Risk Factors and Prevalence of Deep Vein Thrombosis After the 2016 Kumamoto Earthquakes

Koji Sato, MD, PhD; Kenji Sakamoto, MD, PhD; Yoichiro Hashimoto, MD, PhD; Kazuhiko Hanzawa, MD, PhD; Daisuke Sueta, MD, PhD; Sunao Kojima, MD, PhD; Masaya Fukuda, MD, PhD; Hiroki Usuku, MD, PhD; Fumie Kihara, MD; Hiroshi Hosokawa, MD; Yohei Nagai, MD, PhD; Makoto Nakajima, MD, PhD; Yoshiharu Saito; Kayoko Sakai; Sumio Masunaga; Shinji Tanaka; Kazuteru Fujimoto, MD, PhD; Kenji Morihisa, MD, PhD; Katsuo Noda, MD, PhD; Kazuhiro Nishigami, MD, PhD; Kohei Nagata, MD, PhD; Koichiro Fujisue, MD, PhD; Noriaki Tabata, MD; Yukio Ando, MD, PhD; Kenichi Tsujita, MD, PhD; Hisao Ogawa, MD, PhD; Seiji Hokimoto, MD, PhD on behalf of the KEEP Project

Background: After previous earthquakes, a high prevalence of deep vein thrombosis (DVT) has been reported. We examined DVT prevalence and risk factors in evacuees of the Kumamoto earthquakes by performing mobile DVT screening at various evacuation centers around the epicenter.

Methods and Results: For 1 month after the Kumamoto earthquake on 14 April 2016, mobile DVT screening using portable ultrasoundography (US) was performed at 80 evacuation centers. Questionnaires, physical examination, and US of the lower limb were carried out, and simple D-dimer measurements were undertaken for DVT-positive examinees. The total number of examinees was 1,673, of whom 178 (10.6%) had DVT. The prevalence of DVT seemed to be gradually decreasing in the screening period, but age, use of sleep medication, prevalence of hypertension, dyslipidemia, leg edema, and lower leg varix were significantly higher in the DVT positive group than in the negative group. On multivariable logistic regression analysis, high age (≥70 years old), use of sleep medication, lower leg edema, and lower leg varix were significant predictors of DVT. In examinees with these 4 predictors, the DVT positive rate was 71.4%.

Conclusions: In the first month after the Kumamoto earthquakes, DVT prevalence and severity, evaluated on D-dimer level, decreased with the passage of time. Mobile DVT screening indicated significant factors stratifying DVT risk in the evacuees.

Key Words: Deep vein thrombosis; Disaster; Earthquake; Ultrasound; Venous thromboembolism
nervous tone, change in diet, sleep disorders, lack of water, and a shortage of drugs have been implicated as major causes of these diseases.  

DVT is defined as an interruption of blood flow through the deep veins because of formation of a thrombus or clot. DVT typically occurs after immobilization, surgery, or trauma, but also occurs in individuals with no obvious risk factors. A high incidence of DVT in evacuees from an earthquake has been reported after previous earthquakes in Japan. Dehydration induced by limited water supply, prolonged immobility in a crowded evacuation center, and earthquake-related injuries are thought to be the causes of the high prevalence of DVT in evacuees from earthquakes.  

We have already demonstrated the risk and clinical significance of spending a night in a vehicle after a disaster, in order to prevent DVT.  

Based on these previous reports, we suspected a high prevalence of DVT and PTE in evacuees of the Kumamoto earthquakes. In situations where supplies and time are short at the acute phase of an earthquake, performing ultrasound (US) screening for DVT is unrealistic for evacuees. No detailed studies, however, have examined the risk factors of DVT using efficient screening in the acute–subacute phase after earthquakes. Therefore, the Kumamoto Earthquakes thrombosis and Embolism Protection (KEEP) Project was established by the cooperation of local medical institutions (Kumamoto City Hospital, Kumamoto University Hospital, Japanese Red Cross Kumamoto Hospital, Saiseikai Kumamoto Hospital, Kumamoto Chuo Hospital, and National Hospital Organization Kumamoto Medical Center), support organizations (National Cerebral and Cardiovascular Center, Japanese Circulation Society, Japanese College of Cardiology, Japanese Association of Medical Technologists, Japanese Society of Phlebology, The Japan Society of Ultrasonics in Medicine, Japanese Society of Echocardiography, and The Japan Society of Embolus Detection and Treatment), and public departments (Ministry of Health, Labour and Welfare, Kumamoto Prefectural Government, and Kumamoto City Government). We performed mobile screening of DVT in evacuation centers in Kumamoto Prefecture. We investigated the prevalence of DVT and risk factors of DVT in the acute–subacute phase after the Kumamoto earthquakes (between 19 April and 14 May 2016) as part of the KEEP Project.

