

PWHPTC *10<sup>th</sup>* Anniversary SCIENTIFIC CONFERENCE

# Health Effects of Heavy Metal Exposures and Prevention Strategies

**25 November 2015**

Auditorium, Level 1, Main Clinical Block and Trauma Centre  
Prince of Wales Hospital, Hong Kong

# PROGRAMME BOOK

## *Organisers*

Prince of Wales Hospital Poison Treatment Centre  
Hospital Authority, Hong Kong

Centre for Food and Drug Safety, Faculty of Medicine  
The Chinese University of Hong Kong, Hong Kong



## **Welcome message from the Secretary for Food and Health**

I would like to congratulate the Prince of Wales Hospital Poison Treatment Centre (PWHPTC) on its 10th anniversary. Over the past decade, PWHPTC has developed a care model for acute poisoning and helped enhance the poison treatment service for both in-patients and out-patients. The Centre provides timely on-site consultations on severe or unusual poisoning cases to ensure adequate clinical assessment and face-to-face discussion with the admission team on the immediate management plan. PWHPTC has also made notable contributions to the general and specialist training in clinical toxicology.

Poisoning and other toxicological problems are expected to be increasingly complex due to intentional and unintentional exposures to a large number of drugs and chemicals, easy access to toxic agents through various channels, new poisoning hazards, and many other reasons. To meet the greater demand for expertise in clinical toxicology, healthcare professionals should receive broad-based training and continuing medical education. In this regard, the 10th Anniversary Scientific Conference provides not only education opportunities for healthcare professionals to learn the recent advances on clinical toxicology, but also an excellent platform to promote knowledge exchange and collaboration in this area.

I wish the Conference great success and all the participants fruitful exchanges in the discussion.

Dr. Ko Wing-Man, BBS, JP  
Secretary for Food and Health  
The Government of the Hong Kong SAR

## **Welcome message from the Deputy Director of Health**

First of all, I wish to congratulate the Prince of Wales Hospital Poison Treatment Centre (PWHPTC) for your 10th Anniversary. The Centre was established in 2005 under the new initiative of the Government of the Hong Kong SAR to enhance poison prevention and control. Since then, the Centre has functioned as the tertiary referral centre in the Hong Kong Poison Control Network and a training centre for general and specialised training in clinical toxicology. I am also pleased to note the 10th Anniversary Scientific Conference is co-organised by the Centre for Food and Drug Safety, Faculty of Medicine, the Chinese University of Hong Kong, with support from poison centres in the Asia-Pacific region. Over the past 10 years, the PWHPTC and the Centre for Food and Drug Safety together have organised many scientific conferences to promote the importance of poison prevention, medication safety and rational use of drugs and to provide education to healthcare professionals.

The theme this year "Health Effects of Heavy Metal Exposures and Prevention Strategies" is of particular interest to both developed and developing countries. The general public may be exposed to heavy metals because of their common occurrence of environmental pollutants. The potential health risks from such toxic exposures are receiving increasing attention. It is only through knowledge exchange, coordinated efforts and multidisciplinary approach that effective preventive strategies can be planned. As in previous years, the 10th Anniversary Scientific Conference in 2015 provides an opportunity for healthcare professionals and scientists from the region to meet again to discuss poisoning as a public health problem and proactive approach.

In Hong Kong, the Government has initiated to strengthen the capacities and facilities in prevention and control of poisoning in a multi-pronged approach. The Hong Kong Poison Control Network which comprises relevant parties including the Department of Health, the Hospital Authority and other government departments and academic institutions providing toxicology services was established in April 2007 with an aim to enhance and coordinate the poison prevention and control efforts. The main scope of services of the Network includes the provision of poison information and consultative services to health care professionals, poison treatment services, tertiary clinical toxicology laboratory services, toxicovigilance, training, risk communication and public education.

I wish you all a successful conference and for participants from the mainland China, Taiwan, Thailand and overseas an enjoyable stay in our vibrant city.

Dr. Cindy Lai, JP

Deputy Director of Health, the Government of the Hong Kong SAR  
Chairperson of Hong Kong Poison Control Network

## **Welcome message from the Hospital Chief Executive, Prince of Wales Hospital**

On behalf of the Prince of Wales Hospital and the New Territories East Cluster, I am honoured to welcome you all to the Prince of Wales Hospital Poison Treatment Centre (PWHPTC) 10th Anniversary Scientific Conference. I would particularly like to welcome the overseas delegates who have come to Hong Kong to share their extensive knowledge and join our celebration.

