Institution: University of East London

Unit of Assessment: 4

Title of case study: Improving understanding among policy makers, the public and medical professionals of the potential harm that MDMA (Ecstasy) use may have on the neuro-psychological functioning of adults and babies

1. Summary of the impact

Research conducted by UEL's Drugs and Addictive Behaviours Research Group (DAB) and the UEL Institute for Research in Child Development (IRCD) from 1990-2012 has provided key information about the neuro-psychological risks of the use of the drug MDMA (Ecstasy).This information has been used by the US and UK governments, medical professionals and public information organisations. The research was included in the UK government *Advisory Council on the Misuse of Drugs* (ACMD, 2009) review of MDMA effects and informed government and public debate on the legal classification of MDMA. It has also supported associated debates around the potential harmful effects of MDMA. Subsequent media and public engagement with those debates has contributed to increased public awareness of the effects and risks of MDMA and engaged new audiences with important social and scientific issues. More recent research has informed parents and medical practitioners about the potential harmful effects of MDMA on specific aspects of infant functioning when taken during pregnancy.

2. Underpinning research

The psycho-biological effects of MDMA (ecstasy), particularly in terms of its 'recreational' use and effects on the cognition and mood of adult users, have been studied at UEL since 1990. Research in this area was instigated by Professor Andrew Parrott (at UEL until 2004; now Swansea) and has been continued by members of the **Drugs and Addictive Behaviours group** (DAB), including Dr Lynne Dawkins (2005-current), Dr John Turner (1995-current), and Dr Kirstie Soar (2003-current). More recently Professor Derek Moore (UEL 1995-current) and Dr Julia Goodwin (1997-2008, now NPEU, Oxford) from the UEL **Institute for Research in Child Development** (IRCD) have also worked collaboratively with Turner and Parrott, together with Singer (Case Western Reserve University), to explore the effects of MDMA exposure in pregnancy on infant development.

Parrott, Turner and Soar have published numerous widely-cited empirical and review papers, including some of the first papers to demonstrate impaired memory functioning in young recreational ecstasy (MDMA) users compared with aged-matched controls [e.g. 1]. The group led the way in examining both the immediate and longer-term effects of MDMA use on cohorts of young recreational drug users in typical 'rave' conditions. These studies suggested that long-term ecstasy users were significantly impaired on immediate and delayed word recall [1]. The team has continued to investigate the nature of these cognitive/ memory impairments, using a variety of cognitive tasks to measure executive planning, vigilance, psychomotor performance and specific aspects of memory [2, 3]. The work has been published in high impact psychopharmacology journals, and is influential and highly cited in the field.

In 2002, an approach made by Professor Singer of Case Western Reserve University (USA) culminated in the collaborative (UEL / Case Western Reserve) *Drugs And Infancy Study* (DAISY). Co-led at UEL by Moore and Parrott with Turner and Goodwin, the DAISY project was the first, and to-date only, prospective study to investigate the impact of MDMA use during pregnancy on infant development. Through prospective interviews with pregnant poly-drug users, the study ascertained likely patterns of poly-drug exposure across trimesters, showing that infants are most likely to be exposed to MDMA in the first trimester (not later) and that cannabis and tobacco use are likely to feature alongside MDMA use [4]. The key post-natal effect on human infants was shown to be differences in the quality of motor functioning at four months in infants exposed to MDMA, compared to other polydrug-exposed babies [5], a finding that corresponds with the serotonin-related effects found in animals exposed in utero. The DAISY study also went on to show that these negative motor effects are still evident through to 12 months of age in MDMA-exposed babies [6].

The work also suggested that MDMA may contribute to differential sex ratios; women who took part in the study were more likely to give birth to male than female babies [5]. These unprecedented findings have been published in Psychopharmacology, Teratology and Paediatric journals, and have reached a wide audience of psychology, psychiatry, medical professionals, as well as the wider public.

3. References to the research

The following research outputs appeared in peer-reviewed journals with a median impact factor of 3.28. Collectively, they have received over 650 citations (information retrieved from Google Scholar, July 2013).

1. Parrott, A.C. & Lasky, J. (1998). Ecstasy (MDMA) effects upon mood and cognition: before, during, and after a Saturday night dance. *Psychopharmacology*, *139*, 261-268. http://bit.ly/1hzK3cx
2. Parrott, A.C. (2002). Recreational Ecstasy/MDMA, the serotonin syndrome, and serotonergic neurotoxicity. *Pharmacology, Biochemistry and Behavior*, *71*, 837–844. http://bit.ly/17BUCIt
3. Parrott, A.C., Buchanan, T., Scholey, A.B., Heffernan, T., Ling, J. & Rodgers, J. (2002). Ecstasy/MDMA attributed problems reported by novice, moderate and heavy recreational users. *Human Psychopharmacology: Clinical and Experimental*, *17*(6), 309–312. http://bit.ly/17xzOUu
4. Moore, D.G., Turner, J.J.T., Parrott, A.C, Goodwin, J.E., Fulton, S.E. Min, M.O., Fox, H.C., Braddick, F.M.B., Toplis, A., Axelsson, E.L., Lynch, S., Ribeiro, H., Frostick, C.J. & Singer L.T. (2010). During pregnancy, recreational drug-using women stop taking ecstasy (MDMA) and reduce alcohol consumption but continue to smoke tobacco and cannabis. *Journal of Psychopharmacology*, *24*(9), 1403–1410. http://bit.ly/1dyjSAq
5. Singer, L.T., Moore, D.G., Fulton, S., Goodwin, J.E., Turner, J.J.D., Min, M.O. & Parrott, A.C. (2012). Neurobehavioral outcomes of infants exposed to MDMA (Ecstasy) and other recreational drugs during pregnancy. *Neurotoxicology and Teratology, 34*(3), 303–310. http://1.usa.gov/16SZ2XH
6. Singer, L.T., Moore, D.G., Min, M.O., Goodwin, J.E., Turner, J.J.D., Fulton, S. & Parrott, A.C. (2012). One-Year Outcomes of Prenatal Exposure to MDMA and Other Recreational Drugs. *Pediatrics*, *130*(3), 407–413. DOI 10.1542/peds.2012-0666