### Methods

For 1 month after the Kumamoto earthquake on 14 April 2016, between 19 April and 14 May, we performed mobile DVT screening in 80 evacuation centers in Kumamoto Prefecture. First, we selected examinees for lower limb US according to DVT risk factors, such as the number of days and nights in a vehicle, swelling, injury, or pain in the lower limbs, and physical inactivity. After a detailed medical interview and examination (measurement of blood pressure and oxygen saturation), US of the lower limbs was performed using portable US. The following equipment was used: Logiq e with a 4.2–13-MHz linear probe and V scan with a 3.4–8.0-MHz linear probe (GE Healthcare, Chicago, IL, USA); Acuson P500 with a 5–10-MHz linear probe and Acuson Freestyle with a 3–8-MHz linear probe (Siemens, Erlangen, Germany); Viamo with a 7.5-MHz linear probe (Toshiba, Tokyo, Japan); PAOLAS UF 760AG with a 5–12-MHz linear probe (Fukudadenshi, Tokyo, Japan); CX-50 with a 3–12-MHz linear probe (Philips, Amsterdam, Netherlands); SONIMAGE HS1 with a 4–18-MHz linear probe (Konica Minolta, Tokyo, Japan); and HS-1600 with 6–11-MHz linear probe (Hondadenshi, Toyohashi, Japan). US was undertaken from the popliteal fossa to the ankle, with the patient in the sitting position, and the presence of DVT was identified on non-compressibility or visualization of an intraluminal thrombus. We then measured the diameter of the soleus veins in both legs. Blood D-dimer, a degradation product of fibrin, was measured in evacuees who had DVT on blood sampling using a mobile D-dimer test kit (Cobas h232 POC System; Roche Diagnostics International, Rotkreuz, Switzerland). D-dimer >2.0 μg/mL was defined as severe DVT according to the DVT evaluations conducted for evacuees based on previous disasters, and the patients were referred to specialist hospitals as

### Table 1. 2016 Kumamoto Earthquake Evacuee Characteristics (n=1,673)

| Objective findings | SBP (mmHg) | DBP (mmHg) | Heart rate (beats/min) | Percutaneous oxygen saturation (%) | Lower limb edema | Lower limb varix | Right calf size (cm) | Left calf size (cm) | Soleal vein diameter | Palpitation or dyspnea |
|-------------------|------------|------------|------------------------|-----------------------------------|------------------|------------------|---------------------|---------------------|---------------------|----------------------|
| Age (years)       | 70.4±14.0  | 78.9±13.0  | 76.7±11.6              | 97.4 (97.0–98.0)                  | 130              | 302              | 33.2±3.8            | 33.2±3.9            | 6.1±2.2             | 188 (11.2)          |
| Female            | 1,225 (73.2) | 73.2 | 12 (12.6) | 5.4 | 128 (7.7) | 113 (6.8) | 155 (9.2) | 171 (10.6) | 5.1±2.2 | 188 (11.2) |
| Environmental factors and symptoms | | | | | | | | | | |
| Spent night in vehicle (days) | 2.5 (0.0–3.0) | | | | | | | | | |
| Slept on straw mat (days) | 0.8 (0.0–0.0) | | | | | | | | | |
| Slept on floor (days) | 3.2 (0.0–5.0) | | | | | | | | | |
| Sleep medication after earthquake | 399 (23.8) | | | | | | | | | |
| Lower leg symptoms | 730 (43.6) | | | | | | | | | |
| Palpitation or dyspnea | 188 (11.2) | | | | | | | | | |

