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Neuropsychological and Cognitive Performance of Homeless Adults

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Many homeless people may have been exposed to events and situations that could potentially produce neuropsychological impairments. In the current study, 80 homeless participants underwent a battery of tests designed to 1) estimate long-standing established memory and intelligence, which was assumed to indicate prehomeless function and 2) measure current memory and intelligence function. Mental health screening and substance misuse data were also obtained. Results indicated that current memory and IQ were significantly lower than the estimated normal population means and also their prehomeless estimates. The memory score change was from 100.5 to 90.3 ($p < .001$) and IQ change from 98.8 to 95.6 ($p = .038$). The interaction between task type (memory or IQ) and measure (prehomeless or current) was also significant ($p = .003$), signifying that there was a greater change in the domain of memory function than in IQ. Many participants reported substance misuse and clinically significant mental health concerns. We conclude that the homeless individuals in our sample appear to have suffered a reduction in cognitive function, which may have occurred either during homelessness or prior to it.

Keywords: cognition, homelessness, intelligence, IQ, memory, premorbid

Homelessness presents a range of challenges to those governmental and nongovernmental agencies that occasionally or routinely deal with vulnerable and insecurely housed individuals. These include health services, social care providers, governmental benefit agencies, and charities. It has been estimated that within the European Union around 2.7 million people can be defined as homeless (i.e., either literally roofless, in inappropriate housing, or living in overcrowded conditions; Avramov, 1999). When the definition of homelessness is limited to those who are literally roofless, living in temporary shelters or squats, it has been estimated that there are around 85,000 homeless individuals in the United Kingdom (U.K.; Kenway & Palmer, 2003), with comparable figures of 35,000 in Canada and 350,000 in the United States. (Murphy, 2000). Indeed, homelessness has emerged as a major social concern in most developed countries (Toro, 2007).

There are multiple societal and economic factors that influence the level of homelessness, including access to affordable housing, national stability, societal wealth, and local welfare provision (Berger & Tremblay, 1999). However, there are also likely to be multiple intrapersonal factors. Homeless individuals tend to display personality profiles characterised by pessimism and a negative perspective on the past (Pluck et al., 2008) and to report high levels of traumatic events in their childhoods (Pluck et al., 2011; Spence et al., 2006). It is, perhaps then, not surprising that many homeless people display complex psychosocial problems that appear to predate their homelessness and often remain after rehousing (Vostanis, Grattan, & Cumella, 1998).

In addition, systematic literature reviews of cognitive function in children and adolescents (Parks, Stevens, & Spence, 2007) and adults (Backer & Howard, 2007; Burra, Stergiopoulos, & Rourke, 2009; Spence, Stevens, & Parks, 2004) have described high levels of cognitive impairment in samples of homeless individuals. Many homeless people may be at the lower range of cognitive abilities and this may have contributed to their difficulties within society. This could be due to childhood socioeconomic disadvantage, poor family functioning, and inadequate access to education. For example, a homeless sample in the United States was found to have notably poor reading ability (Solliday–McRoy, Campbell, Melchert, Young, & Cisler, 2004). In another study of neuropsychological test performance in homeless individuals in the United States, it was found that education level was the only statistically significant demographic factor, accounting for 29% of the variance (Gonzalez, Dieter, Natale, & Tanner, 2001).

Alternatively, it is feasible that many homeless people have suffered a decline in cognitive function as a consequence of homelessness. In support of this suggestion, homelessness is associated with a range of factors with the potential to impair cognition, including poor nutrition (Evans, 1996), raised levels of substance misuse (Pluck, Lee, & Parks, 2007), and mental illness

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(Spence, 2009). Furthermore, a study of homeless hostel residents in Scotland, estimated that of their sample, 21% showed signs of alcohol-related brain damage (Gilchrist & Morrison, 2005). Therefore, the unresolved issue is whether for a typical homeless adult, cognitive function has always been somewhat lower than the general population, or whether it has declined for some reason over time.