With funding support from the Government, the PWHPTC was established in November 2005 to strengthen the poison treatment and other clinical toxicological services in Hong Kong. Since then, the PWHPTC functions as the tertiary referral centre for poisoning and other toxicological problems. To enhance patient care and maximise resources utilisation, a multidisciplinary team approach and a care model for patients with acute poisoning are adopted. For severe or unusual poisoning, on-site consultation to other HA hospitals are provided, if necessary. The PWHPTC also offers general and specialised training in clinical toxicology. Together with the Centre for Food and Drug Safety and other poison centres and drug safety research centres, the PWHPTC has organised over 15 scientific conferences and workshops to provide education to healthcare professionals to promote poison prevention and medication safety. I would like to commend the dedication and professionalism of the team in the past 10 years. I hope the team will keep up the good work. Close collaboration with other clinical toxicology and public health services in the Hong Kong Poison Control Network will reduce poisoning in Hong Kong.

I am delighted to see the progress made by the PWHPTC as a tertiary clinical toxicology service and training centre. Good networking with other poison centres in the region will facilitate the sharing of expertise, which is particularly required for severe poisoning. The conference theme this year "Health Effects of Heavy Metal Exposures and Prevention Strategies" well illustrates the complexity of clinical toxicology and the importance of a multidisciplinary approach and knowledge exchange. I would like to thank the Organising Committee for putting together a very interesting programme. I wish you all a very successful conference.

Dr. C.T. Hung, JP  
Hospital Chief Executive  
Prince of Wales Hospital  
Hospital Authority

## **Welcome message from the Dean of Faculty of Medicine, CUHK**

It is my great pleasure to welcome you to the PWHPTC 10th Anniversary Scientific Conference with the main theme "Health Effects of Heavy Metal Exposures and Prevention Strategies". Both organisers of the Conference, the Prince of Wales Hospital Poison Treatment Centre (PWHPTC), and the Centre for Food and Drug Safety, Faculty of Medicine, The Chinese University of Hong Kong, were established in 2005. Over the past 10 years, both Centres have organised regular scientific conferences and workshops to provide education to healthcare professionals on drug safety, medication safety, prevention of poisoning and other toxicological problems. With easy access to a large number of drugs and chemicals and the persistence of certain pollutants in the environment, risk assessment and prevention of toxic exposures are challenging tasks even for experts. Recently, the toxic effects of heavy metals have been receiving much public attention. While celebrating the 10th Anniversary of the PWHPTC, the participants will take full advantage of this opportunity to share knowledge.

The clinical pharmacologists in the Faculty of Medicine have had abiding interests and expertise in clinical toxicology, drug safety, medication safety and rational use of medicines. In the past three decades, their contributions to clinical services, education, training, research and public education in these areas have been well recognised. For example, the Drug and Poisons Information Bureau (established in 1987) is listed in the WHO Directory of Poison Centres. I am pleased to note that our Faculty continues to provide leadership to the PWHPTC.

I understand that poison prevention and control are challenging, long-term tasks. I would like to commend the Government's initiatives to enhance clinical toxicology services through facilitating the concerted efforts of functional units of the Hong Kong Poison Control Network, healthcare professionals and academia, to reduce poisoning and other toxicological problems in Hong Kong. I look forward to seeing this multidisciplinary team scale new heights in the years to come.

I trust that all the participants will enjoy and benefit from all these insightful lectures and stimulating discussions.

Prof. Francis K.L. Chan, JP  
Dean, Faculty of Medicine  
The Chinese University of Hong Kong

## Welcome message from the Chairman of the Organising Committee

The Prince of Wales Hospital Poison Treatment Centre (PWHPTC) was jointly established by the New Territories East Cluster, Hospital Authority and the Faculty of Medicine of the Chinese University of Hong Kong in 2005. In celebration of the 10th Anniversary of the PWHPTC and to acknowledge the enormous support in poison prevention and control from the Government of the Hong Kong SAR, the Hong Kong Poison Control Network, the Department of Health, and other territory-wide poison control units, a scientific conference is held on 25 November 2015 at the Prince of Wales Hospital in Hong Kong. On behalf of the Organising Committee, I would like to welcome all participants and thank all speakers and chairpersons for their support. The 2015 conference theme "Health Effects of Heavy Metal Exposures and Prevention Strategies" is chosen to emphasise the importance of multidisciplinary approach, coordinated efforts, close cooperation with local health care system and public health, and regional collaboration between poison centres in prevention and control of poisoning. It is obvious from the conference topics that the public can be exposed to toxic heavy metals for a variety of reasons. To help protect the public from harmful effects of heavy metals in different settings, the clinical toxicologists and poison centres in the region must work closely and share knowledge on prevention strategies.

