

UTILIZAÇÃO DE NOVAS TECNOLOGIAS NA PREVENÇÃO DO SUICÍDIO EM ADOLESCENTES: REVISÃO SISTEMÁTICA DA LITERATURA

USE OF NEW TECHNOLOGIES IN SUICIDE PREVENTION IN ADOLESCENTS: SYSTEMATIC LITERATURE REVIEW

USO DE NUEVAS TECNOLOGÍAS EN LA PREVENCIÓN DEL SUICIDIO EN ADOLESCENTES: REVISIÓN SISTEMÁTICA DE LA LITERATURA

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RESUMO

Introdução: O suicídio é uma das principais causas de morte em adolescentes. Na avaliação do risco de suicídio, a tecnologia está a ganhar terreno. Os adolescentes são utilizadores experientes de tecnologias, justificando intervenções baseadas em novas tecnologias na prevenção do suicídio.

Objetivo: Identificar os benefícios da utilização de novas tecnologias na prevenção do risco de suicídio em adolescentes.

Métodos: Revisão sistemática da literatura. Pesquisa efetuada em bases de dados EBSCOhost e PubMed. Incluídos artigos de acordo com as recomendações PRISMA. Utilizada a conjugação booleana com descritores em língua inglesa: *technolog** AND (APP OR application OR mobile application) AND (suicid*) AND (adolescent OR youth OR puberty).

Resultados: 11 artigos cumpriram os critérios de inclusão e elegibilidade. Os aplicativos móveis ou APP e a deteção da linguagem foram as tipologias encontradas sendo os Aplicativos/APP para smartphone presentes em maior número de estudos. Os resultados comprovam a importância da utilização das novas tecnologias na prevenção do risco de suicídio em adolescentes.

Conclusão: Verificou-se evidência acerca da elevada adesão na utilização de novas tecnologias, úteis na prevenção do risco de suicídio, por parte dos adolescentes. As novas tecnologias foram consideradas bem aceites e acarretam efeitos benéficos. Até ao momento, escassos dados suportam a utilização destas intervenções na prática clínica. O número de estudos sobre esta temática é limitado, sendo necessária a realização de mais investigações.

Palavras-chave: novas tecnologias; APP; prevenção do suicídio; risco de suicídio; adolescentes

ABSTRACT

Introduction: Suicide is one of the main causes of death in adolescents. In assessing suicide risk, technology is gaining ground. Adolescents have experienced users of technology, justifying interventions based on new technologies in suicide prevention.

Objective: To identify the benefits of using new technologies to prevent suicide risk in adolescents.

Methods: Systematic literature review. The research was performed in EBSCOhost and PubMed databases. Included articles according to PRISMA recommendations. Boolean conjugation with descriptors in English was used: *technology** AND (APP OR application OR mobile application) AND (suicide*) AND (adolescent OR youth OR puberty).

Results: 11 articles met the inclusion and eligibility criteria. Mobile applications or APPs and language detection were the typologies found, with Smartphone Applications/APPs present in a greater number of studies. The results prove the importance of using new technologies to prevent the risk of suicide in adolescents.

Conclusion: Evidence demonstrated an elevated adherence to the use of new technologies, useful in preventing the risk of suicide by adolescents. The new technologies were considered to be well-accepted and have beneficial effects. Presently, there is insufficient data to support the use of these interventions in clinical practice. The number of studies on this topic is limited, requiring further investigation.

Keywords: new technologies; APP; suicide prevention; suicide risk; teenagers

RESUMEN

Introducción: El suicidio es una de las principales causas de muerte en adolescentes. En la evaluación del riesgo la tecnología está ganando terreno. Los adolescentes son usuarios experimentados de las tecnologías, lo que justifica intervenciones para la prevención del suicidio basadas en nuevas tecnologías.

Objetivo: Identificar los beneficios del uso de nuevas tecnologías en la prevención del riesgo de suicidio en adolescentes.

Métodos: Revisión sistemática de la literatura. Búsqueda realizada en bases de datos EBSCOhost y PubMed. Artículos incluidos según recomendaciones PRISMA. Se utilizó la conjugación booleana con descriptores en inglés: *technolog** AND (APP OR application OR mobile application) AND (suicid*) AND (adolescent OR youth OR pubertad).

