

EFFECT OF SELF-ADMINISTERED INTERVENTIONS ON RAISING AWARENESS OF SUICIDAL BEHAVIOR AND CRYSTAL METH USE IN ADOLESCENTS FROM AGUASCALIENTES, MÉXICO

Kalina Isela Martínez Martínez

Universidad Autónoma de Aguascalientes

Marielena Eudave-Patiño

Universidad Autónoma de Aguascalientes

Yancarlo Lizandro Ojeda Aguilar

Universidad Autónoma de Aguascalientes

Lorenia Robles Villarreal

Universidad Autónoma de Aguascalientes

Estos autores contribuyeron por igual en este trabajo

Received: 7 noviembre 2024

Revised: 9 noviembre 2024

Evaluator 1 report: 23 noviembre 2024

Evaluator 2 report: 30 noviembre 2024

Accepted: 13 diciembre 2024

Published: mayo 2025

DECLARACIÓN DEL AUTOR INSTITUCIONAL

Certifico que los autores aprobaron la versión final del manuscrito titulado "Effect of self-administered interventions on raising awareness of suicidal behavior and crystal meth use in adolescents from Aguascalientes, México".

ABSTRACT

Self-administered interventions for adolescents, which can be delivered through digital platforms using comics, present an opportunity for preventing suicidal behavior and methamphetamine use in the state of Aguascalientes. This state ranks fourth nationally in suicides among individuals aged 15 to 29 (INEGI, 2022) and has a higher percentage of people who have used methamphetamines at least once in their lifetime compared to the national average (EBCO, 2018). The goal was to evaluate the effectiveness of an intervention to increase awareness of suicidal behavior and crystal meth use, as well as to assess students' perceptions of the intervention.

567 adolescents participated in the intervention for preventing suicidal behavior, and 604 in the intervention for crystal meth use. Data were collected through tests administered before and after presenting a comic, in addition to evaluating the intervention itself. Due to differences in the availability of equipment at the institutions, some students completed the intervention and evaluation on a digital platform, while others used paper questionnaires.

The results show that the average number of correct responses on the post- test was higher than on the pre-test for both the suicidal behavior and crystal meth use interventions. Both differences were statistically significant ($p < .001$ in both cases), and the evaluation of the intervention indicates that students perceive the platform and comics as potentially useful for preventing crystal meth use and suicidal behavior among adolescents. The intervention showed promising results in raising awareness about suicidal behavior and crystal meth use among adolescents in Aguascalientes. Future research should explore its applicability in other regions as well as consider evaluating its long-term effects.

Keywords: suicidal behavior; crystal meth use; instructional platform; self-administered intervention; adolescents

RESUMEN

Efecto de intervenciones autoadministradas en la concientización de la conducta suicida y el consumo de metanfetaminas en adolescentes de Aguascalientes, México. Las intervenciones autoadministradas para adolescentes, que se pueden realizar a través de plataformas digitales mediante comics, presentan una oportunidad para la prevención de la conducta suicida y consumo de metanfetamina en el estado de Aguascalientes. Un estado que ocupa el cuarto lugar a nivel nacional en suicidios entre individuos entre 15 a 29 años (INEGI, 2022) y donde el porcentaje de personas que han usado metanfetaminas al menos una vez en su vida es mayor que el promedio nacional (EBCO, 2018). El objetivo fue evaluar la efectividad de una intervención para aumentar la conciencia sobre el comportamiento suicida y el consumo de cristal, además de evaluar las percepciones de los estudiantes sobre la misma.

567 adolescentes realizaron la intervención de prevención del comportamiento suicida y 604 la del consumo de cristal. Los datos se obtuvieron mediante pruebas administradas antes y después de presentar un cómic, además de la evaluación de la intervención. Debido a diferencias en la disponibilidad de equipos en las instituciones, algunos estudiantes completaron la intervención y la evaluación en una plataforma digital, mientras que otros utilizaron cuestionarios en papel.

Los resultados muestran que el promedio de respuestas correctas en la prueba posterior a la presentación del comic fue mayor que en la prueba previa en la intervención para el comportamiento suicida y el uso de cristal. Ambas diferencias fueron estadísticamente significativas ($p < .001$, en ambos casos) y la evaluación de la intervención indica que los estudiantes perciben la plataforma y los cómics como potencialmente útiles para prevenir el uso de cristal y el comportamiento suicida entre adolescentes. La intervención mostró resultados prometedores en la sensibilización sobre el comportamiento suicida y el uso de cristal entre adolescentes en Aguascalientes. Investigaciones futuras deberían explorar su aplicabilidad en otras regiones además de considerar evaluar su efecto a largo plazo.

