



Internet Addiction in South Korean Undergraduate Students: Relationships with the COMT Genotype (Val¹⁵⁸Met) and Psychological Factors

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Internet Addiction

- Failure to control Internet use
- Excessive preoccupation with the Internet (social media, cybersex, gaming, online stock trading or gambling, information surfing, shopping) (Weinstein et al., 2015; Young et al., 1999)
- Results in physical, psychological, social, and financial distress
- Dependence, tolerance, withdrawal symptoms (Kuss et al., 2014)

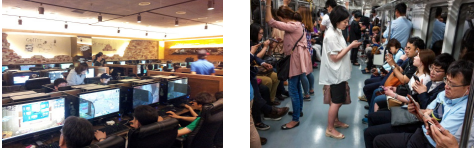


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Internet Usage in South Korea



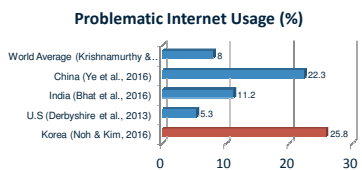
- **82.1%** population at age 3 or older (99.9% of 20's) is Internet users – using the Internet at least once a month (Korea Internet & Security Agency, 2014)
- **89.8%** Internet users are using the Internet every day.



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Internet Addiction in South Korea

- Internet addiction in undergraduate students
- Internet Addiction Test (IAT) (Young, 1998)



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Internet Addiction Test (Young, 1998)

In the past month,

- 0 = Not Applicable
- 1 = Rarely
- 2 = Occasionally
- 3 = Frequently
- 4 = Often
- 5 = Always

Cut Off Points

- 0 - 30 = Normal
- 31 - 49 = Mild
- 50 - 79 = Moderate
- 80 - 100 = Severe

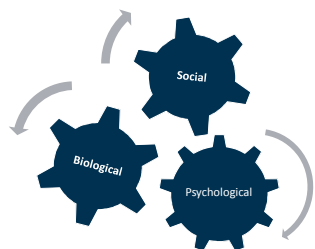
- How often do you find that you stay online longer than you intended?
- How often do you neglect household chores to spend more time online?
- How often do you prefer the excitement of the Internet to intimacy with your partner?
- How often do you form new relationships with fellow online users?
- How often do others in your life complain to you about the amount of time you spend online?
- How often do your grades or school work suffer because of the amount of time you spend online?
- How often do you check your email before something else that you need to do?
- How often does your job performance or productivity suffer because of the Internet?
- How often do you become defensive or secretive when anyone asks you what you do online?
- How often do you block out disturbing thoughts about your life with soothing thoughts of the internet?
- How often do you find yourself anticipating when you will go online again?
- How often do you fear that life without the Internet would be boring, empty, and joyless?
- How often do you snap, yell, or act annoyed if someone bothers you while you are online?
- How often do you lose sleep due to being online?
- How often do you feel preoccupied with the Internet when off-line, or fantasize about being online?
- How often do you find yourself saying "just a few more minutes" when online?
- How often do you try to cut down the amount of time you spend online and fail?
- How often do you try to hide how long you've been online?
- How often do you choose to spend more time online over going out with others?
- How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back online?

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Factors Related to Internet Addiction



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Biological Details of Internet Addiction

- Dopaminergic Pathway
- Catechol-O-Methyltransferase (COMT)
 - An enzyme that catabolizes catecholamines (dopamine, epinephrine, and norepinephrine) and catecholestrogens

The diagram on the left shows a sagittal section of the brain with the dopaminergic pathway highlighted in red. Key regions labeled include the Frontal cortex, Striatum, Substantia nigra, Nucleus accumbens, VTA (Ventral Tegmental Area), and Raphe nucleus. The diagram on the right, titled 'Inactivation of dopamine and norepinephrine by COMT', shows a biochemical pathway where COMT converts dopamine (DA) and norepinephrine (NE) into metabolites like 3-MDA and 3-MHPA. It also shows the conversion of COMT to COMT^{Met} and COMT^{Val} alleles.