Resultados: 11 artículos cumplieron los criterios de inclusión y elegibilidad. Aplicaciones móviles o APP y detección de idioma fueron las tipologías encontradas, siendo las Aplicaciones para Smartphone/APP presentes en el mayor número de estudios. Los resultados demuestran la importancia del uso de nuevas tecnologías para prevenir el riesgo de suicidio.

Conclusión: Se evidenció alta adherencia al uso de nuevas tecnologías, útiles en la prevención del riesgo de suicidio en adolescentes. Las nuevas tecnologías se consideraron bien aceptadas y tienen efectos beneficiosos. Hasta el momento, los datos escasos respaldan el uso de estas intervenciones en la práctica clínica. El número de estudios sobre este tema es limitado, lo que requiere más investigaciones.

Palabras clave: nuevas tecnologías; APP; prevención del suicidio; riesgo de suicidio; adolescentes

INTRODUCTION

Mental health is a growing problem in our society, especially in children and young adolescents. Adolescence is a crucial period for developing social and emotional habits important for mental well-being. The World Health Organization estimates that 1 in 7 (14%) 10-19 year-olds experience mental health conditions, yet these remain largely unrecognized and untreated. Risk factors for suicide are multifaceted and include harmful use of alcohol, abuse in childhood, stigma against help-seeking, barriers to accessing care, and access to means of suicide (WHO, 2021).

Suicide is one of the leading causes of death worldwide among adolescents, ranking second in the 15-19 age group (WHO, 2019). Therefore, strategies for preventing suicide in adolescence should be considered a priority in the field of public health. Efforts aimed at preventing, detecting, and eventually treating adolescents at risk of suicide can prevent suicide, suicide attempts, and deaths.

Currently, the use of new tools, such as technology, is increasing in Medicine and Psychiatry, which is why the concept of "telepsychiatry" is acquiring decisive specificity, with a set of mobile phone applications related to healthcare that are already in existence (American Psychiatric Association, 2020). The use of these mechanisms has gained even more relevance due to the current pandemic caused by COVID-19 since most consultations are now carried out based on digital tools.

In the field of suicide risk assessment, technology is gaining ground, and *face-to-face consultations* are being complemented by online consultations, ensuring a faster and more effective intervention to meet the needs of users. Studies show that 72% of children up to the age of 11 and 96% of teenagers between the ages of 12 and 17 worldwide own a smartphone. Smartphones are ubiquitous and teenagers have phones with them at all times and in all places, even during crises (Pauwels et al., 2017). These facts emphasize the importance of interventions based on new technologies in the prevention of suicide in adolescents.

Given the above, and upon further examination, said the problem had its genesis in the high number of *dropouts* of adolescents at risk, demonstrating the importance of using new technologies applied to suicide as strategies capable of increasing the adolescent's accessibility to health care, available 24/7, which are still scarcely explored in Portugal. Thus, we query ourselves about the benefits of using new technologies in preventing the risk of suicide in adolescents, In response to the above question, a Systematic Literature Review (SLR) was carried out.

1. METHODS

The SLR is one of the most used types of reviews and is defined as a systematic, explicit, and reproducible method that allows the identification, evaluation, and synthesis of studies carried out by researchers to reduce biases. It is a method that allows for a rigorous synthesis of all research related to a specific question, making it possible to obtain the best evidence, and is therefore considered one of the pillars of evidence-based practice (Sousa et al., 2018).

Critical evaluation of the quality of studies that meet the inclusion criteria is fundamental in any SLR. The method guarantees the quality of research results, contributing to minimizing the risk of bias (Apóstolo, 2017).

This SLR used the PICO strategy and was based on the PRISMA recommendations, aiming to identify the benefits of using new technologies to prevent the risk of suicide in teenagers. Based on inclusion criteria, research was carried out by three people simultaneously during the month of January 2021, through the electronic database platforms EBSCOhost (MEDLINE Complete; Cochrane Central Register of Controlled Trials; CINAHL Complete; Library, Information Science & Technology Abstracts; Nursing & Allied Health Collection) and PubMed. A total of 101 articles in English were obtained, of which only 11 were considered eligible and were included in this study.

For the study in question, worldwide, an SLR was performed on publications made between January 2015 and January 2021. The PICO strategy and the PRISMA recommendations were used, and the research question "What are the benefits of using new technologies in preventing the risk of suicide in adolescents?" was formulated.

