

The Neuroscience of Addiction: Awareness and Understanding Among Adults

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Abstract: *Addiction involves interacting biological, psychological and social processes. Neuroscience has contributed to its understanding by examining reward and motivation systems, neurotransmitters, learning, memory, behavioural control and neuroplasticity. This study examined adults' awareness of selected neuroscience concepts related to addiction and described their perceptions of the relevance of neuroscience to understanding, prevention, treatment and stigma. A cross-sectional descriptive design was used. Data were collected through a researcher-developed online questionnaire containing ten multiple-choice knowledge items, eight five-point perception statements and two open-ended questions. Of 103 submissions, four respondents who did not consent were excluded, leaving 99 responses for analysis. Knowledge scores ranged from 0 to 10 ($M = 6.07$, $SD = 2.60$; median = 6). Correct responses were most frequent for the reward system (67.7%) and dopamine (66.7%), while the amygdala item had the lowest correct-response rate (44.4%). Most respondents agreed or strongly agreed that neuroscience knowledge could contribute to prevention and treatment (74.7%) and might help reduce stigma (66.7%). Responses to the reverse-worded statement about personal choice and lack of willpower were mixed. Open-ended responses referred to brain changes, reward and motivation, the difficulty of stopping repeated behaviour, recovery, and the importance of psychological and social influences. These findings describe the participating volunteer sample and should not be generalised to all adults. The questionnaire was developed for this study and has not undergone formal psychometric validation.*

Keywords: addiction; neuroscience; awareness; neuroplasticity; public understanding

1. Introduction

Addiction is a complex phenomenon that cannot be explained by a single cause. Biological processes interact with psychological experiences, learning, social relationships and environmental circumstances. Neuroscience has contributed to the understanding of addiction by examining the brain systems involved in reward, motivation, stress, memory and behavioural control. These systems operate through connected circuits rather than through one isolated brain region or neurotransmitter (Koob & Volkow, 2010; Volkow et al., 2016).

Dopamine is frequently mentioned in public explanations of addiction, but it is not simply a 'pleasure chemical'. It contributes to motivation, reinforcement learning and the significance of cues associated with rewarding outcomes. Glutamate is involved in learning and synaptic plasticity. Brain structures such as the nucleus accumbens, prefrontal cortex, amygdala and hippocampus contribute to reward-related learning, decision-making, emotional processing and memory. Repeated exposure can strengthen learned associations and contribute to persistent patterns of behaviour, although the course of addiction varies across individuals (Everitt & Robbins, 2016; Volkow et al., 2012).

Neuroplasticity, the capacity of the nervous system to change with experience, is relevant both to the persistence of learned behaviours and to the possibility of change through new learning and treatment. However, biological explanations should be presented alongside psychological and social influences. An explanation focused only on weak willpower may encourage blame, while an exclusively

biological explanation may imply that change is impossible. Research on public attitudes suggests that medical or brain-based explanations do not automatically remove stigma (Pescosolido et al., 2010; Racine et al., 2017).

Understanding what adults know about selected neuroscience concepts may help identify areas where clear public education could be useful. The present study therefore examined responses to a short knowledge questionnaire, statements about perceptions of addiction, and open-ended questions about how brain knowledge may contribute to understanding addiction.

1.1 Aim and objectives

The aim was to examine awareness and understanding of selected neuroscience concepts related to addiction among adults aged 18 years and above. The objectives were to assess knowledge of selected concepts using ten multiple-choice items; describe perceptions of the relationship between brain functioning and addiction; explore participants' written views about the relevance of understanding the brain; and describe knowledge scores according to prior relevant education or training.

2. Methodology

2.1 Research design and participants

A cross-sectional descriptive design was used. The questionnaire was distributed online, and participants chose voluntarily whether to take part. The sampling approach was non-probability convenience and voluntary-response

sampling. The dataset contained 103 submissions. Four respondents selected that they did not agree to participate and were excluded. The final analytical sample consisted of 99 consenting adults aged 18 years and above, with no upper age limit.

2.2 Instrument

Data were collected using a researcher-developed Google Forms questionnaire that had not undergone formal psychometric validation. It included demographic questions covering age group, gender, highest educational qualification, occupational status and prior relevant education or training. The knowledge section contained ten multiple-choice questions on the reward system, dopamine, the prefrontal cortex, nucleus accumbens, glutamate and learning, neuroplasticity, repeated exposure and neural pathways, amygdala, hippocampus, and addiction-related brain circuits. Each item included an 'I don't know/Not sure' response option. The perception section contained eight statements rated on a five-point scale from 1 (strongly disagree) to 5 (strongly agree). One statement was reverse-worded and concerned personal choice and lack of willpower. Two open-ended questions asked how understanding the brain might help people understand addiction and what respondents understood differently after completing the questionnaire.

