



## HEALTH SCIENCES

# Structural Model of Suicidal Ideation and Behavior: Mediating Effect of Impulsivity

OLBER EDUARDO ARANGO-TOBÓN, ANYERSON STITHS GÓMEZ TABARES & SILVIA JULIANA OREJARENA SERRANO

**Abstract:** The present study aimed to establish the associations between hopelessness, depression and impulsivity with respect to suicidal ideation and behavior, and to explore the role that impulsivity plays in the mechanism that operates between depression and hopelessness. Through an empirical observational study, with an analytical scope based on a cross-sectional design for a sample of 228 university students and using The Inventory of Suicide Orientation (ISO-30); Beck Depression Inventory (BDI); Beck Hopelessness Scale (BHS); and Barratt Impulsiveness Scale (BIS-11). The results indicated a significant positive correlations between BDI, BHS, BIS and ISO-30. Regression analysis showed that depression, impulsivity and hopelessness explain between 57% and 67% of the variance in the risk of suicidal ideation and behavior. Through the analysis of structural equation modeling, three models were established showing that impulsivity mediates the relationship between depressive symptomatology and suicidal ideation and behavior. This study has implications for mental health intervention and research, in that it emphasizes the importance of impulsivity traits as factors that act as triggers in the association between the presence of depressive symptoms and suicidal behavior.

**Key words:** depression, hopelessness, impulsivity, suicidal ideation and behavior.

## INTRODUCTION

The World Health Organization's World Statistics Report (WHO 2019) reported that in 2016, there were about 800,000 suicide deaths worldwide, equivalent to a mortality rate of 10.6 people per 100,000. The proportion of suicide deaths among men and women between 15 and 44 years of age has been estimated at 13.5 and 7.7, respectively. In Latin America and the Caribbean, the information reported shows lower indicators compared to the rest of the world. In Colombia, this proportion is 11.6 and 2.8, respectively, indicating that suicide mortality in men is almost four times higher than in women.

The goal of the WHO by 2030 is to reduce the suicide mortality rate by one third through

prevention, treatment, promotion of mental health and physical and psychological well-being. Success in achieving that goal depends to a large extent on our knowledge of the different suicide risk factors, their interaction and the nature of the relationships between its predictors.

Currently, there is a considerable body of evidence, which has identified risk factors and causes for suicidal ideation and behavior. In their meta-analysis, Franklin et al. (2017) found that the five main categories for suicidal ideation in terms of the weighted magnitude of risk are, first, the prior ideation of suicide, hopelessness, diagnosis of depression, history of abuse of any kind, and, finally, the diagnosis of anxiety. Erbuto et al. (2018), propose that in addition to the

previous constructs, attention should be paid to psychological pain, mentalization processes (ability to reflect and understand one's mood) and dissociative symptoms as possible mediators of the association between affective temperaments (cyclothymic, depressive, hyperthymic, irritable, and possibly anxious temperament subtypes) and suicidal risk.

While efforts have been made in recent years to determine more accurately these correlates and predictors, there are still theoretical and empirical gaps regarding the mechanisms operating between these components.

One of these gaps concerns the role that impulsivity plays in suicidal ideation and behavior. Impulsivity has been identified as a predisposing mechanism and one of the main categories of suicide risk along with psychological distress (Joiner et al. 2005, Klonsky & May 2010). However, the role it plays in interacting with other risk factors such as hopelessness and depression is still unclear.

Impulsivity is understood as a multidimensional construct made up of different components. Impulsivity has been suggested to include four factors (Whiteside et al. 2005). The first component has been called the sensation seeking, which implies the tendency to perform exciting and stimulating activities; the second has been called urgency, which has been described as the tendency to yield to strong impulses that are accompanied by positive or negative affective reactions; the third, called lack of perseverance, implies an individual's tendency to surrender to boredom, fatigue or frustration, and the fourth component is lack of premeditation, which is related to the tendency to act without considering the possible consequences of behavior (Griffin et al. 2018, Klonsky & May 2010). Several studies have found that these components are significantly associated with risk behaviors and

are considered to be strong predictors of clinical symptoms in various forms of psychopathology (Berg et al. 2015, Cyders & Smith 2008, Smith et al. 2006). In particular, some studies have found high correlations between urgency for negative affective reactions and lack of premeditation on suicidal behavior. In this regard, Lynam et al. (2011) proposed that suicidal behavior is associated with the failure to resist impulses related to risky suicidal behavior and the lack of premeditation on the consequences of such acts when the individual experiences negative affectivity.

Neufeld & O'Rourke (2009) suggest that impulsivity is one of the most significant risk factors for suicide, particularly in individuals with depressive symptomatology and hopelessness. While impulsivity in suicidal ideation and behavior has been sufficiently studied, there is still a debate today about whether the individual who commits suicide does so with little planning or, on the other hand, this behavior is best explained by a series of painful and distressing situations that ultimately enable their ability to commit the suicidal act. In this regard, Anestis et al. (2014) have suggested that the role played by impulsivity traits is not as direct in suicidal behavior as considered in the past three decades, and argue that impulsivity traits should be more understood as distal risk factors that modulate the effect of precipitating events or experiences that would increase the individual's ability to commit suicide.

Hopelessness has recently been reported to be a significant predictor of both depression and suicidal ideation (Horwitz et al. 2017, Mccullumsmith et al. 2014, Wolfe et al. 2019). However, hopelessness has been associated more with suicidal ideation, and impulsivity with suicidal behavior and death. Mccullumsmith et al. (2014) propose that depression mediated by hopelessness leads to suicidal ideation and that

this in turn increases the likelihood of suicide attempts associated with impulsivity and loss of coping skills. While this model succeeds in establishing the transition from ideation to suicide attempt, it does not sufficiently explain the connections between hopelessness and impulsivity.

In this context of evidence, the purpose of this study was, first, to establish the associations between hopelessness, depression and impulsivity with respect to suicidal ideation and behavior, and second, to explore the role played by impulsivity in the mechanism that operates between depressive symptomatology and hopelessness. Accordingly, we hypothesize first, that depression, hopelessness, and impulsivity show positive correlations with suicidal ideation and behavior, and second, impulsivity has a significant mediating effect between depression, hopelessness, and predicting suicidal ideation and behavior.