Data given as mean±SD, n (%) or median (IQR). DBP, diastolic blood pressure; DVT, deep vein thrombosis; SBP, systolic blood pressure.
Predictors of DVT in the 2016 Kumamoto Earthquakes

Variables were analyzed using the unpaired t-test. Categorical variables are shown as percentage and intergroup comparisons were analyzed using the chi-squared test. Relationships between the presence of DVT and other significant parameters in simple logistic analysis were determined by multivariable logistic regression analysis using the backward selection entry method (P<0.05 for inclusion). The Hosmer–Lemeshow goodness-of-fit statistic was calculated. P<0.05 denoted statistical significance and all tests were 2-tailed. Statistical analysis was performed using SPSS version 22.0.

In evacuation centers, examinations were performed after obtaining a signed consent form. This study was performed with the approval of the Kumamoto University Hospital Institutional Review Board (no. 1177).

Statistical Analysis

Data for normally distributed continuous variables are expressed as mean±SD, whereas those with a skewed distribution are expressed as median (IQR). Continuous variables were analyzed using the unpaired t-test. Categorical variables are shown as percentage and intergroup comparisons were analyzed using the chi-squared test. Relationships between the presence of DVT and other significant parameters in simple logistic analysis were determined by multivariable logistic regression analysis using the backward selection entry method (P<0.05 for inclusion). The Hosmer–Lemeshow goodness-of-fit statistic was calculated. P<0.05 denoted statistical significance and all tests were 2-tailed. Statistical analysis was performed using SPSS version 22.0.

Soon as possible.

In evacuation centers, examinations were performed after obtaining a signed consent form. This study was performed with the approval of the Kumamoto University Hospital Institutional Review Board (no. 1177).

Statistical Analysis

Data for normally distributed continuous variables are expressed as mean±SD, whereas those with a skewed distribution are expressed as median (IQR). Continuous variables were analyzed using the unpaired t-test. Categorical variables are shown as percentage and intergroup comparisons were analyzed using the chi-squared test. Relationships between the presence of DVT and other significant parameters in simple logistic analysis were determined by multivariable logistic regression analysis using the backward selection entry method (P<0.05 for inclusion). The Hosmer–Lemeshow goodness-of-fit statistic was calculated. P<0.05 denoted statistical significance and all tests were 2-tailed. Statistical analysis was performed using SPSS version 22.0.

Figure 1. Prevalence of deep vein thrombosis (DVT) on cyclic screening from 19 April to 14 May 2016, after the 2016 Kumamoto earthquakes.

Figure 2. Time course of D-dimer distribution in deep vein thrombosis (DVT)-positive evacuees in the 4 weeks after the 2016 Kumamoto earthquakes.
SATO K et al.

The prevalence of DVT, however, gradually decreased from 33.3% on 19 April to 2.7% on 14 May (Figure 1).

When the screening period was divided into separate weeks and the proportions of D-dimer levels evaluated (D-dimer $<1 \mu g/mL$, low group; $1–1.9 \mu g/mL$, moderate group; and $\geq 2 \mu g/mL$, severe group), the proportion of the low group gradually increased. Evacuees in the high group ($\geq 2 \mu g/mL$) were not observed in the fourth week (Figure 2).

Evacuee Characteristics vs. DVT Status

Table 2 lists the clinical characteristics of the DVT-negative (n=1,495, 89.4%) and DVT-positive (n=178, 10.6%) groups. Age (P<0.001), use of sleep medication (P=0.001), and the prevalence of hypertension (P=0.003), dyslipidemia (P=0.012), leg edema (P<0.001), and lower leg varices (P=0.002) were significantly higher, and soleal vein diameter on US (right, P<0.001; left, P=0.001) was significantly larger in the DVT-positive group than in the DVT-negative group.

Results

Clinical Characteristics

We performed 1,738 examinations for evacuees of the Kumamoto earthquakes. The clinical characteristics of 1,673 examinees after exclusion of the second and subsequent examinations of the same subject are listed in Table 1. The average age was 70.4 years old and the proportion of women was 73.2%. Overall, DVT was detected in 178 examinees (10.6%).

