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Data supplement

Table DS1 Antipsychotic medication ranked by chlorpromazine equivalent (CPZeq) dose in schizophrenia group

Participant number	Gender	Age Years	Duration of illness, years	CPZeq	Antipsychotic dose, mg	Antipsychotics	Drug delivery mode	Positive symptoms, yes/no
7 (I)	Female	39	4	1000	500	Clozapine	Oral/daily	Yes
6 (I)	Female	36	–	800	350 200	Clozapine Amisulpride	Oral/daily Oral/daily	Yes
10 (I)	Male	46	27	700	350	Clozapine	Oral/daily	Yes
11 (I)	Male	56	33	500	1000	Amisulpride	Oral/daily	Yes
14 (II)	Male	26	5	400	20	Olanzapine	Oral/daily	Yes
3 (II)	Male	27	6	400	20	Olanzapine	Oral/daily	Yes
2 (II)	Male	34	8	400	20	Olanzapine	Oral/daily	No
5 (II)	Male	32	11	300	50	Risperidone	Depot/2-weekly	No
15 (I)	Male	52	22	300	50	Risperidone	Depot/2-weekly	Yes
19 (II)	Male	43	12	300	50 7.5	Flupenthixol Olanzapine	Depot/2-weekly Oral/daily	No
20 (I)	Male	38	13	250	500	Zuclopenthixol	Depot/2-weekly	No
9 (I)	Male	47	10	200	400	Amisulpride	Oral/daily	No
16 (II)	Female	49	10	200	400	Amisulpride	Oral/daily	No
12 (I)	Female	35	2	200	4	Risperidone	Oral/daily	Yes
4 (II)	Male	28	7	200	10	Olanzapine	Oral/daily	No
13 (II)	Male	45	7	200	10	Olanzapine	Oral/daily	No
21 (II)	Male	28	4	200	10	Olanzapine	Oral/daily	No
1 (II)	Female	35	12	120	6	Trifluoperazine	Oral/daily	No
17 (I)	Male	41	–	100	5	Olanzapine	Oral/daily	No
18 (I)	Male	41	23	75	50	Flupenthixol	Depot/4-weekly	No

I, schizophrenia subgroup I (non-shifted group); II, schizophrenia subgroup II (phase-shifted group).

Table DS2 Effect of length of illness on sleep, rest/activity and melatonin measures

Parameter	Duration of illness (years)		Statistical difference	
	below 10 (s.d.)	above 10 (s.d.)	F (df 1)	p
Sleep parameter	N=8	N=8		
Sleep period (hh:min)	10:46 (01:03)	08:57 (01:19)	0.161	0.695
Total sleep time	08:59 (00:55)	07:23 (01:16)	0.157	0.699
Sleep latency	00:36 (00:12)	00:26 (00:15)	0.809	0.386
Sleep efficiency	78.4 (6.5)	78.4 (7.9)	0.210	0.888
Sleep onset	01:34 (02:16)	00:28 (01:40)	0.014	0.909
Sleep offset	12:28 (2:16)	9:24 (2:06)	0.150	0.705
Rest-activity rhythm	N=8	N=8		
Period length*	24.27 (0.70)	24.00 (0.000)	0.936	0.352
Peak of activity cycle	17:27 (01:46)	15:24 (02:09)	0.140	0.715
Level of activity (M10 counts)	13393 (6828)	18141 (11297)	0.433	0.523
Level of inactivity (L5 counts)*	1295 (699)	2313 (1435)	0.000	0.998
Amplitude ratio	0.817 (0.089)	0.760 (0.124)	0.809	0.386
Melatonin (MT) rhythm	N=6	N=7		
Period length	24.06 (0.166)	23.97 (0.22)	0.000	0.984
Peak of MT rhythm	07:23 (02:39)	06:13 (02:01)	1.491	0.253
Mesor of MT rhythm	866.6 (439.7)	930.4 (578.2)	1.675	0.228

* error variances not equal: significance threshold: <0.01

SD=standard deviation

Table DS3 Effect of general function on sleep, rest/activity and melatonin measures

