PSYC1022: The Psychology of Addiction

Topic 12: Individual differences in vulnerability to dependence

Dr. Helena Pacitti

Outline:

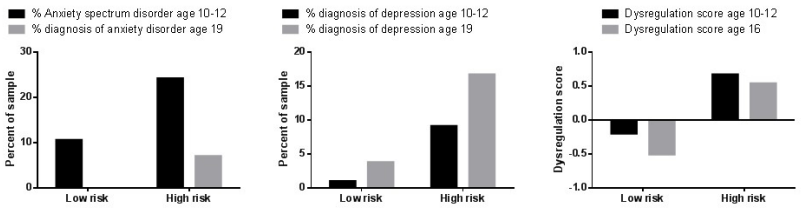
- Pre-existing dysregulation
- Age of onset
- Drug reward
- Dysregulation & loss of control
- Tiffany's cognitive theory
- Dysregulation & quitting

1

Pre-existing dysregulation

Tarter et al (2003 & 2004): examined traits of individuals at risk of substance dependence *prior* to drug use. Tested children age 10-12 of parents who were alcohol or substance dependent (high risk) vs. children of parents of were not dependent (low risk).

- High & low risk children differed on a range of traits: higher anxiety, depression & 'neurobehavioural dysregulation' (difficult temperament, conduct disorder, oppositional defiant disorder, attention deficit hyperactivity disorder, etc.)
- high risk initiated drug use at an earlier age than low risk
- age of initiation was predicted by the child's level of emotional & neurobehavioural dysregulation.
  - A broad spectrum of dysregulated emotional & cognitive traits predicts early onset.



2

Pre-existing dysregulation

Christie et al. (1988): confirmed the role of anxiety & depression as a pre-existing risk factor of substance use disorder

- Median age of onset for anxiety disorders was 15 years; major depressive episode, 24 years; drug dependence, 19 years; alcohol dependence, 21 years.
- 18–30 y.o. with depression or anxiety disorder double the risk for later substance dependence.

TABLE 3. Odds Ratios of Developing Drug Use Disorder After Major Depression or Anxiety Disorders in Young Adults 18–30 Years Old in the Five Sites of the Epidemiologic Catchment Area Program

	Odds Ratio	
Site	Men	Women
New Haven	3.1	2.0
Baltimore	1.0	1.4
St. Louis	3.1	2.4
Durham	1.6	1.8
Los Angeles	2.3	1.8
Combined estimate for the United States	2.2	1.9

3

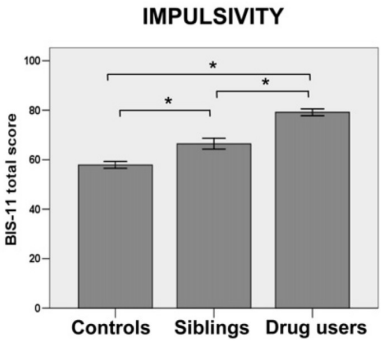
Pre-existing dysregulation

Ersche et al (2010): used the Barrett impulsivity scale (BIS) which is a standard questionnaire used to quantify impulsive traits.

- drug users had higher impulsivity than controls.
- drug users' impulsive personality may have pre-existed drug use or been a consequence of drug use.

To distinguish these two explanations, Ersche also ran non-drug using siblings of drug users & found that they too had higher impulsivity

- Suggests that drug users' impulsivity pre-existed their drug use because it is shared between siblings either due to genetic relatedness or common experience of a dysregulated environment.



4

Age of onset

Tarter et al., (2003 & 2004) demonstrated that dysregulated traits, anxiety, depression & neurobehavioural dysregulation, were associated with earlier onset of drug use.

- Earlier age of onset is associated with a higher risk of becoming dependent, even when individuals are matched for the same total number of years consuming the drug.
  - early age of onset makes one more sensitive to the dependence promoting effects of drugs.
    - dysregulated traits may increase one's risk of dependence by promoting an earlier age of drug use onset.

