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Highlights

HEALTH ASSESSMENT RESULT

Health Impact Assessment of Artisanal and Small-Scale Gold Mining Area in Myanmar, Mandalay Region: Preliminary Research

PREFACE

Our home “The Earth” which is the most beautiful plant in our solar system and known for the only place of living organisms according to our acquired knowledge from the science.

Although, humankind especially our ancestors might have experience of the varieties of natural disasters and phenomenon in the past, the acceleration of exploiting natural resources due to industrialization and technology revolution made various environmental impacts at our present moment. Some of them are visible through our eyes. The crystal-clear river water that our ancestors used in the past for their daily basic turned unclean and intoxicated with heavy metals from industrial waste water during our generation.

Humankinds and surrounding ecosystems have been suffering from natural disasters: ozone layer depletion, global warming, sea level rising, as well as man-made environmental problems: air pollution, water pollution, industrial waste water contamination, etc. which may further lead to the excessive amount of chemicals in our food changes. These problems further lead to the health and social problems. Developed countries have been facing those environmental problems whilst developing countries have much higher impacts due to the issues of poverty as the underlying background.

Poverty remains one of the greatest challenges in developing and underdeveloped countries where many are still struggling for the most basic human needs such as food, clean water, sanitation, education and work.

Due to the global demand and continuously increasing of gold price in recent decades, artisanal and small-scale gold mining known as ASGM became the survival for the living of the people living in poverty. An estimated 10-15 million miners, including 4-5 million women and children may directly involve in ASGM sector, another 100 million people to be reliant upon the sector for their livelihoods, where there are varieties of social conflicts and economic issues. Along with those conflicts and issues, it is also the largest global demand for mercury and release the estimated amount of 1400 tons of mercury annually.

The environmental pollution related to ASGM activities have health impacts as miners and people living surrounding areas have suffered from varieties of health issues such as respiratory distress and lung disease from toxic inhalation, and vomiting, headache, fever, chills, abdominal pains and diarrhea from absorption of elemental mercury.

In order to make solutions for those environmental and social problems, we need transdisciplinary approach of research and practice in collaboration and cooperation between scientists and key stakeholders including various societal partners such as governments, companies, and citizen groups, and then we will clarify the solution to solve the problems as well as the sustainable development for the future generations to become well-beings and live in this beautiful world because this is the only known planet where human beings can survive.

Prof. Masayuki Sakakibara
Project Leader
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Discussing with stakeholders

ABOUT SRIREP PROJECT

Among the environmental pollution problems, the mercury (Hg) pollution problem is one of the most serious problems impacting on the ecosystem and human health. Especially, "Minamata disease" that occurred in Kumamoto and Niigata prefectures in the 1950s and 1960s shocked the world. Despite these, Hg has been used in the industry until now for its unique usefulness, and Hg has been released into the atmosphere. To tackle this issue, the United Nation Environment Program (UNEP) concluded a global treaty, “Minamata Convention on Hg (10 October 2013)”, which works for the reduction of anthropogenic release of Hg and prevention of Hg pollution on global scale. Recent investigations by UNEP have highlighted the continuing significance of Hg pollution in developing countries and its harmful effects on human health and ecosystems.

One of the main causes of Hg pollution is artisanal and small-scale gold mining (ASGM), where Hg is used in the traditional method of amalgamation to extract gold from the ore rock. Although many countries have ratified the Minamata Convention, mercury emissions are increasing rather than decreasing. This indicates that in practical, this poverty-based global environmental problem cannot be solved with ratification of international treaties and NGO activities alone.

Meeting with miners

OUR PURPOSE

The purpose of our FR is to understand the link between poverty reduction and environmental management and to establish a process for constructing sustainable societies through regional innovations in collaboration with stakeholders in ASGM areas and to strengthen related environmental governance in developing countries. In our FS, we will conduct the following three levels of research based on a transdisciplinary approach, within the scope of Association of Southeast Asian Nations (ASEAN) countries: a) case studies of reductions in Hg pollution using a future scenario in ASGM areas of Indonesia and Myanmar; b) study of regional networks that aim to generate Hg-free societies communities in Indonesia and Myanmar; and c) study of improvements in environmental governance in ASEAN countries.

Creating argriculture plot

Through these studies, we will achieve the regional innovation in collaboration with the stakeholders, and we will clarify the solution to solve the global mercury pollution of global environmental problem. In addition, we will also examine the design, practical use, and evaluation method of the transdisciplinary community of practice (TDCOP), a tool in problem-solving of regional communities, by applying the transformative boundary objects (TBOs) in interaction with stakeholders.

Health Impact Assessment of Artisanal and Small-Scale Gold Mining Area in Myanmar, Mandalay Region: Preliminary Research

Background and Method

Increasing artisanal and small-scale gold mining (ASGM) in developing countries including Myanmar has raised health the concerns in mining communities. With the collaboration of Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC), a first preliminary health survey was conducted in Chaung Gyi Village, Thabeikkyin Township, Pyinoolwin District, Mandalay Region, Myanmar, in February 2020 to assess the health conditions of an ASGM community.

