

Sleep quality, insomnia symptoms and academic performance on medicine students

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Abstract

Introduction: Sleep quality and Insomnia symptoms could affect abilities like work or learning. Medicine curricula involves a lot of theoretical and memory content. Sleep disorders can disrupt academic performance. Tobacco, alcohol, drugs, age, obesity, hormones and others biological, mental, environmental and social factors are related to increase poor sleep quality and insomnia symptoms incidence. University students are a vulnerable population to develop sleep disorders

Objective: The goal was to relate sleep quality and insomnia symptoms with academic performance of first year students of surgeon medical career in Yucatan.

Methods: A cross-sectional study was developed, which included 118 first year regular students from Medicine School of the Autonomous University of Yucatan, Mexico.

Participants completed the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), AUDIT test and epidemiological data. Academic performance was assessed by grades earned on written exams and approved courses.

Results: 65 men (19.15 ± 1.60 years) and 53 women (18.98 ± 1.23 years) were included. 98.11% of women and 90.76% of men perceived poor sleep quality. No association was found between sleep quality and academic performance. 73% of women and 66% of men were classified with insomnia symptoms. 50.94% of women and 44.61% of men had poor academic performance. Poor academic performance was related with mild ($p = 0.0035$) and moderate ($p = 0.031$) insomnia symptoms only in women. In men, insomnia symptoms was related to body mass index and living out of a family home.

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Conclusions: A great majority of students perceived poor sleep quality and insomnia symptoms. In women, insomnia symptoms adversely affect academic performance.

Keywords: *Scholar-Average; Sex; Sleep; first year university students.*

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Calidad de sueño, síntomas de insomnio y rendimiento académico en estudiantes de medicina

Resumen

Introducción: La calidad de sueño y los síntomas de insomnio pueden afectar habilidades para trabajar o aprender. La licenciatura de médico cirujano, incluye gran cantidad de contenido teórico y memorístico. Los trastornos del sueño pueden alterar el rendimiento académico. Tabaco, alcohol, drogas, edad, obesidad, hormonas y otros factores biológicos, mentales, ambientales y sociales pueden incrementar la mala calidad de sueño y la incidencia de síntomas de insomnio. Los universitarios son una población vulnerable para desarrollar trastornos del sueño.

Objetivo: El objetivo fue relacionar la calidad de sueño y los síntomas de insomnio con el rendimiento académico de los estudiantes de primer año de la carrera de Médico Cirujano en Yucatán.

Método: Se realizó un estudio transversal que incluyó 118 estudiantes del primer año de la carrera de Médico

Cirujano de la Facultad de Medicina de la Universidad Autónoma de Yucatán. Los participantes respondieron los cuestionarios: calidad de sueño de Pittsburgh (PSQI), índice de severidad de insomnio (ISI), AUDIT y datos epidemiológicos. El rendimiento académico fue evaluado mediante el promedio numérico de calificaciones obtenidas de los exámenes escritos y cursos aprobados.

Resultados: 65 hombres (19.15 ± 1.60 años) y 53 mujeres (18.98 ± 1.23 años) fueron incluidos. 98.11% de las mujeres y 90.76% de los hombres se percibieron con mala calidad de sueño. No se encontró asociación entre la calidad de sueño y el rendimiento académico. 73% de las mujeres y 66% de los hombres fueron clasificados con insomnio. Los niveles de síntomas insomnio moderado y severo fueron mayores en mujeres ($p = 0.02$). 50.94% de las mujeres y 44.61% de los hombres tuvieron pobre rendimiento académico. El pobre rendimiento académico se relacionó con síntomas de insomnio leve ($p = 0.0035$) y moderado ($p = 0.03$) únicamente en el grupo de mujeres. En hombres los síntomas de insomnio se relacionaron con el índice de masa corporal y con vivir fuera del domicilio familiar.

Conclusiones: La gran mayoría de los estudiantes se percibieron con mala calidad de sueño y síntomas de insomnio. En las mujeres, los síntomas de insomnio afectan negativamente el rendimiento académico.