Over the past 10 years, the continuing contributions of the PWHPTC in poison prevention and control in Hong Kong are generally recognised. The PWHPTC functions as the tertiary referral centre, especially for serious or unusual poisoning. A multidisciplinary approach to poisoning and other toxicological problems is adopted. A team of experienced healthcare professionals (led by a clinical professor in clinical pharmacology, therapeutics and toxicology) is dedicated to provide quality poison treatment services, expert information and consultative services and, if necessary, on-site consultations. The PWHPTC provides both general and specialist training in clinical toxicology and therapeutics. The Higher Physician Training based at Department of Medicine and Therapeutics, Prince of Wales Hospital is accredited by the Hong Kong College of Physicians. One of our missions is to contribute to the broad based training and provide the exemplary trainers and high quality programmes required for future Physicians and Specialists in Clinical Pharmacology and Therapeutics of Hong Kong. Together with the Centre for Food and Drug Safety, Faculty of Medicine, the PWHPTC regularly organises or co-organises local, regional and international conferences and workshops to provide education and training on drug safety, rational use of drugs and prevention of medication errors to all healthcare professionals. The clinical pharmacologists of the PWHPTC provide expert advice to the public hospitals on drug evaluation (efficacy, safety, quality and cost-effectiveness) and systems improvements to promote medication safety and prevent drug poisoning. The PWHPTC plays a key role in the Hong Kong Poison Control Network and Hospital Authority Toxicology Service and has good networking with the poison centres in the region in promoting poison control and prevention.

Anniversaries are the special occasions to look back at the past, remember the important events and contributions by the others and plan for a successful future. In 1987, the Drug and Poisons Information Bureau (DPIB) was established by the late Prof. D.M. Davis, Foundation Professor of Clinical Pharmacology at the Chinese University of Hong Kong. In 1989, his successor, the late Prof. Julian A.J.H. Critchley strengthened the 24-hour territory-wide information service, with the assistance of three academic clinical pharmacologists and several trained pharmacists and nurses. The DPIB is one of the two poison centres in Greater China that are included in the WHO Directory of Poison Centres. In 2005, the Hospital Authority (United Christian Hospital), the Department of Health and the DPIB jointly established the Hong Kong Poison Information Centre. The 24-hour telephone hotline 26351111 has been used since 1987. Both the DPIB and the Centre for Food and Drug Safety (established in 2005) contribute to the expert information and consultative services of the PWHPTC on drugs, foods, chemicals, natural toxins and heavy metals. The Clinical Toxicology Centre in Edinburgh, the West Midlands Poisons Unit in Birmingham, the National Poison Control Center, China CDC in Beijing, the Poison Control Center in Taipei, and other poison control centres have provided expert advice on complicated cases and emerging poisoning. The Department of Health has provided data for planning of risk management strategies. Dr. Alex T. Proudfoot, Prof. John Allister Vale, Prof. David Nicholas Bateman, Dr. Jou-Fang Deng, Prof. Brian Tomlinson, Prof. Juliana C.N. Chan, Prof. Richard Yu and Dr. Albert Y.W. Chan have provided advice on poison treatment centre structure, care model for poisoning and training programme for the clinical toxicologists.

The demand for expertise in poison information and treatment is greater than before, because of the increasing complexity of the subject and the changing patterns due to emerging poisons and easy access to toxic agents via various channels. Apart from the doses and the intrinsic toxicity, several factors may determine poisoning severity and patient outcomes, including drug-disease interactions. Patients with drug overdoses and chemical exposures often have other acute and chronic health conditions requiring medical attention. The clinical toxicologists are expected by both their colleagues and the public to have expertise in drug safety, drug toxicology, drug-drug interactions, etc. Therefore, the training in clinical toxicology should not be restricted to poison information and treatment only. To ensure the quality of clinical services and specialist training, the resources earmarked for clinical toxicology must be used effectively.

