Causes and consequences of duration of untreated psychosis in schizophrenia

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and SHÔN W. LEWIS

Background  It is unclear what determines duration of untreated psychosis (DUP) in schizophrenia and why long DUP predicts poor outcome.

Aims  First, to test the hypothesis that specific patterns of symptoms and social functioning acting before treatment prolong DUP; second, to clarify the mechanisms linking DUP with recovery after treatment.

Method  Two hundred and forty-eight consecutive first admissions with schizophrenia were interviewed to assess DUP, symptoms and social functioning at admission, and symptoms were re-assessed after 6–12 weeks.

Results  Median DUP was 12 weeks. Long DUP was predicted by poor insight, social isolation and preserved coping skills, but not by demographic factors. Even allowing for all these variables, long DUP predicted poor outcome.

Conclusions  Longer DUP results partly from a pattern of symptoms and social functioning which reduces concern by the sufferer and relevant others. DUP’s relationship to outcome is strongest in the initial months of psychosis. This has implications for targeting early intervention.

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Long duration of untreated psychosis (DUP) confers a poor prognosis in schizophrenia (Crow et al, 1986; Johnstone et al, 1990; Loebel et al, 1992; Jablensky et al, 1992). These effects appear to persist for years after first onset (Wyatt, 1991; Scully et al, 1997). Reducing delays in initial detection and treatment might improve long-term outcome (Birchwood et al, 1998; McGlashan & Johannessen, 1996). However, what delays presentation is poorly understood. We aimed, first, to identify the illness-related factors which delay treatment. This might clarify the feasibility of, and suggest strategies for, early intervention. We hypothesised that particular symptoms (like poor insight) and aspects of social function (like preserved living skills) prolong DUP. Second, we aimed to investigate the link between DUP and the outcome of treatment, both to exclude confounding variables and to estimate the likely gains from early intervention. Our hypothesis was that long DUP leads to poor treatment response, even after accounting for the severity of the symptoms at admission.

METHOD

Sample  Patients were recruited from consecutive day- and in-patient admissions for first episodes of psychosis over a 26-month period, as part of a randomised, controlled psychological treatment study (the Study of Cognitive Reality Alignment Therapy in Early Schizophrenia – SOCRATES). They were aged 16–64 and admitted from three geographically defined catchment areas (Manchester, Liverpool, North Nottinghamshire) with a combined population of 2 260 000. Communities in these areas ranged from deprived urban populations to prosperous or rural ones. Investigators contacted all in- and day-patient units weekly to find suitable admissions.

Baseline assessments  Three clinicians, one at each centre (R.J.D., C.J.H., S.A.), interviewed and assessed patients within 14 working days of admission. Consensus decisions about DSM–IV diagnoses were made with a central supervisor (S.W.L.). Assessments were made as follows.

Duration of untreated psychosis  We measured DUP from the first onset of delusions and hallucinations. This is measured reliably compared to alternatives such as the time from the onset of deterioration in social function (Larsen et al, 1998). DUP was estimated after combining different sources of information using an algorithm. In every case, there was a face-to-face semi-structured patient interview, supplemented by review of case notes, referral letters and questioning of staff. If relatives were available, they were also interviewed. Interrater reliability was assessed from audiotaped interviews with 11 patients: intraclass correlation was 0.86.

The Positive and Negative Syndrome Scale for schizophrenia  This is a well-validated scale for the assessment of psychotic and allied symptoms (PANSS) (Kay et al, 1987). The raters were trained using interviews with patients, face-to-face and on video. Intraclass correlations for the positive, negative and general subscale scores were 0.93, 0.76 and 0.77, respectively, and for total score was 0.73.

The Social Functioning Scale  This is a widely used, self-completed measure with established reliability and validity (SFS) (Birchwood et al, 1990). Sub-scales give continuously distributed scores for (a) social withdrawal, (b) relationships, (c) social and recreational activities, (d) performance and
competence in activities of daily living, and (e) occupational function.

