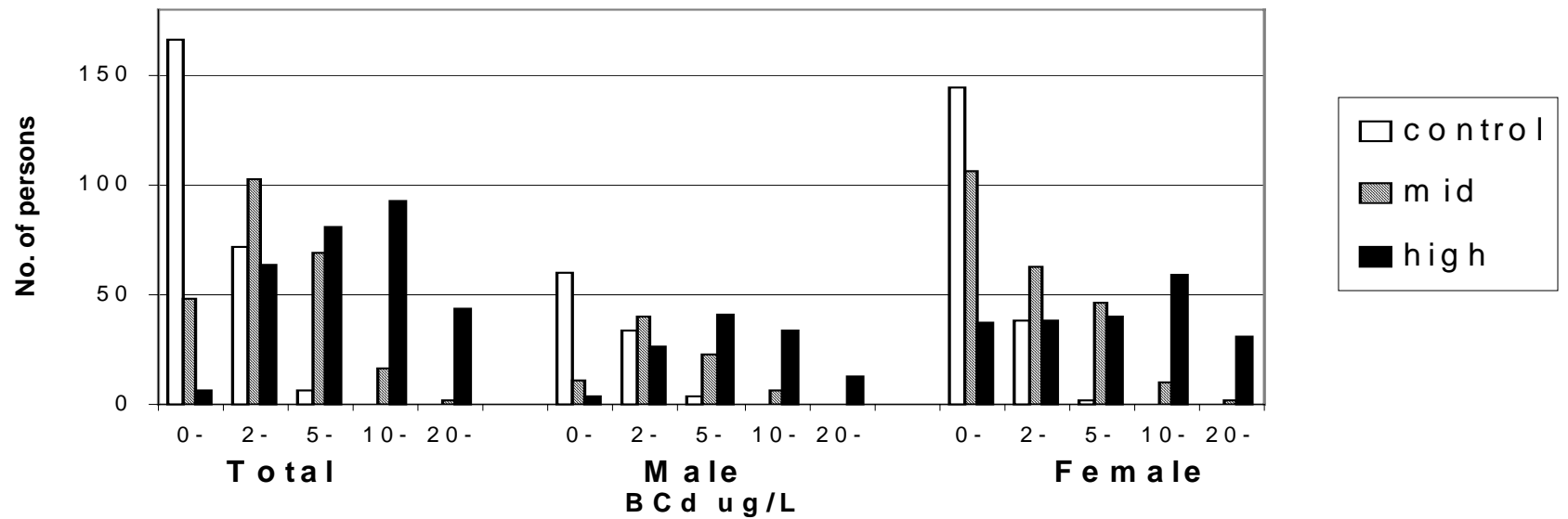


Fig 2. Distribution of B C d in different areas



Geometric mean of urinary total NAG, NAG-B and ALB in different areas and genders

Indices/Area	Total		Female		Male	
	N	G	N	G	N	G
B2M(mg/g creatinine)						
Control area	253	0.165	155	0.153	98	0.184
Medium exposed area	243	0.160	162	0.156	81	0.169
Highly exposed area	294	0.332*	171	0.324*	123	0.343*
RBP (mg/g creatinine)						
Control area	233	0.059	171	0.088	93	0.060
Medium exposed area	239	0.075*	159	0.078	80	0.070*
Highly exposed area	288	0.139*	140	0.139*	118	0.140*
NAG (U/g creatinine)						
Control area	253	1.92	155	1.97	98	1.84
Medium exposed area	243	3.55*	162	4.08*	81	2.71*
Highly exposed area	294	8.06*	171	10.07*	123	5.93*
NAG-B(U/g creatinine)						
Control area	253	0.53	155	0.54	98	0.52
Medium exposed area	243	1.13*	162	1.34*	81	1.25*
Highly exposed area	294	3.12*	171	4.01*	123	2.20*
ALB(mg/g creatinine)						
Control area	253	3.06	155	3.39	98	2.60
Medium exposed area	243	4.34	162	5.12	81	3.11
Highly exposed area	294	5.95*	171	6.92*	123	4.82*

* Compared with control area: $p < 0.05$
 compared with medium exposed area: $P < 0.05$

The cut-off points

for screening the prevalence of renal metabolism indexes

NAG:	15 U/g·Cr
NAGB:	4 U/g·Cr
β 2-MG:	0.8 mg/g·Cr
RBP:	0.3 mg/g·Cr
Alb:	25 mg/g·Cr