Prevalence of DVT and D-Dimer Distribution

Mobile DVT screening was carried out in various shelters, and time-series data were not obtained in the same examinee. The prevalence of DVT, however, gradually decreased from 33.3% on 19 April to 2.7% on 14 May (Figure 1). When the screening period was divided into separate weeks and the proportions of D-dimer levels evaluated (D-dimer $<1 \mu g/mL$, low group; $1–1.9 \mu g/mL$, moderate group; and $\geq 2 \mu g/mL$, severe group), the proportion of the low group gradually increased. Evacuees in the high group ($\geq 2 \mu g/mL$) were not observed in the fourth week (Figure 2).
Predictive Factors of DVT

On simple logistic regression analysis high age (≥70 years old), use of sleep medication, and the prevalence of hypertension, lower leg edema, and lower leg varices were significantly correlated with the presence of DVT. On multivariable logistic regression analysis, high age (OR, 1.849; 95% CI: 1.305–2.622; P=0.001), use of sleep medication (OR, 1.64; 95% CI: 1.167–2.306; P=0.004), lower leg edema (OR, 2.064; 95% CI: 1.290–3.303; P=0.003), and lower leg varices (OR, 1.593; 95% CI: 1.103–2.301; P=0.013) were significant predictors of DVT (Table 3). Hosmer–Lemeshow goodness-of-fit chi-squared was 0.946 with P=0.81.

Derivation of DVT Risk Score

The DVT risk score was defined as the sum of 4 significant predictors of DVT, selected on multivariable logistic regression analysis: high age (≥70 years old), use of sleep medication, lower leg edema, and lower leg varices. The risk score was calculated based on the sum of predictors present in individual examinees. The distribution of the number of factors present and the corresponding prevalence of DVT are shown in Figure 3. The prevalence of DVT progressively increased with an increase in the risk score.

Hospitalization for Severe DVT

When D-dimer exceeded 2.0 μg/mL in DVT-positive examinees, the examinees were referred to special hospitals to assess the systemic risk of thromboembolism. Of 16 evacuees with D-dimer >2.0 μg/mL, 3 required urgent hospitalization based on the judgment that hospitalization was necessary. One of the 3 patients (69-year-old man) was found to have the comorbidity of PTE. Therefore, 60 mg edoxaban was given after the initial heparin therapy, and hospitalization for 51 days was required. The others had DVT without PTE, requiring hospitalization for approximately 2 weeks.

Discussion

We investigated the prevalence and risk factors of DVT in evacuees of the Kumamoto earthquakes for 1 month after the onset of the first earthquake. We performed 1,673 US examinations, mainly at the evacuee centers in areas where damage was the greatest (i.e., in Mashiki Town in the eastern suburb of Kumamoto City and the East Ward of Kumamoto City). To the best of our knowledge, this is the first study on the prevalence and risk factors of DVT in the acute–subacute phase, with evacuees examined at the epicenter after the main earthquake and during continuing aftershocks.

In this study, the prevalence of DVT was 10.6%. The prevalence of DVT in healthy people is 2–4%,16 which is significantly lower than in the present study. Compared with previous reports on the prevalence of DVT after disasters,15,17,18 the present result is considered to be appropriate.

In the present study the prevalence of DVT appeared to gradually decrease with time. In a previous study the prevalence of DVT gradually decreased, as in the present study, but it rose again after aggregation of data from all of the evacuation centers.15 Therefore, data need to be consolidated and analyzed >1 month after an earthquake. As described in the limitations section, careful examination is necessary because the present study was carried out using cyclic screening and did not include time-series data in the same examinee. Additionally, information on intervention for DVT after the earthquakes was extensively disseminated by the media (television, newspaper and Internet), and the environment of the evacuation centers gradually improved during the examination period.