**Follow-up assessments**

Subjects were re-interviewed with the PANSS 6–12 weeks after baseline interview. Follow-up was completed in 87%. Patients treated with CBT or counselling had therapy for 5 weeks, and then booster sessions over another 7.

**Analysis**

Using SPSS 6.1 for Windows, we examined associations between DUP and demographic, symptomatic and social functioning variables at baseline using correlation measures. After initial data analysis, DUP was normalised by taking the logarithm to base 10 (log₁₀DUP) to allow the use of parametric statistics (i.e. Pearson’s r, t-tests), and these results are presented.

Our first hypothesis was that concern about symptoms or social dysfunction, either by patients or their social network, would lead to presentation and hence shorter DUP. We could not measure concern directly so we nominated variables a priori that would be particularly closely related to concern and hence most strongly associated with DUP. We proposed that patients with poor insight would be unconcerned and those who were socially avoidant would also present later, so these items from the PANSS would correlate with long DUP.

We also proposed that patients whose daily living skills were deteriorating would concern others more, whereas those who were poorly socially integrated would cause less concern. We derived an index of social integration from the social withdrawal and relationships sub-scales of the SFS ((a) and (b) above), and an index of coping skills from the SFS daily living competence and performance sub-scales ((d) above). Therefore, we predicted that poor integration and better coping would be associated with longer DUP.

Finally, we predicted that all other PANSS items and demographic factors would not be directly related to DUP, after the specified key variables had been taken into account.

We performed a general factorial analysis of variance (ANOVA) with log₁₀DUP as the dependent variable (this let us include categorical confounders like ethnicity more easily than a multiple regression). First, independent variables were transformed, if necessary, to be suitable for the ANOVA. Heavily skewed or bimodal PANSS items were reduced to binary variables. Age at onset and years of full-time education were normalised by taking the reciprocal of the original values. Substance use was reduced to a binary variable: either daily use of illicit drugs (or alcohol dependence), or not.

The key variables were added as independent covariates. These were the insight variable (from PANSS item G12); social avoidance (PANSS item G16), the social integration index and the coping index (derived from the SFS). Last, confounding demographic and symptomatic variables were added as cofactors (ethnicity, gender, substance misuse, binary PANSS items) or covariates (age at onset and years of education, and all the other PANSS items). We predicted that the key variables would correlate significantly with log₁₀DUP, but not the other symptom or demographic variables. We also repeated the ANOVA with DUP as the dependent variable, to compare the fit of the model.

To test the second hypothesis, about recovery after treatment, we first correlated log₁₀DUP with change in PANSS total score over the follow-up period. Then we used baseline variables (including log₁₀DUP and determinants of log₁₀DUP) to predict change in PANSS as the dependent variable in an ANOVA, as for the analysis of determinants of DUP. This would reveal whether log₁₀DUP still had a significant association with the outcome of initial treatment after correcting for confounders. We included the treatment group in the SOCRATES trial as an independent variable.

