

Report on “Radiation Disaster Recovery Studies”

Course: Radiation Disaster Medicine

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○ Regarding “Radiation Disaster Recovery Studies”

(Describe your thoughts, the process you engaged in and your research progress regarding Recovery from Radiation Disaster.)

Yields of the 4 years that I learned in the differences of multidisciplinary on the health-related radiation effects from academic activities, scientific papers and technical reports through the history of nuclear accidents. In Japan, 1945, the first nuclear weapons related tragedy of human history was reported during wartime after the atomic bombs dropped on the cities of Hiroshima and Nagasaki, more than 200,000 people lost their lives due to blast, heat and high radiation dose from atomic bombs.^[1] The Atomic Bomb Casualty Commission (ABCC: 1947-1975) was established two years later after bombings with the aim to investigate the radio-epidemiological studies on the impact of radioactivity from atomic bombings among survivors. The three major studies had been conducted; one focused on mortality and cancer incidence among A-bomb survivors called Life Span Study (LSS), another one was in utero cohort study and last one was the investigation of radiation-related health effects among their children so called F1 study.^[2] Since 1975 to date, the ABCC was renamed the Radiation Effects Research Foundation (RERF) in order to extend the investigations and to increase the capacity of the follow-up in the cohort studies and F1 studies. According to many publications and technical reports of the epidemiological studies on LSS, in utero cohort and F1 studies from the ABCC-RERF, the risks of cancer and other diseases from exposure to ionizing radiation were estimated as primarily basis and then the estimation was used for the national and international standardization for radiation-related health effects. However, it defines as global standardization of health risk due to radiation exposure, but various health outcomes such as cancers and non-cancer diseases caused by the stochastic effects is not well-known because of lack of information about the basic data on health effects during the first 5 years after bombings.^[1, 3-5] Following the Great East Japan Earthquake on March 11th, 2011, residents who lived near to the Nuclear Daiichi Power Plant were forced to evacuate from their hometown whilst the ionizing radiation emitted to the atmosphere from the explosion of nuclear reactor. In order to response to nuclear hazards in Fukushima areas, the Fukushima prefecture governor has established Fukushima Health Management Survey (FHMS) and cohort epidemiological studies were also established immediately to date.^[6]

In addition, I have learned many special lectures from domestic and international experts from RERF,

IAEA, ICRP, Japan-Red-Cross and so on, which organized by the Phoenix Leader Education Program, Hiroshima University. As well as, many activities such as long-term fieldwork at Fukushima Nuclear Daiichi Power Plant (NPP), visited residents who lived in temporary housings, learn how to monitor the external and internal radiation exposure result from radioactive materials from NPP at Minamisoma Municipal General hospital and to monitoring the radioactive materials emitted to the soil, air, water and ground in affected area and so on. Notably, I could have a chance to do internship at the RERF, department of epidemiology which trained me to understand the importance of accumulating data of A-bomb survivors and general population for the reference at the ordinary time. The department of epidemiology at the RERF is an important department for RERF to estimate the risk of mortality and cancer incidence of A-bomb survivors regarding the effects of radiation exposure. Beyond the leading program, I also belong to the department of epidemiology, infectious disease, control and prevention of Hiroshima University. I have learned about the public health and health promotion policy. Furthermore, I have participated and made oral and poster presentations on the progression of my research in the field of public health and epidemiology in Japan and internationally.

Within the 4 years, I have learned knowledge about radiation-related health effects and radiation epidemiology through the Phoenix Leader Education Program, the department of epidemiology in Hiroshima University and RERF. It has made me think of the current situations of Cambodia and the fact of nuclear power plants will be introduced in Cambodia in the near future. Then, I have figured out that a national health check-ups system has not yet established to schoolchildren and general population in Cambodia, therefore building such as medical examination system will be an important foundation for knowing the health hazard in emergency such as radiation disasters and warfare. In Cambodia, in case disaster may occur in the future and lack of national health basic data before disaster, so it is difficult to understand the range impact of health-related disaster after disasters. Based on that, it is necessary to accumulate health data among school children and general population in Cambodia as well as set it for the reference as a nationally representative. In my doctoral study, I started to conduct a pilot study for the health check-ups system at elementary school in Cambodia. This research emphasized on the health check-up promotion to Cambodia and as the result of this pilot study which could be provided a basis database for reference the current health condition of school children in ordinary time of Cambodia.

References

1. Kamiya, K., et al.:Long-term effects of radiation exposure on health. *Lancet*,386(9992):469-478,2015.
2. Radiation Effects Research Foundation. 2014 - 2015 Annual Report of the Radiation Effects Research Foundation, 2015.
Retrieved from: https://www.rerf.or.jp/en/library/list-e/periodicals/annualreport_e/2014-e/
3. Ozasa, K., et al.:Association of Acute Radiation Syndrome and Rain after the Bombings in Atomic Bomb Survivors. *Radiat Res*,185(6):604-615,2016.
4. Sakata, R., E.J. Grant, and K. Ozasa et al.:Long-term follow-up of atomic bomb survivors. *Maturitas*, 72(2):99-103,2012.