Palabras clave: comportamiento suicida; consumo de cristal; plataforma instructiva; intervención autoadministrada; adolescentes

INTRODUCTION

Methamphetamine (MA) use and suicidal behavior are two problems that affect the public health of Mexico, but specially adolescents. Adolescence is a developmental period of life where experimental behaviors, such as illicit drug use, appear. The risk of initiating drug use in adolescence is related to several factors like altered behavioral motivation, impulsivity (Ivanov et al., 2021), socioeconomic status, quality of parenting and peer group influence (Das, 2016, Ivanov et al., 2021).

According to the Basic Objective Community Study (EBCO, by Spanish acronyms) 2016-2017 (EBCO, 2018), 11.8% of the population between 12 and 65 years in Aguascalientes have used at least one time in their life illegal drugs, this is higher than the 9.9% reported nationally (EBCO, 2018). Specifically in 2013, 9.6% of the population admitted to youth integration centers (CIJ, by Spanish acronyms) reported meth use at list one time in their life, while in 2018 this increases to 38.8%, higher than the 27.1% reported in 2016 nationally (EBCO, 2018).

The data show that the state of Aguascalientes has a severe drug use problem. According to some studies the best way to intervene is to reduce the early initiation of substance use with prevention interventions, specifically in adolescents (Rawson et al., 2007). In United States the results of studies that have analyzed the interventions of MA use in adolescent report that there are difficulties in adolescents to maintain drug- free during treatment and the response to the treatment is poorer compared to adolescents that get into treatment for other drugs like alcohol and marihuana (Buck & Siegel, 2015, Rawson et al., 2007). Rawson (2007) have found that adolescents whit MA treatment have shown rates of depressions and suicide ideation higher than adolescents that assist for treatment of other drugs.

Suicidal behavior includes ideation, planning, attempting, and completing suicide (Borges, 2010). According to recent data, the suicide in Aguascalientes exceeds the national average, which corresponds to 18.4 per 100,000 individuals (National Institute of Statistics and Geography [INEGI, by Spanish acronyms], 2022). Aguascalientes ranks fourth nationally, with young people aged 15 to 29 being the most affected. Additionally, the World Health Organization (WHO, 2019) reported that suicide was the fourth leading cause of death globally among individuals aged 15 to 29 in 2019, highlighting the urgent need for effective preventive measures.

Suicide is a big problem, but it can be preventable. One of the approaches to suicide prevention is the development of socio-emotional life skills in adolescents (WHO, 2021b), skills like understanding how they feel and learning to communicated to others their feelings in an adequate manner.

The prevention of drug use and suicidal behavior in adolescents through self-administered interventions and online platforms has shown promising, yet limited, results. Buller et al. (2008) found that a web-based self-administered intervention increased the smoking cessation rate among students compared to a control group. Schaub et al. (2012) evaluated «Quit the Shit,» an online self-administered intervention aimed at reducing cannabis use and dependency severity. They found significant reductions in both aspects, along with improvements in psychological indicators such as self-efficacy and reductions in symptoms of anxiety and depression.

Norman et al. (2008) highlighted that a mixed intervention, combining an online platform with therapist-led motivational interviews, significantly reduced the initiation of smoking. However, Patten et al. (2006) found that a home-based web intervention was ineffective for smoking cessation compared to a brief clinic-based intervention.

Rooke et al. (2010) demonstrated through a meta-analysis of 42 studies that computerized interventions can significantly reduce alcohol and tobacco use, with a moderate effect size. Interventions that provided personalized feedback based on individual characteristics and user behavior, included interactive elements that actively engaged users, and offered easy access at any time and place were more effective (Rooke et al., 2010). Tiburcio et al. (2016) evaluated «Ventana,» an online intervention with informational videos, and found it reduced substance use and depressive symptoms among Mexican youth.

Additionally, prevention programs using comic strips have been effective. Torrecilla et al. (2004) developed a prevention program using an educational comic about tobacco that significantly increased knowledge and risk perception among adolescents, also providing important social and personal skills. In the study by Sánchez and Robinson (2018), a prevention program for alcohol use was implemented among high school students, and the comic created for the program had a positive impact on adolescents' perceptions of alcoholism. Kapitány-Fövény et al. (2018) evaluated the interactive mobile application «Once Upon a High», that includes interactive comics/cartoons, for legal and illegal drug prevention. The results show that the perceived usefulness of the application has a correlation with a decrease in alcohol consumption.

