**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 modelLack 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 episodesConfirming a history or not of epilepsy and other neurological phenomenon including learning disabilities.Confirming a diagnosis of Hepatitis B, C and HIVConfirming diagnosis of other personality disorders (e.g. borderline)Validating medical and psychiatric historiesValidating 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. |