## MATERIALS AND METHODS

### Participants

This study has an empirical-observational approach, with an analytical scope based on a cross-sectional design. The population was made up of 1,200 college students, between the ages of 18 and 29, from the University of Manizales (Colombia). The sample was selected by means of a non-probabilistic sampling and in an intentional way, having as selection criteria, first those students who agreed to participate in the study and answered the questionnaires in their entirety. And second, considering that the highest rate of suicide attempts and deaths in the city of Manizales, Colombia and in the world is reported in young people between 18 and 29 years of age with changes over time where suicides tend to be found in people still

younger (Delgado et al. 2017, INMLCF 2019, WHO 2019, Sánchez et al. 2002).

Informed consent and measurement instruments were included in a Google Form document. The link was emailed to the 1,200 college students ages 18-29, of whom 228 completed the survey in its entirety. The mean age of the sample was 21.25 years ( $SD=2.9$ ). In terms of gender distribution, 70.60% ( $n=161$ ) were women and 29.40% were men ( $n=67$ ) and according to academic programs, the distribution found was as follows: Business Administration ( $n=22$ ; 9.6%), Social Communication and Journalism ( $n=8$ ; 3.5%), Public Accounting ( $n=32$ ; 14%), Law ( $n=35$ ; 15.4%), Systems Engineering and Telecommunications ( $n=26$ ; 11.4%), Medicine ( $n=44$ ; 19.3%), Marketing ( $n=18$ ; 7.9%) and Psychology ( $n=43$ ; 18.9%). 57.9% were day school and 42.1% night school students. At the time of the survey, 67.1% reported no partner, 26.8% reported being in a relationship, 3.5% were living with their partner, and 2.6% were married. 14.9% of the population reported that they had attempted suicide at least once in life, of which 2.1% ( $n=5$ ) attempted suicide it in the last year.

Participation was voluntary and there was no reward of any kind. The study and the fieldwork protocol complied with the ethical guidelines for research in psychology. All participants gave their informed consent before completing the survey. Likewise, it had the approval of the ethics committee of the Luis Amigó Catholic University (Colombia) and the approval of the University of Manizales (Colombia) for the application of the instruments.

### Instruments

***Inventory of Suicide Orientation (ISO-30)*** (King & Kowalchuk 1994, Osman et al. 2005). This instrument is a 30-item Likert scale that assesses the presence of risk factors associated with suicidal ideation and behavior. It contains

five dimensions associated with suicide: hopelessness, low self-esteem, inability to cope with emotions, social isolation and suicidal ideation. The total score estimates the person's suicide orientation at three levels: Low risk (< 30), moderate risk  $\geq 30$ ) and high risk  $\geq 45$ ). The version adapted and validated in Spanish by Fernández & Casullo (2006) was used, reporting a Cronbach alpha reliability index of .89.

**Beck Depression Inventory** (BDI Beck et al. 1979). This instrument evaluates the severity of depression symptoms in various population groups. It consists of 21 items that identify cognitive and somatic aspects associated with the clinical profile (Schotte et al. 1997). Each item is answered on a scale of 0 to 3. Scores range from 0 to 63. It has been validated in Spanish by Sanz et al. (2014), showing adequate sensitivity and specificity (>.70) to discriminate depressive symptomatology, using the cut-off points of the original version. For Colombia, the inventory has been used in various studies with a university population, proving it to be an instrument with good indicators of reliability (Amézquita et al. 2003, Gómez et al. 2019, 2020). Cronbach's alpha of the BDI in this work was .92.

**Beck Hopelessness Scale** (BHS Beck et al. 1974). This instrument is designed to assess beliefs related to hopelessness, pessimism, motivation toward life and expectations for the future. It consists of 20 dichotomous statements, with the options of true and false and a score of 0 to 1. The total score ranges from 0 to 20. The total score provides an estimate of the level of hopelessness. Colombian validation with a clinical (Rueda-Jaimes et al. 2018) and non-clinical (González-Cifuentes 2009) population at risk of suicide reported adequate reliability and concurrent and predictive validity. For this study, a reliability analysis was performed with Cronbach's alpha (version equivalent to

Kuder-Richardson's coefficient of 20), showing a coefficient of .89.

**Barratt Impulsivity Scale, v.11** (BIS-11 Patton et al. 1995). This is a Likert self-report scale consisting of 30 items and has 4 possible responses (rarely or never, occasionally, often, and always or almost always). It is used to evaluate global impulsivity and three dimensions: cognitive, motor and unplanned impulsivity. The systematic review of the scale by Stanford et al. (2009) reported that the most commonly used cutoff point in psychological studies is 74 for global impulsivity. The BIS-11 Cronbach alpha in this paper was .79 for the global scale.

### Statistical Analysis

The results of scaling were digitized and encoded in an Excel data matrix. SPSS v.25 (IBM Corporation 2017a) was used for statistical analysis. Initially, a sociodemographic description of the sample was performed, followed by a reliability analysis of the instruments. A univariate descriptive analysis of the suicidal risk factor, levels of indicators of depression, impulsivity and hopelessness was performed according to the instruments. The data was checked for normality using the Kolmogorov-Smirnov test, which showed that the variables did not follow a normal distribution ( $p > .05$ ), which is why the non-parametric Kruskal-Wallis H test and Mann-Whitney U test were used for the comparative analyses. R Studio Cloud was used to calculate the size of the effect of the differences found in the comparative analysis, which was estimated using the eta squared statistic ( $\eta^2$ ). The procedure and interpretation established by Fritz et al. (2012) was followed. A correlation analysis was then performed using Spearman's Rho coefficient, and a multi-core logistic regression model was estimated using the suicidal risk factor as a dependent variable.

Finally, two structural equation models are proposed to determine the direct and indirect effect between the variables considered in this study. Amos v. 24.0 (IBM Corporation 2017b) was used for modeling structural equations. Standardized total, direct, and indirect effects were calculated using the Bootstrap method with a 95% confidence interval (Byrne 2016, Hayes 2018). To evaluate the goodness-of-fit of the models, we used the chi-square values ( $\chi^2$ ), the probability level ( $p \geq .05$ ), comparative fit indices ( $IFI \geq .90$  and  $CFI \geq .90$ ), goodness-of-fit index ( $GFI \geq .90$ ) and its corresponding adjusted goodness of fit index ( $AGFI \geq .90$ ), the normalized fit index ( $NFI \geq .90$ ) and Tucker-Lewis index ( $TLI \geq .90$ ) and the root mean square error of approximation ( $RMSA \leq .08$ ) (Byrne 2016, McArdle & Nesselroade 2014).