Considering this information, interventions related to crystal meth use and suicidal behavior are essential. The use of self-administered interventions can help address these health issues. However, it is crucial to evaluate their impact to ensure that these interventions can have a positive preventive effect on adolescents.

MATERIALS AND METHODS

This research is a cross-sectional exploratory study that evaluates the results of self-administrated intervention on raising awareness of suicidal behavior and crystal meth use in adolescents, with the use of two comics

Participants

The sample was obtained from three different high schools from the state of Aguascalientes, Mexico. All the students were between 15 to 20 years old. A total of 567 participants saw and responded to the questions of the comic *Waiting for Valentine* (*Esperando a Valentina*, Spanish name), and 604 of the comic *Reflexes* (*Reflejos*, Spanish name). A total of 602 participants respond to the intervention evaluation of the comics. The participants were selected by convenience for each institution.

Instrument

Comics

The digital platform (<https://fuerzaheroica.org.mx/instruccional/comics-digitales/>) is an educational instructional platform that has 14 comics. For this intervention we use only two comics. *Waiting for Valentine* shows the life of a female adolescent, the way she takes important decisions like where and what to study, where to work, and how to face the successes and failures related to the changes of life and interpersonal relations. On the other hand, *Reflexes* is a comic about male twins who make different life choices (studying or working), leading them to become involved with crystal meth use or to observe problems associated with it in others. Both comics not only inform about the possible consequences of meth consumption or suicidal behavior, but they also show some examples of socioemotional abilities in the main character that could be important for the adolescents, like self-regulation and look for support not only in family or friends, but also whit professionals when needed.

Pretest and Posttest

Both comics were made up of a pretest, the video that showed the animated comic, and a posttest, in that order. The pretest and posttest had the same multiple-choice questions, and these can be seen in Table 1.

Table 1. Pretest and posttest multiple choice questions per comic.

Waiting for Valentine	
Questions	Answers options
1. When a person comments that life is not worth living, that they cannot find a way out...	a. Just trying to get attention. b. It is an alarm sign since in desperation you may look for options that harm your health. c. He is a cowardly person, who does not have a positive attitude. d. I don't know, I'm not sure.
2. When a person shares with you that they feel bad and have fatalistic thoughts...	a. It's better to stay away and avoid her/him as much as you can. b. It is important to listen to her and seek help. c. Don't pay attention to him, since what he says is "crazy." d. I don't know, I'm not sure.
3. When we go through frustrating situations, the best thing is...	a. Do not tell what one feels. b. Express these emotions to a trusted person. c. Solve situations without anyone's help, since they are "our problems." d. I don't know, I'm not sure.

Reflexes	
Questions	Answers options
1. Crystal consumption...	a. It allows you to have a lot of energy and perform better in your activities. b. It is harmless, since it does not generate addiction. c. It causes restlessness and anxiety, hallucinations, lesions on the skin and teeth. d. I don't know, I'm not sure.
2. Among the ingredients with which the crystal is made are...	a. Healthy substances that are manufactured in laboratories. b. Battery acids, drain cleaner, flashlight fuel, antifreeze, acetone, muriatic acid, fertilizer. c. Medication derivatives. d. I don't know, I'm not sure.
3. If a person decides to consume a substance such as crystal...	a. It is your decision and that does not affect others. b. It can begin to affect your physical/emotional health and that of your beloved. c. One must isolate himself completely since he/she is an undesirable person. d. I don't know, I'm not sure.

Evaluation of intervention

The intervention evaluation was responded by google forms or by a paper questionnaire. There were ten questions related to the understanding of the comics, the information presented, and the utility of the intervention to prevent crystal meth use and suicide behavior

Procedure

We make two sessions of one hour each in some schools, or two continuous hours in others according to the time established by the institutions. At the start of the session the adolescents that voluntarily accepted to participate in the research sign the informed assent where they agreed to respond to the questionnaires of the comics and evaluate the intervention at the end. In the schools without internet or computers the comic was presented with a projector to the classroom, and we used paper questionnaires to respond the same questions of the online platform and the intervention evaluation.

For the students that access the platform, they choose the comic first, and then they must introduce name, age and email address, then they answer the pretest where there were three questions related to the topic of the comic that do not give feedback (Table 1). After that, they start the video where the comic was presented, and finalizing the video there were some dichotomic questions related to the subject that, regardless of the answer, give them scientific information and complement it with infographics. The infographics contain information about the subject, myths and realities, protective factors for meth use or suicidal behavior, self-control of thoughts and emotions and examples of how to respond if they identify they have a problem related to the topics presented or if they see someone near them start with a problem. Finally, in the posttest the same three questions presented at the

start were made, whit feedback regardless of the answer selected; and two open questions about the comic and what they like about it. The adolescents that did not use the platform did not have feedback about their answers. There were differences in the quantity of students that saw the comics because some interventions take two days and not all the students were present in both sessions.