To examine cognitive abilities in a sample of homeless individuals, and test whether there is evidence for change in cognitive function, we chose to focus our study on memory and intelligence. These are broad cognitive domains in which neuropsychological tools are available for measuring both current status and estimates of past function (Wechsler, 1999, 2001, 2002). In clinical practice, these allow the comparison of estimated premorbid function with current actual function following neurological illness. However, they can be potentially applied to nonclinical research issues, such as homelessness, in order to examine estimated prehomeless and current cognitive functioning. In addition, cognitive abilities in general (Knudsen, Heckman, Cameron, & Shonkoff, 2006; Noble, McCandliss, & Farah, 2007) and intelligence quotient (IQ) in particular (Rinderman, 2008) have been linked to financial prosperity. Consequently, we anticipated that homeless individuals would tend to score below population norms for these abilities. As memory processes are considered more susceptible to disruption than general intelligence (Lezak, Howieson, & Loring, 2004), we expected that memory ability would be more suppressed than IQ performance in the homeless sample. Hence, we report a study that involved estimation of prehomeless cognitive function and measurement of current level in a sample of homeless adults. We hypothesised that: 1) current memory and IQ would be lower in the homeless sample than the standardised population mean; 2) current memory and IQ performance would be lower than estimated prehomeless levels in the homeless sample; and 3) memory ability would be more suppressed than IQ in the same homeless sample.

Method

Participants

Homeless individuals living in the city of Sheffield (England) were contacted via homeless services, including temporary hostels, day centers, and meals services. Potential participants were also recommended by staff of the Sheffield Homeless Assessment and Support Team of the National Health Service. Inclusion criteria were currently being homeless (defined as lacking a secure tenancy; accessing homeless services; and self-describing as homeless), being at least 18 years of age, willing to commit to up to three hours of interviewing, and willing to remain nonintoxicated for the duration of the interview. Exclusion criteria were not being able to fully understand the study information or consent procedure and reporting or appearing intoxicated at the recruitment stage. Eighty individuals were recruited and basic demographic information of the group is shown in Table 1. Of these 80 individuals, 22 (27.5%) were raised in local authority care or adopted and 27 (33.8%) required special educational services as children. All of the participants were unemployed. The ethnic background of the sample was predominately White (77) with two Black participants and one of ethnic Pakistan origin. The marital status was the following: 60 (75%) single, 13 (16.3%) divorced, four (5%) separated, two (2.5%) bereaved, and one (1.2%) married. Seven (8.8%) were formerly in the Armed Forces and 53 (66.3%) had been incarcerated in the past. We asked each participant for the single most important reason as to "Why they were homeless." Their responses were recorded verbatim and classified into groups; the frequencies of these responses are shown in Table 1.

Table 1
Demographic, Homelessness, and Psychopathology Features of the Full Homeless Sample and Those Excluded and Those Included From the Part Two Comparison of Prehomeless With Current Function

Feature	Full sample ($N = 80$)	Excluded ($n = 44$)	Included ($n = 36$)	Significance
Age	35.2 (9.2)	35.4 (9.6)	34.7 (8.9)	[1]$p = .735$
Sex (M:F)	67:13	35:9	32:4	[3]$p = .260$
Education	10.2 (2.4)	9.4 (2.8)	11.1 (1.4)	[2]$p = .001$
Rough sleeping: (N/Y)	65:15	36:8	29:7	[3]$p = .886$
Total homelessness	67.5 (74.7)	68.8 (81.2)	66.0 (66.9)	[2]$p = .414$
Primary reason given for homelessness				
Alcohol	19 (24%)	8 (18%)	11 (31%)	[3]$p = .196$
Drugs	23 (29%)	14 (32%)	9 (25%)	[3]$p = .503$
Family issues	23 (29%)	12 (27%)	11 (31%)	[3]$p = .747$
Money/housing	6 (7%)	3 (7%)	3 (8%)	[3]$p = .798$
Leaving prison	4 (5%)	3 (7%)	1 (2.8%)	[3]$p = .409$
Mental health	2 (2.5%)	1 (2.3%)	1 (2.8%)	[3]$p = .886$
Harassment	2 (2.5%)	2 (4.5%)	0 (0%)	[3]$p = .195$
Disorganization	1 (1.3%)	1 (2.3%)	0 (0%)	[3]$p = .363$
Total	80 (100%)	44 (100%)	36 (100%)	
Substance misuse	1.7 (1.4)	1.7 (1.3)	1.7 (1.4)	[2]$p = .698$
Psychopathology	89.3 (14.2)	92.4 (11.2)	86.0 (16.5)	[2]$p = .120$