## RESULTS

The risk factor for suicidal ideation and behavior identified shows that, of the 228 university students, 19.3% had indicators of moderate

risk and 18.4% had indicators of high risk of suicide. In relation to the other variables, a symptomatic indicator of severe depression of 6.6% ( $n = 15$ ), moderate depression of 18.4% ( $n = 42$ ) and mild depression of 14.9% ( $n = 34$ ) was identified. The remaining 60.1% ( $n = 137$ ) reported no symptomatic indicators for depression. Regarding the level of hopelessness, it was found that 81 students, 35.5%, reported an indicator of hopelessness, broken down into mild ( $n = 51$ ; 22.4%), moderate ( $n = 21$ ; 9.2%), and severe ( $n = 9$ ; 3.9%) hopelessness. Finally, a global impulsivity factor of 9.2% was identified ( $n = 21$ ).

Table I shows the comparison between suicide risk levels and the psychological variables studied. It was identified that higher scores in hopelessness, impulsivity and depression increase the risk of suicidal ideation and behavior. The differences are statistically significant ( $p < .001$ ), with a high effect size. The calculation of the effect size, using the eta squared statistic ( $\eta^2$ ), shows that the statistical differences found are independent of the effect size, with values above .039 (Fritz et al. 2012).

**Table I. Differences between students based on the risk of suicidal ideation and behavior and the variables of hopelessness, impulsivity, and depression.**

Suicidal ideation and behavior ISO-30		N	AR	Me	M	SD	H (df)	p	$\eta^2$
Hopelessness	Low Risk	142	79.90	1	1.70	1.78	109.19(2)	.000	.476
	Moderate Risk	44	158.42	4	5.36	3.32			
	High Risk	42	185.45	9	9.38	5.79			
Impulsivity	Low Risk	142	90.89	46	47.08	12.94	53.27(2)	.000	.228
	Moderate Risk	44	137.90	58	57.80	13.46			
	High Risk	42	169.80	69	66.57	14.50			
Depression	Low Risk	142	81.73	5	5.58	4.68	101.22(2)	.000	.441
	Moderate Risk	44	148.98	15	14.11	7.52			
	High Risk	42	189.19	23	24.45	10.71			

**Note:** N=Number of cases; AR=Average range; Me=Median; M=Mean; SD=Standard deviation; H=Kruskal Wallis U test statistic; df=degrees of freedom;  $\eta^2$ =eta squared statistic to estimate effect size; p= statistical significance value.

Table II shows the results of the correlational analysis of the various study variables. Statistically significant positive correlations ( $p < .001$ ) were shown between ideation and suicidal behavior (ISO-30), hopelessness (BHS), global impulsivity (BIS-11) and depression (BDI).

In table III, the multinomial logistic regression model is presented using the forward stepwise method. The effect of the independent variables of depression, impulsivity and hopelessness on moderate and high risk of suicidal ideation and behavior was analyzed. The low risk factor was taken as the reference category. The model shows that independent variables explain the variance of the risk of suicidal ideation and behavior between 57% ( $R^2$  Cox & Snell=0.568) and 67% ( $R^2$  Nagelkerke=0.674).

In relation to the moderate risk factor, clinical indicators of depression ( $OR=1.147$ ;  $CI$  95%=1.064–1.136), impulsivity ( $OR=1.034$ ;  $CI$  95%=1.00–1.068) and hopelessness ( $OR=1.517$ ;  $CI$  95%=1.234–1.865) were identified as increasing the probability of suicidal ideation and behavior. In the case of young people who presented high-risk indicators on the ISO-30 scale, it was shown that depression increased the risk probability of suicidal ideation and behavior by 1.3% ( $OR=1.262$ ; 95%  $CI$  = 1.150–1.365), impulsivity by 1.1% ( $OR=1.068$ ;  $CI$  95%= 1.021–1.117) and hopelessness by 1.7% ( $OR=1.670$ ;  $CI$  95%= 1.329–2.098).

To establish the standardized total, direct and indirect effect that independent variables have on suicidal ideation and behavior, three

structural equation models were estimated through the weighted least-squares method, since this allows working with variables that do not meet the univariate and unbiased assumption of normality with relatively small sample sizes (Byrne 2016). In the first model, the direct effect of the dependent variables on suicidal ideation and behavior was estimated, but it did not yield good indicators of goodness of fit, so the model was specified. In models 2 and 3, impulsivity was used as a mediating variable between depression and suicidal ideation and behavior. Both models yielded good indicators of goodness-of-fit (McArdle & Nesselroade 2014) (See Table IV).

Figure 1 shows that the depression variable explains 27% ( $R^2=0.268$ ;  $CI$  95%=0.162–0.382;  $p=.001$ ) of the variation in impulsivity. Likewise, all the independent variables of the model explain 72% ( $R^2=0.715$ ;  $CI$  95%=0.640–0.783;  $p=.001$ ) of the variation in suicidal ideation and behavior in university students. It was found that impulsivity is a variable that mediates depression in the prediction of suicidal ideation and behavior, whose indirect effects are statistically significant ( $p < .001$ ).

Table V shows the standardized total, direct and indirect effects of the study variables. All effects are statistically significant ( $p < .001$ ). Depression (0.555) had the largest total effect on suicidal ideation and behavior. Depression had a significant total effect on impulsivity, the latter being a mediating variable between

**Table II. Spearman’s correlation coefficient (Rho).**

Correlations	M	SD	1	2	3	4
ISO-30	26.80	17.05	---			
BHS	3.82	4.37	.730***	---		
BIS-11	52.74	15.38	.547***	.452***	---	
BDI	10.71	9.93	.758***	.640***	.483***	---

Note: \*\*\*  $p < .001$ .

depression and suicidal ideation and behavior, whose indirect effects are significant ( $p < .001$ ).

In order to verify the effect of depressive symptoms on impulsivity, suicidal ideation and behavior, an additional model was proposed in which the depression variable was segmented into two groups, asymptomatic ( $n=137$ ; 60.1%) and symptomatic ( $n=91$ ; 39.9%). The latter group was obtained by grouping the levels of mild, moderate and severe depression symptoms into a single variable. Figure 2 shows a second model of the group of students with depressive symptomatology. In general terms, the effect of psychological variables on suicidal ideation and behavior was corroborated in the group of individuals with symptoms of depression. In particular, a greater effect of depression on the variation of impulsivity in men than in women was highlighted. All effects are statistically significant ( $p < .01$ ).