Hanzawa et al reported that the risk of developing DVT increased with an increase in the number of days staying in private vehicles,17 but this was not observed in the present study. We suspect that mobile DVT screening did not include evacuees who spent the night in a vehicle because the screening was performed in the daytime. Furthermore, because the evacuees were classified as mainly spending the

| Table 3. Indicators of DVT in Evacuees of the 2016 Kumamoto Earthquakes |
|-------------------------------------------------|
| Simple regression analysis | Multivariable regression analysis |
| OR | 95% CI | P-value | OR | 95% CI | P-value |
| --- | --- | --- | --- | --- | --- |
| Age >70 years (yes) | 2.123 | 1.510–2.984 | <0.001 | 1.849 | 1.305–2.622 | 0.001 |
| Female (yes) | 1.382 | 0.945–2.020 | 0.095 | NS |
| Spent night in vehicle (days) | 0.965 | 0.925–1.007 | 0.105 | NS |
| Sleep medication (yes) | 1.785 | 1.280–2.488 | 0.001 | 1.64 | 1.167–2.306 | 0.004 |
| Hypertension (yes) | 1.615 | 1.174–2.222 | 0.003 | NS |
| Hesitate to urinate (yes) | 0.778 | 0.548–1.104 | 0.16 | NS |
| Lower leg edema (yes) | 2.288 | 1.443–3.628 | <0.001 | 2.064 | 1.290–3.303 | 0.003 |
| Lower leg varix (yes) | 1.745 | 1.218–2.499 | 0.002 | 1.593 | 1.103–2.301 | 0.013 |

Hosmer-Lemeshow goodness of fit: $\chi^2=0.946$, P=0.81. DVT, deep vein thrombosis; NS, not selected.
night in vehicles or staying in the evacuation center, especially in the acute phase, there were not many evacuees who stayed in vehicles at that time during the mobile DVT screening. There was no significant difference in the comorbidity of malignant tumors, which is considered to be a general risk factor of DVT, between the DVT-positive group and the DVT-negative group. On mobile screening there were not many critically ill patients because of the uncomfortable environment of the evacuation center. Therefore, the number of examinees might be insufficient to detect the significant correlation between DVT and malignant tumors.

On multivariable logistic regression analysis high age (≥70 years old), use of sleep medication, lower leg edema, and lower leg varices were significant predictors for DVT. Aging and lower leg varices are known risk factors of DVT, consistent with the present results. Lower leg edema is considered to reflect blood flow disturbance by DVT. An association between the use of sleep medication after an earthquake and the onset of DVT has been reported in a small number of cases. Long-term immobility during sleeping and vasodilation effects due to the use of sleeping tablets, however, might be the cause of DVT. Various sleep medications with different mechanisms of action were used in the present study. Therefore, examining the details of sleep medication was difficult. Further studies are required on the relationship between the use of sleep medication and onset of DVT.

In this study, we calculated the DVT risk score using DVT-positive predictors identified on multivariable logistic regression analysis. A total of 71.4% of examinees who had all 4 factors of the DVT risk score had DVT. In situations where supply of human resources and equipment are insufficient at the time of a disaster, use of this scoring system may help stratify evacuees and provide medical resources appropriately.

Extensive routine US screening for DVT is not necessarily recommended according to the guidelines for the treatment of venous thromboembolism disease. With the use of mobile screening after earthquakes, however, we successfully identified 3 severe patients who required urgent hospital admission. Although there are no clear guidelines on prevention of venous thromboembolism disease after a disaster, efficient screening based on the 4 predictors clarified in this study may be useful for preventing occurrence of severe venous thromboembolism disease.

Lower limb DVT can occur as a proximal type and a distal type. In this study, we could not perform US of the proximal lower limb because it was not possible to set aside a private room for the protection of patient privacy in the evacuation center. As a result, it was not possible to evaluate the prevalence and risk factors of proximal DVT after earthquake in the present study. If the situation permits, the addition of proximal DVT examination after detection of distal DVT might be beneficial, because the relationship between D-dimer level and severity of DVT has not been validated, and US of the proximal lower limb is an expensive and unsafe technique compared with D-dimer measurement. Further investigation of proximal DVT occurring in evacuees after a disaster such as an earthquake is necessary.