Palabras clave: *Promedio escolar; Sexo; Sueño; Universitarios.*

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INTRODUCTION

Poor sleep quality and insomnia are sleep problems that negatively affect people's lives. Produces tiredness, lack of energy, anxiety, irritability or depression, excessive daytime sleepiness, difficulty concentrating, paying attention, remembering or memorizing things, among other skills that complicate work or learning¹⁻³. The prevalence of poor sleep quality and insomnia in adults tend to be very

variable, depending of studied population and diagnostic tools. Some factors are associated with sleep disorders: aged, sex⁴, fertile stage, hormonal levels (for example: cortisol, oestrogen and testosterone)⁵, alcohol, tobacco, caffeine, drugs and energy beverages consumption, sedentary lifestyle, obesity, stress level, low educational level, low economic income, certain ethnic groups, physical sleeping environment and others⁶⁻⁸.

Definition and diagnostic criteria of sleep problems are constantly reviewed and updated internationally, however clinical evaluation and some psychometric tools continue to have value especially as a screening method to identify sleep disorders, particularly in basic level of health attention. The sleep quality is a subjective perception and insomnia is a disorder that implies a diagnosis that must include be included clinical record, psychiatric evaluation and inclusive other tools like polysomnography^{9,10}. However some psychometric test shows insomnia symptoms and its levels that suggested the diagnosis.

The large amount of theoretical curriculum content of medical school programs, especially in the early years, demands use of memory skills to evidence learning. The way to evaluate a course or subject is to measure the level of competences acquired, which could be defined as academic performance (AP)¹¹. There is no consensus about the best way to quantify AP. Several authors propose that the most practical form of measurement is the use of averages or numerical qualifications during a school period obtained from standardized assessments based on oral or written exams^{12,13}.

The prevalence of sleep disorders in medical students is usually high and its impact has been reflected in physical, social and mental health problems as demonstrated in several studies^{1,14,15}. This can also affect their performance at school putting at risk their university career. School dropout at university level is a problem that affects the development of countries such as Mexico. Good academic performance is fundamental to improving school retention rates. Therefore, it is important to determine if insomnia affects school performance in medical students.

METHODS

Participants

The study design was transversal and included a probabilistic sample of 118 first year students of Medicine School at the University of Yucatan. The total enrolment of students was 1034, including the six academics years. In the first year, the total population was 196. The medicine school curriculum of UADY contemplates annual school cycles which begin in August and end in July of the following year. The

application of questionnaires was done taking care that students were not in periods of official exams according to calendar provided in the corresponding curriculum. Data collection was carried out from October to December 2016. The validated Spanish version for Mexican population of Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), and a questionnaire containing some demographic, habits and family variables were applied. For assessment harmful alcohol consumption, was used the AUDIT test, a tool suggested by the World Health Organization, which allows the distinction between occasional and harmful consumption in adolescents and adults¹⁶. All participants were at least 18 years old at the time of the study and signed informed consent. The committee of the Medicine School authorized the present study and all bioethics precepts of the participants were monitored.

Instruments

Pittsburgh Sleep Quality Index (PSQI). Self-administered questionnaire consisting of 24 items, only first 19 are used to obtain the overall score, identifies sleep schedules, sleep associated events such as difficulty sleeping, wakefulness, nightmares, snoring, respiratory disturbances, quality of sleep, intake of sleeping pills and daytime drowsiness. The 19 reagents are grouped into seven components that are rated on a scale of 0 to 3. The sum of the components results in a global rating, where a higher score indicates a lower quality of sleep. In the original¹⁷, PSQI showed a good coefficient of internal homogeneity with Cronbach's alpha = 0.83 and correlation coefficients between the components and the overall score (Pearson's $r = 0.46$ to 0.85). The authors reported that a score > 5 distinguishes subjects with poor sleep from those who sleep well, with a high sensitivity and specificity (89.6% and 86.5%, respectively), with a PPV of 80.66%. This instrument was validated in Mexican population¹⁸, with a satisfactory coefficient of reliability (0.78) and significant correlation coefficients (0.53 to 0.77) between the components and the total sum. So, it was used as a cut-off point to differentiate good from bad sleepers a value of ≥ 5 points.

Each component of PSQI was considerate without problem when the average point was between 0-1 and with problem when it was between 2-3.