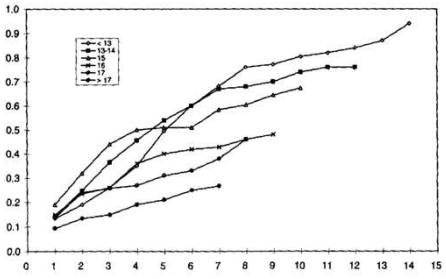


Fig. 2. Estimated probability of developing drug problems versus time since first drug use, separately for subgroups defined by age at first drug use.

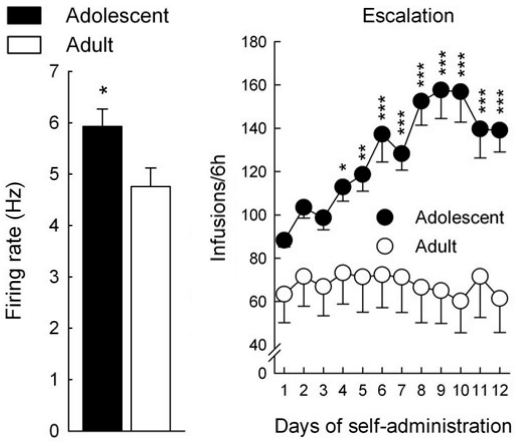
Anthony et al. (1995)

5

Age of onset

Wong et al. (2013): studied role of age of onset on dependence formation. Puberty in rats occurs at postnatal day 41. Two groups: adolescents vs. adults

- adolescents showed greater activity in VTA DA neurons
- when rats were placed on cocaine self-administration, adolescents escalated their consumption to double the level of adults.
- supports early age of onset increasing sensitivity to the rewarding effects of drugs, which determines the escalation to high level, stable drug use.

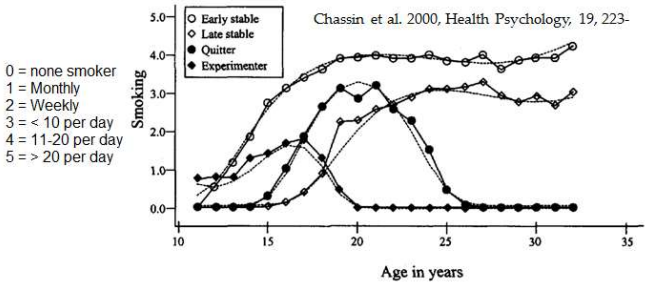


6

Age of onset

Early age of onset does not guarantee that an individual will make the transition to dependence.

- Developmental trajectory for smokers over their smoking career. 4 groups: Experimenters, quitters, early & late stable.
- Two groups were similar in initiating drug use early – experimenters & early stable. The fact that experimenters rapidly quit indicates that early onset does not inevitably lead to stable drug use. However, of the early onset users who established stable consumption, they reached a higher ceiling than the late stable group, indicating that early onset does promote higher levels of stable use.
- Quitters tended to start at a similar late age to the late stable group, yet quitters quit after about 5-10 years, whereas the late stable group maintained use for 10-15 years.
    - Although age of onset influences ones propensity for dependence, it does not determine it.



7

Drug reward

Fergusson et al (2003): differences in reward experience determining dependence can be seen during initial drug experience by the user.

- Subjective reports of cannabis liking during initial exposure predicted future development of cannabis dependence.
    - 34.1% of those who said they did get really high in early experience became dependent, whereas 12.4% of those who said they did not get really high during initial experience became dependent.

- Supports the view that experience of drug reward in early exposure is important for the transition to dependence.

Table 1. Rates of Cannabis Dependence (at Age 16-21 Years) by Subjective Responses to Cannabis (at Age 14-16 Years)