Ethical Considerations

Each adolescent who participated in the study signed an informed assent in which they were informed about the objectives of the study and that their data would be used exclusively for research purposes and handled only by the team that carried out the research. It was also clarified that their participation would not be punished or rewarded at any time.

For the protection of information, we follow the ethical standards of the Autonomous University of Aguascalientes, which limit the availability of information only to the research team. Furthermore, the ethical and scientific aspects of the protocol used in this study were approved by the Institutional Bioethics Committee approved in letter CIB-UAA-32.

Data analysis

Data analysis consisted of descriptive and inferential statistics. We use descriptive statistics to determine the percentage, quantity and frequency, trend (mean and standard deviation) and distribution (using the Shapiro-Wilk test) of the sociodemographic data of the participants, such as: age, institution of origin, sex, the way in which they answered the instruments (platform or paper), and the pretest and posttest correct answers. We use inferential statistics to find out if there were statistically significant differences between the pretest and posttests in the average correct answers. For this we use the Wilcoxon signed-rank test. Additionally, we calculated the effect size with the matched rank biserial. We considered an $< .05$ as an indicator of statistically significant differences. For this analysis, we used Python and the statistical software JASP.

In the first eight questions of the intervention evaluation, students selected the comic that related to the statement presented. We counted how often each comic was selected by each student for each question, and then calculated the percentage of students who selected each comic out of the total number of students evaluating. It is important to note that in the first eight questions students could select one, two or none of the comics depending on the affirmation presented.

For the last two questions, we recorded each student's responses. The responses could be 'yes', 'no', or 'maybe'. After tallying the responses, we calculated the percentage based on the total number of students, like the methodology used for the first eight questions.

RESULTS

Of the 567 participants that saw *Waiting for Valentine*, 62.78% ($n=356$) were male and 37.22% ($n=211$) female. The mean age was 16.37 ($SD=.97$) years, with a range from 13 to 20 years. Most participants (61.73%, $n=350$) answered the pretest and posttest instruments through the platform. These results were very similar to the 604 participants that saw *Reflexes*, where we found that 59.1% ($n=357$) were male and 40.84% ($n=247$) female. Its mean age was 16.35, ($SD=.96$), the age range was between 14 to 20 years old; and most of them used the platform (54.14%, $n=327$). These results can be seen in Table 2.

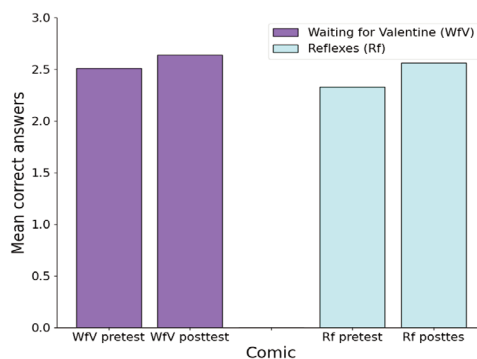
Table 2. Descriptive data of participants by comic.

Variable	Comic			
	Waiting for Valentine		Reflexes	
	Frequency (N=567)	Percent (%)	Frequency (N=604)	Percent (%)
Sex				
Male	356	62.78	357	59.11
Female	211	37.22	247	40.89
Institution				
1	32	5.66	57	9.44
2	331	58.37	343	56.78
3	204	35.97	204	33.78
Answered				
Platform	350	61.72	327	54.13
Paper	217	38.28	277	45.86
Age				
<= 13	1	.18	0	0
14 to 16	323	56.96	352	58.28
17 to 19	240	42.32	250	41.38
>= 20	3	.54	2	.34

According to the correct questions answered by the participants, in general we found a higher average of correct answers in the posttest than in the pretest for both comics. The mean correct answers in the pretest for Waiting for Valentine was 2.51 (SD=.76) and 2.64 (SD=.68) in the posttest. The Shapiro-Wilk test showed that this data had a non-normal distribution ($W=.61$, $p<.001$), so the Wilcoxon test was used to find out if this difference between the pretest and the posttest was significant. The Wilcoxon test indicated that this difference was statistically significant ($W=1562$, $p<.001$). This difference was confirmed by the rank-biserial correlation effect size measure that indicated that the posttest was higher than pretest (-.57).