Insomnia Severity Index (ISI)¹⁹ is a brief, simple and self-administered questionnaire. It consists of seven items. The first assesses the severity of insomnia symptoms (divided into three items); the others serve to measure sleep satisfaction, interferences of daytime function, sleep problems perception by others and concern level of the patient. It presents internal consistency of 0.91 and significant validity when compared to the Athens insomnia scale. Mexican Clinical Practice Guide currently recommends it for epidemiologic studies of insomnia in elderly people. The assessment of test score and its classification was 0-7 points = absence of clinical insomnia, 8-14 = subclinical or mild insomnia symptoms, 15-21 = clinical or moderate insomnia symptoms, 22-28 = severe insomnia symptoms.

In 1989, the World Health Organization (WHO) introduced the Alcohol Use Disorders Identification Test (AUDIT), as an instrument to use for first level of health care, which allows the identification of harmful alcohol consumption. It is a brief, flexible, standardized questionnaire in more than 6 countries, including Mexico²⁰, consisting of 10 items-answers with different phrases to choose with a rating from 0 to 4. The cut-off point for considering harmful alcohol consumption is eight. The sensitivity at this cut-off point is greater than 90% and its specificity greater than 80%.

Academic performance. The Medicine School periodically performs departmental and systematized evaluations called "partial" that correspond to 50% of the final grade of the course, and the other 50% is called ordinary exam (annual test). The first year of the career of Medicine is called Morphological Sciences and grades are expressed in scores from 0 to 100 points. Poor performance was considered when students had one subject not approved or average qualification of 69 points or less; a regular performance were in students with all subjects approved and average between 70 and 79 points, and good performance in students with averages of 80 points or more and all subjects approved.

Methodology

After the randomization, an appointment was made with the selected students; they were informed about objectives of the study and asked for their consent by

signing the corresponding letter. Students who agreed to participate were asked to complete the self-supporting instruments in well-lit rooms, in padded and independent chairs, with no time limit. A researcher was present for any questions. All questionnaires were answered in daylight hours from 8 to 10 am and it was ensured that students had not assessments during the previous 3 days, or on Mondays because of sleep habits associated with the weekend. Consumption of energizing or caffeine beverages was considered positive when it was at least once a week during the previous month.

The students were weighed and measured the same day they completed their questionnaires. For the determination of body mass index (BMI) was used adult calculator from Center of Disease Control and Prevention. With BMI values, the population was classified as low weight (BMI < 18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9) and obesity (BMI ≥ 30) according to WHO criteria.

Grades and number of subjects not approved were officially requested to the Morphological Sciences academic coordination.

Statistical analysis

For comparison between mean ages and grades of males and females, Student's t-test of independent samples was used. The ANOVA test was used for averages and BMI in relation to levels of insomnia symptoms. The difference-of-proportions test was used to relate academic performance to insomnia levels in men and women. Significance value $p < 0.05$.

Ethical considerations

The non-maleficence, justice, autonomy and beneficence aspects of all participants were monitored, as well as the legal precepts and ethical codes established in the General Law on Health in the Field of Health Research in Mexico.

RESULTS

Epidemiological date

The final sample included 65 men (55.08%) and 53 women (44.91%), with mean age of 19.15 ± 1.60 years in men and 18.98 ± 1.23 years in women ($p = 0.52$). 84% of the participants sleep in family home (96% of women and 78.46% of men). About their habits, 18%

Table 1. Association between demographic and clinical variables with respect to levels of insomnia symptoms and sex

Sex	Women				Men		
	Without insomnia N = 14	Insomnia			Without insomnia N = 22	Insomnia	
		Mild N = 31	Moderate N = 7	Severe N = 1		Mild N = 37	Moderate N = 6
BMI	22.5 ± 3.73	23.9 ± 3.36	25.4 ± 6.2	24.8	21.9 ± 2.51*	24.2 ± 3.39*	24.7 ± 0.95*
Sleep in family home	14 (100%)	30 (96.7%)	7 (100%)	0	22 (100%)**	16 (43%)**	4 (66%)**
Smoke	0 (0%)	8 (25.8%)	1 (14.2%)	0	5 (22.72%)	7 (18.97%)	0
Drugs intake	0	1 (3.22%)	0	0	0	0	0
Harmful alcohol consumption	1 (7.14%)	1 (3.22%)	0	0	1 (4.5%)	5 (13.51%)	1 (16.6%)
Energy beverages intake frequently	0	1 (3.22%)	0	0	0	0	0
Caffeine beverages intake	13 (92.8%)	25 (80.6%)	6 (85.7%)	0	15 (68.18%)	21 (56.75%)	5 (85.33)

The values correspond to the frequency and in parenthesis the percentage of each column. No man reported severe insomnia symptoms. * ANOVA $p < 0.001$; ** z test $p < 0.01$.