**RESULTS**

**Sample characteristics**

From 281 eligible first admissions, 248 consented to serial assessments after 32 (11%) refused and 6 (2%) were unable to consent within the recruitment period. Patients were assessed within a median period of 6 days after admission. Demographic details are summarised in Table 1. Overall, cannabis was the most widely used illicit drug (77% of all illicit drug users and 78% of daily users). A further 22 (9% of the sample) used alcohol daily.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>173</td>
<td>(70%)</td>
</tr>
<tr>
<td>Female</td>
<td>75</td>
<td>(30%)</td>
</tr>
<tr>
<td>Age at admission, years:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>median (range)</td>
<td>27.4</td>
<td>(16–64)</td>
</tr>
<tr>
<td>Full-time education, years:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>median (range)</td>
<td>11</td>
<td>(7–21)</td>
</tr>
<tr>
<td>DSM–IV diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schizophreniform disorder</td>
<td>97</td>
<td>(39%)</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>86</td>
<td>(35%)</td>
</tr>
<tr>
<td>Schizoaffective disorder</td>
<td>33</td>
<td>(13%)</td>
</tr>
<tr>
<td>Delusional disorder</td>
<td>22</td>
<td>(9%)</td>
</tr>
<tr>
<td>Psychosis NOS</td>
<td>10</td>
<td>(4%)</td>
</tr>
<tr>
<td>Ethnicity (self-ascribed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>215</td>
<td>(87%)</td>
</tr>
<tr>
<td>African–Caribbean</td>
<td>19</td>
<td>(8%)</td>
</tr>
<tr>
<td>South Asian</td>
<td></td>
<td>(2%)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>(4%)</td>
</tr>
<tr>
<td>Illicit drug use in 12 months before assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>97</td>
<td>(39%)</td>
</tr>
<tr>
<td>Ocasional</td>
<td>30</td>
<td>(12%)</td>
</tr>
<tr>
<td>Weekly</td>
<td>17</td>
<td>(7%)</td>
</tr>
<tr>
<td>Daily</td>
<td>23</td>
<td>(9%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>81</td>
<td>(33%)</td>
</tr>
</tbody>
</table>

NOS, not otherwise specified.

**Duration of untreated psychosis**

This ranged from 4 to 624 weeks. The median was 12 weeks, and mean 38 weeks. Sixteen patients had untreated psychoses for between 2 and 12 years. However, transformation of the DUP by taking the logarithm to base 10 showed that these extreme scores were part of the resulting distribution, rather than being outliers. Mean of log₁₀ DUP was 1.172, corresponding to a DUP of 14.9 weeks.

**Correlates of DUP at admission**

Log₁₀DUP was not significantly associated with gender or age at onset of psychosis, nor was there a significant overall effect of ethnicity (one-way ANOVA). Illicit drug users did not have a log₁₀DUP significantly different from non-users. For users, median DUP was 10 weeks, range 4–624; for non-users median was 14 weeks, range 4–600. There was no trend for increasing frequency of substance misuse to relate to shorter DUP.
At baseline, log_{10} DUP correlated positively with the PANSS total score ($r=0.13$, $P=0.04$): the longer the DUP the more severe the symptoms at admission. Pearson correlations with the positive symptom and general psychopathology sub-scale scores were 0.14 ($P=0.03$) and 0.15 ($P=0.02$), respectively, but with the negative sub-scale $r$ was 0.05 ($P=0.49$).

Although DUP did not correlate significantly with SFS total score (for log_{10}DUP $r=0.04$, NS), this masked correlations with component sub-scales in opposite directions. DUP correlated negatively with the social integration index ($r=-0.14$, $P=0.05$), and positively with the coping index ($r=0.16$, $P=0.03$); thus, long DUP was predicted by worse social integration on the one hand, but by better coping with daily activities on the other.

ANOVA with baseline symptoms, social function indexes and demographics as independent variables predicted 18% of the variance in log_{10}DUP. Poor insight, poor integration and avolition predicted longer DUP. Shorter DUP was predicted by poor coping and the presence of pre-occupation or hostility. Table 2 shows the correlation between these independent variables and DUP corrected for confounders (using β values for each covariate in the ANOVA, and point biscalcorrelation for binary variables). ANOVA with untransformed DUP as the dependent variable had much inferior fit and explanatory power.

**Comparison of day patients and in-patients**

As a first admission study our criteria excluded out-patients and those not referred to specialist services, a potential source of bias. Because we did not have data on these other groups we compared the 36 day patients to the 212 in-patients as an indication of any effect of treatment setting. There was no significant difference in log_{10}DUP, social factors, PANSS total or subtotals, or PANSS absolute or percentage change. Day patients were significantly more likely to use illicit drugs daily, and to have schizoaffective disorder or delusional disorder ($\chi^2$). Adding setting as a variable did not affect the result of the analysis of variance.

