**SUPPLEMENTARY MATERIAL**

**Supplementary Table S1. Impulsivity**

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| **Main Domain** | **Subtypes** | **Other names** | **Definition** | **Tests** |
| **Cognitive Impulsivity** |  | Delay discounting, sensation seeking or urgency | Ability to opt for larger delayed rewards over smaller more immediate rewards |  |
|  | (a) Reflection Impulsivity |  | Decision-making under ambiguity | IGT, MFFT, BIS, DDT |
|  | (b) Risk taking |  | Decision-making under risk | **CGT**, IGT, , GDT |
| **Motor Impulsivity** |  | Inhibitory Control | Ability to suppress emotional, cognitive and behavioural responses |  |
|  | (a) Behavioural Inhibition | Motor Response Inhibition | Process requires to stop a planned movement | **AGN**, SS, Go/NoGo |
|  | (b) Cognitive Inhibition | Focused Attention | Process required to suppress a salient but conflicting stimulus while identifying less salient ones | ST |
| **Non-planning Impulsivity** | Reasoning, Strategic Planning and Problem Solving | Central Executive in working memory model  Lack of pre-meditation | Ability to think ahead and actively search for an appropriate solution | TOL, **SOC**, ROCFT, PMT, TOH, WAIS –III, SSP, SWM |

**AGN= *Affective Go-NoGo (CANTAB)*** , BIS= *Barratt Impulsivity Scale* , BLC= *Big Little Circle*, **CGT= *Cambridge Gambling Task* (*CANTAB*),** CFT= *Continuous Performance Test*, CVLT =*California Verbal Learning Test* , DDT= *Delay Discounting Test*, DSST= *Digit Symbol Substitution Test***,** FFT= *Finger Tapping* Test**,** GDT=*Game and Dice Test***,** IST= Information Sampling Test, IGT= *Iowa Gambling Task*, MFFT= Matching Familiar Figures, PASAT= *Paced Auditory Serial AdditionTask* , PMT= *Proteus Maze Test*,RAVLT= *Rey Auditory Verbal Learning Test ,* ROCFT= Rey-*Osterreith Complex Figure Test*, RT= *Reaction Time*, **SOC= *Stockings of Cambridge (CANTAB****)*, SSP= Spatial Span *(CANTAB*), SS= *Stop**Signal* ,SWM= Spatial Working Memory *(CANTAB*), ST= *Stroop Test* , TEA= *Test of Everyday Attention*, TOH= *Tower of Hanoi*, TOL=*Tower of London (CANTAB*), *TOVA= Test of Variables of Attention,* WAIS-III=*Weschler Adult Intelligence Scale Third Edition.*

**Supplementary Table S2. Chronic opioid use and impulsivity. Previous research findings**

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| **Neuropsychological domain** | **Illicit chronic heroin use** | **Abstinent ex-heroin use** | **Methadone use** | **Other opioids ¹** | **Chronic opioid dependence** |
| **Cognitive Impulsivity (reflection impulsivity) \*** |  | Mintzer *et al* (2005)↓  Verdejo-Garcia *et al* (2007 a)↓ | Pirastu *et al* (2006)↓  Rotheram-Fuller *et al* (2004)↓ | Pirastu *et al* (2006)↑ | Clark *et al* (2006)↓ |
| **Cognitive Impulsivity (risk taking) \*** | Ersche *et al* (2005)↔ | Fishbein *et al* (2007)↓  Fishbein *et al* (2005)↓  Clark *et al* (2006)↓ | Passetti *et al* (2008)↓ |  | Rogers *et al* (1999)↓  Ersche *et al* (2005) ↔ |
| **Motor Impulsivity (behavioural or motor response inhibition) \*** | McNairy *et al* (1984)↓ | Verdejo-Garcia *et al* (2007b)↔  Verdejo-Garcia *et al* (2007a)↓ | Rounsaville *et al* (1982)↔  Passetti *et al* (2008)↔  Specka et al (2000) ↓ | Sjogren *et al* (2005)↓  Vainio *et al* (1995)↔  Schindler *et al* (2004)↔ |  |
| **Motor Impulsivity (cognitive Inhibition) \*** |  |  | Prosser *et al* (2008)↔ |  |  |
| **Non-Planning Impulsivity \*** |  | Fishbein *et al* (2007)↔  Brand *et al* (2008)↔ | Passetti *et al* (2008)↔ | Vainio *et al* (1995)↔  Schindler *et al* (2004)↔ | Ersche *et al* (2006)↓  Ornstein *et al* (2000)↓  Clark *et al* (2006)↓ |