Table 2. Association between grades and insomnia symptoms levels in medical students.

Sex	Women				Men		
	Without insomnia N = 14	Insomnia			Without insomnia N = 22	Insomnia	
		Mild N = 31	Moderate N = 7	Severe N = 1		Mild N = 37	Moderate N = 6
General average	75.12 ± 11.73	69.3 ± 14.21	62.2 ± 14.03	46.5	69.81 ± 16.6	71.83 ± 11.33	73.78 ± 10.2
Poor performance	5 (35.71%)	16** (51.61%)	5* (71.42%)	1 (100%)	10 (45.45%)	17 (45.94%)	2 (33.3%)
Regular performance	5 (35.71%)	10 (32.25%)	1 (14.28%)	0	5 (22.72%)	10 (27.83%)	3 (50%)
Good performance	4 (38.57%)	5** (16.2%)	1* (14.28%)	0	7 (31.81%)	10 (27.61%)	1 (16.6%)

The values correspond to the frequency and in brackets the percentage. Proportions difference between good and poor AP in women with mild insomnia ** (z test, $p = 0.0035$) and in moderate insomnia symptoms *(z test, $p = 0.031$).

of the students report smoking, 9 women (16.98%) and 12 men (18.46%). Only one student reported using *Cannabis*. In terms of alcohol consumption, 9 (8%) complete criteria of harmful alcohol consumption, it represented 3.7% of women and 10.76% of men.

About BMI¹⁶, 4% of women had low weight, 64% normal weight, 23% overweight and 9% had obesity. Meanwhile, in men 6% had low weight, 65% normal weight, 17% overweight and 3% obesity.

Sleep quality and insomnia symptoms

94.06% (111) of students perceived poor sleep quality,

by sex 98.11% of women (52) and 90.76% of men (59). Regarding the components of PSQI, students reported having moderate or severe problems in the following areas: duration of sleep (83% in men and 88% in women) and diurnal dysfunction (48% of men and 81% of women). The students reported not having problems in the following aspects: use of sleep medication (88% in both cases) and sleep efficiency (78% of men and 68% of women). Average of night sleep hours were 5.9, 6.05 on men and 5.2 on woman. Poor sleep quality was not associated to poor academic performance ($p = 0.86$). Average score comparison between women (69.4 ± 14.2) and men (71.05 ± 13.2)

on the poor quality sleep group was not significant ($p = 0.52$).

Insomnia symptoms occurred in 69.5% of students: 73% of women and 66% of men: 58.5% of women and 56.9% of men corresponded to mild level, 24.5% of women and 9.23% of men had moderate insomnia symptoms (difference 15.27% 95% CI 0.72-30.18, χ^2_5 , $p = 0.02$) and only a woman had severe insomnia symptoms according to ISI test.

Table 1 shows the relationship between demographic variables and level of insomnia symptoms in men and women.

Regarding the BMI, the ANOVA analysis in women was not significant ($p = 0.28$) however in men the increase of BMI was related to insomnia ($F = 9.15$, $p < 0.001$). Insomnia was not present in women who didn't smoke, consume energy drinks or drugs. Most of the students frequently drank caffeine beverages and no association was found, in neither sleep quality nor insomnia. Insomnia was not in men who sleep in a family home.

Academic performance

56 students (47.45%) were considered with poor, 34 (28.81%) with regular and 28 (23.72%) with good AP. Classified by sex, 29 men (44.61%) had poor, 18 (27.68%) had regular and 18 (27.69%) good AP. 27 women (50.94%) poor, 16 (30.18%) regular and 10 (18.86%) with good AP. No significant differences between men and women.

Table 2 shows the values of average grades, insomnia symptoms level and AP in first year men and women of Yucatan University Medicine Program.