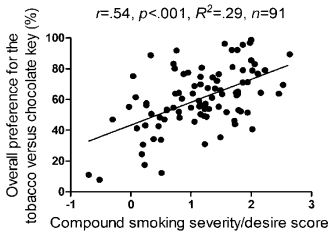
Symptom	Total No. of Subjects	Subjects Who Were Cannabis Dependent (at Age 16-21 y), %	OR (95% CI)	*P* Value
Positive symptoms				
Got really high				
No	113	12.4	1.0	
Yes	85	34.1	2.8 (1.6-4.9)	<.001
Felt happy				
No	57	5.3	1.0	
Yes	141	28.4	7.1 (2.1-24.1)	<.001
Felt relaxed				
No	52	7.7	1.0	
Yes	146	26.7	4.4 (1.5-12.9)	.004
Did silly things				
No	138	16.7	1.0	
Yes	60	33.3	2.5 (1.2-5.0)	.009
Laughed a lot				
No	62	8.1	1.0	
Yes	136	27.9	4.4 (1.6-11.9)	.002
Negative symptoms				
Felt ill, dizzy				
No	150	19.3	1.0	
Yes	48	29.2	1.7 (0.8-3.6)	.15
Felt frightened				
No	170	21.2	1.0	
Yes	28	25.0	1.2 (0.5-3.1)	.65
Passed out				
No	190	21.1	1.0	
Yes	8	37.5	2.3 (0.5-9.8)	.27

8

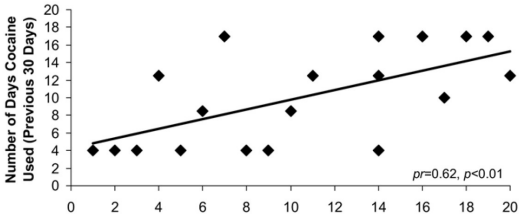
Drug reward

Individual differences in experience of drug reward can also been seen at subsequent stages of the drug use career.

- Hogarth (2012): found preferential choice of tobacco over chocolate in a concurrent choice procedure, was associated with nicotine dependence in a sample of student smokers with an average age of 20 & 4 years of smoking.
- Moeller et al. (2009): association between preferential cocaine picture choice & cocaine dependence in cocaine addicts with an average age of 45 & 15 years of cocaine use.



Hogarth (2012)



Moeller et al (2009)

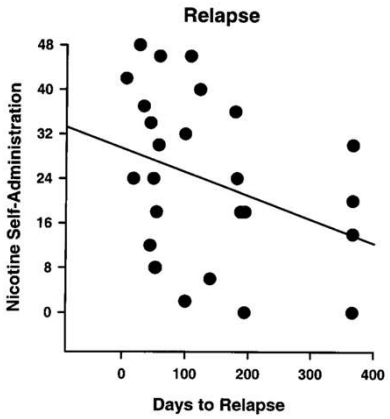
9

Drug reward

Perkins et al. (2002): smokers who had an average of 41.5 & 22.7 years of smoking, on a concurrent choice procedure in which they could choose between two nasal sprays, one containing nicotine & the other placebo.

- Preferential selection of the nicotine spray over 48 trials provided an index of the rewarding properties of nicotine.
- Participants then quit smoking & preferential nicotine choice predicted a shorter number of days to relapse.

Thus, experience of drug reward predicts the propensity to relapse.



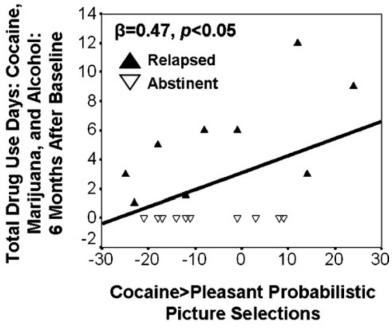
10

Drug reward

Moeller et al. (2013): found a similar association between preferential selection of cocaine pictures over pleasant pictures & the number of days in which a lapse to drug or alcohol use occurred during the 6 month treatment period that followed.

These studies indicate that experience of drug reward is an individual difference which determines the:

1. probability of transitioning from experimentation to stable use
2. level or severity of stable drug use maintained over time
3. the ability to quit drug use at the end stage of a drug use career.



11

Dysregulation & loss of control

Dysregulation caused or exacerbated by drug use is associated with an inability to quit using drugs at the end phase of a drug use career.