Parameter	General assessment of function		Statistical difference	
	< 50 (s.d.)	> 50 (s.d.)	F (df 1)	p
Sleep parameter	N=10	N=9		
Sleep period	10:57 (01:05)	08:57 (01:11)	1.813	0.198
Total sleep time	09:02 (01:13)	07:35 (01:16)	1.459	0.246
Sleep latency	00:36 (00:14)	00:28 (00:14)	0.573	0.461
Sleep efficiency*	77.8 (6.4)	79.9 (7.4)	0.193	0.667
Sleep onset	01:17 (02:18)	00:48 (01:54)	0.109	0.746
Sleep offset	12:30 (02:00)	09:45 (02:24)	0.31	0.586
Rest-activity rhythm	N=10	N=9		
Period length	24.19 (0.64)	24.00 (0.00)	2.519	0.133
Peak of activity cycle	17:46 (01:43)	15:39 (02:11)	0.947	0.346
Level of activity (M10 counts)	17451 (11368)	13275 (4454)	2.253	0.154
Level of inactivity (L5 counts)	1852 (1374)	1750 (1153)	1.033	0.326
Amplitude ratio	0.784 (0.141)	0.777 (0.126)	0.06	0.81
Melatonin (MT) rhythm	N=8	N=8		
Period length	24.04 (0.155)	23.99 (0.206)	0.071	0.795
Peak of MT rhythm	07:26 (03:30)	06:20 (02:05)	0.146	0.709
Mesor of MT rhythm	659.7 (473.3)	949.0 (511.3)	0.158	0.698

* error variances not equal: significance threshold: <0.01

SD=standard deviation

<50: N=10, >50: N=9

Table DS4 Correlations between chlorpromazine (CPZ) equivalents for antipsychotic doses and sleep, rest/activity and melatonin measures

Parameter	Spearman's correlation coefficient, R	Statistical
	CPZ equivalents	difference, p
Sleep parameter	N=20	
Sleep period	0.212	0.369
Total sleep time	0.224	0.343
Sleep latency	-0.228	0.333
Sleep efficiency	-0.023	0.924
Sleep onset	-0.302	0.196
Sleep offset	-0.073	0.758
Rest-activity rhythm	N=20	
Period length	0.307	0.187
Peak of activity cycle	-0.235	0.318
Level of activity (M10 counts)	0.425	0.062
Level of inactivity (L5 counts)	0.043	0.858
Amplitude ratio	0.103	0.665
Melatonin (MT) rhythm	N=17	
Period length	0.112	0.669
Peak of MT rhythm	-0.130	0.619
Mesor of MT rhythm	-0.440	0.077

Table DS5 Effects of positive symptoms on sleep, rest/activity and melatonin measures

Parameter	Positive residual symptoms		Statistical difference	
	yes mean (s.d.)	**no** mean (s.d.)	F (df 1)	p
Sleep parameter	N=8	N=11		
Sleep period	10:11 (01:42)	09:52 (01:25)	1.969	0.181
Total sleep time	08:30 (01:29)	08:14 (01:25)	1.696	0.213
Sleep latency	00:31 (00:16)	00:33 (00:14)	0.385	0.544
Sleep efficiency*	79.2 (9.06)	78.4 (4.98)	0.042	0.841
Sleep onset	23:48 (02:05)	01:58 (01:37)	0.41	0.532
Sleep offset	10:13 (02:50)	11:54 (02:13)	2.659	0.124
Rest-activity rhythm	N=8	N=11		
Period length*	24.02 (0.06)	24.16 (0.61)	3.015	0.103
Peak of activity cycle	15:21 (02:03)	17:47 (01:41)	1.939	0.184
Level of activity (M10 counts)*	18057 (12726)	13594 (4225)	0.272	0.609
Level of inactivity (L5 counts)	1701 (1381)	1877 (1191)	0.078	0.789
Amplitude ratio	0.817 (0.103)	0.755 (0.146)	0.591	0.454
Melatonin (MT) rhythm	N=7	N=7		
Period length	24.00 (0.24)	24.03 (0.13)	0.039	0.847
Peak of MT rhythm	05:50 (02:47)	07:42 (02:46)	0.33	0.859
Mesor of MT rhythm*	467.6 (228.6)	1066.3 (501)	9.207	0.01
Pos. symptoms by Age interaction			5.029	0.045
Antipsychotic medication	N=8	N=11		
CPZ equivalents*	537.5 (272.2)	222.3 (88.9)	0.16	0.695