Prof. Thomas Y.K. Chan, BBS, JP

Chairman, Organising Committee

Director, Prince of Wales Hospital Poison Treatment Centre

Director, Centre for Food and Drug Safety

Faculty of Medicine, The Chinese University of Hong Kong

## Organisers and Organising Committee

### Organisers

Prince of Wales Hospital Poison Treatment Centre  
Hospital Authority, Hong Kong

Centre for Food and Drug Safety  
Faculty of Medicine  
The Chinese University of Hong Kong, Hong Kong

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Centre for Food and Drug Safety, CUHK, Hong Kong  
National Institute of Occupational Health and Poison Control, China CDC  
Poison Control Center, Shandong Province, China  
Poison Center, Taipei Veterans General Hospital, Taiwan  
Prince of Wales Hospital Poison Treatment Centre, HA, Hong Kong  
Ramathibodi Poison Center, Bangkok, Thailand

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Dr. Jones C.M. Chan  
Prof. Ellis K.L. Hon  
Prof. Brian Tomlinson  
Dr. Ming-Ling Wu  
Dr. Raymond S.M. Wong (Secretary)

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Prof. Winai Wananukul  
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## Programme

### **8:30 – 9:00** *Registration*

#### **9:00 – 9:05** WELCOME REMARKS

Prof. Thomas Y.K. Chan, BBS, JP  
Chairman, Organising Committee, and  
Director, Prince of Wales Hospital Poison Treatment Centre, and  
Director, Centre for Food and Drug Safety

#### **9:03 – 9:08** OPENING ADDRESS

Dr. Wing-Man Ko, BBS, JP  
Secretary for Food and Health  
Food and Health Bureau  
The Government of the Hong Kong SAR

#### **9:08 – 9:15** GROUP PHOTOS

#### **9:15 – 10:45** ROLES OF POISON CONTROL CENTRES

##### **Chair Persons:**

Prof. Brian Tomlinson  
Dr. Jones C.M. Chan

#### **9:15 – 10:00** **Prevention and Monitoring of Heavy Metal Poisoning**

Dr. Hong-Shun Zhang

#### **10:00 – 10:45** **Indications and Stocking of Antidotal Therapy for Common Heavy Metal Poisoning**

Dr. Ming-Ling Wu

### **10:45 – 11:00** *Tea Break*

#### **11:00 – 12:40** MANAGEMENT AND PREVENTION OF POISONING OUTBREAKS

##### **Chair Persons:**

Dr. Raymond S.M. Wong  
Prof. Winai Wananukul

**11:00 – 11:30 Inorganic Mercury Exposures in Household Users and Non-Users of Skin-Lightening Cosmetic Products and its Nephrotoxicity**

Dr. H.L. Tang

**11:30 – 12:05 Prevention of Heavy Metal Exposures at Home**

Dr. Jian-Fang Zou

**12:05 – 12:40 Severe Inorganic Arsenic Poisoning Caused by Folk Medicines**

Dr. Jones C.M. Chan

*12:40 – 14:00 Luncheon*

**14:00 – 16:00 ENVIRONMENTAL TOXICOLOGY AND RISK MANAGEMENT**

**Chair Persons:**

Prof. Thomas Y.K. Chan

Prof. Ellis K.L. Hon

**14:00 – 14:30 Clinical Application of Biomarkers in Lead Poisoning**

Prof. Winai Wananukul

**14:30 – 15:00 Regulatory Control of Heavy Metals in Chinese Medicines**

Mr. Stephen Yung

**15:00 – 15:30 Accumulation and Health Risk of Heavy Metals in Vegetables Grown on Contaminated Soil**

Prof. Thomas Y.K. Chan

**15:30 – 16:00 Strategies to Reduce Lead Exposure from Drinking Water**

Dr. Raymond S.M. Wong

**16:00 – 16:10 CLOSING REMARKS**

Prof. Thomas Y.K. Chan

## Prevention and Monitoring of Heavy Metal Poisoning

*Dr. Hong-Shun Zhang, National Institute of Occupational Health and Poison Control, China CDC, China*

重金屬一般是指比重大於 5 或密度大於  $4.5\text{g/m}^3$  的金屬元素，包括金、銀、銅、鉛、鋅、鎳、鈷、鉻、汞、鎘等大約 54 種元素。重金屬對人體的健康危害由來已久，古羅馬人喜歡使用鉛質材料作為餐具，飲用酒和葡萄汁時也要加入鉛，由此導致大量人發生嚴重鉛中毒，被認為是古羅馬帝國滅亡的重要原因之一。上世紀發生的痛痛病、水俣病、黑腳病等環境災難性事件也均是由重金屬引起。我國重金屬開採、冶煉以及使用總量均居世界首位，近年來重金屬對人群健康影響已經成為最突出的公共衛生問題之一。據不完全統計，近 10 年來國內發生的鉛、鎘、砷、汞、鉻等 5 種重金屬（類金屬）群體性健康影響事件就在 50 起以上，其中鉛佔 50% 以上。