2.3 Procedure and ethical considerations

Participants were shown information about the study and asked to provide consent before proceeding. Participation was voluntary, and respondents could discontinue before submitting the questionnaire. The form did not request names, email addresses, locations or personal histories of addiction or substance use. Participants were informed that responses would be treated confidentially and used for academic research purposes. Non-consenting submissions were excluded. The dissertation does not report formal ethics committee approval, and no such approval is claimed in this article.

2.4 Scoring and analysis

Each correct knowledge response received one point. Incorrect and 'I don't know/Not sure' responses received zero, giving a total possible score from 0 to 10. Frequencies and percentages were calculated for demographic information and individual knowledge items. The knowledge score was summarised using the mean, standard deviation, median and range. Perception items were summarised separately using response frequencies, item means and the proportion selecting agree or strongly agree. The reverse-worded item was interpreted in its original direction. Knowledge means by prior relevant education or training were compared descriptively only. Open-ended responses were read and grouped into broad descriptive themes; this was not a formally validated qualitative coding procedure.

3. Results

3.1 Sample and knowledge scores

Of the 103 submissions received, 99 (96.1%) consented to participate and were included in the analysis; four (3.9%) were excluded because consent was declined. All 99 consenting records contained responses to all ten knowledge items. The mean knowledge score was 6.07 out of 10 (SD = 2.60), with a median of 6 and a range from 0 to 10. Fourteen respondents (14.1%) answered all ten items correctly, while two respondents (2.0%) scored zero.

3.2 Item-level knowledge

Knowledge area	Correct n	Correct %	Unsure n
Reward system	67	67.7	10
Dopamine	66	66.7	11
Prefrontal cortex	59	59.6	18
Nucleus accumbens	53	53.5	12
Glutamate and learning	62	62.6	9
Neuroplasticity	63	63.6	10
Repeated exposure and neural pathways	66	66.7	12
Amygdala	44	44.4	19
Hippocampus	58	58.6	19
Addiction-related circuits	63	63.6	8

Correct responses were most frequent for the reward system (67.7%) and dopamine (66.7%). The amygdala item had the lowest correct-response rate (44.4%). Unsure responses were most common for the amygdala and hippocampus items (19 each), followed by the prefrontal cortex item (18).

3.3 Perceptions of addiction neuroscience

Agreement or strong agreement was reported by 74.7% of respondents for the statement that neuroscience knowledge can contribute to better prevention and treatment approaches. A total of 66.7% agreed or strongly agreed that understanding the neuroscience of addiction may help reduce stigma. Agreement was also observed for statements concerning brain changes and neural pathways (64.6%), repeated behaviour and neural pathways (64.6%), neuroplasticity and persistence or recovery (63.6%), the reward system and difficulty controlling behaviour (62.6%), and the roles of dopamine and glutamate (57.6%).

Responses to the reverse-worded statement that addiction is primarily a matter of personal choice and lack of willpower were mixed: 24.2% agreed or strongly agreed, 47.5% disagreed or strongly disagreed, and 28.3% selected the neutral option. The items are reported separately and should not be interpreted as a single validated attitude scale.

3.4 Prior education or training and open-ended responses

Respondents who reported prior relevant education or training had a descriptive mean knowledge score of 6.96 (n = 26, SD = 2.81), compared with 5.78 among those who reported no prior training (n = 69, SD = 2.47). Four respondents selected 'Not sure' (M = 5.25, SD = 2.63). These are descriptive comparisons and do not establish statistical significance or causation.

Open-ended responses were grouped into broad descriptive themes: understanding why addiction can be difficult to stop; moving beyond blame and simple explanations; learning about reward, dopamine and brain structures; recognising recovery and the possibility of change; acknowledging psychological and social factors; and the potential value of prevention and public education. These themes summarise respondents' comments and should not be interpreted as a formal qualitative analysis or evidence that the questionnaire changed attitudes.