Finally, when replicating the proposed model with the group of students without symptoms of depression, the indicators of goodness and fit and the estimates of psychological variables on suicidal ideation and behavior were not

satisfactory, which corroborates the findings of model 2.

## DISCUSSION

Current evidence shows a considerable number of risk factors for suicidal ideation and behavior. However, there is still controversy over the mechanisms that operate between these factors that determine the suicidal act. Suicide must be approached from a perspective that not only involves the association of different correlates and the identification of risk factors, but also focuses on clarifying the underlying mechanisms that operate between various predictors, their interactions and finally their causal elements.

Due to the multiple limitations reported by studies on predictors and risk factors for suicide, there is not yet an established paradigm that can provide a complete overview of how to prevent, intervene, and predict future suicides. The main objective of this study was to establish the relationships between hopelessness, depression and impulsivity with respect to suicidal ideation and behavior, and

**Table III. Multinomial logistic regression analysis.**

Suicidal ideation and behavior ISO-30		$\beta$	SE	$\chi^2$ Wald	df	p	OR	95% CI OR	
								Lower Limit	Upper limit
Moderate Risk	Intersection	-5.439	1.003	29.389	1	.000			
	Hopelessness	0.417	0.105	15.655	1	.000	1.517	1.234	1.865
	Impulsivity	0.033	0.017	3.825	1	.050	1.034	1.000	1.068
	Depression	0.137	0.038	12.792	1	.000	1.147	1.064	1.236
High Risk	Intersection	-9.975	1.570	40.364	1	.000			
	Hopelessness	0.513	0.116	19.422	1	.000	1.670	1.329	2.098
	Impulsivity	0.066	0.023	8.312	1	.004	1.068	1.021	1.117
	Depression	0.233	0.047	24.166	1	.000	1.262	1.150	1.385

**Note:**  $\beta$  = beta coefficient; SE = standard error; Wald = power of contrast statistic; df= degrees of freedom; p = statistical significance value; OR. = Odds Ratio or result of the regression equation. ( $\beta$ ).

to explore the role that impulsivity plays in the mechanism operating between depression and hopelessness.

According to the first hypothesis, regarding the relationships between depression, hopelessness and impulsivity, our results support the evidence that these three factors increase the risk of suicidal ideation and behavior. In addition, it was found that depressive symptoms, followed by hopelessness and finally impulsivity represent strong positive correlates and explain a high variance (67%) of the risk of suicidal ideation and behavior. The analyses of this study indicate that hopelessness and depression are two clinical correlates that explain the increased risk of suicide in participants.

In this regard, Wolfe et al. (2019) examined hopelessness as a predictor of suicidal ideation in a sample of 158 young people, following pharmacological treatment for depression. Their results indicated the existence of positive relationships between hopelessness and suicidal ideation, regardless of changes in the severity of depressive symptomatology. This is consistent with our findings and seems to suggest a dynamic of independence between levels of hopelessness and depressive symptomatology which have a direct effect on suicidal ideation and behavior (Horwitz et al. 2017). Erbuto et al. (2018) point out that hopelessness plays a crucial role in mediating between affective temperaments and suicidal risk. Patients with a hyperthymic temperament consistently demonstrate less depression and hopelessness than those with bipolar or dysthymic symptoms.

Evidence from cognitive theories of suicide reinforces this idea (Smith 2006, Wenzel & Beck 2008) and has pointed to strong links of cognitive risk factors, such as hopelessness, ruminative thinking, information processing biases, and low self-efficacy in predicting suicidal ideation and tendencies, which seems to make sense within the context of our results. Our multinomial regression model indicated that hopelessness represents a greater risk of suicidal ideation and behavior than the risk found by depressive symptomatology or impulsivity. Therefore, hopelessness could be understood as a proximal cognitive risk factor capable of directly generating suicidal ideation and behavior without any mediation of depressive symptoms or impulsivity (Ballard et al. 2015, Burke et al. 2016, Kuo et al. 2004).

However, there is conflicting evidence regarding the role of hopelessness in the risk of suicidal ideation and behavior. Wang et al. (2015) found that hopelessness, depression, and impulsivity contribute significantly to the development of suicidal thoughts, but such contribution depends on how these factors interact with each other. In their study, they examined the three factors together to explore the mechanism of effects on suicidal ideation in a clinical sample of patients with major depressive disorder, and found that hopelessness, mediated by the severity of depression, has an indirect effect on suicidal ideation.

In this regard, the patients with high levels of hopelessness mediated by depressive

**Table IV. Goodness-of-fit statistics of structural models predicting suicide risk and attempt.**

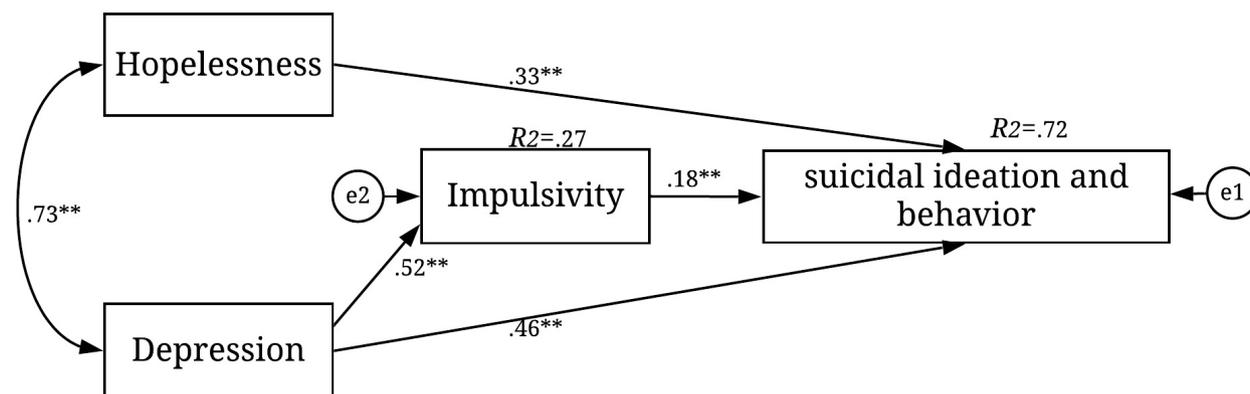
<i>Model</i>	$\chi^2$	<i>df</i>	<i>p</i>	<i>IFI</i>	<i>CFI</i>	<i>NFI</i>	<i>TLI</i>	<i>GFI</i>	<i>AGFI</i>	<i>RMSEA</i>
<b>1</b>	31.432	1	0.000	0.701	0.686	0.694	-0.886	0.931	0.308	0.366
<b>2</b>	0.332	1	0.564	1.007	1.0	0.997	1.041	0.999	0.993	0.000
<b>3</b>	0.409	1	0.522	1.005	1.0	0.999	1.101	0.998	0.977	0.000

