

# Safety awareness concerning lead exposure in the radiology departments of general hospitals

## 醫院放射科對於鉛毒危害之安全意識

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### Abstract

#### 摘要

**Background:** Lead has been one of the most toxic elements in human environment, while environmental lead has been shown to generate significant impacts on the health of the general public. However, environmental lead has not been well studied on those working in the hospitals' departments which are potentially exposed to lead exposure. Safety hospital programs and occupational health settings should include lead surveillance for health literacy of the healthcare professionals.

#### 背景：

含鉛物質為人類生存環境中，最主要毒汙染物之一。且環境中的鉛已被證明產生對公眾的健康顯著的影響。然而，在那些醫院環境中長期使用鉛材料作為輻射屏蔽的部門工作人員來說，其可能暴露於危險鉛環境中工作，但卻一直沒有任何研究及報告。因此，每家醫院或主管機關應該把含鉛之有害物質列為醫院環境安全與工作人員健康之重要議題。安全的醫院項目和職業的衛生設置，應包括醫療專業人員對鉛的暴露的監控及瞭解。

**Methods:** A survey on 29 radiologists and radiological technicians, 18 males and 37 females, who have worked more than one year in the departments of radiology and radiation oncology which have installed lead for radiation shielding in 6 general hospitals in the metropolitan Taipei city. Another 26 administration staffs in the same hospitals were recruited as the reference. All were without residential exposure to environmental and occupational lead exposure from their residence, and without hair been dyed, permed, bleached, or straightened for at least 6 months before the sampling. Adequate and only the newest hair growth were sampled and collected from the study subjects. Careful

sample preparation were used to remove adhering particles and fluids which may also contain metals, while high resolution inductively coupled plasma-mass spectrometry (ICP-MS) was employed for lead concentrations. Quality control was carried out by repeat re-analysis of pooled hair extracts.

#### 方法：

調查在各 29 名放射技術師和放射科之相關技術人員，其中男 18 例，女 37 例，已在台北市 6 家綜合醫院工作，在放射科及放射腫瘤科部門，安裝鉛材質作為輻射屏蔽環境工作長達一年以上。另外，在同一個醫院的另外 26 管理人員的聘任作為對照組。所有人都沒有在他們的居住環境和職業性鉛暴露的接觸，且抽樣期間沒有染髮，燙髮，漂白，或拉直，採樣前至少 6 個月。只有針對新成的頭髮進行採樣，並從研究對象收集。避免採樣品被可能含有金屬溶劑除去毛髮附著的顆粒和流體，利用高分辨率電感耦合 ( ICP-MS ) 中的溶液採用鉛濃度等離子體 - 質譜法。質量控制是通過匯集頭髮提取物的重複再進行的分析。

**Results:** Those worked in the radiology and radiation oncology departments were shown with hair lead (*ug per gram*,  $0.62 \pm 0.45$ ; 95% confidence interval 0.08- 1.79) significantly higher ( $r^2$  11.2%;  $p$  value  $<0.05$ ) than those in the reference ( $0.32 \pm 0.31$ , 95% CI 0.004- 0.95), while gender, duration of working in the departments, and ages of these individuals were not shown with significant association.

#### 結果：

研究指出，那些在放射線和放射腫瘤部門工作人員，被證明毛髮含有鉛濃度 ( 微克/每克， $0.62 \pm 0.45$ ; 95% 置信區間 0.08~1.79 ) 顯著更高 (  $R^2$  11.2%;  $p$  值  $<0.05$  ) ，明顯高於對照組管理人員之毛髮含鉛濃度 (  $0.32 \pm 0.31$  ， 95% CI 0.95 0.004- ) 。性別以及年齡任職時間長短於部門期間，在研究報告並沒有顯著差異。

**Conclusion:** Significant higher lead concentrations in the hair samples of those worked in the hospital departments which employed lead installation for radiation protective shielding. Health literacy regarding safety procedure, indoor ventilation and replacement of lead shielding, are recommended in occupational safety for healthcare professionals.

**結論：**

使用鉛材料為輻射防護屏蔽的醫院中，任職於放射科室工作人員之頭髮含鉛濃度是明顯高於一般人員。基於健康與安全之考量，改善室內通風條件及更換含毒之鉛屏蔽材料是保障工作人員安全與健康之途徑。

**Methods**

The data was analyzed by linear regression models which lead concentration (ug/g) was dependent variable, age (year), gender (male/female), working period (month), and exposure (no/yes) were independent variables, statistic significant level was set with  $p < 0.05$ .

數據分析通過線性回歸模型顯示濃度為非固定因子（微克/克），年齡（年）、性別（男/女）、工作期（月）、和暴露（否/是）為固定因子，統計分析顯著值為  $p < 0.05$ 。

Table

	n/mean %/ SD	Lead concentration Mean $\pm$ SD, range	Simple linear regression			Multiple linear regression			
			B(95%CI)	$\beta$	P	B(95%CI)	$\beta$	P	
Age (year) (range 20-58)	34.6	9.7	0.474 $\pm$ 0.415, (0.004- 1.786)	-.009 (-.021, .003)	-.207	.133	-.007 (-.023, .010)	-.157	.414
				R square = 2.4%					
Working period (month) Range (0.20-320)	85.1	86.5	0.474 $\pm$ 0.415, (0.004- 1.786)	-.001 (-.002, .001)	-.104	.455	.000 (-.002, .001)	-.097	.617
				R square = 0.8%					
Gender (n, %)									
Male	18	32.7	0.527 $\pm$ 0.555, (0.025- 1.786)	Reference			Reference		
Female	37	67.3	0.450 $\pm$ 0.339, (0.004- 1.319)	-.077 (-.322, .168)	-.087	.531	-.106 (-.339, .127)	-.120	.366
				R square = 1.1%					
Exposure (n, %)									
No	26	47.3	0.321 $\pm$ 0.311, (0.004- 0.949)	Reference			Reference		
Yes	29	52.7	0.616 $\pm$ 0.453, (0.081- 1.786)	.295 (.081, .508)	.358	.008	.311 (.084, .539)	.379	.008
				R square = 11.2%					
				R square for all factors = 12.2%					

The lead of concentration was not associated with age, gender or length of working, but it was associated with whether or not people expose the risk factor. If people expose to risk factor, the concentration of lead in their hair is higher. Exposure alone explain 11.2% of total variance of concentration of lead in people's hair while other three factor just added 1% of the variation.

研究指出，頭髮含鉛的濃度與工作人員之年齡、性別、及工作時間長短並無明顯差異。但是，與是否暴露於含鉛毒之危險因子有明顯關連。其結果證明，暴露於鉛毒危險因子下之工作人員，其頭髮中含鉛量有明顯較高。個別樣與整體樣品之交叉比對誤差為 11.2%。年齡，性別，與工作時間長短之總合誤差為 1%。