- There is evidence that dysregulation in established drug users is *not* associated with greater experience of drug reward & therefore does not confer a risk for cessation failure for this reason.
- Dysregulation in established drug users confers an inability to exert cognitive control over drug use, presumably because of damage to the brain mechanisms involved in behavioural regulation

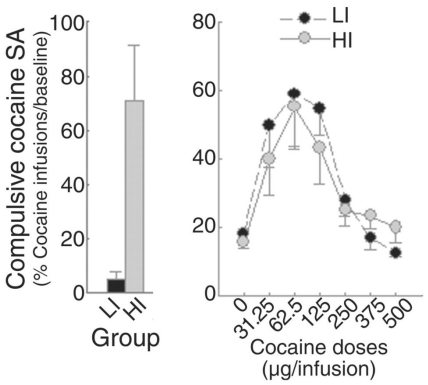
Tallulah Brockman Bankhead
1902 – 1968
Hollywood actress

12

Dysregulation & loss of control

Belin et al (2008): assessed dysregulation in rats using a procedure in which the presentation of a light signaled that the rat had to stay still, whereas the second presentation of the same light signaled that the rat could obtain food from a nose hole. Moving towards the nose hole in response to the first light was punished by loss of food.

- Rats were defined as low impulsive (LI) if they could stay still in response to the first light & were defined as high impulsive (HI) if they made mistakes by moving in response to the first light.
- Rats were then extensively trained on cocaine SA before introduction of a punishment schedule in which pressing the cocaine lever was punished with a foot-shock.
  - models end stage of drug use career when mounting harms from drug use should lead to quitting.

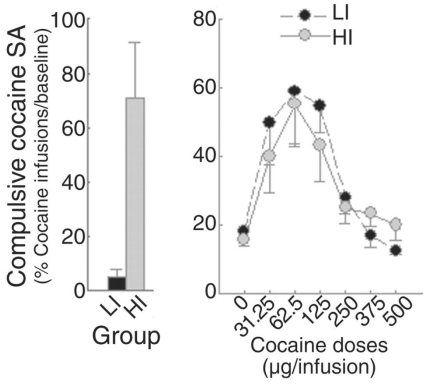


13

Dysregulation & loss of control

LI rats reduced cocaine SA to 5% of baseline following the introduction of punishment. Punishment only reduced cocaine SA in HI rats to 70% of baseline.

- The failure of HI rats to quit could be due to them experiencing the cocaine as having a higher reward value which they offset against the punishment. Or, HI may lack the ability to exert cognitive control over established drug use.
- Both groups were tested for the number of cocaine infusions they would SA across a range of doses, they were matched, suggesting they had equal experience of drug reward.
- HI rats lacked the ability to exert cognitive control over established drug use following the introduction of punishment of drug-taking behaviour.



14

Dysregulation & loss of control

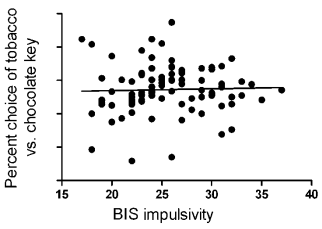
Hogarth (2011): impulsivity in smokers not associated with preferential choice of tobacco over choc.

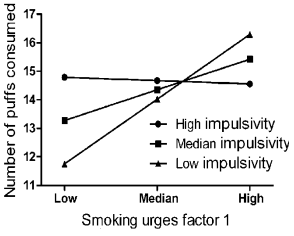
- suggests that impulsivity was not linked with higher relative reward value of tobacco.

Impulsivity was associated with a decoupling of the number of puffs consumed from a cigarette from subjective craving to smoke

- LI smokers level of urge to smoke correlated with the number of puffs consumed.
- HI smokers urge to smoke had no relationship with the number of puffs consumed.

Suggests that smoking behaviour of HI smokers is not governed by their subjective desire to smoke. Smoking is an automatic behavioural routine that is independent of desire; presumably less subject to cognitive control.





15

Tiffany's cognitive theory

Tiffany (1990): compiled studies which reported correlation between craving (urge) to use drugs & the amount consumed.

- "The correlations between self-reported urges & drug-use behavior are not exceptionally strong. The average correlation across all nine coefficients was .40, accounting for approximately 16% of the variance. Even if only the significant correlations are examined, the average coefficient is .50, indicating only 25% shared variance between self-reported urges and actual drug-use behavior" (p. 150).