5. Grant, E.J., et al.:Solid Cancer Incidence among the Life Span Study of Atomic Bomb Survivors: 1958-2009. Radiat Res,187(5):513-537,2017.

6. Yasumura, S., et al.:Study protocol for the Fukushima Health Management Survey. J Epidemiol,22(5):375-383,2012.

○ Title of Doctoral Thesis

Title: The pilot study for health check-ups system at elementary school in Cambodia

(カンボジア王国における小学生を対象とする健康診断システム構築に関するパイロット調査)

○ Summary of Doctoral Thesis

(Describe so as to be easily understood, by relating it to“Radiation Disaster Recovery Studies”.)

[Introduction and Aims]

Schools are well-known as places for providing education to all people. The World Health Organization (WHO) has added more roles to the schools for the health promotion programme to the school children. In 1995, health check-up was introduced in the schools under the frameworks for Health Promotion in School (HPS) by WHO. Establishment of health check-ups system at elementary schools could contribute not only for the health and welfare of children but also accumulating national health basic data in ordinary time.

In Japan, primary school health examination has been introduced since the Meiji era, and their basic data functions as a basis for evaluating health problems caused by atomic bomb damage in Hiroshima and Nagasaki and nuclear damage in Fukushima. In Cambodia as well, based on the fact that nuclear power plants will be introduced in the future, building such a medical examination system will be an important foundation for knowing the health hazards in emergency such as radiation disasters and warfare. However, in Cambodia, a national health check-ups system has not been established yet to schoolchildren and general population. This is the pilot study on school health check-ups in cooperation with the government of Cambodia aimed to promote health check-ups system in Cambodia.

[Materials & Methods]

This study was conducted at Teacher Training elementary school in Siem Reap province, Cambodia in June 2016 and August 2017. The subjects were all students at graders 3 and 4 (academic year 2016), 3 and 6 (academic year 2017) at the elementary school. Totally, 349 students were asked to participate in this study and 294 of them agreed after written consent of parents. Except for 2 students whose data were missed, totally 292 students, 135 in 2016 and 157 in the 2017, were analyzed.

This study contains questionnaires, physical examination for ENT, lung and heart as well as urinalysis, using Japanese school health check-ups model. We used the WHO guideline of growth reference, in which the growth chart was classified by Standard Deviation (SD) of BMI value. The reference value of SD is set different depending on month old and is classified as Overweight: $>+1SD$, Obesity: $>+2SD$, Thinness: $<-2SD$, and Severe thinness: $<-3SD$. The questionnaire included major 16 items such as current and past

health status, subjective symptoms, vaccination history, which was answered by parents. We diagnosed the results based on the evaluation criteria which was set by using the result of the questionnaire and/or physical examinations. For the students suspected of unhealthy, face-to-face interview was conducted in 2016, but in 2017, a recommendation letter was given without interviews. This study was approved by the Ethics Committee in Ministry of Health, Cambodia (Permission No. 0085 NECHR) and Hiroshima University, Japan (Permission No. E-224-1).

[Results]

Totally 292 students (mean age: 9.8±1.7 years, 54.5% boys and 45.5% girls) were eligible for data analysis. The overweight and underweight prevalence was 15.1% and 8.6%, respectively. In the results of the questionnaire, dental caries (62.3%), weight stunt (24.7%), history of sudden tachycardia (6.2%), history of arrhythmia (2.1%), syncope during exercise (1.0%), chest pain during exercise (4.5%), dyspnea on exertion (14.0%) and dyspnea during walking (8.6%) were observed. The vaccination coverage was 50.0% (Diphtheria), 47.3% (Pertussis), 60.6% (Tetanus), 62.0% (BCG), 41.8% (Hepatitis B), 66.4% (Polio) and 79.8% (Measles). In physical examination, 20 (6.9%) students were suspected of otitis media by otoscopy but none of them had hearing deficits. Two (0.7%) students had hypertrophy tonsillar grading 3 and 2 (0.7%) students had rale. Urinalysis results showed that 7 (2.4%) students had proteinuria 1+ and 1 (0.3%) student had hematuria 2+ with proteinuria 1+.

Based on the evaluation criteria of this study, 38 (13.0%) students (10 in 2016 and 28 in 2017) were suspected of having health problem. In 2016, among the 10 students, 7 of their parents were answered that their children had cardiopulmonary symptoms, but we did not find abnormality in physical examination and after interview we diagnosed four of them as healthy. We also diagnosed as healthy for one student with tonsillar hypertrophy after interview. However, one with rale was advised to continue follow-up at hospital and another was recommended for further examination at hospital because of abnormal urinalysis.

In 2017, 28 (9.6%) students were diagnosed as unhealthy. Among them, 27 (9.2%) had cardiopulmonary symptoms without any physical findings. Another one had rale with high fever. All the 28 students received a recommendation letter for further check at hospital.

