INTRODUCTION

Walking is an essential part of a person’s activities of daily living (ADL), socializing, and recreation. Walking speed is currently used as a proxy measure to evaluate community ambulation. Walking speed is also a reliable and objective measure of recovery of the walking ability and walking performance.

The ability to cross the road safely is important to maintain health. An inability to cross the road safely makes it harder to access health services and reduces social contact, thereby adversely affect health. Patients with schizophrenia have decreased walking speed because of a smaller stride length. Reduced muscular power is associated with a reduction in the walking speed in persons without mental disorders. Patients who are hospitalized in psychiatric hospitals can suffer physical impairment as a result of decreased physical activity during long-term hospitalization. Physical impairment may represent a major impediment to achieving a normal walking speed in schizophrenia patients. Without adequate physical performance levels, ADL may suffer on every level, along with cognition and skills deployment. However, few studies have examined the factors affecting walking speed in schizophrenia patients in Japan. Determination of the physical function necessary to attain an acceptable walking speed would help physiotherapists and occupational therapists to select appropriate therapeutic exercises. Consequently, we investigated the factors affecting walking speed in schizophrenia patients who were inpatients at a psychiatric hospital.
SUBJECTS AND METHODS

The study subjects were 37 patients with schizophrenia who were hospitalized in a psychiatric hospital. The demographic data of the patients are shown in Table 1. All patients were admitted to a psychiatric rehabilitation ward. The exclusion criteria were patients using a wheelchair, those with mental disorders too severe to allow them to understand the study explanation, and those whose ADL score was decreasing because of orthopedic disorders such as spinal cord injury.

Consent to participate in this study was obtained from the subjects following a verbal explanation of the study purpose and study content. The study was carried out with the approval of the Research Ethics Committee of Kansai University of Welfare Sciences.

The measured assessment items included age, duration of hospitalization, duration of disease, muscle strength (30-s chair stand test\(^7\)), balance ability (one-leg standing time with eyes open/closed, Functional Reach Test [FRT\(^8\)] and Timed Up & Go Test [TUGT\(^9\)], flexibility (long sitting position toe-touching distance\(^10\)), walking speed (10-m maximum walking speed\(^11\)), and the antipsychotic drug intake.

The one-leg standing time with eyes open/closed was measured for the dominant foot, with the subject standing barefoot with both hands at the waist and the nondominant foot elevated; the maximum time was set at 60 s. The criterion for ending the measurement was when the elevated foot touched the floor, the hands were removed from the waist, or the supporting leg moved. FRT was measured for both hands in accordance with the method reported by Tsushima et al.,\(^12\) using a reach measuring instrument (OG Wellness Technologies Co., Ltd.).

To determine the subjects’ fast walking speed, the time to walk 10 m of a 14-m walkway in a controlled room was recorded. The patients were informed that they would be timed for part of the 14-m walkway and to walk as fast and safely as possible without running. Each patient performed the test twice, and the fastest time was recorded.

The long sitting position toe-touching distance was measured using the long sitting position trunk flexion equipment (EKJ09, EVERNEW INC.), in accordance with the measuring methods of the New Physical Fitness Tests by the Japanese Ministry of Education, Culture, Sports, Science and Technology.

The 30-s chair stand test, the one-leg standing time with eyes open/closed, FRT, the long sitting position toe-touching distance, walking speed (10-m maximum walking speed\(^13\)), and the antipsychotic drug intake, were each measured twice, with the maximum/fastest values adopted as representative values. To establish the antipsychotic drug intake, the average dosage (i.e., the chlorpromazine-equivalent dosage) 1 month before measurement day was extracted from medical records.

By applying Spearman’s rank-order correlations, the associations between the walking speed and the measured variables, i.e., age, duration of hospitalization, 30-s chair stand test, one-leg standing time with eyes open/closed, FRT, TUGT, long sitting position toe-touching distance, and the antipsychotic drug intake, were assessed. Factors influencing walking speed were analyzed by stepwise multiple regression analysis. Statistical analysis was performed using IBM SPSS statistics 22.0. The significance of relationships was evaluated at the P <0.05 level.

RESULTS

The mean walking speed of all 37 subjects was 1.5±0.5 m/s (0.4–2.5), and for 6 of the 37 (16%) subjects, the walking speed was less than 1.0 m/s. The correlations between the walking speed and the parameters assessed in this study are shown in Table 2. The walking speed was significantly...
The walking speed is an important predictor of walking capability along the spectrum from limited household ambulation to unlimited community ambulation. Furthermore, the walking speed is a simple but highly reliable and responsive parameter indicating walking ability. In Melbourne, Singapore, and Los Angeles, pedestrian crosswalk speeds are reported to be 0.44 m/s (mean), 0.73–0.78 m/s (median), and 1.32 m/s (mean), respectively. In an American study, the median crosswalk speeds were 0.74–1.06 m/s. Nojiri et al. previously reported that a walking speed of 1.0 m/s is necessary for Japanese pedestrians to cross safely. Therefore, in Japan, a walking speed greater than 1.0 m/s is necessary for community ambulation. In the current study, 16% of patients were unable to walk at speeds of 1.0 m/s or more and so had restrictions when crossing the road; the other 84% of subjects were capable of successfully using pedestrian crossings. Therefore, interventions are necessary not only to achieve independence of walking but also to improve walking speed.