symptoms reported more suicidal thoughts. On the contrary, those participants who had only high levels of hopelessness, without the mediation of depressive symptomatology, did not report suicidal ideations. Wang et al. (2015) concluded that hopelessness is not a direct cause of suicidal ideation and behavior and only takes hold when mediated by depression. Our results indicate the existence of correlations between hopelessness and depression. However, we also found independence between both constructs with respect to the prediction of suicidal ideation and behavior. In other words, both factors have a direct effect independent of each other.

In accordance with the foregoing, and considering our second hypothesis, which indicates that impulsivity has a mediating role in both depression and hopelessness and that such mediation increases its effect on suicidal ideation and behavior, our results provide evidence that partially proves this assumption; since we found that depression, hopelessness and impulsivity show direct effects on suicidal ideation and behavior, while impulsivity acts as a mediator of depressive symptoms, whose indirect effects are significant in the prediction of suicidal ideation and behavior.

In this regard, previous studies have warned that impulsivity is a risk factor that enables the transition from ideation to suicide attempt (Auerbach et al. 2017). Impulsivity responses have also been found to increase with the number of suicide attempts, especially among young people (Bagge et al. 2013, Kasen et al. 2011). Klonsky & May's (2010) study of three population groups, consisting of 2,011 military personnel, 1,296 college students, and 399 high school students found that high urgency, understood as the tendency to act impulsively in the face of negative emotions, is a common trait in people who have both suicidal ideation and a history of attempted suicide. A similar study with adolescents in school showed that emotional factors that shape negative cognitions about oneself and the future were more associated with suicidal ideation, while impulsive behavioral reactivity to those emotions was uniquely associated with suicide attempt (Auerbach et al. 2017).

These findings indicate that impulsivity is associated with the broad spectrum of suicidal behavior, with distinctions of traits for suicidal ideation and attempt. However, the associations between clinical factors and suicidal behavior in these studies have been addressed under hypotheses of direct causal relationships,



**Figure 1. Mediation of impulsivity on the symptoms of depression.**  
**\*\*p<.001**

avoiding more complex patterns of association involving impulsivity as a mediating mechanism in the association between mood factors and suicidal ideation and behavior. In our study, we found that impulsivity is a factor that mediates between the presentation of depressive symptomatology and suicidal ideation and behavior, whose indirect effect did not occur with hopelessness. Current evidence has shown that traits of impulsivity alone are not as strong or sufficient predictors of future suicide and it is suggested that it is the result of the ability to commit suicide that involves aspects of impulsivity (Hadzic et al. 2019, Sun et al. 2020).

On the other hand, other cross-sectional and longitudinal studies have pointed out that impulsivity is a strong marker of risk for suicide, particularly for suicidal ideation and attempts. Wang et al. (2015) reported that impulsivity moderates the severity of depression in the relationship between hopelessness and suicidal ideation. They found that patients with greater impulsivity were more likely to develop suicidal ideation even if they had high or low levels of depression. This evidence is consistent with

our second hypothesis and reinforces the idea of the close interaction between depression and impulsivity and the effect of the latter on suicidal ideation and behavior. Furthermore, from the interpersonal psychological theory of suicidal behavior (Joiner 2005, Jordan et al. 2018, Van Orden et al. 2010), impulsivity is a factor intricately linked to an individual’s ability to commit suicide. Impulsivity as a personality trait may have an indirect effect on the continuity or fluctuations of suicidal ideation, which, along with other factors, including hopelessness, the presence of depressive symptoms, and exposure to painful events and high psychosocial stress, may together increase the individual’s ability to commit suicide, especially during youth (Hadzic et al. 2019).

In this regard, the findings revealed that impulsivity also acts as a trigger that can be a determinant for the suicidal act in those young people with depressive symptomatology, in which case, the mediating role of impulsivity has greater heuristic value and explanatory potential (Gómez 2020, Gómez et al. 2019).

**Table V. Standardized total, direct and indirect effects of predictor variables on response variables.**

Variables		<i>Impulsivity-BIS-11</i>			<i>Suicidal ideation and behavior - ISO-30</i>		
		<i>Effects</i>	<i>CI 95%</i>		<i>Effects</i>	<i>CI 95%</i>	
			<b>Lower</b>	<b>Upper</b>		<b>Lower</b>	<b>Upper</b>
Depression	Total	0.518**	0.403	0.618	0.555**	0.454	0.664
	Direct	0.518**	0.403	0.618	0.460**	0.347	0.574
	Indirect	---	---	---	0.095**	0.051	0.142
Hopelessness	Total	---	---	---	0.333**	0.207	0.441
	Direct	---	---	---	0.333**	0.207	0.441
	Indirect	---	---	---	---	---	---
Impulsivity	Total	---	---	---	0.184**	0.10	0.262
	Direct	---	---	---	0.184**	0.10	0.262
	Indirect	---	---	---	---	---	---

\*\*p<.001.

The results of our study may guide future research that will make it possible to deepen the understanding of the correlates of suicidal ideation and behavior, in order to identify the explanatory nature of the relationships and interactions between hopelessness, depression, and impulsivity. Given the limited evidence of the role of impulsivity in suicidal ideation and the widespread use of self-reported questionnaires, we suggest that further studies involve methodologies that assess not only impulsivity as a personality construct (impulsivity traits), but that observations also be carried out from a neuropsychological perspective involving executive functions such as inhibitory control, cognitive flexibility, and emotional regulation.