重金屬對人體的健康危害可分為急性和慢性兩類，急性健康危害主要見於職業暴露和災害性事故，慢性健康危害主要見於持續的環境和食品污染以及地質環境影響。如果能夠明確危害來源和暴露途徑，重金屬對人體的健康影響是可以預防和控制的。國內一系列的研究顯示：2003 年以前，國內兒童血鉛平均水準為  $92.9\mu\text{g/L}$ ，33.8% 的兒童血鉛水準超過  $100\mu\text{g/L}$ ；而在 2013 年的一項調查結果發現國內兒童血鉛水準為  $29.52\mu\text{g/L}$ ，超過  $100\mu\text{g/L}$  的比例僅為 0.06%。這與國內近年來實施一系列兒童鉛中毒防控措施密切相關。

國內對重金屬對人體健康危害問題非常重視，近 10 年投入大量人力物力用於相關工作，出臺了《重金屬污染防治規劃》、《重金屬污染診療指南》等指導檔，開展了重金屬污染環境監測、調查和治理等防控措施。國內重金屬健康危害監測的重點放在污染源監測、人群重金屬暴露接觸監測（飲用水、食品以及公共場所空氣和降塵等）和敏感人群生物接觸標誌物監測三個方面，有些監測已經作為地方常規工作開展（如飲用水和食品中的鉛、鎘、砷等重金屬元素，兒童的血鉛水準等）。連續動態的重金屬監測資料可以為進一步的防控措施提供依據，也是評價治理措施是否有效的最佳手段。

## Indications and Stocking of Antidotal Therapy for Common Heavy Metal Poisoning

*Dr. Ming-Ling Wu, Poison Center, Taipei Veterans General Hospital, Taiwan*

Heavy metal poisonings are known to cause various system toxicities. The antidotes of metal poisonings are chelation agents, such as British anti-Lewisite (dimercaprol, BAL), calcium disodium edetate ( $\text{CaNa}_2\text{EDTA}$ ), dimercaptosuccinic acid (DMSA), 2,3-dimercaptopropanesulfonic acid (DMPS), which forms a complex with toxic heavy metals and leads to their removal (Table). Chelators are of great importance in the treatment of metal poisonings, including arsenic, mercury, lead, copper, chromium, iron, thallium and other forms of toxic metal poisoning.

Table: Heavy metal chelators

Chelator	Main indication	Other application
$\text{CaNa}_2\text{EDTA}$	lead	manganese, cobalt ?
DMPS	mercury, arsenic, lead (chronic)	copper, chromium, cobalt ?
DMSA	lead, arsenic, mercury	
Prussian blue	thallium, radioactive cesium	
Dimercaprol (BAL)	arsenic, mercury, lead (in addition to EDTA)	Copper
D-Penicillamine	copper (Wilson disease)	lead, mercury rheumatoid arthritis, cystinuria
Deferoxamine	iron, aluminum	

Although chelators are very essential for heavy metal poisonings, yet insufficiently stocked in health care facilities. The cause appears to be related to low incident of metal poisonings, limited hospital resources, cost and unfamiliarity with chelators. National Taiwan Poison Center established a chelator storage and distribution system for the response of the various metal poisoning accidents since 2001. The most life-saving chelators were chosen. The clinical use of BAL is now limited due to its adverse effects and availability of safer chelators. Penicillamine and iron chelator are available in major hospitals because they have other applications. For above reason, Taiwan Poison Center initially stocks three chelators (EDTA, DMSA and DMPS) for the most common forms of heavy metal intoxication-lead, arsenic, or mercury. Prussian blue is added to the stock list due to thallium poisoning incident in 2014. Cases of heavy metal poisoning which we have dealt with will be presented for discussion.