4. Problem Behaviours

The findings relate to how participants understood addiction-related behaviours and the possible contribution of brain processes to difficulty controlling repeated behaviour. Agreement with statements about reward systems, neural pathways and neuroplasticity suggests that many respondents recognised that repeated behaviour may be connected with learning and brain functioning. However, responses to the statement that addiction is primarily a matter of personal choice and lack of willpower were mixed: 24.2% agreed or strongly agreed, 47.5% disagreed or strongly disagreed, and 28.3% were neutral. This pattern does not support a single shared view among participants. It highlights the importance of explaining problem behaviours without reducing addiction either to personal weakness or to brain mechanisms alone. The open-ended responses also mentioned stress, family and social circumstances, recovery and access to support, indicating that respondents referred to both biological and wider contextual factors. These descriptive responses should not be interpreted as a clinical assessment of participants or as evidence about the prevalence of addictive behaviours in the general population.

5. Discussion

The mean score of 6.07 out of 10 shows that respondents answered, on average, approximately six of the ten selected knowledge questions correctly. Since the questionnaire was developed for this study and has not been validated, this result should not be labelled as a definitive level of 'good' or 'poor' awareness. Instead, it provides a descriptive snapshot of the participating sample. The relatively higher correct-response rates for the reward system and dopamine may reflect the prominence of these concepts in public discussions of addiction. The lower rate for the amygdala item and the number of unsure responses for the amygdala, hippocampus and prefrontal cortex suggest that some specific brain structures may be less familiar to respondents.

The perception findings indicate that many respondents recognised the possible relevance of neuroscience to prevention, treatment and stigma reduction. However, these responses reflect beliefs about the usefulness of neuroscience knowledge, not evidence that neuroscience education actually reduces stigma or improves treatment outcomes. Previous research has cautioned that brain-based explanations may reduce some forms of blame without necessarily producing more accepting attitudes in every context (Pescosolido et al., 2010; Racine et al., 2017). A balanced explanation should therefore recognise brain

processes while also acknowledging agency, psychological experiences, social circumstances and access to care.

The mixed responses to the statement about personal choice and lack of willpower indicate that participants did not share one uniform view. Nearly one quarter agreed or strongly agreed with the statement, while just under half disagreed or strongly disagreed and more than one quarter were neutral. This supports the value of communicating addiction in a way that avoids both moral blame and biological determinism. Addiction-related processes can affect learning, motivation and behavioural control, but a short awareness questionnaire cannot capture the full range of individual experiences.

The open-ended comments were broadly consistent with this balanced view. Participants referred to reward, brain changes and learned behaviour, while some also recognised the importance of stress, family, environment, support and access to treatment. These responses suggest that participants could describe several possible uses of neuroscience knowledge, but they do not demonstrate that respondents acquired lasting knowledge or changed their behaviour as a result of completing the questionnaire.

The descriptive difference in knowledge scores by prior relevant education or training is consistent with the possibility that previous exposure to related subjects may be associated with familiarity with the selected concepts. However, the groups were unequal in size, the sample was not randomly selected, and no inferential test was planned. The difference should not be interpreted as evidence that training caused higher knowledge scores.

6. Implications

The findings point to potential value in public education that explains reward-related learning, the roles of relevant brain systems and the possibility of change through neuroplasticity. Educational materials may be especially useful when they clarify concepts that were less frequently answered correctly, such as the amygdala and other specific brain structures. Communication should avoid blame-based explanations while also avoiding the suggestion that biology alone determines behaviour. The present study did not test an educational intervention, so these implications are suggestions for future awareness initiatives rather than demonstrated effects.

7. Limitations

The study has several limitations. First, voluntary online convenience sampling limits representativeness and generalisability. Second, the questionnaire was researcher-developed and had not undergone formal validation or reliability testing. Third, ten knowledge items cover only a small selection of neuroscience concepts. Fourth, the cross-sectional design cannot establish causal relationships or changes over time. Finally, the open-ended responses were brief and were grouped into broad descriptive themes rather than analysed using a formal qualitative method. Future studies could use validated measures, more systematic

sampling and pre-test/post-test designs to evaluate the effects of educational material.

8. Conclusion

This study described awareness and perceptions of selected neuroscience concepts related to addiction among 99 consenting adults. Knowledge scores varied, with a mean of 6.07 out of 10. The reward system and dopamine items had the highest correct-response rates, while the amygdala item had the lowest. Most respondents considered neuroscience knowledge potentially useful for prevention and treatment, and many believed it might help reduce stigma. Nevertheless, views about personal choice and willpower were mixed. Open-ended responses highlighted brain changes and reward-related learning, alongside recovery and psychological and social influences. The findings should be interpreted as descriptive evidence from a volunteer sample rather than as a representation of all adults. Further research using validated measures and more systematic sampling is needed. Public education may be most useful when it explains addiction through a balanced biopsychosocial framework rather than attributing it solely to willpower or biology.

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