\*= *p<*0.05; ↔= *no difference in neuropsychological (impulsivity) performance*; ↓= *neuropsychological (impulsivity) deficits present*; ↑= *improvement in neuropsychological (impulsivity) performance when compared to healthy controls*, other opioids 1 =*buprenorphine, morphine, oxycodone and/or tramadol*.

**Supplementary Table S3. Summary of screening and diagnostic instruments and their outcome measures**

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| **Screening Tests** | **Measures** |
| Mini International Neuropsychiatric Instrument (MINI) *v5.0.* | Diagnosis of 15 Axis 1 and 1 Axis 2 (lifetime anti-social personality disorder) DSM-4 psychiatric illnesses and substance misuse/dependence presented in 24 modules. |
| Case records from addiction, psychiatric and General Practitioner’s Services. | Identification of non fatal overdose episodes  Confirming a history or not of epilepsy and other neurological phenomenon including learning disabilities.  Confirming a diagnosis of Hepatitis B, C and HIV  Confirming diagnosis of other personality disorders (e.g. borderline)  Validating medical and psychiatric histories  Validating substance misuse career and current drug and alcohol use.  Scottish Index of Multiple Deprivation (SIMD). |
| Post Trauma Amnesia Questionnaire *v1.0.* | Information on head and other cerebral insults and consequential post trauma amnesia. |
| Urine analysis for drug screen. | Using self contained on site drug test kits for presence of amphetamine, cannabinoids, opioids, benzodiazepine and cocaine.  Subsequent lab investigations used ELISA followed up by TLC methodologies. |
| **Diagnostic Tests** | **Measures** |
| Mini International Neuropsychiatric Instrument (MINI) (Section L) *v5.0.* | Diagnosis of opioid misuse/dependence (lifetime and current). |
| Maudsley Addiction Profile (MAP) *v1.0.* | Information on substance misuse history, health risk behaviour, physical and psychological health, personal and social functioning in the last 30 days. |
| Fagerström Test for Nicotine Dependence (FTND) *v1.0.* | 6 items with a diagnostic score ranging from 0 (no nicotine dependence) to 10 (very severe nicotine dependence). |
| Clinical Opiate Withdrawal Scale (COWS) *v1.0.* | 11 objective and subjective symptoms of opioid withdrawal. Scores ranged from 0-48. |
| Urine analysis for drug screen. | Using self contained on site drug test kit for presence of amphetamine, cannabinoids, opioids, benzodiazepine and cocaine.  Subsequent lab investigations used ELISA followed up by TLC methodologies. |
| **Cognitive Tests** | **Measure** |
| National Adult Reading Test (NART) *v2.0.* | WAIS-R Full Scale (IQ=70-131), Verbal Scale (IQ=72-127) and Performance Scale (IQ=74-128). |
| CANTAB*eclipse v3.0.* |  |
| Cambridge Gambling Task (CGT). | Quality of Decision Making.  Risk Taking and Overall Proportion Bet , Deliberation Time or Latency.  Delay Aversion and Risk Adjustment. |
| Affective Go-NoGo (AGN). | Total Commissions/Distractor Errors.  Total Omissions/Target Errors.  Correct Mean Latency or Reaction Times. |
| Stockings of Cambridge (SOC). | Initial Thinking Times (at each stage).  Subsequent Thinking Times (at each stage). Problems solved in minimum number of moves. |