## **Inorganic Mercury Exposures in Household Users and Non-Users of Skin-Lightening Cosmetic Products and its Nephrotoxicity**

*Dr. H.L. Tang, Princess Margaret Hospital, Hong Kong*

Mercury exists in several forms: elemental or metallic mercury, inorganic mercury and organic mercury. Mercury is toxic in any forms. Mercury poisoning can occur after ingestion, inhalation and absorption through the skin. In inorganic mercury poisoning, mainly the kidneys and the central nervous system are affected. Nephrotoxicity is manifested as nephrotic syndrome and tubular dysfunction causing proximal (type 2) renal tubular acidosis with or without Fanconi syndrome. Acute exposure of large doses can cause acute tubular necrosis. As early as 1818, mercury was known to cause proteinuria in humans. Subsequent reports confirmed that nephrotic syndrome can develop after inorganic mercury exposure and the underlying renal pathology is mostly membranous nephropathy. In recent years, skin-lightening cosmetic creams containing inorganic mercury are an important cause of mercury poisoning. Both household users and non-users of skin-lightening cream are exposed to mercury. Widespread household contamination and secondary contamination of family members (household non-users) have been reported. We describe here four cases of minimal change disease following exposure to mercury-containing skin-lightening cream as household users. The duration of cream usage ranged from 2 to 6 months. The mercury content of the facial creams was very high (7420 - 30000 parts per million). All patients were female and presented with nephrotic syndrome and heavy proteinuria (8.35 – 20.69 g/day). The blood and urine mercury levels were 26 - 129 nmol/L and 316 - 2521 nmol/day, respectively. Renal biopsy revealed minimal change disease in all patients. The use of cosmetic cream was stopped and chelation therapy with D-penicillamine was given. Two patients were also given steroids. The time for blood mercury level to normalize was 1 - 7 months, whereas it took longer for urine mercury level to normalize (9 - 16 months). All patients had complete remission of proteinuria and the time to normalization of proteinuria was 1 - 9 months. Mercury-containing skin-lightening cream is hazardous because skin absorption of mercury can cause nephrotic syndrome. The public should be warned of the danger of using such products. In patients presenting with nephrotic syndrome, a detailed history should be taken, including the use of skin-lightening cream. With regard to renal pathology, apart from membranous nephropathy, minimal change disease should be included as another pathological entity caused by mercury exposure or intoxication.

## Prevention of Heavy Metal Exposures at Home

*Dr. Jian-Fang Zou, Poison Control Center, Shandong Province, China*

In the past 30 years, economy has experienced rapid development in China, led to a massive increase in energy consumption and serious environmental pollution. Heavy metal pollution has become one of the main environmental problems in China.

Inorganic chemical hazards include lead, chromium, arsenic, cadmium, mercury, zinc, copper, cobalt, nickel; organic mainly included organic mercury, tin and other organic matter. The top five kinds of metal are important pollutants, classified as strong carcinogenic substances by the International Cancer Research Agency. High levels of heavy metals exposure can lead to permanent intellectual and developmental disabilities, including reading and learning disabilities, behavioral problems, hearing loss, attention problems, damaging development of visual and motor function.

Heavy metal pollutants mainly come from mining, sewage irrigation, metal products manufacturing and other related activities. These toxic substances not be biodegradable, discharged into the atmosphere, water and soil, involved in the food chain of biological amplification absorbed by the body, and become the important pollution source of the family.

Family metal pollution mainly comes from: (1) the food contamination, seafood and animal innards, preserved egg, tableware; (2) Chinese herbal medicine, health care products etc. (3) household items: thermometer, cosmetics, toys, batteries; (4) home decorate; (5) water: from the water dispenser, the faucet, filling beverages.

Four prevention measures for heavy metal pollution: (1) Chinese policies, the 12th five-year plan to prevent heavy metal pollution: cities to the country-side; from groundwater, surface water to the sewage; soil heavy metals pollution to reduce the fuel. (2) Perfect the laws and regulations, strengthen supervision. (3) Establish poison prevention and control system (for example platform, plan, implementation and safeguard) (4) Health education.

**Key Words:** Heavy metal, Poison, Prevention, Home.



## Severe Inorganic Arsenic Poisoning Caused by Folk Medicines

*Dr. Jones C.M. Chan, Prince of Wales Hospital Poison Treatment Centre, Hong Kong*

Inorganic arsenic poisoning is rare in Hong Kong. It usually occurs in settings of acute intentional overdose, chronic occupational exposure or consumption of drinking water with high inorganic arsenic content in some parts of the world. Inorganic arsenic is highly toxic. Acute ingestion of toxic amounts of inorganic arsenic usually causes severe gastrointestinal symptoms such as vomiting, diarrhoea, abdominal pain, dehydration and shock. Long-term exposure to high levels of inorganic arsenic can cause skin melanosis and keratosis, chronic airway disease, hepatomegaly and liver cirrhosis, peripheral neuropathy, diabetes mellitus, cardiovascular disease, and is linked to increased risk of various malignancies.

