Homelessness and Cognitive Impairment: An Exploratory Study in Tokyo, Japan

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Abstract

Objective: Homelessness has frequently been associated with neuropsychological impairment. This has been observed using general screening tests for dementia as well as tests of more focal abilities, particularly executive function. Most studies have been of homeless individuals from North America with none reported from Japan.

Methods: In this exploratory study we interviewed a sample of 16 homeless adults from Tokyo, Japan, and performed tests of cognitive function, assessed head injury, addictive behaviours (drug use, gambling, alcohol abuse), and recorded details of homelessness history. The cognitive examination involved the Japanese Adult Reading Test to estimate premorbid intelligence quotient, the Wisconsin Card Sorting Test to measure frontal lobe–related cognitive function, and the Mini-Mental State Examination to measure global cognitive impairment associated with dementia.

Results: Among the 16 homeless individuals, 7 (44%) displayed global cognitive impairment. In addition, executive function tended to be poor. In contrast, estimated premorbid intelligence quotient was within the normal range. Substance abuse in general was not at a level to cause clinical concern, although a high level of pathological gambling was observed. There were no associations between cognitive function and clinical and addictive behaviour variables, although associations were noted between cognitive scores and time spent homeless.

Conclusion: The results suggest high levels of neuropsychological impairment in this sample of homeless adults in Japan. Furthermore, cognitive impairment is acquired rather than developmental in origin, and is proportional to the length of time spent homeless.

Key words: Behavior, addictive; Frontal lobe; Homeless persons; Intelligence; Neurobehavioral manifestations

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Introduction

Various studies have reported high levels of cognitive impairment among homeless individuals. It has been suggested that approximately 56% to 80% of homeless adults in the US display neuropsychological impairment.[1,2] There may be various reasons for such low neuropsychological performance by homeless adults. A study in Canada estimated that 53% of their homeless sample had suffered a traumatic brain injury.[3] In the UK, one study estimated that 21% of their homeless sample had alcohol-related brain damage.[4] A US-based study further revealed that 35% of their sample displayed global cognitive impairment, based on the Mini-Mental State Examination (MMSE) score, although frontal lobe–related executive functional impairment was even more prominent.[5]

There is a fairly consistent picture of a high prevalence of cognitive impairment among homeless populations in the English clinical literature. Although the studies are predominantly from the US, a systematic review has revealed a handful of studies of homeless samples from Australia, the UK, Brazil, Germany, and Spain.[6] Nevertheless there remains none from Asian countries such as Japan. This is despite a long-standing presence of significant numbers of homeless individuals in Japanese cities.[7] Studies in different countries are important for a number of reasons: they provide information locally that could be useful to clinicians and social workers, and on an international scale they address issues of whether psychiatric phenomena are observed globally.

In addition to the observations of cognitive impairment, there is an issue of premorbid, or in this case pre-homeless, cognitive function. Neurocognitive development is known to correlate strongly with socio-economic status[8] so one would expect adult homelessness to be linked to a lower childhood intelligence quotient (IQ). Indeed, this has been observed many times in the western academic literature.[9] Although essentially a psychological issue, this also has various psychiatric implications as a lower premorbid IQ is associated with raised susceptibility

to post-traumatic stress disorder,[10] greater risk of developing substance dependence,[11] and earlier onset of dementia[12]; all of which are also associated with homelessness. In addition, estimations of premorbid IQ in the presence of cognitive impairment can indicate whether the impairment was acquired or developmental in origin.

In the current research we studied cognitive impairment, as indexed by global cognitive functioning and frontal executive impairment, in a sample of homeless adults living in central Tokyo, Japan. In addition, IQ was estimated and associations between cognitive function and homelessness-related variables such as addictive behaviours were investigated.

Methods

Definition of 'Homeless' and Inclusion Criteria

Concepts of homelessness vary internationally. In Japan, 'homeless' is frequently taken to mean literally 'sleeping rough'.[13] Nonetheless this narrow definition has problems as many homeless people in Japan move dynamically between rough sleeping and temporary accommodation or construct their own temporary dwellings in parks or on riversides.[14] In most developed countries the concept of homelessness is somewhat broader, including anybody who lacks permanent or adequate housing, for example, those sleeping rough, in hostels, shelters, and temporary supported accommodation.[15] For consistency, we used a broad definition of homelessness that encompasses the international understanding of the term and can be applied across cultures. This is based on 3 conditions: (i) self-defining as homeless in a wide interpretation; (ii) accessing services for homeless people; and (iii) lacking secure housing, e.g. a tenancy.[9] Additional inclusion criteria were that participants were at least 18 years old, able to understand the recruitment information and give consent, and were not intoxicated.