P - Teens

I - New technologies

C - Use

O - Benefits in preventing suicide risk

The objective was to identify the benefits of using new technologies to prevent the risk of suicide in adolescents.

The inclusion criteria for the articles were defined (Table 1): studies published in the last seven years (2015-2021), in Portuguese, English, and Spanish, carried out with adolescents, which describe the use of new technologies to prevent suicide risk.

Table 1- Inclusion criteria

Inclusion criteria
- Studies published in the last 7 years
- Studies published in Portuguese, English, and Spanish
- Primary Studies, Randomized Clinical Trials, Quasi-experimental Studies, and Qualitative Studies
- Studies carried out in adolescents
- Use of new technologies: APP or Mobile Applications
- Application used to prevent suicide risk

The following Boolean conjugation with the English descriptors was used: technology* AND (APP OR application OR mobile application) AND (suicide*) AND (adolescent OR youth OR puberty).

Table 2 describes the process of conjugating the descriptors and keywords of said research in the databases.

Table 2 - Boolean Conjugation

Boolean conjugation	EBSCOhost	PubMed
technology* AND (APP or application or mobile application) AND (suicide*) AND (adolescent or youth or puberty)	- MEDLINE Complete – 37 - Cochrane Central Register of Controlled Trials – 13 - Library, Information Science & Technology Abstracts – 4 - CINAHL Complete – 3 - Nursing & Allied Health Collection: Comprehensive - 2	
Total articles = 101	59	42

In the research and literature analysis phase, to find the best available evidence and minimize possible biases, the methodological quality of the studies was evaluated by three critical evaluators. For each study, aspects related to the methodology used, population, intervention, and results obtained were analyzed. Its evaluation was also carried out using the instruments proposed by the Joanna Briggs Institute (2017), namely the Checklist for Randomized Controlled Trials, Checklist for Quasi-Experimental Studies, and Checklist for Qualitative Research. For inclusion in this SLR, and to make the process clearer and without allegations of subjectivity, only studies that presented medium or high methodological quality were considered.

2. RESULTS

From the bibliographic research process carried out with this methodology, on the EBSCOhost platform, we obtained 66 articles for the initial selection. After inserting the first inclusion criteria (last 7 years), 59 articles were found. Of these, 8 were repeated, and the database eliminated 6 items from the results list and, after analysis, 2 more articles were found that were in duplicate. There were 51 articles, 18 of which were excluded by the analysis of the titles, leaving 33 articles in this database. Replicating the same methodology on the PubMed platform, 42 articles were found. Of these, 37 were repeated and 4 were excluded by title, leaving 1 article. In total, 34 articles were selected for analysis of abstracts.

Through the analysis of the abstracts, 15 articles were excluded, leaving 19 articles for analysis according to the eligibility criteria. Through this analysis, 8 articles were excluded, and a total of 11 articles were selected to be included in this review.

Figure 1 illustrates the PRISMA flow diagram corresponding to the identification, analysis, selection, and inclusion of articles.