Forty patients with chronic skin disorders were found to have inorganic arsenic poisoning in Hong Kong in August 2015. They all had consumed arsenic-containing folk medicine prescribed outside Hong Kong for treatment of their skin conditions for few months. Outbreak of this kind of "subacute" inorganic arsenic poisoning has never been described locally. The clinical toxicities and laboratory findings will be reported here. The general principles and the challenges of management of inorganic arsenic poisoning in this group of patients will be discussed.

## Clinical Application of Biomarkers in Lead Poisoning

*Prof. Winai Wananukul, Ramathibodi Poison Center, Bangkok, Thailand*

In clinical practice, making diagnosis, monitoring progression of diseases and tracking response to therapy are mainly based on signs and symptoms. Laboratory tests or biomarkers are used to increase accuracy. Nowadays, we put effort to detect early stage of disease and for early intervention. At this stage, the patients are usually asymptomatic or have only nonspecific symptoms. Biomarkers are needed for these purposes. There are 3 types of biomarkers. The applications and limitations of each type are different. Biomarkers of exposure quantify magnitude of exposure, but do not directly reflect their effects on health. Biomarkers of effects indicate existence of effects on target organs but may not specify the causative agents. Biomarkers for susceptibility are commonly genetic tests and applied for identifying population at risk. Combination of these different types of biomarkers may improve the accuracy and decrease their limitations.

Blood lead level (BLL) is widely used as a biomarker of lead poisoning. In fact, it indicates recent lead exposure and may not well correlate with body burden or soft tissue lead content. However, lead toxicity is associated with lead in soft tissue and bone. Using BLL to predict severity of lead poisoning is by extrapolation. In clinical practice, patient with typical signs and symptoms of lead poisoning, BLL alone is sufficient for the diagnosis. In contrast, BLL will make confusion in some situations; patients having high BLL without sign or symptom of lead poisoning or patient with clinical manifestation of lead poisoning but having only modestly high BLL. Patients who are receiving chelating therapy, the BLL is also not proper to reflect the remaining body burden lead. These situations are the limitations of BLL.

Free erythrocyte protoporphyrin (FEP), a biomarker of effect, is used to differentiate acute exposure from chronic subclinical lead toxicity. In addition to BLL, CaNa<sub>2</sub> EDTA mobilization test may be helpful for determination body burden lead. Though, it is a controversial test. It should be used for monitoring and making the decision of continuing or stopping chelating therapy.

In summary, by apply various biomarkers of lead together would be helpful for the accurate diagnosis as well as making a plan for treatment of lead poisoning.

## Regulatory Control of Heavy Metals in Chinese Medicines

*Mr. Stephen Yung, Department of Health, The Government of the Hong Kong SAR*

The Chinese Medicine Ordinance, Cap. 549 of Laws of Hong Kong, was enacted in July 1999 to regulate the practice, use, trading and manufacture of Chinese medicine. The Chinese Medicine Council of Hong Kong (the Council), an independent statutory body established under the Chinese Medicine Ordinance, were set up in September 1999 to devise and implement the regulatory measures for Chinese medicine. The Chinese Medicine Division of the Department of Health (DH) is responsible for the enforcement of Chinese Medicine Ordinance and providing professional and administrative support to the Council. The Council devised limits of heavy metals to ensure the safety and quality of Chinese medicine.

To safeguard public health, the DH has put in place a market surveillance system under which samples of proprietary Chinese medicines (pCm) and Chinese herbal medicines (Chm) would be collected from the market for testing on a regular basis. Testing items include heavy metals (arsenic, cadmium, lead and mercury), pesticide residues, western medicines and microbial content. The DH has also established a mechanism for healthcare professionals to report adverse incidents relating to Chinese medicines, as well as set up a public enquiry hotline.

From 2013 to 2015 (up to August), about 4900 pCm samples and 1000 Chm samples were tested for heavy metals. Eight (<0.2%) pCm samples were found exceeding the limit as set out by the Council. Investigation and control measures were implemented accordingly.

The failure rate for heavy metals in Chinese medicines tested in the past three years is low. Nevertheless, the DH will continue to stay vigilance to ensure the safe use of Chinese medicines in Hong Kong.