According to the 5% prevalence rate among control group

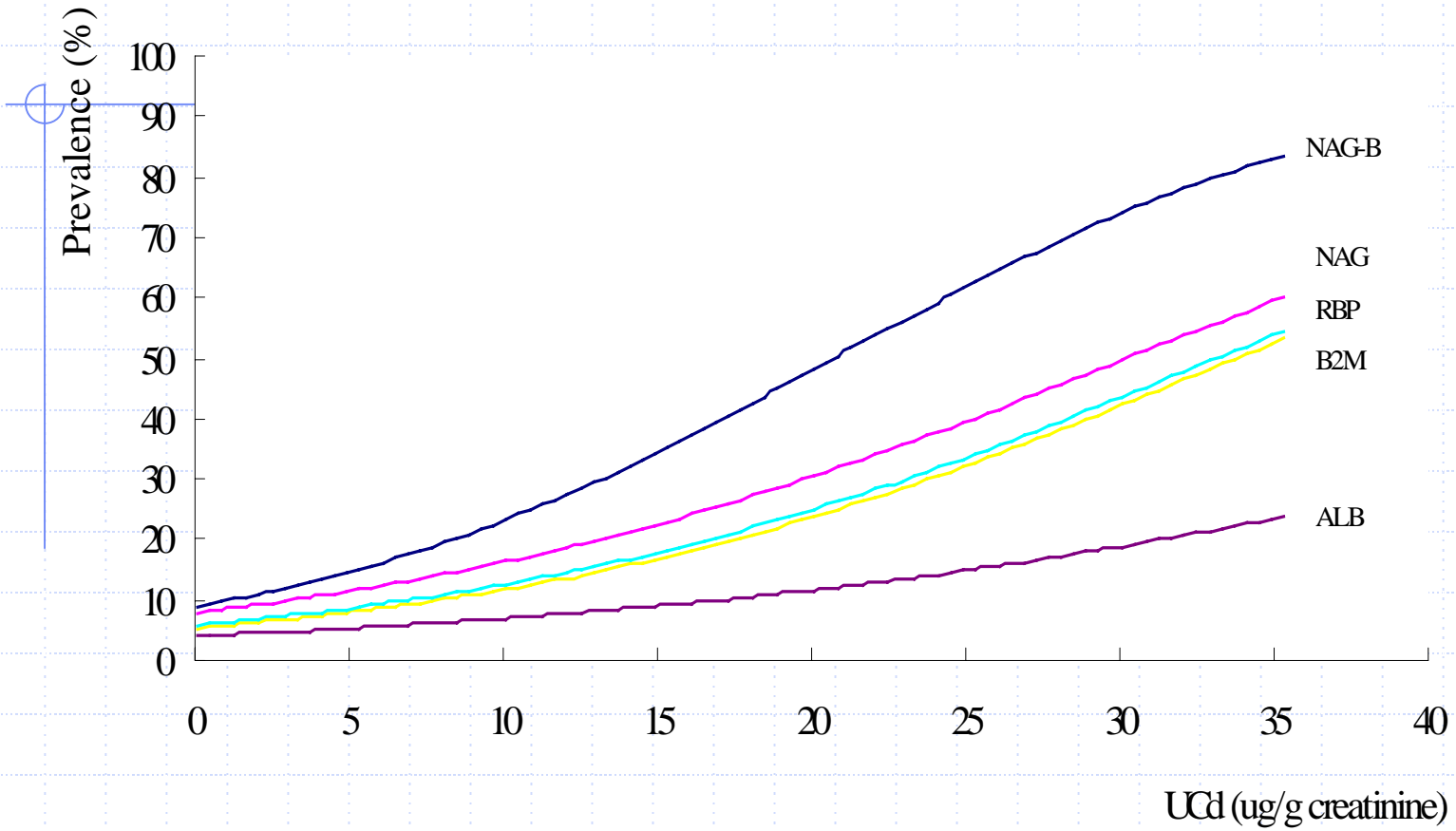


Figure 1. Dose-response curves of UCd and urinary NAG-B, NAG B2M, RBP and ALB



Estimation of benchmark dose for renal dysfunction caused by cadmium exposure*

	b_0	B_1	P_0^{**} +/-	P_d^{***} +/-	χ^2	P
B2M	1.3171	0.0102	10/90	20/80	3.92	0.044
NAG	1.3376	0.0111	12/88	23/77	4.19	0.041
NAGB	1.3518	0.0125	13/87	24/76	4.01	0.045
RBP	1.2406	0.0109	6/94	15/85	4.31	0.038
ALB	1.3111	0.0079	10/90	20/80	3.92	0.044

Table 5. LBMD estimates of UCd (ug/g creatinine) for urinary indicators of renal dysfunction

	b0	b1	BMD-05	LBMD-05	P values*
NAG	-2.449	0.081	6.70	5.87	0.67
NAG-B	-2.323	0.112	4.46	3.99	0.51
B2M	-2.871	0.085	8.36	7.31	0.50
RBP	-2.783	0.084	7.98	6.98	0.54
ALB	-3.172	0.057	15.06	12.18	0.78

$$\ln(p/(1-p)) = b0 + b1 * d$$

* P values were obtained from the chi-squared test with Pearson goodness of fit test, if $P > 0.05$, the equation is good fit.





THANKS