Participants

A total of 16 participants were recruited from a charitable homeless service in central Tokyo, Japan. Each was offered 1000 Yen (approximately US$10) for their participation. Ten participants were recruited while attending the charity's centre to receive skills development (cooking classes) and a hot meal. This included all but one of the clients who attended the service on 4 separate days when the researchers visited. The one individual who declined to participate was a woman aged approximately 40 to 50 years. A further 6 participants were recruited at the organisation's night-time outreach event in a Tokyo park; they were recommended by the outreach service staff who knew our inclusion criteria, and they agreed to participate.

Procedure and Assessments

All participants gave written informed consent after the procedures were explained to them in detail. The protocol was approved by the research ethics committee and was conformed to the provisions of the Declaration of Helsinki

(as revised in Edinburgh 2000). First, participants were interviewed concerning demographic and homelessness-related variables followed by assessments of addictive behaviours. They were asked whether they had ever used any of a range of different substances (e.g. cannabis, cocaine, heroin), even if only once. Although brief, the sum of substances tried provides a useful measure of polysubstance abuse and predicts other clinical features.[16] Actual current substance dependence was measured with a Japanese translation of the Leeds Dependence Questionnaire, a 10-item validated self-report measure of dependence on any substance of abuse.[17] The total score ranges from 0 to 30 ('0' means 'Never', 1 'Sometimes', 2 'Often', and 3 'Nearly always') and a score of > 20 indicates dependence. Next, severity of alcohol abuse was assessed with the Alcohol Use Disorders Identification Test (AUDIT); a score of > 7 is considered to indicate problematic drinking. This validated and reliable scale was developed by the World Health Organization[18] and is available in Japanese.[19] To assess problem gambling, we used the DSM-IV criteria[20] as operationalised in a brief structured interview.[21] Originally published in English, we used a Japanese translation. Examples of gambling behaviour were adjusted to the local environment (e.g. the inclusion of pachinko).

Cognitive assessment focused on 3 domains: estimated intelligence, frontal lobe–related cognitive function, and global cognitive status. To estimate intelligence we used the Japanese Adult Reading Test (JART) that measures pronunciation of 50 kanji compound words.[22] Reading tasks such as the JART are known to be accurate estimators of IQ and are little affected by neurological and psychiatric illness. For example, various studies have shown their accuracy in IQ estimation even in the presence of Alzheimer's disease.[22,23] For this reason they are considered estimators of premorbid IQ.

To assess frontal lobe–related cognitive function we used the Wisconsin Card Sorting Test (WCST).[24] This is considered a gold standard for cognitive assessment of frontal lobe impairment. Its reliability has been repeatedly demonstrated and its validity is demonstrated by its sensitivity to prefrontal cortical damage[25] and activations of frontal regions by healthy controls during task performance.[26] The WCST is considered an excellent high-level test of executive function,[27] particularly cognitive flexibility.[26] As is usual with this test, we reported the number of categories completed and the percentage of perseverative errors.[28] Perseverative errors are those that repeat a previous response type despite it no longer being successful. Finally, the MMSE[29] was included as it provides a valid and reliable general screening of global cognitive impairment associated with dementia.[30] The Japanese version of the MMSE has been shown to be a reliable measure of cognitive impairment in mixed dementia patients.[31]

Statistical Analyses

For bivariate correlational analyses, Pearson statistics were used for normally distributed data and Spearman's rho

for data that was not. When there was a need to control for additional factors, parametric partial correlations were employed. The critical value for significance was 0.05 and all p values were based on 2-tailed tests. All calculations were performed with the Statistical Package for the Social Sciences Windows version 21.0 (SPSS Inc., Chicago [IL], US).

Results

Demographic and Clinical Features of the Homeless Participants

All of the 16 participants were male with a mean (± standard deviation) age of 51.5 ± 11.0 years. The mean age of first episode of homelessness was 36.8 ± 12.0 years. Most (11/16, 69%) individuals had been continually or mainly homeless since the first episode of homelessness. Indeed, the mean time spent homeless over a lifetime was 14.3 ± 10.6 years. The mean duration of education for the group was 11.4 ± 3.1 years. When asked where they had slept the previous evening, 5 (31%) reported rough sleeping. This was usually in a public place such as a major train station. The remainder described various forms of temporary accommodation, including group homes, shelters, and bed and breakfast establishments.