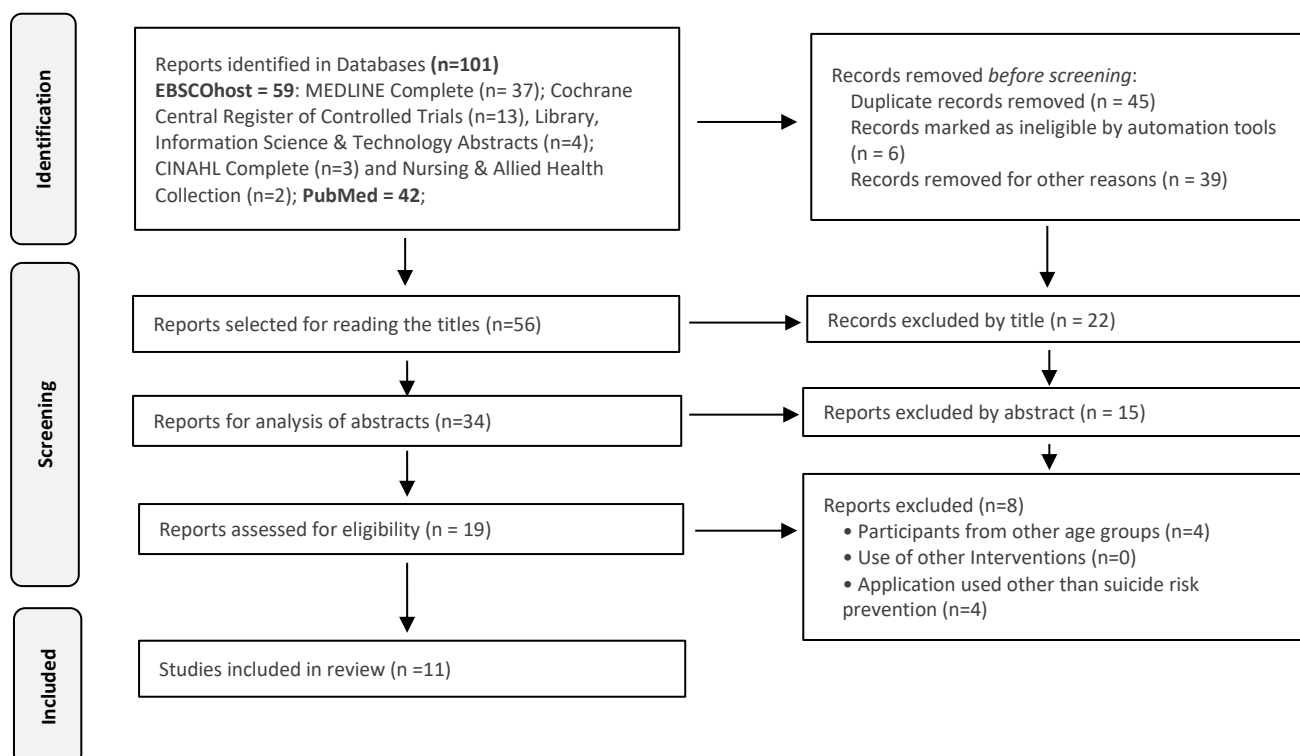


Figure 1 - PRISMA 2020 flow diagram

In summary, 11 articles were included in this SLR that met the inclusion and eligibility criteria published in the years 2015-2021. All articles included are analyzed in the following table (Table 3).

Table 3 - Analysis of articles and JBI Critical Appraisal

Authors / Year	Study Type	JBI quality	Population	Intervention	Results
Tighe et al., 2020	Randomized clinical trial	High (11/13)	Adolescents (n=13)	<i>iBobbly</i> mobile app	The use of this application improved the results in terms of psychological distress and suicidal ideation. The effects were not statistically significant. However, <i>iBobbly</i> was considered by teenagers to be effective, acceptable, and appropriate.
Cohen et al., 2020	Qualitative study	High (8/10)	Adolescents (n=60)	Language acquisition through a smartphone application	These techniques produced acceptable results, despite being collected in a less controlled environment than in trials.
O'Grady et al., 2020	Quasi-experimental study	Medium (7/9)	- Design Group (n=6) - Health professionals (n=5) - Adolescents (n=18)	<i>SafePlan</i> mobile app	Developed a mobile app called <i>SafePlan</i> capable of providing an interactive safety plan to support users with suicidal thoughts or behavior.
Czyz et al., 2020	Quasi-experimental study	High (8/9)	Adolescents (n=32)	Psychosocial intervention that identifies risk factors through a mobile application within the first 2 weeks after discharge	This study illustrated the application of existing methods to identify early signs of suicidal crises. The findings point to the usefulness and feasibility of using longitudinal data obtained through a mobile application to produce valuable early markers of a suicidal crisis.
Allen et al., 2019	Qualitative study	High (8/10)	Adolescents (n = N/A)	Monitoring methods and computational analysis	Important predictive method of identifying suicidal thoughts and behaviors carried out through the use of smartphones and other technologies for longitudinal assessment, monitoring of risk factors, and modern computational techniques.
Hetrick et al., 2018	Qualitative study	High (9/10)	- Adolescents (n=11) - Health professionals (n=16)	Mobile application through a co-design <i>methodology</i>	The development of the app, using a co-design process, is a significant step forward due to the incorporation of the youth perspective. The inclusion of opinions from healthcare professionals and youth in a co-design process <i>highlighted</i> disparate needs, motivations, and intentions for the app.
Daray et al., 2018	Qualitative study	High (8/10)	Adolescents (n = N/A)	CALM mobile app	This app interacts with the user by providing evidence-based tools to resolve crises and thus prevent suicide.
Pauwels et al., 2017	Quasi-experimental study	High (8/9)	Adolescents (n=21)	Backup mobile app	Decrease in Beck's Suicidal Ideation Scale score after using <i>BackUp</i> . The application was used several times and evaluated as very or very useful in suicidal crises.
O'Brien et al., 2017	Quasi-experimental study	High (8/9)	- Adolescents (n=20) - Parents (n=20)	<i>Crisis Care</i> mobile app	Acceptability and usability for teenagers and parents. <i>Crisis Care</i> has the opportunity to improve safety plan procedures with a focus on the family, interventions, and treatment for adolescents with suicidal behavior.