Drug use is partially governed by desire, and partially automatic:

- "This model proposes that drug-use behavior in the addict represents activity controlled largely by automatic processes. Thus, drug-use behaviors represent skills that are relatively fast & efficient, stimulus bound, initiated & completed without intention, difficult to impede, cognitively effortless & capable of being enacted in the absence of awareness" (p. 163).

Belin et al (2008) & Hogarth (2011): dysregulation promotes governance of drug use by automatic behavioural routines rather than desire, presumably rendering drug use behaviour less susceptible to self-control (habits over goal-directed actions).

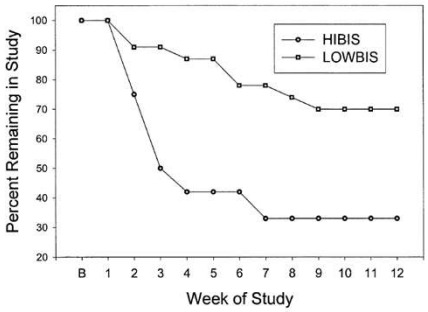
Correlation
.83*
.56
.44*
.59*
.30*
−.04
.52*
.31*
.07

16

Dysregulation & quitting

Moeller et al. (2001): examined relationship between impulsivity & quit success. 50 cocaine addicts attending a 12 week treatment program.

- Although all subjects attended week 1, HI were more likely to stop attending treatment (40% less likely) until only 30% of HI patients remained compared to 70% of LI patients.
- It is assumed that individuals who stop attending are likely to have relapsed since the last session, providing evidence that impulsivity (dysregulation) confers weaker capacity to quit.



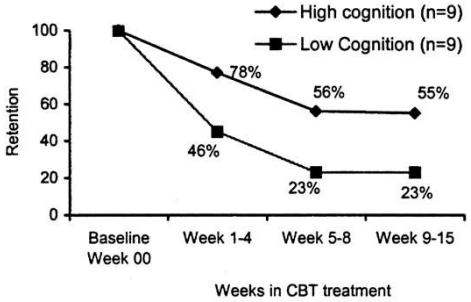
17

Dysregulation & quitting

Cognitive impairment is also associated with poorer survival within treatment.

Aharonovich et al (2003): 18 cocaine-dependent individuals examined over 15 week treatment program. Baseline: MicroCog™ Assessment of Cognitive Functioning- evaluates attention/mental control, memory, spatial processing, reasoning/calculation, reaction time, information processing accuracy, information processing speed, cognitive functioning, cognitive proficiency.

- Low scorers on the composite score (low cognition) had 20% higher likelihood of terminating treatment than high scorers.



18

Dysregulation & quitting

Lasser et al (2000): 4411 respondents to a US National Comorbidity Survey. Focus on rates of self-reported current smoking & rates of quitting over individuals' lifetime.

- 22.5% with no mental illness currently smoked & 42.5% had quit
- respondents with a mental illness were more likely to currently smoke & showed less ability to quit.
- psychosis showed a zero rate of quitting, although the other mental illnesses were fairly uniform in the reduction in quit rates compared to the group with no mental illness.

This suggests that dysregulation of any form can confer an inability to quit.

Smoking Status Among Respondents According to Mental Illness in the Past Month

Diagnosis in Past Month	US Population, %	Current Smokers, %	Quit Rate, %
No mental illness	50.7	22.5	42.5
Social phobia	4.0	31.5†	29.2‡
Agoraphobia	1.3	48.1§	23.2‡
Panic disorder	1.4	42.6‖	32.9
Major depression	4.9	44.7§	26.0‖
Dysthymia	1.7	38.2†	22.0†
Panic attacks	2.0	46.4§	29.8‡
Simple phobia	6.3	36.8§	33.3‡
Nonaffective psychosis	0.2	45.3	0
Alcohol abuse or dependence	2.6	56.1§	16.9§
Antisocial personality, antisocial behavior, or conduct disorder	14.6	45.1§	27.8§
Posttraumatic stress disorder	2.3	44.6§	23.2†
Generalized anxiety disorder	1.7	54.6§	28.9‡
Drug abuse or dependence	1.0	67.9§	22.4†
Bipolar disorder	0.9	60.6§	25.9

19

Dysregulation & quitting

Hitsman et al. (2013): meta-analysis of studies which compared smokers with & without major depression (MD+ and MD-) on short term (<3 months) & long term abstinence (≥6 months) following treatment.