**Does DUP predict symptoms after 3 months?**

Overall, 215 (87%) of patients were re-assessed prospectively with the PANSS at 6–12 weeks. Mean baseline PANSS scores at baseline and follow-up were 88.7 (s.d.=16.8) and 64.5 (s.d.=18.7). PANSS score change was measured by a mean of 23.9 points (s.d.=19.3), or 40% (s.d.=31.3), by 6–12 weeks.

Longer DUP clearly predicted less improvement in PANSS during treatment. Log_{10}DUP correlated 0.32 (Pearson’s r, $P<0.0005$) with PANSS score at re-interview and, after allowing for baseline PANSS, the partial correlation for log_{10}DUP and PANSS at re-interview was 0.28 ($P<0.0005$). The partial correlation between log_{10}DUP and change in PANSS, controlling for PANSS at baseline, was 0.29 ($P<0.0005$).

To examine DUP as a predictor of response to treatment we used the change in PANSS score between baseline and re-interview as the dependent variable in another ANOVA. Change in PANSS was calculated as a percentage of baseline score. Log_{10}DUP, age, education, gender, ethnic group, daily drug use and treatment group within the Socrates trial (counselling, CBT or no psychotherapy) were entered as independent variables. The four primary variables from the previous analysis – insight, social avoidance, social integration and coping – were also entered. Finally, the strongest predictors of log_{10}DUP (see Table 2) were included as independent variables.

This model explained 13% of the variance in change in PANSS. Log_{10}DUP remained a predictor of change ($β=-0.17$, $P=0.041$), with longer DUP again predicting less improvement. Better social integration predicted more improvement in PANSS score (i.e. greater decrease over treatment: $β=-0.18$, $P=0.046$). Surprisingly, better coping predicted less improvement ($β=+0.30$, $P=0.001$). Insight, the strongest predictor of long DUP, was not significantly associated with change in PANSS ($β=0.04$, $P=0.64$). Male gender predicted less improvement (point biserial correlation 0.14, $P=0.055$). Other demographic variables were not strongly associated with PANSS change (all $P>0.30$); nor was treatment condition ($P=0.52$). We repeated the ANOVA, substituting DUP for log_{10}DUP as an independent variable, but again its explanatory power and fit were poorer (DUP $β=0.09$, $P=0.40$).

We used the model with log_{10}DUP to estimate the size of the effect of DUP on treatment outcome (see Table 3 and Fig. 1). We used the gradient of log_{10}DUP against PANSS change, mean values of log_{10}DUP and PANSS change, and the proportion of variance explained by the model to calculate the percentage change in PANSS score predicted by a given DUP (Altman, 1991).

**Table 3 Predicted impact of duration of untreated psychosis on the amount of improvement in Positive and Negative Syndrome Scale (PANSS) score after 12 weeks of treatment**

<table>
<thead>
<tr>
<th>DUP</th>
<th>Mean improvement in PANSS score</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>−44%</td>
<td>−50 to −39</td>
</tr>
<tr>
<td>6 months</td>
<td>−38%</td>
<td>−41 to −34</td>
</tr>
<tr>
<td>1 year</td>
<td>−35%</td>
<td>−40 to −30</td>
</tr>
<tr>
<td>6 years</td>
<td>−29%</td>
<td>−40 to −18</td>
</tr>
</tbody>
</table>

1. DUP, duration of untreated psychosis.
2. Change in total score divided by (baseline total score −30), since minimum score =−30.
3. CI, confidence interval for the mean.

**Fig. 1 Predicted change in Positive and Negative Syndrome Scale (PANSS) against duration of untreated psychosis (with 95% CIs).**
**DISCUSSION**

Duration of untreated psychosis emerged as the single strongest predictor of symptom severity after 6–12 weeks of treatment in this sample, the association remaining strong even controlling for severity of symptoms at baseline. This replicates previous findings in a large, prospectively assessed, first-admission sample. We modelled the determinants of DUP: poor insight, avolition and poor social integration were linked to long DUP, whereas hostility and poor coping led to a short DUP. However, these variables did not fully account for the link between long DUP and response to treatment. This suggests that the link is not explained by a subtype of illness that causes both a long DUP and a poor outcome, as proposed by Crow et al (1986).