The health impact assessments such as (1) general physical examination, (2) evaluation of the signs and symptoms of chronic mercury (Hg) intoxication, (3) respiratory examinations, (4) neurological system examinations, (5) evaluation of the lung function such as the value of forced vital capacity (FVC), the forced expiratory volume in 1 s (FEV1), and other interpretation by using a portable spirometer (Spirodoc) and (6) hair sampling for analysis of content of Hg and other heavy metals was conducted in ASGM miners and non-miners (n=29; 18 men and 11 women).

(a)

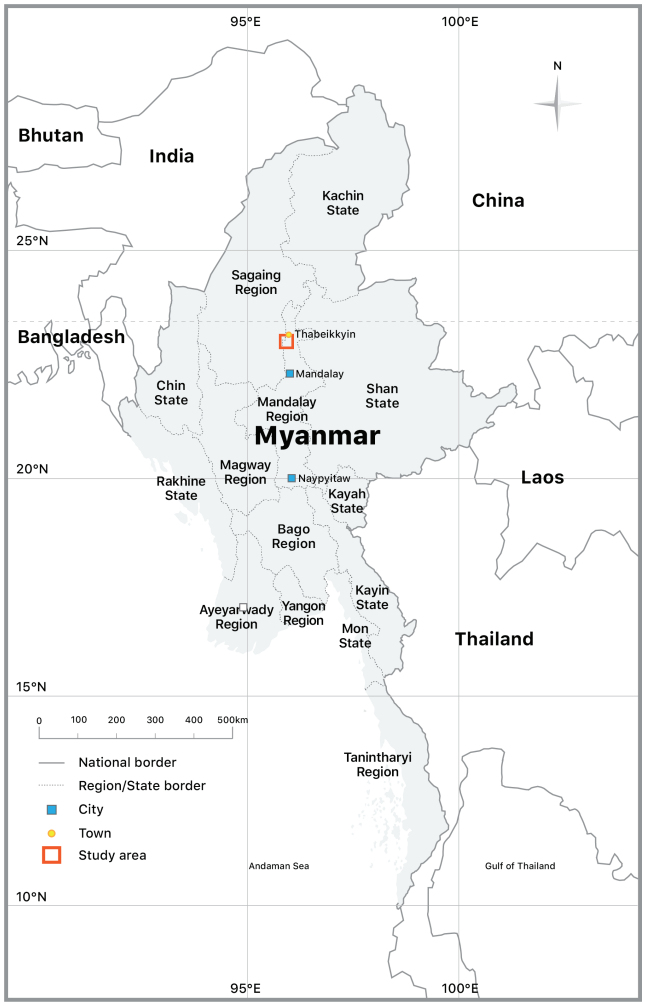
(b)

(a) Conversation with local mining community

(b) and (c) Miners from Chaung Gyi Village, Thabeikkyin Township, Pyinoolwin District, Mandalay Region take part in health assessment.

(c)

HEALTH ASSESSMENT RESULT

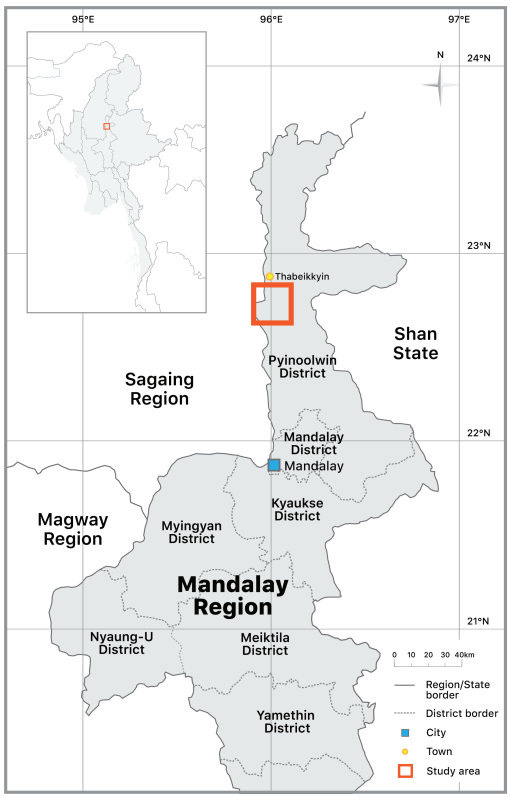


(a)

