

Report on the Japanese Workshop on Antarctic Medical Research and Medicine 2012: creating collaborations and extending the local Asian network in Antarctic medicine

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2012 年南極医学医療ワークショップ報告

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要旨: 2012 年の南極医学医療ワークショップが 7 月 28 日、国立極地研究所で開催された。このワークショップは、日本の南極地域観測での医学・医療の成果を報告し、同時に次期の医学研究計画の立案を支援することを目的として、2004 年から毎年開催されている。今年は 30 施設から 37 人の参加者があり、南極医学の多様な問題、南極現場での医療に関して 14 演題の報告がなされた。

2006 年からは南極観測にかかわる中国、インド、韓国の医学・医療担当者の参加を得ており、今年も中国、韓国からの報告があった。本ワークショップは南極医学研究および医療に関し、アジアにおける重要なネットワークとして機能しており、情報交換および議論を通して南極医学研究および医療での発展が期待できる。本報告ではそれぞれの報告の要旨を掲載する。

Abstract: The “Workshop on Antarctic Medical Research and Medicine 2012” was held on 28 July 2012 at the National Institute of Polar Research, Tokyo, Japan. This workshop has been held annually since 2004 to present results from medical research and operational medicine conducted by the Japanese Antarctic Research Expedition (JARE) and to discuss medical research programs for the next expedition team. Thirty-seven participants from 30 institutes contributed to the workshop. There were 14 presentations concerning various aspects of Antarctic medical research and practical medicine.

Antarctic medical doctors from China, India, and Korea have also participated in this workshop since 2006. Chinese and Korean medical doctors who will be members of the next wintering team reported on their countries’ Antarctic medical activities of this year. This workshop plays an important role as a local Asian network for Antarctic medical research and medicine. It is expected that the workshop will stimulate and encourage participating researchers to develop Antarctic medical research projects and medicine through the exchange of information and discussion. This article summarizes the collected abstracts from the workshop.

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1. Introduction

The “Workshop on Antarctic Medical Research and Medicine 2012” was held on 28 July 2012 at the National Institute of Polar Research (NIPR) in Tokyo, Japan. The results of medical research and operational medicine conducted by the Japanese Antarctic Research Expedition (JARE) are presented at this annual workshop, and the medical research programs for the next expedition team are discussed. Since its inception in 2004, this one-day workshop has been scheduled between late July and August on a Saturday, for the convenience of the medical doctors.

The participants and contributors were 37 individuals from 30 institutions, including 5 doctors who had overwintered at Syowa Station (69°00'S, 39°35'E) and medical doctors participating in the JARE-54 starting that November 2012. Resident medical doctors of the JARE-53 joined the discussion from Syowa Station through a real-time teleconference system via the Internet. There were 14 presentations concerning various aspects of Antarctic medical research and practical medicine.

This workshop has an important role as a local Asian network for Antarctic medical research and medicine. Antarctic medical doctors from various Asian countries have been invited to the workshop since 2006. Because each country has only a small group of Antarctic medical researchers, collaboration with other countries is necessary for productive discussion. Accordingly, Chinese and Korean members of next winter's medical teams reported on their countries' Antarctic activities. The following presents a summary of the abstracts from the workshop.

2. Abstracts

2.1. *Medical report of the 52nd JARE winter party*

Takako Aoyama (JARE-52)

A doctor of JARE-52 reported on medical activities at Syowa Station and presented an outline of the medical research conducted. Dental and skin problems were the most frequent complaints, as well as an outbreak of the common cold after the first flight.

2.2. *Introduction to King Sejong Station and the application of International Classification of Functioning*

Jinho Jheong (Korea Polar Research Institute)

King Sejong Station, located on King George Island, accommodates two major expeditions: the summer and winter research parties. The winter party, comprising 16 scientists and engineers, stays at King Sejong Station year-round. The station's clinic has one permanent medical doctor. The majority of patients here present with orthopedic or gastrointestinal problems. The subject of medical research in 2013 is to applicate World Health Organization-International Classification of Functioning at King Sejong Station.