Regarding clinical features, 7 (44%) of the participants reported a previous psychiatric hospital admission and 2 (13%) reported a history of head trauma involving loss of consciousness. Substance abuse was generally low. The majority (n = 15) stated that they had never tried any of a range of illicit substances, including cannabis, cocaine, heroin, and hallucinogens. One individual stated that he had abused solvents. Accordingly, on the Leeds Dependence Questionnaire all participants scored 0 or very low; the highest total score was 3 and the group mean score was 0.7 ± 1.1. Similarly, low levels of alcohol dependence were detected with the AUDIT. Among the 16 participants, only 2 (13%) scored in the range considered problematic drinking (> 7) and the group mean score was only 3.7 ± 4.7. In contrast, 5 (31%) reported pathological levels of gambling based on the DSM-IV criteria.

Cognitive Function and Impairment

The MMSE gives an overall measure of cognitive impairment associated with dementia. The mean score of the homeless sample was 23.9 ± 4.8, slightly below the usual 'normal' range of 24 to 30.[30] Seven (44%) scored below the normal range (score < 24) although most were within the range of mild cognitive impairment (score of 18-23); only 2 (13%) scored < 18 indicative of severe cognitive impairment.

Frontal cognitive function was assessed with the WCST. The study group scored a mean of 1.9 ± 1.9 categories correct and committed high levels of perseverative errors (mean, 57.8 ± 20.3%) indicating frontal-subcortical cognitive impairment. In the WCST normative sample, scoring only 0, 1, or 2 categories correct was observed in only 17.3% of healthy adults, but this range was shown by 59.3% of patients with frontal lobe damage.[24] In our sample of homeless adults, 12 (75%) scored in this low range. Thus poor performance on the WCST may be more common in Japanese homeless adults than in confirmed cases of frontal brain damage. If we take the most stringent criteria, scoring 0 categories correct, achieved by less than the bottom 1% of the normative sample, we found that 4 (25%) of the homeless participants scored at that level. In contrast to these observations of cognitive impairment, the estimated mean premorbid IQ was 93.9 ± 15.4 which is within the 'normal' range.[32] The homeless individuals did not score significantly below the Japanese national estimated population mean (t[15] = –1.579, p = 0.14).

Associations of Cognitive Function with Homelessness and Clinical Variables

Correlations between cognitive performance and homelessness and alcohol abuse variables are shown in the Table. The relationship between cognitive function and drug use was not investigated due to the low levels of reported use. Although alcohol abuse was observed, there were no significant correlations between level of alcohol use and cognitive variables. The highest level of addictive behaviour observed in the current research was for gambling, yet no statistically significant correlation with cognitive functioning was noted. Nor was there a significant relationship between age at first being homeless and cognitive variables. This does not mean that cognitive function is not linked to homelessness. We found significant correlations suggesting worse performance on the MMSE and on estimated IQ linked to extended homelessness.

Table. Correlations between cognitive performance and homelessness and alcohol abuse variables.

	WCST categories	WCST perseveration	Premorbid IQ	MMSE
Length of homelessness (controlled for age)	-0.395 (p = 0.15)	0.087 (p = 0.76)	-0.525 (p = 0.04)	-0.530 (p = 0.04)
Age of first homeless episode	0.108 (p = 0.69)	-0.135 (p = 0.62)	0.342 (p = 0.20)	0.078 (p = 0.77)
Alcohol audit score	-0.373 (p = 0.16)	-0.130 (p = 0.63)	-0.069 (p = 0.80)	-0.060 (p = 0.83)

Abbreviations: *IQ = intelligence quotient; MMSE = Mini-Mental State Examination; WCST = Wisconsin Card Sorting Test.*

Nonetheless it is likely that these 2 significant correlations reflect overlapping phenomena. When IQ was used as a covariate in the correlation between length of homelessness and MMSE scores, the relationship was no longer statistically significant (p = 0.43). Similarly, when MMSE scores were used as a covariate, there was no longer a significant correlation between IQ and length of homelessness (p = 0.46). Finally, there were no significant differences for the cognitive variables between those participants with a psychiatric hospital admission and those without.

Discussion

The findings of this study suggest that the small sample of homeless adults interviewed in this research demonstrated poor frontal lobe cognitive functioning. This is of interest because these cognitive abilities are involved with adaptive behaviour and executive function, reasoning, problem-solving, etc.[33] One hypothesis is that poor executive function may contribute to social and economic difficulties that place one at risk of homelessness. This is unlikely to be a selective impairment, however, and likely occurs in the context of a wider picture of cognitive difficulties. Previous research in Europe and the US has shown that low function in other cognitive domains, for example, memory,[9] is also associated with homelessness. Although limited by the small sample, our preliminary evidence is that a sizable proportion of Japanese homeless individuals appear to have a generalised cognitive impairment. Our data revealed that 44% of the sample scored abnormally, with 13% scoring in the range of severe cognitive impairment on the MMSE.