- pooled odds ratio was 17%, meaning that MD+ participants had a 17% lower chance of remaining abstinent at <3 months.
- MD+ group also had a 19% lower chance of remaining abstinent at ≥6 months.

Thus major depression has a modest but reliable effect on reducing the ability to quit.

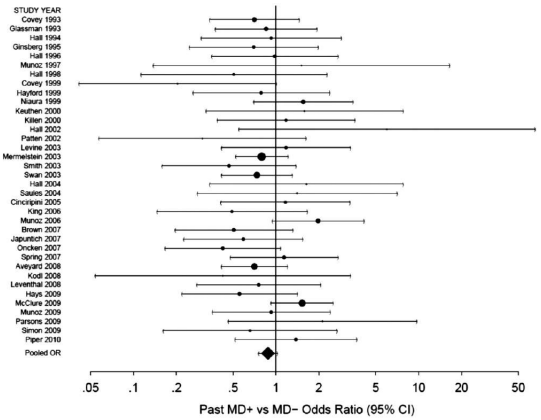


Figure 2 A forest plot of the OR comparing short-term abstinence rates for past MD+ versus MD- smokers in the placebo/lowest intensity control arms. The size of the circle for each individual effect is proportional to the study's weight in the analysis. Area inversely proportional to the variance of the log-OR estimator. Error bars show the 95% CI. The diamond indicates the overall short-term random effect. The point of no association is indicated by the solid vertical line. An OR <1 indicates a lower abstinence rate among past MD+ smokers

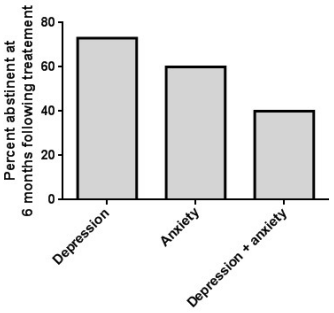
20

Dysregulation & quitting

A number of studies have also shown that depression and/or anxiety are associated with poorer quit rates following treatment for dependence on cocaine (Rounsaville, 2004), alcohol (Rounsaville et al. 1987; Charney et al. 2010), or cocaine, alcohol or heroin (Charney et al. 2005)

Charney et al (2005): found an additive effect, wherein depression plus anxiety conferred a greater risk of relapse than a diagnosis of either depression or anxiety alone.

- One may assume that dysregulated trait (depression, anxiety, impulsivity, cognitive impairment) combine (add up) to render individual less able to quit.



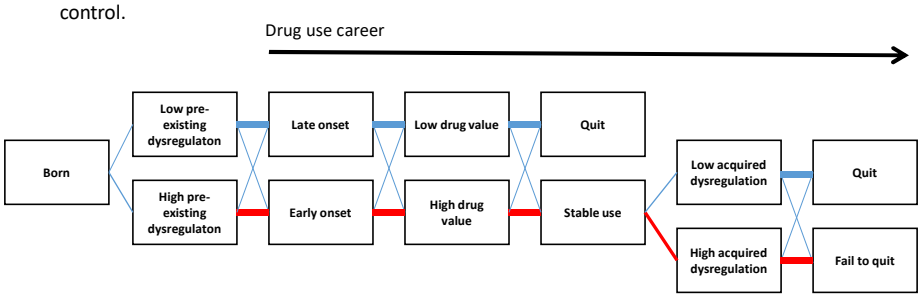
Redrawn from Charney et al. (2005)

21

Summary

Knowledge & understanding of three phases of individual differences in vulnerability to dependence:

1. Pre-existing dysregulated traits (anxiety, depression, cognitive impairment, impulsivity) is associated with early onset of drug use;
2. transition from experimentation to stable use is promoted jointly by earlier age of onset & by individual differences in the experience of drug reward value;
3. at the end stage of the drug use career, experience of greater drug reward produces an inability to quit & dysregulated traits (anxiety, depression, cognitive impairment, impulsivity), caused or exacerbated by drug use, combine to confer an inability to quit drugs due to loss of cognitive control.



22