COMT-Catechol O-Methyl Transferase; DA-Dopamine; Met-Methyl; Val-Valine; COMT-Single Nucleotide Polymorphism; Biol Med Genet Spec Vol 15, No 4, 2005.

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SNP of COMT Gene

- Single Nucleotide Polymorphism (SNP)
 - Variation in a single nucleotide
 - Common genetic variation
 - Predict susceptibility to environment, risk of particular disorders, response to certain medications
- SNP of COMT gene
 - Genotypes: Val/Val, Val/Met, Met/Met
 - Val/Val: ↑ COMT → ↓ Dopamine
 - Met/Met: ↓ COMT → ↑ Dopamine
- Researches
 - Psychiatric disorders, addictive disorders, Parkinson's disease, cancer, pain
 - Response to treatment

The diagram on the left shows a DNA double helix with a single nucleotide change (SNP) highlighted. The diagram on the right shows a chromosome 22 with a red triangle indicating the COMT gene. The variants are labeled as Val¹⁵⁸Met and Val/Val.

Genotype: Met/Met, Val/Met, Val/Val

Chromosome 22: COMT Val¹⁵⁸Met, Val/Val

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Purpose of the Study

- Identify issues related to the feasibility of conducting a cross-sectional study using web-based survey and saliva samples for genotyping among undergraduate students in South Korea:
 - Recruiting 250 participants.
 - Completion of web-based surveys to assess psychological risk factors for Internet addiction.
 - Successful procurement of saliva samples to analyze COMT genotype.
 - Successful analysis of saliva samples/COMT genotype.
- Investigate the associations among Internet addiction severity, psychological factors (depression, social anxiety, self-esteem, self-efficacy, perceived stress, and coping strategy), and COMT genotype among undergraduate students in South Korea.

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Participants

- Sample size: 250 (N=241: 80% power, two sided, $\alpha = .05$)
- Inclusion criteria
 - Enrolled undergraduate students, 18 years old or older.
 - Internet users who have used Internet at least once in the previous month.
 - Native Korean speakers.
- Exclusion criteria
 - Having psychotropic medications, estrogen hormonal drugs including any types of birth control, or dietary supplement that mainly include catechin or quercetin in the previous month.
 - Pregnant.



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Procedures

- IRB approval (UNC-CH & Local IRB in Korea)
- Recruitment
 - Convenience sampling
 - Setting: 2 universities in Seoul and Seoul metropolitan area
 - Flyer on-line and off-line
 - Incentive: 5000KRW (\$4~5) gift card
- Web-based survey: UNC Qualtrics



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Measures

Variables	Instrument	Feature	Reliability
Feasibility		Final sample size, rate of response, rate of missing data, challenges and facilitators of the study process	N/A
Internet addiction	KIAT	Self-report, 20-item, 6-point Likert	$\alpha = .91$
Depression	CES-D	Self-report, 20-item, 4-point Likert	$\alpha = .91$
Social anxiety	K-SAD	Self-report, 28-item, 5-point Likert	$\alpha = .92$
Self-esteem	RSES	Self-report, 10-item, 4-point Likert	$\alpha = .86-.87$
Self-efficacy	Self-Efficacy Scale	Self-report, 10-item, 4-point Likert	$\alpha = .88$
Stress	PSS	Self-report, 10-item, 5-point Likert	$\alpha = .75-.76$
Coping	Brief COPE	Self-report, 28-item, 4-point Likert	$\alpha = .50-.90$

Note: KIAT (Korean Internet Addiction Test); COMT (Catechol-O-Methyltransferase); SNP (Single Nucleotide Polymorphism); SES (Socio Economic Status); CES-D (Center for Epidemiologic Studies - Depression scale); K-SAD (Korean version of Social Avoidance and Distress scale); RSES (Rosenberg Self-Esteem Scale); PSS (Perceived Stress Scale)



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Saliva Collection

- Oragene® DNA OG-500 (2ml)
- Easy, non-invasive, stable at room temperature for years
- Do not eat, drink, smoke or chew gum for 30 minutes before saliva collection