The results for Reflex were similar to those found for Waiting for Valentine. We found more correct answers in the posttest ($M=2.56$, $SD=.68$) than the pretest ($M=2.33$, $SD=.82$). The Shapiro-Wilk test showed a deviation from normality ($W=.78$, $p<.001$), therefore, we used the Wilcoxon test, which showed that this difference was statistically significant ($W=5670$, $p<.001$). The effect size was -.52 by the rank-biserial correlation measure. These results can be seen in

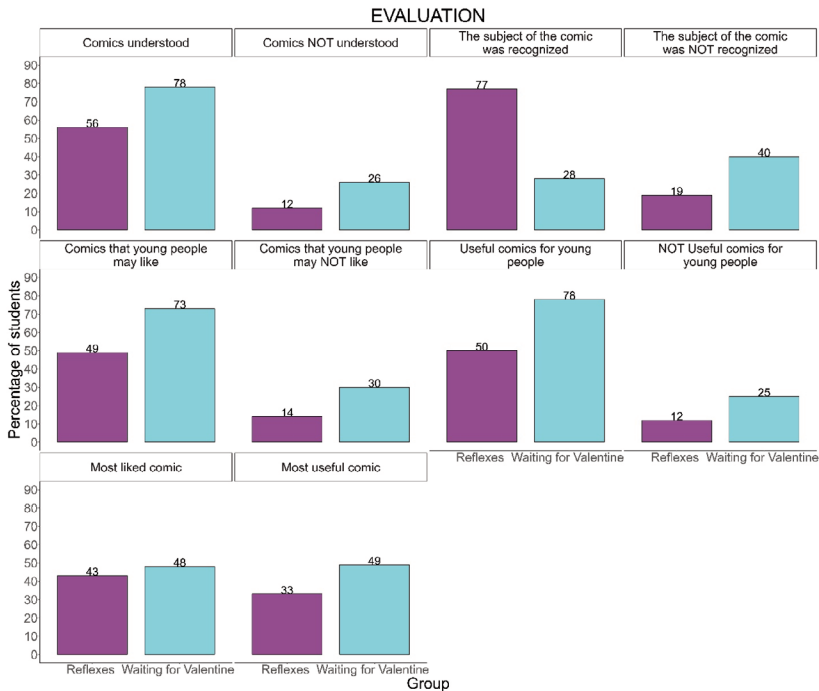
Figure 1. Comparison between pretest and posttest in mean correct answers per comic.



EFFECT OF SELF-ADMINISTERED INTERVENTIONS ON RAISING AWARENESS OF SUICIDAL BEHAVIOR AND CRYSTAL METH USE IN ADOLESCENTS FROM AGUASCALIENTES, MEXICO

The participants that respond to the evaluation intervention were 602, 60.96% (n=367) were male and 39.03% (n=235) female. In Figure 2, the results of the first eight questions of the intervention evaluation are presented. The results show that 56% (n=335) of the students reported understanding the comic Reflexes, and 78% (n=471) understood the comic Waiting for Valentine. Only 12% (n=71) did not understand Reflexes, while 26% (n=156) did not understand Waiting for Valentine. 77% (n=463) of students recognized the subject of Reflexes, whereas 28% (n=169) recognized the subject of Waiting for Valentine. Among those who did not understand Reflexes, 19% (n=115) found it unclear, compared to 40% (n=239) for Waiting for Valentine.

Figure 2. Responses of the students to the questions of the Intervention evaluation



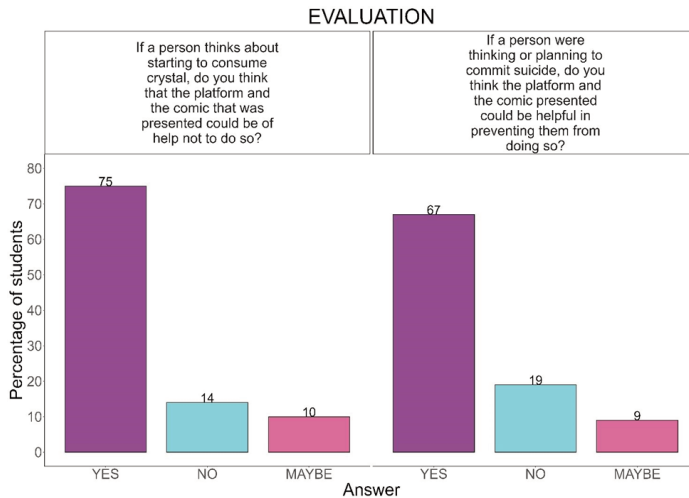
Note. Each square at the top of the graph is the affirmation presented to the students. The number at the top of the bars is the percentage of the total of students.