The proportions difference between good and poor AP in women with mild insomnia symptoms was significant ($p = 0.0035$), in moderate insomnia symptoms was also significant ($p = 0.031$), and the only one with severe insomnia symptoms had poor AP. There were no differences in AP of women without insomnia symptoms. The good and poor AP in men with insomnia symptoms did not show significant differences.

DISCUSSION

The poor quality of sleep and insomnia symptoms are frequent worldwide health problems, vulnerable groups are adolescents and university students. The

present study evaluated the medical freshmen in a southeast university of Mexico.

The average age of participants was 19 years with no sex differences. Age is a biological factor that reduces the time of sleep and changes the phases of sleep duration. The most of studies, that evaluate the sleep quality and insomnia on students of the health area, were performed during their clinical practice, residence or even physicians recently graduated, therefore were older than this study population^{4,21,22}. The age increases poor sleep quality prevalence. However, some studies reported that in adolescents the environmental light can increase sensitivity and produce a change in circadian cycle, so the hormone levels can be altered and finally decrease sleep quality and increase insomnia symptoms²³. During the last years of the career, hospital's work and practices increase because they are necessary to strength clinical competencies, however this condition, especially during the undergraduate rotating internship, increased stress level, fatigue, anxiety and burnout syndrome, which finally produce poor quality and sleep problems^{4,21-26}. This study included medical students without clinical practice or night work, however high prevalence's of poor sleep quality and insomnia symptoms were found, probably one limitation was not to evaluate level of anxiety, stress or depressive symptoms that are other variables associated with poor sleep quality.

The relationship between poor sleep quality and overweight or obesity has been amply demonstrated in previous researches. In this study, the prevalence of overweight was 32% of women and 30% of men, which is slightly lower of 35% and 34%, respectively, according to the National Health and Nutrition Survey of 2012 (ENSANUT)²⁷ for the same age range in the same country. BMI between women with or without insomnia symptoms did not show any significant differences; in men with insomnia, BMI was higher than the no insomnia group; other studies have shown that sleep disorders are different among men and women with obesity. This sex differential response may be associated with some kind of hormonal response to stress and behavioural to sleep deprivation^{28,29}. A recent study proposed that the percentage of body fat is the cause of the differential effect³⁰.

A study conducted in Mexican health students reported that up to 33.3% of them consumed tobacco, in this study there was 19%, with no sex differences. The prevalence of tobacco consumption in the region according to the National Survey of Addictions³¹ 2012 was 13.7% in the same age range in the same country. Smoking is probable related to lifestyles of students. All women in this study who consumed tobacco had insomnia, in men there was no relation. There is no consensus about if smoking causes insomnia or vice versa, however it is known that tobacco has stimulating effects that can alter neurosecretion and affect circadian rhythms³.

According to ENSANUT 2012,²⁷ the prevalence of alcohol consumption in population under 20 years of age was 28.8 and 21.2% in men and women respectively. In the study population, was determined harmful consumption of alcohol in 3.7% of women and 10.76% of men. At the international level, the association between alcoholism and insomnia has already been evidenced in the general population^{6,32}. In this study, the level of alcohol consumption was lesser than the Mexicans reports for the same age, may be due the diagnostic tool that was used or because only was considerate the harmful consumption level.

In North America and Europe, adolescents between 11 and 18 years, increased the consumption of energy beverages, being higher in men. The most benefits are subjective, only showing some impact on sports performance; however in great majority of consumers it has negative effects such as headaches, insomnia or hyperactivity⁸. Caffeine is the most commonly consumed psychoactive substance in the world. It is available in coffee and other foods and beverages, used to mitigate drowsiness, improve performance and other effects. Caffeine usually prolongs sleep latency, reduces total sleep time, decreases sleep efficiency and sleep quality perception. Sleep in older adults may be more sensitive to caffeine compared to young people⁷. In Yucatan, approximately 1% of medical students consume energy beverages weekly. Caffeine consumption was very frequent on the study population but the amount of caffeine consumed was not quantified and this may be the reason why there was no relation between caffeine and poor sleep quality and insomnia.