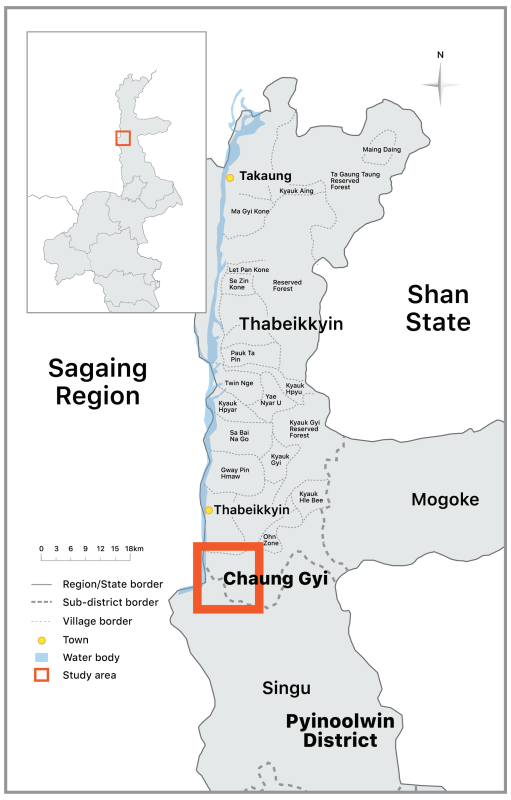
Result

Respiratory function of miners was similar to that of non-miners. However, miners' respiratory function or the values of both FVC and FEV1 declined with longer mining activity duration. In total, 3 out of 18 miners showed neurological signs and symptoms such as mild tremors and ataxia. The median concentration of the hair Hg was significantly higher in miners than non-miners (P = 0.01), and 9 out of 18 miners and 2 out of 11 non-miners showed the warning level of mercury.

Participants from local ASGM community



(b)



(c)

Study area. (a) Map of Myanmar with states and regions. (b) Map of the Mandalay Region with districts. (c) Chaung Gyi Village, Thabeikkyin Township, Pyinoolwin District, Mandalay Region.

HEALTH ASSESSMENT RESULT

Analysis of heavy metals in hair samples.

Heavy Metals	Miners	Non-Miners
Hg, µg/g *	0.93 (0.72–1.44)	0.63 (0.53–0.67)
Pb, µg/g	6.09 (3.67–17.61)	5.26 (2.08–8.77)
As, µg/g	0.20 (0.12–0.33)	0.16 (0.11–0.24)
Cd, µg/g	0.04 (0.01–0.10)	0.05 (0.02–0.17)
Cu, µg/g	11.09 (10.11–13.27)	11.92 (10.82–15.09)

Values are expressed as median (interquartile range). * P = 0.01; Mann–Whitney test.

Correlation among the variables in miners and non-miners.

Classification	Miners	Non-miners
FVC and age	0.001 $^{\Delta}$	0.001 $^{\Delta}$
FEV1 and age	0.001 $^{\Delta}$	0.001 $^{\Delta}$
FVC and smoking	0.26 $^{\Delta}$	0.01 $^{\Delta}$
FEV1 and smoking	0.004 $^{\Delta}$	0.01 $^{\Delta}$
FVC and mining duration	0.001 *	-
FEV1 and mining duration	0.007 *	-
FVC and Hg level	0.68 *	0.80 *
FEV1 and Hg level	0.74 *	0.80 *
FVC and Pb level	0.12 *	0.70 *
FEV1 and Pb level	0.06 *	0.70 *

Data are presented as *P* values, with $P < 0.05$ showing statistical significance. $^{\Delta}$ Mann–Whitney test. * Spearman's Rho correlation test.

Discussion

We found that, despite an association between declining respiratory function and length of time mining, only a minority of miners showed clinical features of chronic mercury intoxication.

Since this preliminary study has limitations, such as a small sample size and the variation in the characteristics of the participants, such as different age and BMI of the two groups, these findings alone cannot determine the health status of the studied community. However, as this was the first preliminary clinical survey conducted in the ASGM community in Myanmar, these findings are important as they demonstrate merit in support of future clinical studies of ASGM communities.

In future, the comparative health impact assessment surveys of the ASGM community in the study area will be conducted with a larger sample size in the control area, and they should involve the analysis of other bioindicators such as a urinary Hg analysis, as an indicator of chronic Hg intoxication by elemental Hg, along with the medical indicators such as a pulmonary function test.

This report entitled

> **Health Impact Assessment of Artisanal and Small-Scale Gold Mining Area in Myanmar, Mandalay Region: Preliminary Research**

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Local miners' one of ASGM activity

HEALTH ASSESSMENT ACTIVITIES

Neurological assessment: examining the knee reflex

Neurological assessment: examining the knee reflex

Health assessment: general examination

Health assessment: taking hair sample of the miner

Neurological assessment: finger nose test

Health assessment: general examination

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Professor Dr. Hiroki Kasamatsu attained his doctoral degree of Forest Policy from Alliance Graduate School of Agriculture, Ehime University in 1998. Then, he started his career as a researcher at Mountainous Region Research Center of Shimane Prefecture. From 2011, he worked in the Faculty of Agriculture, Ehime University, and now he belongs Faculty of Collaborative Regional Innovation. His current interest spreads widely through the rural area development.

He is researching social problems and economic situations not only in Japan but also in Indonesia. A lot of the time, he begins his investigations triggered by casual conversations everyday by living with inhabitants. He thinks that he must first learn from real life.

In SRIREP Project, he is trying to use his research style to make TDCOPs.