Considering the results of the interview in 2016, totally 88.7% (259/292) students were diagnosed as healthy in this study.

[Discussion]

In this study we revealed that 88.7% of the schoolchildren diagnosed as healthy. This result could be one of basis data for the current health condition of children in ordinary time of Cambodia. On the other hand, we found students with health problem, such as cardiopulmonary subjective symptoms, abnormal urinalysis, rale sound and recommended them for further check at a hospital. These results suggest that the health check-ups was performed effectively as a 1st screening.

Contrary to previous reports, the prevalence of overweight (15.1%) was more than underweight

(8.6%) in this study. These results suggested that possibility of change of nutritional status, life-style in home, the activity of school time or other factors among elementary school children in Cambodia, but selection bias should be considered because this study conducted only in a public school in urban area. To promote physical activity and healthy eating in order to prevent obesity or lifestyle-related diseases will become necessary to the future children in Cambodia.

The parents-report vaccination coverage was as low as 41.8% for hepatitis B virus (HBV), although Cambodia is highly endemic area for HBV infection with high hepatocellular carcinoma mortality rate. Elementary school is supposed to be the most optimal institution to grasp the health condition of the whole pediatric population where assessment for the vaccination can be done. From this assessment on HBsAb, it will be useful for catch-up vaccination of HBV to school children with lack of antibody.

[Conclusion]

In this pilot study, we showed the prevalence of healthy among schoolchildren of Cambodia and detected the students with possibility of health problem through this screening and recommended for visit hospital. Base on the results, we assume that health check-ups system in elementary school in nationwide will be effective reference to the health surveillance in ordinary time in Cambodia.

o Other theses and sub-dissertation published in academic research journals

1. Hiroko Yamada, Kazuaki Takahashi, Olline Lim, Somana Svay, **Channarena Chuon**, Sirany Hok, Son Huy Do, Mayumi Fujimoto, Tomoyuki Akita, Noboru Goto, Keiko Katayama, Masahiro Arai, and Junko Tanaka : Hepatitis E Virus in Cambodia: Prevalence among the General Population and Complete Genome Sequence of Genotype 4. PLoS One,10(8):e0136903,2015. (Impact factor: 3.54, peer-review)
2. Terumi Kaishima, Toshiko Fujii, Toshihiko Matsuoka, Kazuki Sakamune, Shintaro Nagashima, Chikako Yamamoto, **Channarena Chuon**, Mami Yamashita, Masayo Yamato, Hiroko Fuji, Basilua Andre Muzembo, Aya Sugiyama, Masayuki Ohisa, Tomoyuki Akita, Keiko Katayama, Junko Tanaka : Study of the issues of receiving hepatitis screening and the rate of consulting hospital -The rate of recognized receiving hepatitis screening and that of the unrecognized-. Kanzo,57:634-648,2016. (peer-review)
3. Junko Matsuo, Son Huy Do, Chikako Yamamoto, Shintaro Nagashima, **Channarena Chuon**, Keiko Katayama, Kazuaki Takahashi, and Junko Tanaka : Clustering infection of hepatitis B virus genotype B4 among residents in Vietnam, and its genomic characters both intra- and extra-family. PLoS One,12(7):e0177248,2017. (Impact factor: 3.54, peer-review)
4. Aya Sugiyama, Masayuki Ohisa, Shintaro Nagashima, Chikako Yamamoto, **Channarena Chuon**, Toshiko Fujii, Tomoyuki Akita, Keiko Katayama, Yoshiki Kudo, Junko Tanaka : Reduced prevalence of hepatitis B surface antigen positivity among pregnant women born after the national implementation of immunoprophylaxis for babies born to hepatitis B virus-carrier mothers in Japan. Hepatology Research,47(12):1329-1334,2017. (Impact factor: 1.94, peer-review)

5. Mayumi Fujimoto, **Channarena Chuon**, Shintaro Nagashima, Chikako Yamamoto, Ko Ko, Somana Svay, Sirany Hok, Olline Lim, Masayuki Ohisa, Tomoyuki Akita, Keiko Katayama, Junko Matsuo, Kazuaki Takahashi, Junko Tanaka : A seroepidemiological survey of the effect of hepatitis B vaccine and hepatitis B and C virus infections among elementary school students in Siem Reap province, Cambodia. *Hepatology Research*,48(3):E172-E182,2018. (Impact factor: 1.94, peer-review)
6. Aya Sugiyama, Toshiko Fujii, Shintaro Nagashima, Masayuki Ohisa, Chikako Yamamoto, **Channarena Chuon**, Tomoyuki Akita, Junko Matsuo, Keiko Katayama, Kazuaki Takahashi, Junko Tanaka : Pilot study for hepatitis virus screening among employees as an effective approach to encourage employees who screened positive to receive medical care in Japan. *Hepatology Research*,48(3):E291-E302,2018. (Impact factor: 1.94, peer-review)