Previous studies report prevalence of poor sleep quality in about 30% of students worldwide, however is suggested that the prevalence in Latin American countries may be higher than 50% with regional differences³. Mexican psychology students reported 30% of poor sleep quality¹⁵. In this study it was found that 94.06% of medical students report poor sleep quality. The high prevalence of poor sleep may be caused by the change related to the start of university life or the type and amount of academic content of the medicine program.

This study included first-year medical students because they do not require night-time guards and thus avoid effect of sleep deprivation. In general, these students are late adolescents in whom hormonal changes associated with puberty as well as neurochemical changes associated with brain development can increase susceptibility to develop sleep disorders²³. On the other hand, the level of stress and anxiety increase by changes in social roles associated with university life.

Currently, the use of electronic devices for communication is practically indispensable. The magnitude and adherence to use of social networks is remarkable, especially in young people, so it can potentially reduce hours assigned to sleep and rest predisposing to development sleep disorders²³.

Learning strategies in each student depend on their personal conditions; many of them use night-times schedules for study and school tasks, affecting habits and quality of sleep.

Poor sleep quality and insomnia are related. However they evaluate different aspects of sleep, so their prevalence in the same population are usually different. In this study, more than 90% of students perceived poor sleep quality but only 69.49% had insomnia. Nevertheless, these values were higher than 33% of insomnia reported by Alsaggaf on medical student of Middle East country²¹. These differences could be explained by racial, environmental factors or using a specific diagnostic tool.

All the students who lived in a family home denied insomnia symptoms. 25% of men and 5% of women don't live in a family home. Is a common tradition in small cities of Mexico, like Merida, Yucatan, that students leave their family home when they marry or graduate and even some never emancipate

from family and develop a traditional large family. In this context, university students who come from other states have to live out of their family home, which implies a stress caused by new responsibilities that could affect sleep. In support of this, a study of adolescents in China demonstrated that attending a school far from home is associated with insomnia³³.

To evaluate school performance, we used the average of the assessments and approved subjects as the studies of Lombardo et al.¹⁴ and Veldi et al.²⁶ No difference on academic performance between men and women was found. In women, but not in men, insomnia was associated with poor academic performance. Insomnia probably allowed responses for better adaptation in men than women. In other hand, the present study did not evaluate memory skills, it was assumed by their implication since the contents that evaluate the exams of the first year of medicine career are mainly theoretical concepts. There is evidence that memory is affected differently between men and women exposed to stress, and insomnia represents a stressor⁴.

Other factor that explain differences of sex, is the effect of sexual hormones, especially oestrogen, which has been linked to certain neural and physiological characteristics associated with better cognitive competence^{34,35}, therefore the present results are controversial, because women with insomnia had poor AP compared to men. The high prevalence of insomnia and poor quality of sleep demonstrate the importance of design strategies that improve quality sleep and reduce insomnia as a mechanism to increase the life quality of medical students, reducing the risk of poor AP and improve scholar indicators.

CONCLUSIONS

Great majority of first year medical students on southeast Mexico perceived poor sleep quality and insomnia symptoms.

Almost 50% of the students evaluated showed poor academic performance (three months after entering university), which represents a risk of dropping out of school.

Students with and without sleep quality did not show academic performance differences.

Living outside of a family home and body mass index were related with insomnia symptoms in men,

but not in women. Insomnia symptoms were absent in women whom not consumed tobacco, drugs and energy beverages.

Women with poor academic performance had higher prevalence of insomnia symptoms

INDIVIDUAL CONTRIBUTION

- HARZ: Professor of UADY Medical School for 17 years, specializes in cellular and molecular neurobiology, whose line of research are chronic diseases and their impact on public health. He was the general director of the project.
- DFEC: Professor of Medical School for 20 years, she is psychologist and has a doctorate in anthropological studies, belongs to the National System of Researchers. She was an assessor for the manuscript and statistical analyses.
- POP: Physician recently graduated, who during the last two years has been working on chronic disease laboratory at UADY Medicine School. She is planning to continue her career on the paediatric field. She developed a field work, apply all the test and realize the data bases.

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PREVIOUS PRESENTATIONS

Part of the results of this work, have been approved to be presented as a poster at the International Psychology Conference to be held in Amsterdam in July 2017

FINANCING

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CONFLICT OF INTERESTS

No conflicts of interests were expressed by the authors. 🔍

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