49% (n=295) of the students selected Reflexes as the comic they thought youth would like, and 73% (n=442) chose Waiting for Valentine. 14% (86) of the students mentioned that Reflexes might not appeal to youth, while 30% (n=182) said the same for Waiting for Valentine. Waiting for Valentine was considered the most useful comic for youth by 78% (n=468), with 50% (n=299) also finding Reflexes useful. Only 12% (n=70) thought Reflexes would not be useful for youth, while 25% (n=150) thought the same for Waiting for Valentine. The most liked comic was Waiting for Valentine with 48% (n=286), closely followed by Reflexes with 43% (n=267). In terms of usefulness, Waiting for Valentine led with 49% (n=296), compared to 33% for Reflexes (n=200).

In Figure 3, the results of the last two questions of the intervention evaluation are presented. The results show that 75% (n=449) of the students believe that if a person considers starting to use crystal meth, the comic and platform could be helpful in preventing them from doing so. Only 14% (n=87) mentioned that the platform and comic would not be helpful, and 10% (n=62) were unsure of their effectiveness. Regarding whether the comic and

platform could help prevent thoughts or plans of suicide, 67% (n=404) of the students thought they could be helpful, 9% (n=53) were unsure, and 19% (n=115) did not believe they would be effective.

Figure 3. Responses of the students to the open questions of the Intervention evaluation.



Note. The number in the top of the bars is the percentage of the total of students.

Overall, the results indicate that students perceive the platform and comics as potentially helpful tools for preventing crystal meth use and suicidal behavior among adolescents. Additionally, *Waiting for Valentine* was the most understood, liked, and considered useful comic for youth, despite some difficulty in understanding the specific subjects presented in the comic. It is also noteworthy that there were few differences in preferences for the most liked comic.

DISCUSSION AND CONCLUSION

The objective of this study was to evaluate the effectiveness of a self-administered intervention, based on animated comics, in increasing awareness of suicidal behavior and crystal meth use among adolescent students. Additionally, assess the students' perceptions of the intervention, focusing on its utility and their understanding of the comics and the information presented, within schools in the state of Aguascalientes. According to the pretest and posttest evaluations, the prevention intervention successfully increased adolescents' awareness about crystal meth use and suicide behavior, regardless of whether the intervention was web-based or in paper, showing significant differences. The increase of awareness about crystal meth use and suicide behavior, could also increase risk perception and may reduce the likelihood of initiating or maintaining substance use and stop the suicide attempts (Mendez-Ruiz, 2018).

All the information provided, and the identification of some socioemotional abilities in the main characters of the comics, give adolescents the opportunity to consider the consequences and all the information before deciding to consume crystal or commit suicide. Mann (1972) mentions that stable decision-making is a function of relevant considerations before a choice is made.

The preventive intervention carried out in this study took only two hours, two topics were presented, and the intervention evaluation was made. The duration of the intervention per topic takes one hour, like the approach used by Norman et al. (2008), where they found a reduction in smoking initiation in a group with online intervention.

EFFECT OF SELF-ADMINISTERED INTERVENTIONS ON RAISING AWARENESS OF SUICIDAL BEHAVIOR AND CRYSTAL METH USE IN ADOLESCENTS FROM AGUASCALIENTES, MÉXICO

Several studies have highlighted the effectiveness of self-administered and digital interventions in substance use prevention. Rooke et al. (2010) found that these interventions are moderately effective, especially when combined with intermittent professional support. Schaub et al. (2012) also demonstrated that combining cognitive-behavioral techniques with self-help elements provides an accessible and effective approach, complementing traditional treatments. Torrecilla et al. (2004) emphasized the importance of interactive educational strategies, showing that the use of comics can increase knowledge and risk perception among young people.

The effectiveness of these interventions can be attributed to several key factors. First, the use of comics and interactive content captures the attention of young people and facilitates the understanding of complex information in an engaging and accessible manner (Torrecilla et al., 2004; Sánchez and Robinson, 2018). Second, the flexibility of digital platforms allows for their implementation in various contexts, from school environments to homes, thereby expanding their reach and accessibility (Tiburcio et al., 2016; Kapitány-Fövényi et al., 2018). These studies underscore the potential of digital interventions and innovative educational methods in substance use prevention, highlighting their flexibility and accessibility. However, more literature is needed on the specific components that should be considered in the planning and execution of prevention programs that use comics as a main tool.

Some weaknesses of the study include variability in implementation, with some students using digital platforms and others using paper, which could have affected the uniformity of experience and perception, although results showed no difference. Additionally, the lack of long-term follow-up limited the assessment of its lasting impact. Technological limitations in some institutions hindered the consistent application of the digital intervention.