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DNA Extraction

- PrepIT-L2P procedure at Bio-Behavioral Lab at School of Nursing, UNC

<https://www.youtube.com/watch?v=8lFfmNRunqc>


- Incubate the samples at 50°C
 - Release of the DNA
 - Permanent inactivation of the nucleases
- Took 500µL of the sample into the micro-centrifuge tube and add 25µL of the solution
- Vortex for a few seconds
- Ice for 10 min to remove impurities
- Centrifuge for 5 min at 17,000 x g
- Take the supernatant into the new micro-centrifuge tube

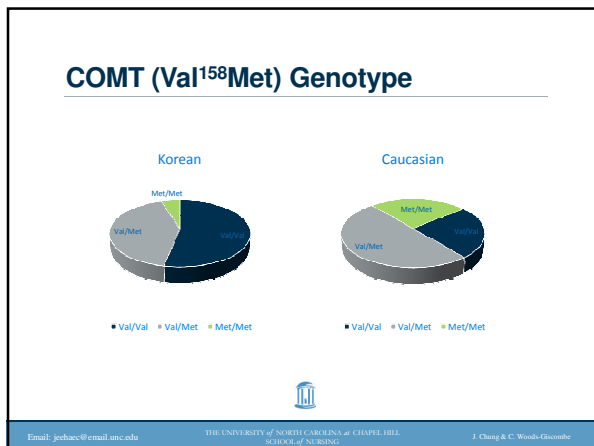
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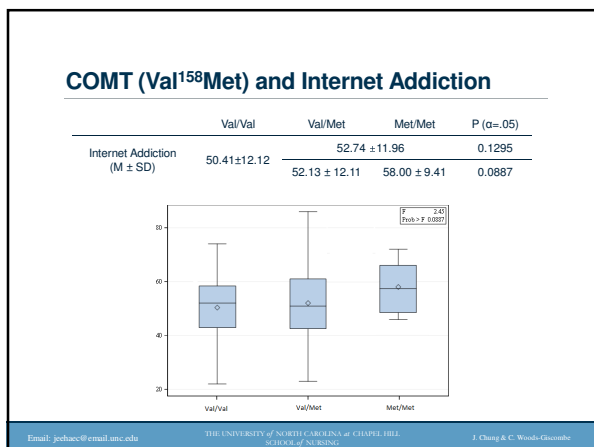
DNA Extraction

- Add 95% 600µL ethanol, wait for full precipitation of DNA, and centrifuge for 2 min at 17,000 x g
- Discard the supernatant and take the pellet at the bottom which contains DNA
- Wash the pellet with 250µL 70% ethanol carefully
- Store with 50µL TE solution, the DNA storage buffer.
- Incubate the extracted DNA at 50°C for 1 hour to complete rehydration of DNA
- Quantification of DNA
- Store in the freezer at -80°C
- Ship extracted DNA to a support company for genotyping



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Psychological Factors & Internet Addiction

Internet Addiction		Normal Users	Problem Users	P (α=.05)
Depression (X ²)	Normal	104	102	0.0003*
	Depression	9	35	
Social Anxiety (X ²)	Normal	87	81	0.0027*
	Anxiety	26	56	
Perceived stress		15.38 ± 4.75	19.04 ± 5.27	<.0001*
Self-Esteem		32.17 ± 3.89	28.86 ± 4.56	<.0001*
Self-Efficacy		30.58 ± 3.31	28.32 ± 4.03	<.0001*
Active Coping		24.72 ± 3.89	23.46 ± 4.14	.0144*
Avoidant Coping		18.88 ± 3.92	21.12 ± 3.90	<.0001*

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Discussion

- Findings
 - High rate of problematic Internet users (54.8%)
 - Significant relationship between psychological factors (depression, social anxiety, perceived stress, self-esteem, and self-efficacy) and Internet addiction
 - No significant relationship between COMT (Val¹⁵⁸Met) genotype and Internet addiction or psychological factors
- Implications for research
 - Deeper understanding about Internet addiction in Korean undergraduate students
 - Further statistical analysis
 - Study with other ethnic groups
 - Interventions



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