The co-production of [5] and [6] was supported by a jointly-shared grant of $2.66m from the US government's *National Institute on Drug Abuse* (NIDA/NIH, DA14910; 09/30/01 – 07/31/07)

4. Details of the impact

The research described above has been used to inform national and international political, professional and public debate about the risks of MDMA use. It has provided key evidence influencing UK and US governmental debate about the drug's legalisation and allowed medical professionals and specialist information websites to provide better-evidenced and more accurate advice to groups, including pregnant women and recreational drug users. Contributions to media discourse have supported both the delivery of more accurate media coverage of issues relating to the effects of the drug and increased public awareness of those issues.

Informing US policy makers, health professionals, and public about the potential harmful effects of MDMA.

Parrott and Turner's publications from 1998 through to 2004 feature on the US government's National Institute of Health, *National Institute on Drug Abuse* (NIDA) website. This site provides information resources that are authoritative, respected and used by a wide range of US policy makers, health professionals, drug users and members of the US public as core information on the potential harmful effects of drugs on adult functioning. Four UEL-authored papers, including [1], are cited on the website as key pieces of research evidence for the harmful effects of MDMA [a].

Informing UK government debate about the legal classification of MDMA.

In the UK the same work, outlining the potential neurological and psychological risks of MDMA use, has informed government debate and decisions relating to the legal classification of MDMA, and

specifically to its status as a Class A versus Class B drug. In 2008, Parrott, Turner, Soar, and Milani made invited contributions to the 2009 Home Office *Advisory Council on the Misuse of Drugs* (ACMD) review of MDMA, which cites [b]. Parrott was one of only eight expert witnesses called to give oral evidence; Turner, Soar and Milani also provided written evidence on the negative effects of the drug. Papers published by the UEL group – including [1] and [3] - are referenced frequently in the report [b]. Whilst the ACMD report recommended that MDMA be re-classified to Class B, Home Office Ministers in fact rejected this recommendation, a decision informed in part by the work of the UEL team, which evidences the long-term negative effects of MDMA on memory and mood.

Engaging audiences with drug legalisation debates: contributions to media discourse

Parrott's subsequent extensive engagement in public debate with the Chair of ACMD (David Nutt) about the use of evidence, and conclusions of the ACMD report [c], ensured that the research not only influenced policy, but also enhanced public awareness and understanding of some of the most important issues relating to the use of the drug. In September 2012, Parrott took part in Channel 4 television's "Drugs Live" programme, in which he debated the potential negative effects of MDMA on adults with David Nutt and Val Curran. Parrott made a significant contribution to the programme in proposing the arguments for the potential 'side-effects' of MDMA if used in therapy. In so doing, he referred to studies undertaken at UEL (both by him whilst he was here and, subsequently, by the rest of the team) that have reported long-term negative effects on memory and mood. Moore was also an invited member of the expert audience for that programme, which reached a peak audience of more than 2 million viewers [d]. A You Tube link to the programme had received in excess of 5,000 views in July 2013.

The reach of these impacts on UK public awareness of, and engagement with, issues pertaining to the drug legalisation debate was extended by subsequent contributions to international public and media discourses on that topic, with Parrott, Turner and Moore all contributing to media debates engaging both UK and overseas audiences. On 28 September 2012, for example, Moore contributed to a debate with Val Curran about whether the Drugs Live programme had given a sufficiently clear message about the negative effects of MDMA generally and about the importance, more specifically, of ensuring that young women recognise the danger that its use might pose to unborn babies dangers before they are aware of their pregnancy. The debate was broadcast on the Voice of Russia UK, the Russian government's international radio broadcasting service. A You Tube link to the programme had been accessed more than 600 times by July 2013 [e].

Raising awareness among international public audiences about the dangers of MDMA use in early pregnancy.