2.3. *Summary of medical missions at Zhongshan Station in 2011*

Wu Quan (Beijing Jishuitan Hospital)

Zhongshan Station is one of China's Antarctic research stations, and is located at 69°22'24"S, 76°22'40"E. It can support 20–25 people over the winter. The medical unit at Zhongshan is newly equipped with various types of large-scale medical equipment, including an anesthesia machine, C-arm X-ray unit, B-type ultrasound system, and autobiochemical analyzer. The unit consists of four subunits: a consulting room, operating room, pharmacy, and ward. One practitioner is dispatched annually by Chinese National Antarctic Research Expedition as sole charge of the medical mission. During 2011, there was 1 medical evacuation; 10 cases of injury, including a lumbar fracture, knee injury, hand injury, and superficial soft tissue injury; and 23 cases of infectious disease requiring treatment. A study was conducted on the relation between sleeping rhythm and cognitive impairment in the winter researchers sponsored by the National Natural Science Foundation of China. The preliminary results indicate that the alteration of photoperiods leads to sleeping disorders with concomitant impairments in memory and the ability to make calculations.

2.4. *Establishment of the NIPR Ethics Committee in 2012*

Kentaro Watanabe (NIPR)

Because some research programs are proposed by JARE medical doctors, who are employees of the NIPR, it has been a topic of discussion whether the NIPR should establish an ethics committee for its Antarctic medical research. Research programs involving collaborations with other research institutions or universities can be examined by those institutions' ethics committees, but if the program is developed by a medical doctor working for the NIPR, it is proposed that the NIPR should have its own ethics committee.

We gathered examples of committee rules from other organizations and drafted a committee rule to suit the NIPR and JARE. The rule stipulates that the committee should consist of three members from the Medical Committee for JARE and the Medical Examination Committee for JARE members, one professor from a medical college, two professors from the NIPR, two of the directors and two deputy directors from Antarctic Operation Center, experts from the liberal arts and social science fields, and members of the public.

The deliberation procedure was scheduled to start in late August 2012 with the completion of application forms and other relevant procedures. The author is sincerely grateful to those who helped to establish this committee.

2.5. *Psychological study on wintering members of JARE-52 and members who have returned*

(1) Psychological study of mood

Tetsuya Kawabe (Osaka Prefecture University)

In this research, 72 wintering members of JARE-50—JARE-52 completed psychological questionnaires concerning their 1) mood (Profile of Mood States test), 2) motivation, and 3) personality (Big Five Inventory test). The surveys were administered six times for JARE-50, and seven times for JARE-51 and JARE-52. The results revealed several differences among the JARE-50, JARE-51, and JARE-52 participants in terms of

mood. Differences depended on the study period; e.g., scores for anger and hostility changed remarkably during the period of midnight sun in JARE-50 and JARE-51, but this change was not seen in JARE-52. In addition, POMS scores were generally flat for JARE-52, and competitive motivation changed during the travel back to Japan.

(2) Psychological study of mental state

*Tetsuya Kawabe*¹, *Asako Sasaki*² (¹*Osaka Prefecture University*, ²*Ritsumeikan University*)

This study examined how the wintering members of JARE perceived their experience in Antarctica after they returned to Japan and how they readjusted to life in Japan. We conducted interviews with these individuals 9–11 months after returning to Japan. Forty-three interviews with male members of JARE-47–JARE-50 were analyzed based on the Modified Grounded Theory Approach, and six categories representing their experience of Antarctica and their mental state were determined. These categories included 1) confusion and difficulties brought on by confronting the reality of Japan, 2) the ability to separate Antarctica from daily life in Japan, 3) smooth adaptation to social situations, 4) identification of new aspects of oneself, 5) lingering thoughts regarding Antarctica, and 6) remembering Antarctica as a past experience. These six categories suggest that the returning members experience inner (psychological) adaptation and external (social) adaptation phases, and that readjustment is variable among the members.