## **Accumulation and Health Risk of Heavy Metals in Vegetables Grown on Contaminated Soil**

*Prof. Thomas Y.K. Chan, The Chinese University of Hong Kong, Hong Kong*

There has long been concern about contamination of agricultural soil by heavy metals because of their non-biodegradable and persistent nature and their accumulation in vegetables, with the potential to cause adverse health effects. Food chain contamination is the major pathway for the entry of heavy metals and other toxic pollutants into the body. Most heavy metals are toxic to humans. Vegetables are rich in nutrients essential for our health but contamination by heavy metals can reach toxic levels. It is important to understand the accumulation and health risk of heavy metals in vegetables grown on contaminated soil for effective risk management.

Both natural and anthropogenic sources can be responsible for soil contamination with heavy metals. Wastewater from rapid urbanisation and industrialisation has been used for irrigation. Heavy metals in wastewater are generally not removable even after sewage treatment. A major pathway of soil contamination is through atmospheric deposition of heavy metals from point sources such as metaliferous mining, smelting and industrial activities. Non-point sources of contamination include fertilisers, pesticides and organic manures and composts.

Vegetables take up heavy metals by absorbing them from contaminated soils, as well as from deposits on parts of the vegetables exposed to the polluted air. In fact, atmospheric deposition is a major source of heavy metal contamination for vegetables grown in urban and industrial districts. The uptake and accumulation of heavy metals in vegetables depend on many factors, including the soil concentration, physicochemical properties and mobilisation of heavy metals, soil properties, interrelationship between vegetables and soil physical factors, the maturity and types of vegetables, atmospheric deposits and the types of irrigation water. The efficiency of different vegetables in absorbing heavy metals can be evaluated by uptake or soil-to-vegetable transfer factors.

Prolonged exposures to heavy metals through consumption of contaminated vegetables may lead to accumulation in various organs, ultimately leading to organ dysfunction and ill health. The status of heavy metal concentrations in vegetables in the farms and the markets should be monitored. The implications for human health based on risk assessment studies and preventive strategies from production to consumption should be considered.

## Strategies to Reduce Lead Exposure from Drinking Water

*Dr. Raymond S.M. Wong, Prince of Wales Hospital Poison Treatment Centre, Hong Kong*

Exposure to lead is a significant health concern, particularly for young children and infants. Lead is a naturally occurring metal which is found in rocks, soil, water and air. Lead in drinking water is primarily from materials and components associated with the water distribution system and plumbing. Lead is typically an "endpoint" problem, with the highest concentrations of lead near the tap. Lead may be present in various parts of the plumbing system such as lead solder, brass fixtures, and lead pipes. Lead is then leached into the water passing through the plumbing system. The amount of contact time between water and lead sources can affect the concentration of lead found in drinking water. The longer water remains standing in the plumbing system, the greater the potential for it to absorb lead. For this reason, the lead concentration has the potential to be at its highest when water has remained unused overnight or longer. Additional factors such as water chemistry, temperature, and age of the plumbing materials can affect the amount of lead in the water.

The only way to determine how much lead is present in the drinking water is to have the water tested. Depending on the cause of the problem, a number of strategies have been used in various countries to reduce lead exposure in drinking water, including:

- Adjusting the water chemistry to produce stable water quality conditions that inhibit lead release
- High velocity flushing (especially inside the home) to remove particulate lead
- Removing service lines and plumbing materials that contain lead
- Use only cold water for drinking and food preparation
- Use an alternative source of potable drinking water
- Installing an additional treatment barrier at the tap such as a point of use filter
- Lining or coating of lead service lines

The responsibility for actions to reduce the level of lead in drinking water is collective and requires actions of water suppliers, property owners (public or private) and personnel installing or carrying out works on water supply pipes.

## CME / CNE / CPE Accreditations

<b>CME</b>		
<b>Institution</b>	<b>Points</b>	<b>Category</b>
Hong Kong College of Family Physicians	5	Cat. 5.2
Hong Kong College of Community Medicine	Pending	-
Hong Kong College of Emergency Medicine	5	PP
Hong Kong College of Paediatricians	5	Cat. E
The Hong Kong College of Pathologists	5	PP
Hong Kong College of Physicians	5	-
Hong Kong College of Obstetricians and Gynaecologists	5	Non-OG
<b>CNE: 5 points accredited</b>		
<b>CPE: 3 points accredited</b>		