Note. Age and education are shown in years, total homelessness is in months over lifetime, substance misuse = the sum of the number of substances used regularly (defined as at least four times per week over at least 2 weeks) in the past year. Psychopathology = the total P score on the Personality Assessment Screener (high scores indicate a greater probability of psychopathology). Inferential statistics were between those included ($n = 36$) and those excluded ($n = 44$) from the Part 2 comparison.
[1] Indicates a *t*-test was used. [2] Indicates a Mann-Witney U test was used. [3] Indicates that a χ^2 test was used.

Measures and Procedure

Estimates of past cognitive function were performed with the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001). Despite the name of this test, it is specifically designed and validated to estimate past IQ and memory test scores. This is based on a well-established method of determining past cognitive function, one that is often used to estimate cognitive decline in the context of head trauma, dementia, and forensic evaluations (Franzen, Burgess, & Smith–Seemiller, 1997); namely, the reading and pronunciation of irregular words in the English language. This was chosen because irregular word reading is primarily an index of past learning, scores are very stable in the presence of cognitive decline compared to other measures of intellectual functioning (Green et al., 2008) and are highly correlated with cognitive performance (Nelson, 1991).

The WTAR is a relatively recently developed test, evolved from a long tradition of word-reading tasks (Blair & Spreen, 1989). Findings from a similar reading vocabulary test, the National Adult Reading Test—Revised (NART-R; Nelson, 1991), which is used to estimate IQ, suggested that it may underestimate scores in those with brain injury (Morris, Wilson, Dunn, & Teasdale, 2005). Studies of the WTAR in traumatic brain injury have shown that it either underestimates (Mathias et al., 2007) or accurately predicts IQ (Green et al., 2008). Another study that used the NART-R suggested that it more accurately predicted IQ than other cognitive domains. In fact, the NART-R predicted IQ better than it predicated any of 26 different measures, derived from 14 commonly used neuropsychological assessments measuring motor performance, executive function, memory, sustained attention, visual perception, and language skills (Schretlen, Buffington, Meyer, & Pearlson, 2005). While Schretlen and colleagues used subtests of the Wechsler tasks, they mixed versions of them (e.g., Wechsler Adult Intelligence Scale – Revised, Wechsler Adult Intelligence Scale III, and Wechsler Memory Scale – Revised [WMS-R]). However, they did not use the WTAR. Thus, three different reference norms were used in their study. The current study's strength is that all of our Wechsler tests used the same reference normative group.

According to the WTAR manual, estimation procedures require that the standard score for each individual be compared with a demographics predicted WTAR score that is based on past academic achievement (Wechsler, 2001). The WTAR manual noted that if this difference is more than −20, then WTAR performance should not be used to predict IQ and memory scores. Although potentially limiting the application of this assessment, it acts as a quality control measure, and ensures that the test is only applied when it can validly estimate past cognitive performance. To measure current memory function, we used the Wechsler Memory Scale – III Abbreviated (WMS-III, Wechsler, 2002) and to derive current IQ scores the Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999). We used this combination of the Wechsler tests since they were at the time the only available tests that were conormed on the same population and offered estimation of both IQ and memory function. In addition, we measured general psychopathology with the Personality Assessment Screener (PAS, Morey, 1997) and recorded substance misuse histories and past psychiatric contact.

Individuals underwent approximately two and a half hours of testing after signing an informed consent and reporting being nonintoxicated during the day of testing. All homeless individuals were paid a participation fee equivalent to about 50 Canadian dollars. The research protocol was approved by the regional National Health Service Ethics Committee and Research Governance services.