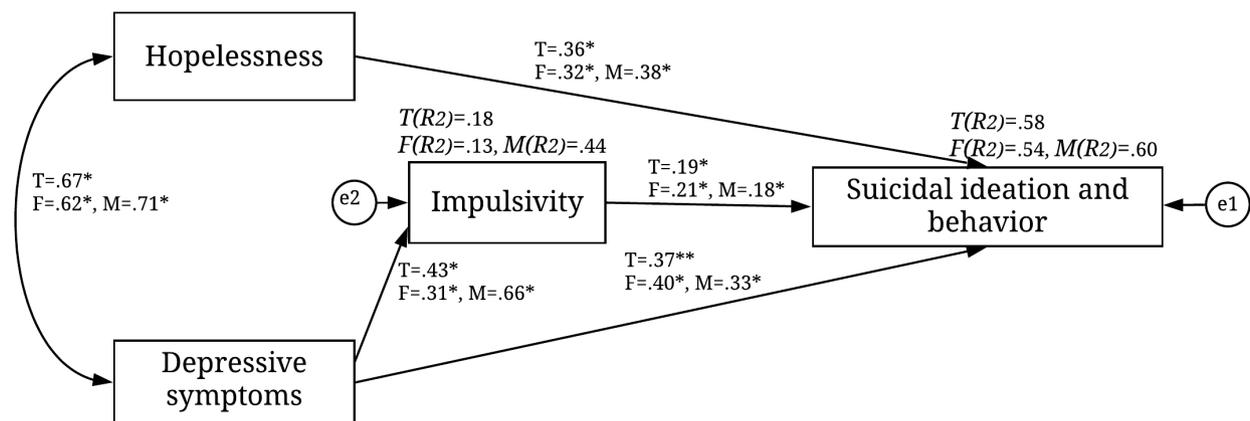
**Limitations**

It is important to mention the limitations of this study. First, we do not know if the participants at the time of answering the questionnaires had recent events that could be related to clinical symptoms related to anxiety disorders or the presence of bipolar symptoms. These comorbidities and especially bipolar disorders, are strong risk factors that increase the probability of suicidal ideation and behavior and could have an effect on the responses to

the questionnaires and thus affect in general the correlations found and in particular the direct effects or indirect of the variables of interest. Second, being based on a cross-sectional design and a small non-clinical sample, our results cannot be generalized to a general community, or to samples with a diagnosis of depression. Third, retrospective information on the trajectories of suicidal ideation and behavior in the sample was not taken into account, and therefore, the identification of risk factors and possible predictors are based on statistical correlates, but lack longitudinal evidence. Finally, all the questionnaires used were obtained by self-report, so they are not exempt from biases that lead to interpretations and results with a certain probability of error. Therefore, the results of the present study should be read taking into account the above.

**CONCLUSIONS**

This study provides supplementary evidence on the association of depression, hopelessness and impulsivity with suicidal ideation and behavior. It also constitutes an important contribution to existing literature with implications for the



**Figure 2.** Mediation of impulsivity by gender on the symptoms of depression \**p*<.01; \*\**p*<.001. Note: T=Total sample; F=Female; M=Male.

understanding and intervention of patients with mental pathologies associated with suicidal risk. Specifically, it highlights the importance of evaluating impulsivity traits as factors that act as triggers in the association between the presence of depressive symptoms and the risk of suicide in young people.

According to the results of the present study, it is important that suicide risk prevention programs consider the direct effect and interaction that depressive symptoms and hopelessness have on suicidal ideation and behavior. Therefore, it is necessary to implement programs that include cognitive behavioral assessments in which not only depressive symptoms are identified, but also cognitive perception processes related to hopelessness and personality dimensions with impulsivity are established. The foregoing establishes an evaluation process that can generate clinical alerts and plan interventions early to reduce the probability that potentially suicidal ideations and behavior will be generated.

### Author contributions

OEA contributed to the conceiving of the original idea, conduct drafted, critically reviewed, and approved the manuscript for publication. ASG contributed to the conceiving of the original idea, to collected and analyzed the data. SJO critically revised the manuscript approved the manuscript for publication. All the authors read and approved the final manuscript for publication.

### REFERENCES

- AMÉZQUITA M, GONZÁLEZ R & ZULUAGA D. 2003. Prevalencia de la depresión, ansiedad y comportamiento suicida en la población estudiantil de pregrado de la Universidad de Caldas, año 2000. *Rev Colomb Psiquiatr* 32(4): 341-356. <http://www.redalyc.org/pdf/806/80632404.pdf>.
- ANESTIS MD, SOBERAY KA, GUTIERREZ PM, HERNÁNDEZ TD & JOINER TE. 2014. Reconsidering the Link Between Impulsivity and Suicidal Behavior. *Pers Soc Psychol Rev* 18(4): 366-386. <https://doi.org/10.1177/1088868314535988>.
- AUERBACH RP, STEWART JG & JOHNSON SL. 2017. Impulsivity and Suicidality in Adolescent Inpatients. *J Abnorm Child Psychol* 45(1): 91-103. <https://doi.org/10.1007/s10802-016-0146-8>.
- BAGGE CL, LEE HJ, SCHUMACHER JA, GRATZ KL, KRULL JL & HOLLOWMAN G JR. 2013. Alcohol as an acute risk factor for recent suicide attempts: a case-crossover analysis. *J Stud Alcohol Drugs* 74(4): 552-558. <https://doi.org/10.15288/jsad.2013.74.552>.
- BALLARD ED, PATEL AB, WARD M & LAMIS DA. 2015. Future disposition and suicidal ideation: Mediation by depressive symptom clusters. *J Affect Disord* 170: 1-6. <https://doi.org/10.1016/j.jad.2014.08.029>.
- BECK AT, WEISSMAN A, LESTER D & TREXLER L. 1974. The measurement of pessimism: The Hopelessness Scale. *J Consult Clin Psychol* 42(6): 861-865. <https://doi.org/10.1037/h0037562>.
- BECK AT, RUSH AJ, SHAW BF & EMERY G. 1979. *Cognitive therapy of depression*. New York: Guilford Press.
- BERG JM, LATZMAN RD, BLIWISE NG & LILIENTHAL SO. 2015. Parsing the heterogeneity of impulsivity: A meta-analytic review of the behavioral implications of the UPPS for psychopathology. *Psychol Assess* 27: 1129-1146. <http://dx.doi.org/10.1037/pas0000111>.
- BURKE TA, CONNOLLY SL, HAMILTON JL, STANGE JP, ABRAMSON LY & ALLOY LB. 2016. Cognitive Risk and Protective Factors for Suicidal Ideation: A Two Year Longitudinal Study in Adolescence. *J Abnorm Child Psychol* 44(6): 1145-1160. <https://doi.org/10.1007/s10802-015-0104-x>.
- BYRNE B. 2016. *Structural equation modeling with Amos, 3<sup>rd</sup> ed.*, Routledge.
- CYDERS MA & SMITH GT. 2008. Clarifying the role of personality dispositions in risk for increased gambling behavior. *Pers Individ* 45: 503-508. <http://dx.doi.org/10.1016/j.jpaid.2008.06.002>.
- DELGADO LP ET AL. 2017. *Política Pública de Salud Mental del departamento de Caldas: Un aporte al bienestar y a la inclusión*. Manizales: Editorial Universidad Autónoma de Manizales.
- ERBUTO D ET AL. 2018. Mediators in the Association Between Affective Temperaments and Suicide Risk Among Psychiatric Inpatients. *Psychiatry* 81(3): 240-257. [doi:10.1080/00332747.2018.1480251](https://doi.org/10.1080/00332747.2018.1480251).
- FERNÁNDEZ M & CASULLO MM. 2006. Validación factorial de una escala para evaluar riesgo suicida. *AIDEP-AIDAP* 1(21): 9-22. <https://www.redalyc.org/pdf/4596/459645448002.pdf>.