The intervention demonstrated several notable strengths. Using animated comics as a preventive tool proved to be an innovative and engaging approach for adolescents, facilitating their understanding and interest in complex topics such as substance use and suicidal behavior. The stories of the characters in the comics were friendly, easy to understand, and relatable, increasing their relevance for adolescents and show them examples of socioemotional abilities that could be important for the adolescents, like self-regulation and the importance of look for support not only in family or friends, but also whit professionals when needed. Additionally, pre- and post-intervention evaluations allowed for an objective measurement of the increase in awareness about crystal meth use and suicide behavior among participants. The flexibility in application enabled implementation both in internet-accessible environments and in those without it thus broadening its reach. Students perceived the platform and comics as potentially useful tool for preventing methamphetamine use and suicidal behavior, suggesting that this type of intervention can be well-received and effective among the adolescent population. Lastly, the intervention was brief and non-intrusive, with sessions lasting one to two hours, allowing integration into the school routine without significant disruptions, facilitating its implementation in a larger number of educational institutions.

In conclusion, this study highlights the importance of self-administered interventions using comics for adolescents. The combination of accessibility, interactivity, and cultural relevance makes comics a valuable and effective tool in prevention programs targeting adolescents. Integrating comics into self-administered interventions can enhance educational and preventive impact and could reduce substance use and prevent suicidal behavior among young people. These findings underscore the need to continue exploring and developing comic-based interventions to maximize their preventive and educational potential on diverse topics.

FUNDING AND SUPPORT

This research was found by the National Council of Humanities Science and Technology (CONAHCYT) through project number 3225 entitled «Development and evaluation of indicated and selective intervention programs in methamphetamine, fentanyl and heroin users, and their comorbidity with mental health problems and suicidal behavior.»

ACKNOWLEDGEMENTS

To the National Council of Humanities, Science and Technology (CONAHCYT) for financing this study through a PRONAI project number 3225 entitled «Development and evaluation of indicated and selective intervention programs in methamphetamine, fentanyl and heroin users, and their comorbidity with mental health problems and suicidal behavior.»

To the Heroic Force Team Platform Creators and the students of the Addictive Behavior Research Laboratory of the Autonomous University of Aguascalientes for their support in collecting data and the

REFERENCES BIBLIOGRAPHIC

- Borges, G., Nock, M. K., Medina-Mora, M. E., Hwang, I., & Kessler, R. C. (2010). Psychiatric disorders, comorbidity, and suicidality in Mexico. *Journal of Affective Disorders*, 124(1–2), 98–107. <https://doi.org/10.1016/j.jad.2009.10.022>
- Buller, D. B., Borland, R., Woodall, W. G., Hall, J. R., Hines, J. M., Burris-Woodall, P., et al. (2008). Randomized trials on consider this, a tailored, internet-delivered smoking prevention program for adolescents. *Health Education & Behavior: The Official Publication of the Society for Public Health Education*, 35, 260–281. doi:10.1177/1090198106288982
- Buck, J. M., & Siegel, J. A. (2015). The effects of adolescent methamphetamine exposure. *Frontiers in Neuroscience*, 9. <https://doi.org/10.3389/fnins.2015.00151>
- Das, J. K., Salam, R. A., Arshad, A., Finkelstein, Y., & Bhutta, Z. A. (2016). Interventions for adolescent substance abuse: An overview of systematic reviews. *Journal of Adolescent Health*, 59(4), S61–S75.
- EBCO. (2018). Diagnóstico del consumo de drogas en el área de influencia de CIJ Aguascalientes. EBCO 2018 (cij.gob.mx).
- INEGI. (2022). Estadísticas a propósito del día mundial para la prevención del suicidio. *Instituto Nacional de Estadística y Geografía*. Press conference 503. Retrieved July 24, 2024, https://www.inegi.org.mx/contenidos/saladeprensa/aproposito/2022/EAP_SUICIDIOS22.pdf
- Hutton, H. E., Wilson, L. M., Apelberg, B. J., Avila Tang, E., Odelola, O., Bass, E. B., & Chander, G. (2011). A systematic review of randomized controlled trials: Web-based interventions for smoking cessation among adolescents, college students, and adults. *Nicotine & Tobacco Research*, 13(4), 227–238.
- Ivanov I, Parvaz MA, Velthorst E, Shaik RB, Sandin S, Gan G, Spechler P, Albaugh MD, Chaarani B, Mackey S, Banaschewski T, Bokde ALW, Bromberg U, Büchel C, Quinlan EB, Desrivieres S, Flor H, Grigis A, Gowland P, Heinz A, Ittermann B, Martinot J-L, Paillère Martinot M-L, Artiges E, Lemaitre H, Nees F, Orfanos DP, Paus T, Poustka L, Hohmann S, Millenet S, Fröhner JH, Smolka MN, Walter H, Whelan R, Schumann G, Garavan H, (2021) Substance Use Initiation, Particularly Alcohol, in Drug Naïve Adolescents: Possible Predictors and Consequences From a Large Cohort Naturalistic Study, *Journal of the American Academy of Child & Adolescent Psychiatry*. doi: <https://doi.org/10.1016/j.jaac.2020.08.443>.
- Kapitány-Fövény, M., Vagdalt, E., Ruttkay, Z., Urbán, R., Richman, M. J., & Demetrovics, Z. (2018). Potential of an interactive drug prevention mobile phone app (once upon a high): questionnaire study among students. *JMIR serious games*, 6(4), e9944.
- Mann, L. (1972). Use of a “balance-sheet” procedure to improve the quality of personal decision making: A field experiment with college applicants. *Journal of Vocational Behavior*, 2(3), 291–300.
- Méndez-Ruiz MD, Ortiz-Moreno GA, Eligio-Tejada IA, Yáñez-Castillo BG, Villegas-Pantoja MA. Percepción de riesgo y consumo de alcohol en adolescentes mexicanos de preparatoria. *Aquichan* 2018; 18(4): 438–448. DOI: 10.5294/aqui.2018.18.4.6
- Norman, C. D., Maley, O., Li, X., & Skinner, H. A. (2008). Using the internet to assist smoking prevention and cessation in schools: A randomized, controlled trial. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 27, 799–810. doi:10.1037/a0013105