Statistical Analyses

Where it was necessary to compare continuous demographic, substance misuse, and psychopathology data, *t* tests were employed or Mann-Whitney *U* tests for data that were not normally distributed (distributions were checked with Kolmogorov–Smirnov tests). For categorical data, χ^2 tests were used. To compare IQ and General Memory scores, one-sample *t* tests were used to compare acquired data to the Wechsler scale-estimated population mean of 100 and standard deviation (*SD*) of 15. To test the main hypotheses regarding prehomeless estimates and current function, a 2 × 2 repeated-measures analysis of variance (ANOVA) was used, with task type as one factor (memory or IQ) and measure as the other factor (prehomeless estimate or current). Effect sizes for ANOVA interactions are estimated with eta squared (η^2). For one sample *t* tests and contrasts, these are estimated with Cohen's *d*.

Results

Our data analysis was conducted in two parts. The first part describes the entire sample of 80 homeless individuals. Here, we present data suggesting lower cognitive functioning in both memory and intelligence in the presence of significant psychiatric symptoms and drug misuse. Six participants chose not to complete the WMS-III memory scale and two withdrew prior to completion of the WASI IQ test. This was due to the testing being abandoned at the request of the participants.

In the second part, estimations of prehomeless cognition function were performed. When this methodology was applied to the 80 participants who completed the WTAR, 40 demonstrated abnormally low reading ability as compared with that which would be expected based on their demographics. The manufacturer of the WTAR test indicates that estimation of function should not be performed in such cases. Of the remaining 40 participants, four did not complete the current status memory and IQ tests described previously. Consequently, full data on both measurement points of cognitive function (i.e., prior to being homeless and homeless) were available for the remaining 36 participants. Demographic information comparing the full sample of 80, and those included in, and those excluded from the second part of the analyses are shown in Table 1.

Part One: Overall Current Memory and IQ Function

Within this section we attempted to test our first hypothesis that current memory and IQ would be lower in the homeless sample than the standardised population mean. We found that the mean WMS-III Total Memory score of the whole sample was 85.1 (*SD* = 16.2) and the mean WASI full-scale IQ score of the group was 84.3 (*SD* = 15.7). On both of these assessments, the general

population mean is estimated at 100, with a *SD* of 15. The scores by the homeless group were compared to the population mean using one-sample *t* tests and were found to be significantly lower for both Total Memory scores, $t(73) = -7.9$, $p < .001$, $d = .99$ and IQ, $t(77) = -8.8$, $p < .001$, $d = 1.0$. Therefore, on measures of Total Memory and IQ function, the homeless sample scored significantly below the estimated normal population. A breakdown of the scores into standard qualitative categories (Wechsler, 1999) is shown in Table 2. Of particular note are the proportions of people scoring in the "extremely low" range, 18.9% for Total Memory, and 19.2% for IQ. This score range corresponds to more than two *SD* below the normative mean, and would be expected in a normal sample in only 2.2% of cases (Wechsler, 1999). To examine the relationship between duration of homelessness and cognitive measures, correlations were performed. There were no significant correlations with IQ or Total Memory scores for either the total months spent homeless over the lifetime or total months of the current homeless episode (all $p > .23$).

Psychiatric and substance misuse problems were common among the sample. Thirty-two (40%) out of the full sample of 80 participants reported daily use of either crack cocaine or heroin in the past year. On the PAS, all participants scored at levels indicative of at least a "moderate" risk (psychopathology scores ≥ 50) for problems of clinical significance (Morey, 1997). The mean psychopathology score was 89.3 (*SD* = 14.2). Fifty-eight (72.5%) reported past psychiatric contact and 20 (25%) a psychiatric hospital admission.