- FRANKLIN J ET AL. 2017. Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. *Psychol Bull* 143(2): 187-232. <https://doi.org/10.1037/bul0000084>.
- FRITZ CO, MORRIS PE & RICHLER JJ. 2012. Effect size estimates: Current use, calculations, and interpretation. *J Exp Psychol Gen* 141(1): 2-18. <https://doi.org/10.1037/a0024338>.
- GONZÁLEZ-CIFUENTES C. 2009. Propiedades psicométricas de la escala de desesperanza de Beck en una muestra bogotana. *Psychologia* 3(2): 17-30. <https://www.redalyc.org/articulo.oa?id=297225531001>.
- GÓMEZ AS. 2020. Psychosocial Factors and Clinical Predictors of Suicide Risk in College Students. *MJCP* 8(3). <https://doi.org/10.6092/2282-1619/mjcp-2602>.
- GÓMEZ AS, NÚÑEZ C, CABALLO VE, AGUDELO MP & GRISALES AM. 2019. Predictores psicológicos del riesgo suicida en estudiantes universitarios. *Behavioral Psychology* 27(3): 391-413. <https://www.behavioralpsycho.com/wp-content/uploads/2019/12/03.Gomez-27-3oa.pdf>.
- GÓMEZ AS, NÚÑEZ C, AGUDELO MP & GRISALES AM. 2020. Riesgo e Ideación Suicida y su Relación con la Impulsividad y la Depresión en Adolescentes Escolares. *RIDEP* 54(1): 147-163. <https://doi.org/10.21865/RIDEP54.1.12>.
- GRIFFIN SA, LYNAM DR & SAMUEL DB. 2018. Dimensional conceptualizations of impulsivity. *Personal Disord* 9(4): 333-345. <https://doi.org/10.1037/per0000253>.
- HADZIC A ET AL. 2019. The association of trait impulsivity and suicidal ideation and its fluctuation in the context of the Interpersonal Theory of Suicide. *Compr Psychiatry* 98: 152158. <https://doi.org/10.1016/j.comppsy.2019.152158>.
- HAYES AF. 2018. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach, 2<sup>nd</sup> ed., New York, NY: Guilford Press.
- HORWITZ AG, BERONA J, CZYZ EK, YEGUEZ CE & KING CA. 2017. Positive and Negative Expectations of Hopelessness as Longitudinal Predictors of Depression, Suicidal Ideation, and Suicidal Behavior in High-Risk Adolescents. *Suicide Life Threat Behav* 47(2): 168-176. <https://doi.org/10.1111/sltb.12273>.
- IBM CORPORATION. 2017a. IBM SPSS Statistics for Windows, Versions 25.0 [programa de ordenador]. Armonk, NY: IBM Corporation.
- IBM CORPORATION. 2017b. AMOS for Windows, Versions 24.0 [programa de ordenador]. Armonk, NY: IBM Corporation.
- INMLCF - INSTITUTO NACIONAL DE MEDICINA LEGAL Y CIENCIAS FORENSES. 2019. Informe Forensis datos para la vida. Bogotá: Grupo Centro de Referencia Nacional
- Sobre Violencia. <https://www.medicinalegal.gov.co/documents/20143/386932/Forensis+2018.pdf/be4816a4-3da3-1ff0-2779-e7b5e3962d60>.
- JOINER TE. 2005. *Why People Die by Suicide*. Harvard University Press, Cambridge, MA.
- JOINER TE, BROWN JS & WINGATE LR. 2005. The Psychology and Neurobiology of Suicidal Behavior. *Annu Rev Psychol* 56(1): 287-314. <https://doi.org/10.1146/annurev.psych.56.091103.070320>.
- JORDAN JT, SAMUELSON KW & TIET QQ. 2018. Impulsivity, Painful and Provocative Events, and Suicide Intent: Testing the Interpersonal Theory of Suicide. *Suicide Life Threat Behav* 49(4): 1187-1195. <https://doi.org/10.1111/sltb.12518>.
- KASEN S, COHEN P & CHEN H. 2011. Developmental Course of Impulsivity and Capability from Age 10 to Age 25 as Related to Trajectory of Suicide Attempt in a Community Cohort. *Suicide Life Threat Behav* 41(2): 180-192. <https://doi.org/10.1111/j.1943-278x.2011.00017.x>.
- KING JD & KOWALCHUK B. 1994. ISO - 30. Adolescent Inventory of Suicide Orientation - 30. Minneapolis, United States: NCS-Pearson.
- KLONSKY ED & MAY A. 2010. Rethinking Impulsivity in Suicide. *Suicide Life Threat Behav* 40(6): 612-619. <https://doi.org/10.1521/suli.2010.40.6.612>.
- KUO WH, GALLO J & EATON W. 2004. Hopelessness, depression, substance disorder, and suicidality. *Soc Psychiatry Psychiatr Epidemiol* 39(6): 497-501. <https://doi.org/10.1007/s00127-004-0775-z>.
- LYNAM DR ET AL. 2011. Assessing the basic traits associated with psychopathy: Development and validation of the Elemental Psychopathy Assessment. *Psychol Assess* 23: 108-124. <http://dx.doi.org/10.1037/a0021146>.
- MCARDLE JJ & NESSELROADE JR. 2014. Basics of structural equation modeling. In Mcardle JJ & Nesselroade JR (Eds), *Longitudinal data analysis using structural equation models*, p. 27-37. Washington, D C, US: American Psychological Association
- MCCULLUMSMITH CB ET AL. 2014. Simple Measures of Hopelessness and Impulsivity are Associated with Acute Suicidal Ideation and Attempts in Patients in Psychiatric Crisis. *Innov Clin* 11(9-10): 47-53. [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4267799/pdf/icns\\_11\\_9-10\\_47.pdf](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4267799/pdf/icns_11_9-10_47.pdf).
- NEUFELD E & O'ROURKE N. 2009. Impulsivity and Hopelessness as Predictors of Suicide-Related Ideation among Older Adults. *Can J Psychiatry* 54(10): 684-692. <https://doi.org/10.1177/070674370905401005>

