



## Survey for Frequency and Severity of Biological Effects Caused by Occupational Static Magnetic Field Exposure

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Similar to time-varying magnetic fields, exposure to high-intensity static magnetic fields (SMFs) elicits short-term biological responses in the human body [1]. The major effect is temporal sensations due to the displacement of the body under the inhomogeneous magnetic fields. Magnetic resonance imaging (MRI) is a powerful tool in diagnostic imaging that uses strong SMFs for image acquisition. However, its health effects have been a concern for employees who work in the vicinity of MRI systems because of occupational SMF exposure during routine MRI examinations. The present study featured a questionnaire survey, daily report collection, and an experimental study to clarify the severity and frequency of the biological effects caused by occupational SMF exposure. MRI technologists (e.g., radiology technologists or nurses in the radiology department) were the targets of the present study.

The questionnaire surveys were mailed to 5763 facilities, 4921 male employees, and 2241 female employees in Japan in which MRI systems were installed. 2072 managers, and 2422 male and 1175 female employees answered (collection rates: 36.0, 49.2, and 52.4, respectively). Daily reports were collected from 1) 16 participants from 3 institutions who participated for 2-4 weeks (192 data) and 2) 58 participants from 6 institutes who reported for 5 working days (314 data). Approximately 37% of respondents experienced temporal symptoms during work [2]. The frequency of declaration of any symptoms was significantly higher in work records collected in the MRI room (16.8% vs. 3.3% control, chi-square test) during the 2-4 weeks of participation. The reported rate of SMF-core symptoms (e.g., headache, vertigo, and metallic taste) was 7.9%, which was at the same level as that for SMF-related symptoms (e.g., tiredness; 8.9%). However, the declaration rate dropped to 7.5% when the collection period was shortened to 5 working days. Physical loads such as assisting patients during work had no influence on symptom occurrence.

Temporal changes in standing balance were then evaluated by a balance plate measured at pre- and post-exposure to 1 T SMFs in the MRI room. The evaluation of body sway under both eyes-opened and -closed conditions showed neither severe nor long-lasting changes in standing balance. On-site recording of static posture under approximately 200-400 mT or  $83 \pm 10$  mT SMFs by motion-capture system [3] indicated significant increases in total sway path ( $p < 0.05$ , 2-way ANOVA). However, the effects seemed to not be severe since the actual changes in parameters were very small.

These results indicated that occurrence of temporal sensations near an MRI system was relatively rare and the severity was low.

## References

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