Since their publication in 2012, findings from the DAISY study - the first in the world to report the effects of MDMA on motor and cognitive functioning in human infants - have likewise been widely covered by popular and news media [f]. They were, moreover, also reported in detail on leading pregnancy information websites in the UK and USA [e.g. g]. Prior to the publication of the research findings, such sites gave only very generic advice against illicit drug use during pregnancy, and had no firm evidence of the negative effects of MDMA specifically on the long-term development of babies. One of the most popular UK pregnancy websites, BabyCentre UK, has since updated their drug advice pages to make reference to the DAISY study's findings about the effects of MDMA on infant motor function [g]. The site, which is visited millions of times each month by pregnant women or those planning pregnancies, refers specifically to a paper from the study [5].

Improving understanding among medical and health professionals

As well as being used to inform general public audiences, the DAISY findings were widely reported and discussed on medical websites in the UK and US. Between 28 February and 2 March 2012, that coverage included discussion of the results published in [5] on US News' *HealthDay* site, MedicineNet.com, and DrugRehab.us*;* the article also received a particularly high number of views on *Medical News Today*, where it was listed as the 'editor's choice' [h].

Publications by UEL researchers have led to invitations for them to share their research findings and the expert knowledge accruing from their work with a wide range of medical health professionals, through contributions to live events. Parrott's expertise remains much in demand

among medical professional groups, and he continues to draw on evidence gathered during his time at UEL in meeting that demand. Throughout the period of the DAISY project – which ran up to and through 2008 - Moore accepted numerous invitations to present lectures and workshops on the study for audiences of paediatricians and health professionals, including at the British Association for Community Child Health. These led to an invitation to provide a chapter (published in 2011) on the potential pre-natal effects of MDMA for a book in the prestigious Clinics in Developmental Medicine series (McKeith) [i]. This provided access to data on the potential harmful effects of MDMA, including preliminary data from the Daisy study, for professionals from other disciplines, particularly including paediatricians, neurologists and general practitioners,

Raising awareness among drug users of the potential harmful effects of MDMA

The UEL team's work on MDMA has featured regularly, not just on TV news (e.g. ITV News, Channel 4 News and the BBC's World Service) and in the national press, but on independent websites set up to inform drug users [j]. It has also been presented at the Club Health Conference in Ibiza (2008) and Prague (2011), where the research results were used to inform a non-academic audience of policy-makers, law enforcement agencies, a wide range of health professionals, nightclub owners and clubbers. Work has also been presented at the National Drug Treatment Conference to policy makers, clinicians and service users.

5. Sources to corroborate the impact

[a] For reference to the research – including [1] - on the US Government NIDA advice web pages: http://1.usa.gov/19iHgB1 notes 2, 16, 18 and 22.

[b] The 2009 Home Office Advisory Council on the Misuse of Drugs (ACMD) confirms the provision of written evidence by Turner and Soar (p. 44). The significance of the contribution made by UEL work to the legalisation debate is suggested by the proportion of report references (6 of 81) to work authored here, including [1] and [3]: http://bit.ly/18JALCU p. 37.

[c] There are many examples of Parrott's widespread engagement in public debate about the ACMD consultation and evidence base for the proposed re-classification of MDMA. These included coverage by the Daily Telegraph (e.g. http://bit.ly/19X3YhC) and BBC (http://bbc.in/17BGM8P), as well as an open letter published in Addiction Today (http://bit.ly/1aOyhIr). Parrott had, by this point, left UEL, but drew extensively on research conducted here in making his case.

[d] For Parrott's discussion of the evidence (much of it based on work done at UEL) for the harmful effects of MDMA on "Drugs Live: The Ecstasy Trial" (27 September 2012): http://bit.ly/1aMwhyj. The YouTube link to the programme, showing 5500+ views at July 2013, is: http://bit.ly/16SdrIR

[e] The YouTube link to Moore's debate with Curran on the Voice of Russia UK, showing 600+ views at July 2013, is: http://bit.ly/1asLIiT

[f] For examples of coverage of the DAISY findings in mainstream UK daily newspapers see articles in The Scotsman (http://bit.ly/1dXGI7g) and the Irish Examiner and http://bit.ly/1f82PFU)

[g] For reference to [5] on BabyCentre UK: http://bit.ly/1hzf9kv. The site is accessed by around 5 million visitors each month: number verified in an email from the Editor – available on request.

[h] For coverage between 28 February and 2 March 2012 of findings published in [5] on UK and US medical information sites: http://bit.ly/1aNbtqB (US News); http://bit.ly/16SN8wX MedicineNet.com); and http://bit.ly/18142tt (DrugRehab.us). The Medical New Today article – listed as the Editor's Choice – may be found at: http://bit.ly/1f8liSM

[i] The chapter in Clinics in Developmental Medicine is: Moore, D.G., Turner, J.J.T. et al (2011). In-utero exposure to the popular 'recreational' drugs MDMA (Ecstasy) and Methamphetamine (Ice, Crystal): preliminary findings. In Philip Preece and Ed Riley (Eds). Alcohol, Drugs and Medication in Pregnancy: The Outcome For The Child. John Wiley & Sons. ISBN-10: 1-898683-88-3: http://bit.ly/1h5A7tx

[j] The ACMD report citing Parrott and Turner's work appears on independent drug information websites such as Erowid (http://bit.ly/19itKNJ) and DrugScope (http://bit.ly/17x8qGe)