Study Limitations
The present study had some limitations. First, we could not investigate all evacuees of the Kumamoto earthquakes. Because the present study was conducted for evacuees who were thought to be more likely to develop DVT, the true prevalence of DVT is considered to be lower than the present result. Second, the data were obtained on mobile screening of below-knee DVT screening, and were not obtained on follow-up of the same subject. Third, the total number of evacuees after the Kumamoto earthquakes was assumed to be approximately 180,000 people, therefore, we screened only a small proportion of the evacuees. Fourth, the data were obtained from mobile screening of below-knee DVT, and no screening of proximal or whole leg DVT was carried out.

Conclusions
In the first month after the Kumamoto earthquakes, the prevalence and severity of DVT, as evaluated using D-dimer, decreased over time. Of the examinee characteristics and clinical signs, high age, use of sleep medication, lower leg edema, and lower leg varices were independent significant predictors of DVT.

Acknowledgments
The authors thank Saki Ogata, Rina Usui, Kahoru Fujisue, and Shiori Kotegawa for data collection. We thank Ellen Knapp, PhD, from Edanz Group (www.edanzediting.com/ac) for editing a draft of this manuscript.

Disclosures
The authors declare no conflicts of interest.

References
1. Sueta D, Akahoshi R, Okamura Y, Kojima S, Ikemoto T, Yamamoto E, et al. Venous thromboembolism due to oral contraceptive intake and spending nights in a vehicle: A case from the 2016 Kumamoto earthquakes. Intern Med 2017; 56: 409–412.
2. Sueta D, Hokimoto S, Hashimoto Y, Sakamoto K, Hosokawa H, Nishigami K, et al. Venous thromboembolism caused by spending a night in a vehicle after an earthquake (night in a vehicle after the 2016 Kumamoto earthquakes). Can J Cardiol 2018; 34: 813. e9–e10.
3. Watanabe H, Kodama M, Okura Y, Aizawa Y, Tanabe N, Chinushi M, et al. Impact of earthquakes on takotsubo cardiomyopathy. JAMA 2005; 294: 303–307.
4. Aoki T, Fukumoto Y, Yasuda S, Sakata Y, Ito K, Takahashi J, et al. The Great East Japan Earthquake Disaster and cardiovascular diseases. Eur Heart J 2012; 33: 2796–2803.
5. Watanabe H, Kodama M, Tanabe N, Nakamura Y, Nagai T, Sato M, et al. Impact of earthquakes on risk for pulmonary embolism. Int J Cardiol 2008; 129: 152–154.
6. Sakuma M, Nakamura M, Hanzawa K, Kobayashi T, Kuroiwa M, Nakanishi N, et al. Acute pulmonary embolism after an earthquake in Japan. Semin Thromb Hemost 2006; 32: 856–860.
7. Leor J, Poole WK, Kloner RA. Sudden cardiac death triggered by an earthquake. N Engl J Med 1996; 334: 413–419.
8. Nakano M, Kondo M, Wakayama Y, Kawanada A, Hasebe Y, Shafee MA, et al. Increased incidence of tachyarrhythmias and heart failure hospitalization in patients with implanted cardiac devices after the great East Japan earthquake disaster. Circ J 2012; 76: 1283–1285.
9. JCS, JSH and JCC Joint Working Group. Guidelines for disaster medicine for patients with cardiovascular diseases (JCS 2014/JSH 2014/JCC 2014): Digest version. Circ J 2016; 80: 261–284.
10. Takakura R, Himeno S, Kanayama Y, Sonoda T, Kiriyama K, Furubayashi T, et al. Follow-up after the Hanshin-Awaji earthquake: Diverse influences on pneumonia, bronchial asthma, peptic ulcer and diabetes mellitus. Intern Med 1997; 36: 87–91.
11. Hokimoto S. Risk of cardiovascular disease after earthquake disaster. Circ J 2018; 82: 650–651.
12. Kabrtil C, Varrao R, Goldhaber SZ, Rimm E, Camargo CA Jr. Physical inactivity and idiopathic pulmonary embolism in women: Prospective study. BMJ 2011; 343: d3867.
13. Parkin L, Sweetland S, Balkwill A, Green J, Reeves G, Beral V. Body mass index, surgery, and risk of venous thromboembolism in middle-aged women: A cohort study. Circulation 2012; 125:...
Appendix