OSMAN A ET AL. 2005. The inventory of suicide orientation-30: Further validation with adolescent psychiatric inpatients. *J Clin Psychol* 61(4): 481-497. <https://doi.org/10.1002/jclp.20086>.

PATTON JH, STANFORD MS & BARRATT ES. 1995. Factor structure of the Barratt Impulsiveness scale. *J Clin Psychol* 51(6): 768-764. [https://doi.org/10.1002/1097-4679\(199511\)51:6%3C768::aid-jclp2270510607%3E3.0.co;2-1](https://doi.org/10.1002/1097-4679(199511)51:6%3C768::aid-jclp2270510607%3E3.0.co;2-1).

RUEDA-JAIMES GE ET AL. 2018. Validación de la Escala de Desesperanza de Beck en pacientes con riesgo suicida. *Rev Psiquiat y Salud Men* 11(2): 86-93. <https://doi.org/10.1016/j.rpsm.2016.09.004>.

SÁNCHEZ R, OREJARENA S, GUZMÁN, & FORERO J. 2002. Suicidio en Bogotá: un fenómeno que aumenta en poblaciones jóvenes. *Biomedica* 1(22): 417-24. <https://doi.org/10.7705/biomedica.v22iSup2.1190>.

SANZ J, GUTIÉRREZ S, GESTEIRA C & GARCÍA-VERA MP. 2014. Criterios y baremos para interpretar el "inventario de depresión de Beck-II" (BDI-II). *Behav Psycho* 22(1): 37-59. [https://www.behavioralpsycho.com/wp-content/uploads/2019/08/03.Sanz\\_22-10a.pdf](https://www.behavioralpsycho.com/wp-content/uploads/2019/08/03.Sanz_22-10a.pdf).

SCHOTTE CK ET AL 1997. Construct validity of the Beck Depression Inventory in a depressive population. *J Affect Disord* 46(2): 115-125. [https://doi.org/10.1016/s0165-0327\(97\)00094-3](https://doi.org/10.1016/s0165-0327(97)00094-3).

SMITH JM, ALLOY LB & ABRAMSON LY. 2006. Cognitive vulnerability to depression, rumination, hopelessness, and suicidal ideation: multiple pathways to self-injurious thinking. *Suicide Life Threat Behav* 36(4): 443-454. <https://doi.org/10.1521/suli.2006.36.4.443>.

STANFORD MS. 2009. Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences* 47(5): 385-395. <https://doi.org/10.1016/j.paid.2009.04.008>.

SUN X ET AL. 2020. ROC analysis of three-dimensional psychological pain in suicide ideation and suicide attempt among patients with major depressive disorder. *J Clin Psychol* 76: 210-227. <https://doi.org/10.1002/jclp.22870>.

VAN ORDEN KA. 2010. The interpersonal theory of suicide. *Psychol Review* 117(2): 575-600. <https://doi.org/10.1037/a0018697>.

WANG Y ET AL. 2015. Role of depression severity and impulsivity in the relationship between hopelessness and suicidal ideation in patients with major depressive disorder. *J Affect Disord* 183: 83-89. <https://doi.org/10.1016/j.jad.2015.05.001>.

WENZEL A & BECK AT. 2008. A cognitive model of suicidal behavior: theory and treatment. *Applied Preven Psycho* 12(4): 189-201. <https://doi.org/10.1016/j.appsy.2008.05.001>.

WHITESIDE SP, LYNAM DR, MILLER JD & REYNOLDS SK. 2005. Validation of the UPPS impulsive behaviour scale: a four-factor model of impulsivity. *Europ J Personal* 19(7): 559-574. <https://doi.org/10.1002/per.556>.

WOLFE KL ET AL. 2019. Hopelessness as a Predictor of Suicidal Ideation in Depressed Male and Female Adolescent Youth. *Suicide Life Threat Behav* 49(1): 253-263. <https://doi.org/10.1111/sltb.12428>.

WHO - WORLD HEALTH ORGANIZATION. 2019. World health statistics 2019: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization.

#### How to cite

ARANGO-TOBÓN OE, TABARES ASG & SERRANO SJO. 2021. Structural Model of Suicidal Ideation and Behavior: Mediating Effect of Impulsivity. *An Acad Bras Cienc* 93: e20210680. DOI 10.1590/0001-3765202102010680.

*Manuscript received on April 29, 2021;  
accepted for publication on July 26, 2021*

#### OLBER EDUARDO ARANGO-TOBÓN<sup>1</sup>

<https://orcid.org/0000-0002-9831-5734>

#### ANYERSON STITHS GÓMEZ TABARES<sup>1</sup>

<https://orcid.org/0000-0001-7389-3178>

#### SILVIA JULIANA OREJARENA SERRANO<sup>2</sup>

<https://orcid.org/0000-0002-6468-3766>

<sup>1</sup>Luis Amigó Catholic University, Faculty of Psychology, Basic and Applied Neuroscience Research Center, Transversal 51A #67B 90, 050035, Medellín, Colombia

<sup>2</sup>Industrial University of Santander, School of Medicine, Basic and Applied Neuroscience Research Center, Cra 27 Calle 9, 680001, Bucaramanga, Colombia

Correspondence to: **Olber Eduardo Arango Tobón**

E-mail: [olber.arangoto@amigo.edu.co](mailto:olber.arangoto@amigo.edu.co)

#### Acknowledgments

We thank all the students who participated in this study.