The second question in this research addressed premorbid cognitive function. We were unable to support the suggestion that low estimated IQ is associated with general homelessness in the Japanese context. Although as a whole group our sample scored a mean IQ of 94, lower than the estimated Japanese population mean of 100, this is only slightly, and not significantly, lower. Scores from the US and UK homeless samples tend to be somewhat lower, for example, in 2 key studies they were about 15 points below the estimated population mean.[2,9] The most obvious explanation for this difference is cultural — different socio-economic contexts will vary in how much intelligence contributes to socio-economic status such as homelessness. For example, the greater income inequality in the UK and US compared with Japan[34] may lead to greater ability-based socio-economic mobility in those countries.

Taken together, we have evidence of within-normal-range premorbid IQ in the presence of frontal lobe cognitive impairment and global cognitive impairment. This means that the poor performance on the MMSE or WCST is unlikely to be caused simply by the participants naturally being at the lower end of the population intelligence spectrum. If that were the case, they would have achieved low premorbid IQ. A better explanation is that some of the participants have acquired impairments of executive cognitive functioning. This agrees with previous work in

the UK and the US suggesting that cognitive impairments in homeless adults are acquired in the context of those features linked to homelessness, e.g. substance abuse, head injury, and psychological trauma.[1,35]

Nevertheless in the current research we found no association between factors frequently linked to cognitive function or impairment and homelessness. For example, serious mental illness (indexed by psychiatric admission) was not associated with cognitive ability. This contrasts with previous research suggesting that cognitive impairment is closely associated with severity of mental illness and social functioning.[36] Our inability to detect similar associations may be due to the heterogeneity of this sample who became and remained homeless for multiple reasons. In general psychiatric samples, serious mental illness is linked to a cognitive profile that includes executive function impairment and furthermore, severity of cognitive impairment predicts socio-economic factors such as employment.[37] Not all mentally ill individuals become homeless, however. There is evidence that some homeless mentally ill individuals have better cognitive functioning than similarly mentally ill individuals who are not homeless.[38] This indicates a possible survivor bias, in which a sub-sample of mentally ill individuals is able to remain homeless because of their relatively preserved cognitive status. Alternatively, a simpler explanation for the lack of association between mental illness and cognitive function in this research is the sample size. In this exploratory study, only 16 homeless individuals participated. We must accept the strong possibility that associations have been missed due to the lack of statistical power.

A further limitation is the cross-sectional sampling. Such a procedure is much more likely to recruit long-term homeless individuals than those who experience only short periods of homelessness. The mean time spent homeless in the studied sample was 14.3 years. It should be kept in mind therefore that these results are biased towards the situation of the long-term homelessness. It may be that individuals with extended periods of homelessness have different cognitive profiles to those with short periods of homelessness. This was suggested by our correlational analyses. We observed significant correlations between length of homelessness and premorbid IQ and the MMSE score. In both cases these suggested lower cognitive functioning associated with longer periods of homelessness. This is to be expected, if one assumes that either lower premorbid IQ or acquired cognitive impairment / dementing illness increases the risk of becoming and staying homeless, or that extended homelessness itself produces cognitive impairment.

Nonetheless it is likely that there is an interaction between IQ and dementing illness and the relationship to homelessness. In general, a higher premorbid IQ protects against the development of dementing illnesses as it provides individuals with a 'cognitive reserve'.[12] In our findings, the relationship between MMSE score and length of homelessness was not significant when IQ was added as a covariate. This suggests that a combination of low cognitive

reserve and acquired global cognitive decline is the central feature of neuropsychological impairment among the homeless.

A limitation of the current research is that a cross-sectional design was used, and associations between cognitive variables and time spent homeless were inferred from self-report data. Ideally, homeless cohorts should be followed up longitudinally; this is pragmatically very difficult in such a transient, dynamic, and often disengaged population. Another major limitation of the research is the small sample size. This also reflects the difficulty of access to homeless populations for research purposes. Nevertheless the current data provide an exploratory analysis that could inform larger clinical studies.

The implications of this study are that there may be many homeless individuals in Japan who have clinically significant levels of cognitive impairment. Furthermore, this exploratory study suggests that the cognitive impairment is acquired, not developmental, in origin. Homeless individuals are often disengaged from social and medical services and so special measures such as outreach programmes may be necessary to provide them with appropriate psychiatric or neurological care. In addition, cognitive impairment may negatively impact on other aspects of health care, such as clinic attendance and appropriate use of medication. Further research is needed with larger samples to confirm the observations made here and to examine in more detail the wider medical implications of cognitive impairment among homeless populations in Japan.

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Declaration

The authors have no conflicts of interest to declare.

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