2.6. *Investigation into exposure of human skin to ultraviolet (UV) radiation, using artificial collagen sheets at Syowa Station*

Tetsuya Takahashi (Shimane University)

Employing a unique evaluation method, collagen sheets were used to examine the skin damage caused by short-wavelength UV light during a season of exposure to the Antarctic ozone hole. The collagen sheets were exposed outdoors for 25 and 50 d in the spring, when the ozone hole was present, and in the ozone-hole-free autumn. Samples from the exposed collagen sheets were analyzed for total protein and terminal amino acid (AA) concentrations as an index of collagen fragmentation. The results showed that the amounts of extractable collagen and terminal amino acid concentrations during the spring exposure were approximately two and five times higher, respectively, when compared with those exposed during the autumn. Next, a collagen sheet was covered with a polypropylene film containing zinc oxide and was exposed outdoors. The total amino acid content of the collagen sheet covered by a film with a zinc oxide decreased to nearly one-fourth the amount in a collagen sheet covered with a zinc-oxide-free film, even during the spring exposure. In other words, the addition of zinc oxide suppressed collagen deterioration by UV light very effectively, even if the exposure lasted 50 d in spring, when the ozone hole appears. As described above, the collagen sheet method used for this evaluation could be used to quantify the protective effects of UV-blocking film against the high-energy UV light that reaches the ground when the ozone hole appears.

2.7. *Physiological adaptation of humans to Antarctica during the summer of JARE-53*

Junichiro Yamauchi^{1, 2}, *Shigeo Kawada*^{2, 3}, *Ryuta Kinugasa*^{2, 4}, *Mitsunori Miyazaki*⁵, *Keisuke Kida*⁶, *Noriteru Morita*⁷, *Kazuki Takizawa*⁸, *Taichi Yamaguchi*⁹, *Takeshi*

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The adaptation of human biological systems to Antarctica is poorly understood. Therefore, we investigated how humans adapt physiologically to the Antarctic environment. This study was partially supported by a grant for the Polar Research Phase VIII Project of the National Institute of Polar Research.

2.8. *Ornithine improved moderate vitamin B6 deficiency and sleep in JARE members during the summer*

Masahisa Horiuchi¹, Hirohiko Kanesada², Takahiro Miyata³, Kentaro Watanabe², Akihito Nishimura⁴, Takashi Kokubo⁵, Takayoshi Kirisako⁵
(¹Kagoshima University, ²National Institute of Polar Research, ³Ikeda Clinic, ⁴Kyowa Hakko Bio Co., Ltd., ⁵Kirin Holdings Company, Ltd.)

Alterations in amino acid (AA) levels and sleep among expedition members in Antarctica have not yet been fully examined. JARE members who stayed in Antarctica during the summer season for 3 months from December 2010 were examined. A randomized double-blind study of ornithine ingestion (400 mg/day) for 4 weeks was performed after the members provided informed consent. Sleep conditions were evaluated subjectively by the Obstructive Sleep Apnea questionnaire (brief version). Alterations in blood AAs, in addition to biochemical changes such as increased Creatine Phosphokinase and Lactic Dehydrogenase levels, were observed among the expedition members. It was concluded that ornithine ingestion was beneficial for minimizing sleep disturbances and improving vitamin B6 levels.

2.9. *A report on telemedicine from Syowa Station*

Nobuko Hashimoto, Yuichi Kuwahara (Syowa Station, JARE-53)

The resident medical doctors at Syowa Station demonstrated the station's medical equipment via a teleconference system, showing the efficacy of the system for telemedicine support. Every month, a telemedicine drill was scheduled to connect with a designated general hospital near Tokyo, and the system was proved practicable.

2.10. *Experience of using a telemedicine system at Syowa Station*

Yutaka Okada (Tsubasa Clinic/JARE-51)

The telemedicine system at Syowa Station was set up by the JARE-45. Thereafter, the wintering teams used this system for diagnosis and therapeutic treatment or social medicine, but there were no outbreaks of serious illness or incidences of trauma. Unfortunately, two team members were injured during wintering over of JARE-51 following an accident at Syowa Station. This incident demonstrated the usefulness of the telemedicine system, enabling us to consult an orthopedist (at Tokatsu Hospital, Japan) regarding the treatment. The telemedicine system demonstrated a sufficiently stable connection and broadcast a clear enough image for the specialist to diagnose and treat the patients.