To examine the influence of substance misuse and psychiatric history on cognitive function, additional ANOVAs were performed. As a group, those with past-year daily use of heroin or cocaine achieved mean IQ scores of 85.6 (*SD* = 14.3), the group without daily use of heroin or crack cocaine achieved mean scores of 83.5 (*SD* = 16.6); this small difference in scores was not statistically significant, $F(1, 76) = .58$, $p = .562$, $d = .14$. Regarding Total Memory performance, those with past-year daily use of heroin or cocaine achieved mean scores of 89.1 (*SD* = 16.0), the group without daily use of heroin or crack cocaine achieved mean scores nearly 7 points lower, at 82.5 (*SD* = 16.0), but this difference in scores was not statistically significant, $F(1, 72) = 1.7$, $p = .087$, $d = .44$.

When the sample was grouped on mental health history, it was found that those who reported past psychiatric contact achieved mean IQ scores of 84.6 (*SD* = 14.4), and the group without past psychiatric contact achieved mean scores of 83.6 (*SD* = 18.9). This difference was not statistically significant, $F(1, 76) = -.26$, $p = .795$, $d = .07$. For Total Memory performance, those with past psychiatric contact achieved mean scores of 86.7 (*SD* = 13.2) and the group without past psychiatric contact achieved mean scores of 87.2 (*SD* = 16.5). Again, this difference in scores was not statistically significant, $F(1, 72) = 1.5$, $p = .879$, $d = .03$.

Table 2
Proportions of the Full Homeless Group Who Scored in Particular Qualitative Classifications for Memory and Full Scale IQ

Classification	Score range	Total memory	Full IQ
Superior	120–129	0	1 (1.3%)
High average	110–119	4 (5.4%)	3 (3.8%)
Average	90–109	29 (39.2%)	23 (29.5%)
Low average	80–89	13 (17.6%)	19 (24.4%)
Borderline	70–79	14 (18.9%)	17 (21.8%)
Extremely low	69 & below	14 (18.9%)	15 (19.2%)

Part Two: Prehomeless Estimation of Cognitive Function

In this section, we aimed to evaluate our second hypothesis, that current memory and IQ performance would be lower than estimated prehomeless levels in the homeless sample. As previously noted, prehomeless estimation of function was only available on 36 individuals from the original sample of 80. The demographic, substance misuse and psychopathology details of these 36 participants are shown in Table 1, where they can be compared with the details of those who were excluded. The only significant difference between the two groups was on years of education. Not surprisingly, those who were excluded on the basis of poor reading ability had received fewer years of formal education. Regular use of drugs in the past year was common in both included and excluded groups. Indeed, of the 36 in the included group, 14 (38.9%) reported daily use of either crack cocaine or heroin in the past year. All included participants scored at the level of at least moderate risk for problems of clinical significance on the PAS (Morey, 1997). Twenty-five (69%) of these participants reported past psychiatric contact and 6 (17%) had previous psychiatric hospital admissions.

To test the second hypothesis, that current memory and IQ would be lower than prehomeless estimates, we examined the pair-wise comparisons between prehomeless or current estimates of memory and IQ in a repeated-measures ANOVA with task type and time as within-subjects factors. Mean estimated prehomeless and current General Memory and full-scale IQ scores are shown in Table 3. It was found that General Memory was significantly lower than the estimated prehomeless score, $F(1, 35) = 18.0$, $p < .001$, $d = 1.19$. Current IQ was also significantly lower than prehomeless IQ estimated from word-reading ability, $F(1, 35) = 4.6$, $p = .04$, $d = .62$.

Next, we aimed to test our third hypothesis that General Memory ability would be more suppressed than IQ in the same homeless sample. We examined the two-way interaction between task type and measure (prehomeless estimate or current). This interaction was found to be statistically significant, $F(1, 35) = 10.5$, $p = .003$, $\eta^2 = .23$, indicating that, in comparison to general intellectual function as measured by IQ, there was a greater drop in memory function.

Finally, to examine further the relationship between duration of homelessness and cognitive function, additional correlations were performed between homeless duration variables and the individual differences between current and prehomeless IQ and memory scores. There were no statistically significant correlations with IQ or General Memory score changes for either the total months spent homeless over the lifetime or total months of the current homeless episode (all $p > .66$).