Authors / Year	Study Type	JBİ quality	Population	Intervention	Results
Gregory et al., 2017	Quasi-experimental study	Medium (7/9)	Adolescents (n=76)	<i>Be Safe</i> mobile app	<i>Be Safe</i> allows users to create a digital safety plan, informs them about mental health resources in the community, and guides users in decision-making. This study shows that a high percentage of adolescents have a smartphone (65.8%), 18% downloaded the <i>BeSafe app</i> before discharge and the majority (68%) admitted that they would do so after discharge. Only 6% were opposed to downloading the app.
Kennard et al., 2015	Qualitative study	High (9/10)	- Health professionals (n=5) - Adolescents (n=5) - Parents (n=5)	Smartphone application with a security plan for suicide prevention	All professionals report that an application that contains the security plan for smartphones is a useful and important tool for treatment; Parents consider that a cell phone app with the security plan improves their teen's safety; Teens stated that this mobile app is useful and admitted that they would feel comfortable using it at home or school during a crisis.

3. DISCUSSION

To understand the benefits of using new technologies that prevent the risk of suicide in adolescents, 11 studies of different types of research that met the inclusion criteria defined in the methodology were analyzed.

Regarding the investigation design of the studies included in this review, we obtained: 1 Randomized Clinical Trial; 5 Quasi-Experimental Studies, and 5 Qualitative Studies.

Regarding the typology of new technologies on the subject of suicide, the research carried out highlighted mobile applications or APPs and language detection. Thus, it was decided to group the results of the studies included in these categories, to facilitate the attainment of conclusions and reinforce the meaning of the findings, as recommended by the Joanna Briggs Institute (2014).

3.1 Smartphone Apps/Apps

Through the analyzed studies, we can identify the existence of 7 smartphone applications that can be used to prevent the risk of suicide in adolescents. It should be noted that the development of these applications is in different phases their design, development, and application.

Regarding the *iBobbly application*, a randomized clinical trial by Tighe et al. (2020) was carried out to assess its use and acceptability. The results of using the *iBobbly app* were positive. This study showed that teenagers frequently use technology in general and found the *iBobbly app to be* culturally safe and of therapeutic value. Using this app has shown interest in suicide prevention and emotional well-being, and has been associated with self-reported improvements in psychological and mental well-being, health literacy, and stigma reduction.

The *SafePlan application* was developed and tested in collaboration with healthcare professionals through an iterative design process in the investigation of O'Grady et al. (2020). The primary function of this app is to provide an interactive safety plan to support teens with suicidal thoughts or behaviors as an adjunct to face-to-face therapy. This participatory process involved health professionals and information technology specialists and resulted in the creation of a mobile health intervention technology that has the potential to increase accessibility to mental health services. This app has passed the initial testing phase, relevant recommendations have been implemented, and is ready to use.

Hetrick et al. (2018) describe the development of a mobile application through a co-design methodology in which adolescents and health professionals participate in the development of the application. The app is designed to facilitate and extend existing face-to-face services for teens with depression, including those at risk for suicidal behavior. The inclusion of opinions from healthcare professionals and adolescents in a co-design process highlighted disparate needs, motivations, and intentions for the app. This co-design process is a significant advance over many of the currently available apps (and other technology-based interventions) that were designed to address mental health issues due to the incorporation of the teen perspective. Furthermore, ensuring that both health workers and adolescents are involved in their development ensures that their needs are met. The app promises to be a tool to assist health professionals and adolescents in the management of depression and suicide-related behaviors, however, it still needs to be tested.