2.11. *Progress of the study on Legionella spp. at Syowa Station (2010–11)*

Norifumi Shimoeda¹, Yoshikazu Ishii² (¹JA Tochigi Shimotsuga General Hospital, ²Toho University)

For the past 15 years, *Legionella* spp. have been observed in the hot-water supply system to the bathing facilities at our Antarctic wintering stations. Until 2006, the 16S rDNA gene from *Legionella* spp. was detected in the bathing facilities (specifically, in the shower heads, ultrafilter, biofilms, etc.) at Syowa Station or Dome Fuji; however, *Legionella* spp. in the hot-water supply system at Syowa can now be controlled using a silver ion sterile system. Although it has a negative impact on the bathing facilities, we are also interested in the *Legionella* spp. in the environment of Antarctica. The specific 16S rDNA of *Legionella* spp. or host amoeba has been detected since 2008 in the soils and pebbles of East Ongul Island, and was also detected in the Antarctica at 50 km from the Syowa Base in 2010 and 2011.

2.12. *Medical research of JARE-54*

(1) A novel method for the prevention and measurement of motion sickness

Tatsuhisa Hasegawa, Hirofumi Oe (JARE-54)

The problem of motion sickness is caused by exposure to a passive motion environment. Although it is commonly observed, an effective method for its prevention has not been established. In this study, we evaluate the safety and efficacy of serotonin blockers for preventing motion sickness. Additionally, we assess the usefulness of EtCO₂ (partial pressure of end tidal CO₂) deterioration as a subjective index of motion sickness.

(2) Efficacy of equilibrium measurements for estimating the mental state of wintering personnel in polar regions

Tatsuhisa Hasegawa, Hirofumi Oe (JARE-54)

Exposure to confined and unconventional environments commonly induces adverse psychological effects. Previous studies have reported that detection of subtle equilibrium disorders using posturography was useful for estimating a person's mental fatigue and anxiety. This study aims to establish a convenient method to assess mental state using a widely available device (a "Wii" game console system).

(3) Medical research programs to be continued by JARE-54

Hirofumi Oe, Tatsuhisa Hasegawa (JARE-54)

We will take over three research projects from the JARE-53 medical team: 1) a study on food and health, 2) a psychological study on wintering members, and 3) a survey of *Legionella* spp. around Syowa Station.

2.13. *Study of environmental factors that influence lower urinary tract symptoms*

Atsushi Ikeda¹, Koji Kawai², Koji Yoshimura³, Hiroyuki Nishiyama³ (¹Hitachi General Hospital, ²University of Tsukuba, ³Kyoto University)

Background and purpose: Lower urinary tract symptoms are generally caused by a range of urological issues, and can have a negative impact on quality of life. Lower urinary tract symptoms are most commonly related to factors such as age, psychiatric status, urological disease [Benign Prostatic Hyperplasia, overactive bladder syndrome, etc.], and environmental factors. However, few studies have demonstrated a relationship between urinary symptoms and work environment. Our purpose is to elucidate the influence of work

environment on urinary symptoms. As a preliminary study, we will examine the urinary symptoms of workers in a polar environment.

Methods: We plan to administer questionnaires regarding urination to the members of the 54th expedition team. We will use three questionnaires: the International Prostate Symptom Score—Quality of Life—Overactive Bladder Syndrome Score and Pittsburgh Sleep Quality Index questionnaires. We will also examine frequency–volume charts to compare the answers from the questionnaires with real urination data, which will be collected before departure from Japan, regularly at Syowa Station, and after returning to Japan. We will also investigate the presence or absence of complications and the influence of medication.

We will analyze possible changes over time of each item on the questionnaires, and analyze patterns in the frequency–volume charts. Statistical analysis will be performed using JMP software (version 9.02; SAS Institute, Inc., Cary, NC).

Expected results and their value: This study will provide more information regarding the change in urination patterns caused by working in a polar environment. In addition, we are initiating similar studies among nurses and shift workers using results of periodical company-based health examinations. We hypothesize that comparison of these studies will show that the number of sunshine hours or seasonal variations will influence urination.

3. Conclusion

This workshop inspired its participants to propose new and challenging directions for medical research and medicine in Antarctica, and enabled them to enjoy discussions during break periods and small receptions as well as in the presentation sessions. The workshop has also been noted by the Expert Group on Human Biology and Medicine of the Scientific Committee of Antarctic Research (SCAR), as given below (July 2012):

‘Members should be encouraged to develop local networks within their geographical area to engage other doctors involved in Antarctic Research from universities and institutions not yet linked to SCAR, such as has been effectively formed in Asia.’

It is expected that the workshop will stimulate and encourage Asian Antarctic medical research projects and medicine.