KEEP Project Organization
Principal Investigator: Seiji Hokimoto, Kumamoto University.
Steering Committee: Yoichiro Hashimoto, Kumamoto University City Hospital (Chair), Makoto Nakajima, Sunao Kojima, Hiroshi Hosokawa, Kenji Sakamoto, Yohei Nagai, Kazuhiko Hanzawa, Sumio Masunaga, Shinji Tanaka, Shoko Shimada, Kiyomi Kawasaki, Tomoko Higashi, Yoichiro Ito, Chieko Hamano, Yasuko Hayashi, Takahiro Yamasaki, Keiko Kudo, Yuji Itou, Chizuru Imada, Masahide Kakimoto, Yukiko Hara, Keiko Yamaguchi, Junji Yamaguchi, Hiroo Yamaguchi, Taku Yamasaki, Chieko Fujita, Tetsuya Tsuda, Kazumi Tsuruta, Toshihiro Teshima, Takeshi Otsuji, Hiroshi Okabe, Chiho Ogawa, Shigeki Oda, Keiko Omachi, Yumi Okazaki, Kazuhito Ogata, Yuji Ogata, Yumi Ogata, Hiroshi Oka, Chieko Fujimoto, Yukiko Kamiyama, Hiroki Tajiri, Shinji Tanaka, Ryoji Yokote, Akiharu Yoshioka, Rie Koyoshi, Hideto Sako, Kyohei Sato, Akiyoshi Shimizu, Yoshitsugu Shirakawa, Yusuke Sugi, Yasuhiro Sedutsu, Susumu Takase, Masao Takahashi, Naoko Takayama, Takuro Takumi, Emiko Takeda, Kazuko Tajiri, Hideki Tashiro, Kazuhiro Tanaka, Hideto Chazen, Yuko Tsuda, Sayuri Tsuruda, Yoshihiro Tsuruda, Kaiko Doi, Tomoyuki Tobushi, Junichiro Nishie, Yumi Nohara, Kaori Hara, Koji Higuchi, Akiko Fuyjima, Soshi Hei, Shiori Horikawa, Yoshihisa Horioze, Masami Mikata, Yoji Morii, Nagisa Morikawa, Natsumi Morito, Tomoluko Yamamoto, Toshinori Yuasa, Shingo Yunoue, Yuka Yoshimine, Satoshi Yoshimura, Isei Yoshimoto.