* error variances not equal: significance threshold: <0.01

CPZ=Chlorpromazine

SD=standard deviation

Table DS6 Comparison of CPZ equivalents in non-shifted and phase-shifted SZ patients

	Mean (s.d.)		Statistical difference*	
	Non-shifted SZ I	Phase-shifted SZ II	F (df 1)	p
Phase position	N=10	N=10		
CPZ equivalents*	412.5 (320.9)	272.0 (102.5)	0.008	0.932

* error variances not equal: significance threshold: <0.01

CPZ=Chlorpromazine

SD=standard deviation

Table DS7 Descriptive statistics of rest/activity clusters, sleep and circadian parameters of schizophrenia patients classified by type of antipsychotic medication

	High/medium potency D2 receptor antipsychotics		Broad profile antipsychotics			
	Flupenthixol, Trifluoperazine, Zuclopenthixol		Amisulpride	Clozapine	Olanzapine	Risperidone
Number, n (Male, Female)		3 (2, 1)	3 (2, 1)	3 (1, 2)	8 (8, 0)	3 (2, 1)
Clusters of rest/activity patterns						
SZ I, Non-shifted - Hypersomnia	(n)	+ (1)	-	+ (1)	-	+ (1)
SZ I, Non-shifted - Fragmented	(n)	+ (1)	+ (2)	+ (2)	-	-
SZ I, Non-shifted - Irregular-fragmented	(n)	-	-	-	+ (1)	+ (1)
SZ II, Phase shifted - Delayed	(n)	-	-	-	+ (5)	+ (1)
SZ II, Phase-shifted - Non-24h rhythm	(n)	+ (1)	+ (1)	-	+ (2)	-
Sleep parameters		Mean (range)	Mean (range)	Mean (range)	Mean (range)	Mean (range)
Sleep period (hh:mm)		08:48 (07:41 to 10:41)	09:31 (08:29 -11:07)	11:27 (09:59 - 12:13)	10:35 (09:29 - 12:23)	08:36 (07:20 - 09:43)
Total sleep time (hh:mm)		07:07 (05:40 - 09:18)	07:48 (06:51 - 09:03)	09:12 (7:16 - 11:01)	08:31 (05:46 - 10:49)	07:57 (06:43 - 09:13)
Sleep latency (min)		22 (12 - 32)	44 (35 - 59)	32 (18 - 57)	43 (20 - 74)	18 (9 - 24)
Sleep efficiency (%)		80.8 (75.3 - 87.3)	82.0 (81.0 - 83.3)	80.1 (73.3 - 90.2)	80.3 (58.5 - 88.8)	92.7 (90.9 - 95.1)
Sleep onset (hh:mm)		00:40 (23:02 - 02:20)	00:57 (22:10 - 04:44)	22:49 (21:48 - 23:23)	02:18 (23:56 - 04:10)	00:04 (22:35 - 02:02)
Circadian parameters						
Peak of activity cycle (hh:mm)		15:54 (14:16 - 17:11)	16:50 (11:57 - 19:29)	15:48 (15:06 - 17:02)	18:00 (16:36 - 19:50)	15:09 (13:13 - 17:10)
Peak of MT rhythm (hh:m)		06:25 (05:22 - 07:29)	07:39 (03:57 - 13:27)	03:40 (03:20 - 04:00)	07:42 (04:48 - 10:33)	03:57 (03:02 - 05:31)
Mesor (ng)		1347 (1063 - 1630)	316 (122 - 565)	301 (145 - 456)	1051 (603 - 1556)	773 (355 - 1265)