Discussion

In the complete sample of homeless individuals, a full-scale IQ score of 84.3 was reported. This is significantly lower than is

Table 3
WTAR Estimated Prehomeless and Current Levels of General Memory (WMS-III) and Full Scale IQ (WASI) in the Subset of Individuals Where Prehomeless Estimation of Cognitive Function Was Valid

Cognitive domain	*n*	Prehomeless estimate *M* (*SD*)	Current level *M* (*SD*)	95% CI
Memory**	36	100.5 (12.5)	90.3 (14.7)	5.4–15.2
IQ*	36	98.8 (7.1)	95.6 (12.5)	.19–6.2

Note. Lower scores indicate worse performance. CI = confidence interval (of the difference in means, prehomeless estimate – current).
* $p < .05$. ** $p < .01$.

estimated for the normal population. Indeed, 19.2% of the sample scored in the "extremely low" range, having IQ scores less than 70. Our findings are consistent with previous reports of IQ in homeless samples, which ranged from the "low average" (Seidman et al., 1997) to "average" range (Louks & Smith, 1988). Using the same IQ test as used in our study (WASI), Solliday-McRoy and colleagues (2004) studied a sample of homeless shelter residents in the United States and found a mean full-scale IQ of 83.7, with 20% scoring in the "extremely low" range. This finding is very similar to that found in our U.K. sample. It is estimated that scores in this range would occur in only about 2.2% of the general population and are suggestive of "probable mental retardation" (Wechsler, 1999). Similarly, another study used the WASI to investigate intellectual functioning in homeless adults registered with a general practitioner in the U.K. They reported a full-scale IQ of 92 (Oakes & Davies, 2008). They also inferred from IQ scores and medical records that 12% of their participants had an intellectual disability predating homelessness.

Memory scores were also relatively low in the current study. With a mean Total Memory score of 85.1, the homeless sample scored significantly below the estimated population mean of 100, with 18.9% scoring in the "extremely low" range. Furthermore, performance of half of the participants could not be used to validly estimate prior cognitive function due to low reading scores. This is a limitation to the study, and reduces the generalizability of the findings that explore prehomeless estimation of function. When comparing those who were included in, and those excluded from, the second part of the analyses, it was found that the only significant difference was that those included had more years of formal education. This is not surprising, as the division was based on reading ability. Consequently, the sample used for prehomeless estimation of function represents only better educated homeless individuals. Nevertheless, this group did resemble the overall group in terms of sex, age, psychopathology, substance misuse, and reasons given for homelessness.

When considering the subsample of 36 for whom estimation of cognitive function was appropriate, it was observed that there appears to have been a drop in cognitive function from prehomeless times to current functioning. This was true for both IQ and memory. The results also indicated that the magnitude of the change was greater for memory than for IQ. Of the broad cognitive functions, memory is probably the most susceptible to acquired compromise (Lezak et al., 2004). If the individuals in our sample had been naturally lower functioning, then memory and IQ scores would have been equally depressed.

However, the current study does not provide any support for suggestions that homelessness itself is the reason for cognitive changes. We found that there were no significant correlations between duration of homelessness and cognitive function, either measured as actual current memory/IQ scores, or as difference scores between prehomeless estimates and current function. Furthermore, no associations between past-year substance misuse or past psychiatric contact and cognitive function were detected.

Two previous studies have estimated prehomeless IQ and measured current IQ among homeless adults. In one study, homeless people with severe mental illness had more of a decline in IQ than individuals without psychopathology, from the "average" to "borderline" range (Adams, Pantelis, Duke, & Barnes, 1996). Another study reported that homeless individuals' decline from the "average" to "low average" range was associated with alcohol-related problems, depression, and other related mental health issues (Bremner, Duke, Nelson, Pantelis, & Barnes, 1996). However, the reliability of both findings is questionable since their standardised data were outdated (e.g., from the 1940s) and reference population norms were not the same. Nevertheless, their findings suggest that homelessness per se is not the cause of cognitive decline, but that many of the factors that are known to coexist with homelessness, such as malnutrition, alcohol abuse, and severe mental illness, are likely important contributors.