Dispatch From Japanese Association of Medical Technologists
Kikuko Akimitsu, Emi Asamikawara, Kayoko Abe, Yoshiyu Arizuma, Mayumi Andou, Mariko Andou, Katsunori Bettou, Hiroshi Chiba, Yuji Chiba, Tamae Doi, Ayaka Eto, Kayoko Ebuchi, Yusuke Emura, Shota Fukushige, Masami Fukuda, Moe Fukunaga, Azusa Fukumitsu, Yusuke Fukuyoshi, Rika Fujita, Yutaro Fuchino, Kuniko Furukawa, Yuko Furukawa, Sanae Furushima, Asuka goto, Yuki goto, Shinsaku Hatake, Takama Hamano, Yasuko Hayashi, Takahiro Hayashida, Minako Haraguchi, Miho Harada, Shouchi Haruta, Yasuhiko Hanba, Atsushi Higashi, Kohei Horikawa, Katsuyoshi Ikeda, Honami Ikeda, Taketoshi Izumi, Aiko Ide, Yoshiaki Ide, Futoshiki Igeduchi, Yuji Ito, Chizuru Imada, Ryuyie Imada, Kanako Imamura, Shigeo Iwahashi, Akari Kakino, Saori Kobayashi, Kenzo Komaru, Taeko Kondo, Fumika Kotou, Masahide Kakimoto, Yukiko Katou, Yukari Kamiyama, Hiroki Kameyama, Osamu Kawazu, Emiko Kawano, Takamichi Kitagawa, Naoko Kitamura, Ayano Kid, Fumiki Kinoshita, Yu Kinoshita, Keiko Kudo, Miki Kubo, Yuko Kuratsuwa, Akiko Kurokawa, Kayo Kurokawa, Makoto Kuroda, Kazumi Koga, Sanae Kojima, Izumi Masamoto, Hiroki Masuda, Sumio Masunaga, Aimi Matsukos, Haruka Matsuo, Takuya Matsuku, Yugo Matsushima, Yu Matsuhashi, Chiiho Matsushima, Masato Matsubayashi, Mayu Matsuura, Kaori Matsutomo, Tamami Matsutomo, Chiharu Maruta, Yuji Maruyama, Kazuhiro Miura, Daisuke Miura, Hirofumi Miura, Masahiro Mizukami, Masami Mitsuohi, Hiroshi Mine, Naoko Minoda, Yasuhiro Miyazaki, Harumi Miyazawa, Ryoko Miyahara, Ayumi Miyamoto, Mitsuaki Mut, Kenta Mutou, Etsuko Munaraku, Yasuto Muroharo, Tomoko Motou, Hiroshi Momota, Takayuki Mori, Mayumi Morishita, Shinji Morimoto, Hiroko Nakao, Yukino Nakasako, Kaori Nakahama, Koji Nakashima, Tetsuya Nakashima, Harunobu Nakashima, Yukimi Nakamura, Akiko Nakano, Akiko Nakan, Keisuke Nagano, Kato Nakamura, Yohei Nakayama, Miho Nishiyu, Yuji Nishikata, Yoshikazu Nishida, Akiko Nishiyori, Kiku Nonaka, Yuuki Okubo, Tamami Osaka, Miki Otani, Kie Onishi, Hidenori Onishi, Mikiko Oohara, Yoshikazu Omae, Keiko Omachi, Yumi Okazaki, Kazuhito Ohtade, Yuji Ogata, Yukari Ogata, Yori Ogata, Hiroshi Okabe, Chihio Ongawa, Shigeki Oda, Akhiro Onizuka, Michio Ono, Nao Onodera, Daiki Oyama, Noriko Saito, Yoshiharu Saito, Tsukasa Sakaguchi, Yuko Sakami, Mitsuru Sakata, Hisasu Sasaki, Takao Sato, Yuki Sato, Ayaka Samehashita, Sumika Sawada, Hiromichi Shibata, Hirofumi Shiga, Chiemi Shigyou, Naomi Shibata, Mutsumi Shimashima, Toshikio Shimada, Ayumi Shimokawa, Kimiyoshi Shinyashiki, Sumika Sugahara, Aya Sugita, Iwao Takiuchi, Yasutsumi Takeuchi, Emiko Takeda, Kyoko Takemoto, Hiroshi Tajiri, Shinji Tanaka, Rika Tanaka, Kenji Tanoue, Megumi Tanoue, Keisuke Tabuchi, Kyoko Tsuisha, Kaori Tsushida, Tsunomu Tsuda, Kazumi Tsuruta, Yoshihiro Teshima, Takeshi Terajima, Yoshihiro Tomioka, Masatomo Tomizono, Ayako Tomita, Manao Toyoshima, Kouji Uesaka, Masafumi Ueda, Mayumi Ueno, Naomi Uehara, Yukishih Uehara, Yoshih Ujikawa, Yuka Ushijima, Aki Ujihara, Souns Uchida, Yoshih Uchida, Satoru Umihata, Toru Umihata, Yusuke Uramoto, Makio Yahiro, Katsutoshi Yamaguchi, Keiko Yamaguchi, Junji Yamagushi, Hiroo Yamaguchi, Taku Yamakami, Keiichiro Yamamichi, Nobuhisa Yamamura, Kenji Yamamoto, Kei Yamamoto, Tami Yamamoto, Ryoo Yokote, Akiharu Yoshioka, Masatsugu Yoshiki, Shunsuke Yoshida, Momoko Yoshida, Tatsuya Yoshinoue, Terutada Waki, Yurie Watanabe, and Hideaki Watanabe.