Daray et al. (2018) describe the theoretical foundations and technical aspects used for the development of the first Spanish application for smartphones, called CALMA. This app interacts with the user by providing tools based on dialectical behavioral

therapy to resolve crises and prevent suicide. This tool was initially developed to be prescribed by a mental health professional as a supplement to psychological and psychopharmacological treatments, but it can also be used by adolescents who do not have access to the health system or are afraid of being stigmatized. The CALMA app provides information, promotes activities aimed at reducing vulnerability, to prevent new crises, and provides psychoeducational content on suicide and its prevention. In the future, this application will be the subject of a clinical trial to determine whether these interventions are effective in treatment when administered via smartphone, as they prove to be in face-to-face treatment with a professional.

The BackUp smartphone application is an evidence-based tool to support people in a suicidal crisis that was developed, validated, and implemented by Pauwels et al. (2017). During the application implementation phase, the authors verified that most of the elements of the sample used the *BackUp* several times and that suicidal ideation after its use showed a small, but not significant, decrease in the Beck Suicidal Ideation scale score. Backup was evaluated positively and translates that self-help tools can have a positive impact on reducing suicidal ideation and evaluated as very or very useful in times of suicidal crisis.

Crisis Care smartphone app is based on cognitive-behavioral techniques that have been effective in reducing suicide-related symptoms in adolescents and were tested for feasibility and acceptability by O'Brien et al. (2017). Developed as an intervention for adolescents with suicidal behavior and their parents, to be used after hospital discharge when there is an increased risk of suicide, requiring, at this stage, continuity of care and supervision. The results demonstrated acceptability and usability, suggesting the usefulness of technological interventions such as *Crisis Care*, used as an adjunct to treatment for adolescents with suicidal behavior and their parents after hospital discharge. *Crisis Care* is currently in preparation to be tested in a randomized clinical trial.

The *Be Safe application* is an existing application, and a study by Gregory et al. (2017) assessed the feasibility of incorporating the adolescent safety plan into the app and creating a digital safety plan at the time of discharge. The authors of this study concluded that there is a lot of interest from adolescents in using smartphone-based applications at the security level. These apps can play an important role in the safety plan at outpatient discharge, and smartphone interventions can improve access to health care after discharge.

Kennard et al. (2015) carried out a study to identify effective treatment goals and safety plans and promote the development of a smartphone application that contains a safety plan for suicide prevention. To carry out this study, health professionals experienced in the area of suicide in adolescents, adolescents with a history of suicidal ideation and/or attempted suicide, and their parents or legal representatives were included. All health professionals reported that the application containing the security plan for smartphones would be a useful and important tool for treatment. Most teenagers reported owning a smartphone and spending most of their time sending text messages, accessing the internet, and using mobile phone applications. They mentioned that this mobile app would be useful, admitting that they would feel comfortable using it at home or school during a crisis. Parents reported that their children use their cell phones and many mobile applications a lot, so they consider that a cell phone application with a security plan would be convenient, easily accessible, and would improve the safety of the teenager. Adolescents and parents indicated a high degree of use and comfort with smartphones and mobile phone applications. For this reason, a mobile app with a customized security plan would allow for greater availability of individualized and targeted interventions.

3.2 Language detection

Language detection is used as a suicide prevention strategy. Textual resources are extracted from online publications (forums, tweets, and other social networks) to identify the risk of suicide. Statistical classification algorithms, using logistics, regression algorithms, randomization, and support vector machine (*Support Vector Machine*) are applied to identify patterns and relationships between text content and suicide.

Cohen et al. (2020) evaluated the use of an app to explore the feasibility of incorporating procedures to capture the language and predict the level of suicide risk through language analysis. We used computer models trained on samples of suicidal language that were used to assess the risk of suicide, which can be predicted based on examples of language from this pilot study. These techniques for capturing the language and measuring the level of risk using these methods have produced viable results in adolescents. These findings are an opportunity to implement new methods to support decision-making regarding suicide and other mental health issues. As a limitation, it was identified that the data were collected in a less controlled environment of adolescent mental health therapy sessions compared to trials.

Similarly, Allen et al. (2019) in their exploratory study described recent developments in monitoring methods and computational analysis to solve some of the problems related to suicide prevention in adolescents. The authors concluded that we currently can use smartphones and other technologies to carry out intensive longitudinal assessments, monitoring of risk factors, and modern computational techniques to develop predictive methods of suicidal thoughts and behaviors.

Most of the studies analyzed point out as a limitation the scarce amount of data that support the use of interventions based on technologies in clinical practice and preventive strategies, and point to the need for further studies to test their effectiveness in preventing suicide among adolescents. It is necessary to carry out clinical trials to analyze the effectiveness and cost-effectiveness of these tools so that they can be widely implemented in clinical practice.