Our homeless sample had significant levels of psychopathology and high levels of substance misuse. The results highlight the coexisting mental health concerns of many homeless people. It is likely that low cognitive function presents an additional burden to those individuals with mental health problems. Homeless people with mental illnesses may have greater problems in the retention of information about medication regimes or appointment commitments. For example, it has been shown in a sample of Canadian homeless individuals that prescriptions for psychiatric medications are unfilled on approximately a quarter of occasions (Hwang & Gottlieb, 1999). This may feasibly be linked to memory problems, even if written information is provided, low levels of literacy may still affect ability to comply.

Overall, our findings suggest that many currently homelessness individuals have experienced a reduction in cognitive function at some point. We suggest that change is multifactorial in etiology. Indeed, a recent study of psychiatric outpatients in the United States compared those with past histories of homelessness with those without such histories. They found high levels of cognitive impairment in general, but no differences between the groups (Bousman et al., 2010). This suggests that factors associated with homelessness, but not specific to it, such as mental illness, are the cause of cognitive impairments.

One group of factors may comprise distal effects of those illnesses that can precipitate homelessness; for instance, severe mental illness or substance misuse. In addition, it is known that many homeless individuals had very difficult childhoods. In one recent psychiatric description of homeless adults, multiple aspects of their childhood environments were described that could be considered potentially harmful to psychological development. This included the observation that only 5% of the homeless adults reported that their father had been present in the family when they

were children (Spence, 2009). Another study found that 89% of a sample of homeless adults reported childhood traumas such as sexual abuse (Pluck et al., 2011).

Another group of factors could be those operating during homelessness itself, such as malnutrition, greater exposure to infectious diseases, stress, and head injuries. One way to address this issue is to examine the extent to which cognition might improve following successful rehousing of homeless people. A study of a U.S. sample of mentally ill homeless people found significant improvement in cognitive functions with rehousing (Caplan, Schutt, Turner, Goldfinger, & Seidman, 2006; Seidman et al., 2003). However, the findings were inconsistent, and some subgroups performed significantly worse than they had before rehousing. The American Psychological Association Task Force on Homelessness (2010) have indicated that there are not yet sufficient data to identify an optimal housing and rehabilitation approach; however, they do suggest that it is likely the "use of different modalities to meet the needs of different populations (p. 34)" is optimal. In the U.K., this takes the form of a "complex trauma" approach in which residential and psychological services are offered depending upon individual client needs (Jarrett, 2010; Spence, 2009).

The current findings suggest that many homeless individuals display below average cognitive functioning. However, further interpretations and explanations of this fact should be made cautiously. In particular, care should be taken that such observations, for example about IQ, are in no way used to justify stereotypes or prejudices concerning the homeless. Topics such as this inevitably involve sensitive issues, and it is imperative that they are considered nonjudgmentally. The role taken in the current research is to describe the situation as it exists. Further application of findings such as these should be within a caring and respectful framework, and certainly not used in any way that might stigmatise an already vulnerable group of individuals. In addition, interpretation of the current findings should be made cautiously in light of certain methodological issues.

One limitation is that we inferred longitudinal changes from a cross-sectional study using psychometric procedures. However, the homeless are transient and longitudinal follow-up is pragmatically difficult. Another limitation was inherent in the population tested; many individuals had such low levels of word-reading ability that estimation of longstanding cognitive levels was invalid. Nevertheless, we have shown that, at least in a subsample of homeless individuals, there is evidence for reduction in cognitive functions, as revealed both with IQ and general memory performance. Further research is needed to identify the features that are causing, or have caused, cognitive changes in this group.

The observation of frequent cognitive impairment offers ways in which applied psychologists and other behavioural scientists can contribute to tackling this difficult problem. Examples could include cognitive rehabilitation techniques, such as those developed within neuropsychology, integrated with rehousing projects for homeless individuals. Other applications could involve screening programmes for previously undiagnosed learning difficulties in homeless populations, with consequent targeted assistance. Potential interventions considering cognitive function could be applied at the local level, to improve the lives of homeless individuals, or increase the chances of successful rehousing.

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