Ringsberget et al. reported that, for 75-year-old women, there was a significant correlation between walking speed and one-leg standing time. Rantanen showed that walking speed in the elderly and lower-limb muscular strength are significantly related, and that lower-limb muscle weakness reduces walking speed in the elderly. The current study established that the walking speed was correlated with the 30-s chair stand test, the one-leg standing time with eyes open, the one-leg standing time with eyes closed, and TUGT (P < 0.05).

Table 3 shows the results of multiple regression analyses. In the stepwise multiple regression analyses, the walking speed was most significantly explained by the TUGT ($R^2=0.583$).

### Table 2. Correlation between walking speed and measured parameters (n=37)

| Parameter                              | Mean | SD  | r      | P value |
|----------------------------------------|------|-----|--------|---------|
| Age (years)                            | 61.6 | 6.0 | −0.070 | 0.682   |
| Duration of hospitalization (months)   | 176.9| 161.0| −0.207 | 0.219   |
| Duration of disease (months)           | 475.9| 130.5| −0.101 | 0.552   |
| 30-s chair stand test (times)          | 12.9 | 5.1 | 0.465  | 0.004   |
| OLST with eyes open (s)                | 10.9 | 12.9| 0.533  | <0.0001 |
| OLST with eyes closed (s)              | 3.1  | 2.8 | 0.459  | 0.004   |
| FRT (cm)                               | 20.9 | 7.5 | 0.307  | 0.064   |
| TUGT (s)                               | 8.8  | 4.2 | −0.719 | <0.0001 |
| LSPTTD (cm)                            | 22.7 | 11.2| −0.174 | 0.309   |
| Antipsychotic drug intake (mg)         | 807.2| 651.9| 0.009  | 0.959   |

Table 3. Stepwise multiple regression analysis for prediction of walking speed

| Parameter | $R^2$=0.583 | B     | SE     | β      | P value |
|-----------|-------------|-------|--------|--------|---------|
| TUGT      | −0.093      | 0.013 | −0.771 | <0.01  |

B, regression coefficient; SE, standard error of regression coefficient; β, standard partial regression coefficient.

In this study, the factors influencing walking speed in schizophrenia patients were examined. The analysis revealed that the walking speed was most significantly associated with the TUGT.

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The risk of falling can be affected by the drugs a patient

**DISCUSSION**

In this study, the factors influencing walking speed in schizophrenia patients were examined. The analysis revealed that the walking speed was most significantly associated with the TUGT.
is administered. In particular, psychotropic drugs, which act on the central nerve system, have been reported to increase the risk of falling/tumbling.\(^{26}\) Moreover, the risk of falling/tumbling further increases in patients taking multiple psychotropic drugs.\(^{27}\) Therefore, the antipsychotic drug intake in patients with schizophrenia may have an effect on ADL. In the current study, no significant correlation was found between antipsychotic drug intake and walking speed. The reason for the low involvement of antipsychotic drug dosage is suspected to be that antipsychotic drugs were prescribed by physicians only after assessment of ADL and physical function/ability.

In patients with schizophrenia who have decreased walking speed, it is also necessary to evaluate the dynamic balance ability and to perform rehabilitation according to the results.

There were some limitations in the present study. First, because antipsychotic drug intake was evaluated, but psychological function was not evaluated, the influence of psychological function on walking speed is not clear. Second, neither the duration of disease nor the duration of hospitalization was found to be correlated with walking speed. However, if these durations become prolonged, the patients’ spheres of activity may become narrowed, resulting in decreased physical activity and physical function. Furthermore, the walking speed may also be adversely affected. Because the objective measurement of physical activity using a pedometer was not performed in the present study, additional examination of physical activity should be conducted. Third, this was a cross-sectional study; we believe that the effect on walking speed of improved balance ability can be determined by follow-up or intervention studies, which will require further evaluation.

CONCLUSION

To extract the factors that affect walking speed in hospitalized schizophrenia patients, their physical function and antipsychotic drug dosage were examined. In the current study, dynamic balance was found to have the greatest influence on walking speed. Furthermore, the walking speed was less than 1.0 m/s in 16% of the subjects, indicating that these patients would likely have difficulty in crossing the road safely. Therefore, in schizophrenia patients, interventions to improve walking speed are necessary to promote outdoor activities.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.
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