**Limitations and methodology**

This was a first-admission rather than first-contact sample, which may be a source of bias. Although day patients were not significantly different from in-patients on most variables, differences between out-patient or primary-care contacts and our sample may be greater. None the less, the administrative incidence for schizophrenia-related disorders in this study (0.67 per 10 000 per year) compares to the 0.8 per 10 000 per year reported by Der et al (1990) and suggests most first episodes were included. Importantly, we did not collect data concerning pathways to care or responsiveness of services, which might well affect DUP. Service factors examined elsewhere include poor recognition of psychosis and under-treatment after recognition (Johnstone et al, 1986; Larsen et al, 1998). Clear evidence of the contribution of these effects relative to illness-related factors is lacking.

Critically for the analysis of determinants of DUP, we have no information actually gathered during the period of untreated psychosis, so we rely on baseline measures to estimate these variables retrospectively. Nor could we measure ‘concern’ directly, so we depended on indirect measures like insight and coping. Although we expect that these distortions generally pre-dispose to type 2 error, it may be that retrospective bias affects some variables more than others.

Previous studies have been limited by relatively small or uncharacteristic samples; unstandardised assessments made some time after first treatment; and a lack of longitudinal, prospective follow-up. Many have excluded patients with significant drug use or dependence. These limits reduced the degree to which their findings generalised to clinical practice, and potentially introduced bias. In our sample, the effect of illicit drug use on DUP and change in symptoms was small. However, the change in symptoms over 3 months is more of an estimate of speed of recovery than long-term outcome, which we did not assess.

**DUP and its determinants**

We found the median DUP to be 12 weeks (mean 38 weeks), which is shorter than in some other studies. Definitions of DUP based on duration of delusions and hallucinations, as here, give shorter DUPs than definitions which depend on the duration of other, less clear-cut symptoms (Hafner et al, 1993). In similar samples, MacMillan et al (1986) found delay from onset of positive symptoms to admission had a median of 18 weeks, and Ring et al (1991) 9 weeks.

Overall social function was not significantly associated with DUP, but different aspects of social function had different effects, which suggests that treating social dysfunction in schizophrenia as a simple global deficit is untenable in studies such as this. The prediction that social avoidance would independently delay patients from acting on their own concerns, or under pressure from others, was not borne out. Although hostility, avolition and preoccupation were not predicted to be determinants of DUP before the analysis, it is easy to see that they do not necessarily invalidate the basic hypothesis that concern and acting on concern determine the timing of presentation.

It is possible to argue that poor insight and avolition could as well be consequences...
of long DUP as causes of it. However, the
direction of causation is clear with other
variables: poor coping with the activities
of daily living must lead to early presenta-
tion, rather than long DUP improving
coping skills. Therefore, the simplest way
to explain the overall pattern of findings
is that concern causes presentation; at
present there is no evidence to the contrary.
This is consistent with sociological models
for the determinants of presentation for
many other illnesses, based on concern by
the patient or significant others (Mechanic,
1978).

**DUP and recovery**

DUP predicted less recovery after 3 months
treatment even after covarying for the
determinants of DUP and the severity of
symptoms at baseline. Although these
variables do not fully mediate the relation-
ship between continuing, untreated
symptoms and poor recovery, the psycho-
logical or biological processes that might
are unclear.

If delaying treatment has an effect on
recovery, how large might it be? Modelling
of the effect of DUP on change in PANSS
scores over the treatment period allowed
us to estimate this (see Fig. 1). It appears
that the gains in treatment effect resulting
from earlier detection will be much greater
in the early stages of illness (Table 3);
reducing DUP from 6 months to 1 month
produces gains in outcome similar to redu-
cing it from 6 years to 1 year. This
emphasises the importance of ensuring an
efficient community recognition and
referral system, with prompt delivery of ef-
factive treatments, particularly for patients
with recent onset of psychotic symptoms.

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