- Patten, C. A., Croghan, I. T., Meis, T. M., Decker, P. A., Pingree, S., Colligan, R. C., et al. (2006). Randomized clinical trial of an internet-based versus brief office intervention for adolescent smoking cessation. *Patient Education and Counseling*, 64, 249–258. doi:10.1016/j.pec.2006.03.001
- Rawson, R., Gonzales, R., McCann, M. and Ling, W. (2007). Use of methamphetamine by young people: is there a reason for concern? *Addiction* 102, 1021–1022. doi:10.1111/j.1360-0443.2007.01899.
- Rooke, S., Thorsteinsson, E., Karpin, A., Copeland, J., & Allsop, D. (2010). Computer delivered interventions for alcohol and tobacco use: a meta analysis. *Addiction*, 105(8), 1381–1390.
- Sánchez, V. G., & Robinson, D. (2018). Diseño de un cómic sobre el alcoholismo y la percepción en estudiantes de 3°, 4° y 5° de secundaria en tres I.E. de Los Olivos, Lima 2018. En *Universidad César Vallejo eBooks*. https://alicia.concytec.gob.pe/vufind/Record/UCVV_07f8a50443ff83c1535034b45c64ef07.
- Schaub, M. P., Sullivan, R., Stark, L., & Ter Bogt, T. (2012). A randomized controlled trial of a web-based self-help intervention to reduce cannabis use. *Journal of Substance Abuse Treatment*, 43(1), 98–107. doi:10.1016/j.jsat.2011.10.011
- Tiburcio, M., Lara, M. A., Aguilar, A., Fernández, M., Martínez, N., & Sánchez, A. (2016). Web-Based Intervention to Reduce Substance Abuse and Depressive Symptoms in Mexico: Development and Usability Test. *JMIR Mental Health*, 3(3), e47. doi: 10.2196/mental.6001
- Torrecilla García, M., Ruano García, R., Plaza Martín, D., Hernández Mezquita, M. A., Barrueco Ferrero, M., & Alonso Díaz, A. (2004). *Jóvenes y tabaco: prevalencia, patrón y actitud ante el consumo de tabaco*. *Anales de Pediatría*, 60(5), 440–449. doi:10.1016/s1695-4033(04)78303-4.
- WHO (2021a) Suicide worldwide in 2019. World Health Organization. Retrieved July 25, 2024, <https://www.who.int/publications/i/item/9789240026643>
- WHO. (2021b). *Suicide*. World Health Organization. R Retrieved July 25, 2024, <https://www.who.int/news-room/fact-sheets/detail/suicide>
- WHO (2018) National suicide prevention strategies: progress, examples and indicators. World Health Organization. Retrieved July 25, 2024, <https://www.who.int/publications/i/item/national-suicide-prevention-strategies-pro>