Privacy and confidentiality of the application were some of the limitations pointed out in the studies carried out by Kennard et al. (2015) and by O'Grady et al. (2020). The small sample size was considered to be another one of its limitations (O'Brien et al., 2017).

3.3 Implications for practice

In this SLR, research of worldwide interest was found that highlighted the need to consider the use of new technologies in suicide prevention programs. It is a fact that technologies have a greater impact on the younger population, with adolescents being one of the groups at greatest risk of suicidal behavior, and therefore the use of technology, especially via the internet and mobile applications, should be considered.

O'Brien et al. (2017) argue that the speed at which adolescents can communicate and receive answers through smartphones can be identified as a distinct advantage to using in treatment.

Importantly, participants reported that they would recommend other similar apps to their peers (Tighe et al., 2020).

In the study by Gregory et al (2017), it is important to emphasize that all adolescents who downloaded the application before discharge were hospitalized for the first time in a psychiatric service. The authors refer that the results they found demonstrate the tension between restriction and incorporation of access to smartphones by adolescents during hospitalization, highlighting the need for a future study on this dimension.

There is a high trend in the use of technology to prevent suicidal behavior, which reveals the existence of numerous experiences and tools that can already be used in clinical practice. Most of these tools are in English and it is useful for these technologies to adapt to other languages to achieve greater coverage.

3.4 Limitations

Some limitations should be pointed out, such as the reduced number of studies included in the analysis, which demonstrates the need to carry out more research on this topic; the heterogeneity of the type of studies found, with only 1 Randomized Clinical Trial found; the fact that the Apps/Apps for smartphones are in different stages of development, where currently only a few are available for immediate use; and also, regarding applications/APPs, the lack of consensus on the instruments used and the interventions to be included in it.

CONCLUSION

Through this SLR we can conclude that there is evidence of good adherence to the use of new technologies, that are useful in preventing the risk of suicide by the adolescent population. Some studies point to the beneficial effects of this use in terms of accessibility and improvement of communication between adolescents/health professionals, identification of predictors of suicidal crisis, an increase in self-help strategies to reduce suicidal ideation, in the definition of a personalized safety plan and as an adjunct to conventional treatment in several stages, including follow-up. Interventions that combine the use of new technologies associated with conventional treatment models may constitute an asset for the prevention of suicide risk.

A high percentage of teenagers own a smartphone and use these devices frequently to send text messages, access the internet, and use applications. Thus, the existence of applications developed for suicide prevention would be advantageous for this population. Overall, the results found show the importance of using new technologies aimed at preventing the risk of suicide for this age group.

Regarding the typology of new technologies referenced in the analyzed studies, mobile applications or APPs and the detection of language on the subject of suicide stand out, with Smartphone Applications/APPs being the typology addressed in a greater number of studies. However, we found that these applications are in different stages of development and that few are already validated, and ready to be used.

We can consider that smartphones and other technologies can provide an access point to facilitate the early identification of risk factors and the implementation of the intervention, representing the key to future advances in the identification of suicidal thoughts and behaviors in adolescents.

The new technologies were considered well-accepted and tolerated in the prevention of suicide in adolescents, however, to date, there is little data to support the use of such interventions in clinical practice. There are still a limited number of studies on this topic and any of them are in Portuguese. More research is needed to test the advantages of implementing new technologies in preventing suicide among adolescents, as well as conducting clinical trials that can analyze their effectiveness and cost-effectiveness so that they can be widely used in clinical practice.

AUTHOR CONTRIBUTIONS

Conceptualization, A.M.P. and J.F.; data curation, A.M.P., J.F. and J.C.S.; formal analysis, A.M.P., J.F. and J.C.S.; investigation, A.M.P., J.F. and J.C.S.; methodology, A.M.P., J.F. and J.C.S.; project administration, A.M.P. and J.F.; resources, A.M.P., J.F. and J.C.S.; software, A.M.P., J.F. and J.C.S.; supervision, A.M.P., J.F. and J.C.S.; validation, A.M.P., J.F. and J.C.S.; visualization A.M.P., J.F. and J.C.S.; writing-original draft, A.M.P. and J.F.; writing-review and editing, A.M.P., J.F. and J.C.S.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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