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Reducing Intrusive Suicidal Mental Images in Patients With Depressive Symptoms Through a Dual-Task Add-on Module: Results of a Multicenter Randomized Clinical Trial

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Objective: To examine the safety and efficacy of a brief cognitive dual-task (using eye movements) add-on module to treatment as usual (TAU) in reducing the severity and frequency of intrusive suicidal mental images and suicidal ideation. ***Method:*** We conducted a single-blind, parallel multicenter randomized trial (No. NTR7563) among adult psychiatric outpatients ($N = 91$; $M_{age} = 34.4$, $SD = 13.54$; 68% female) with elevated depressive symptoms and experiencing distressing suicidal intrusions in the Netherlands. Primary outcome was the severity (Suicidal Intrusions Attributes Scale) and frequency (Clinical Interview for Suicidal Intrusions) of suicidal mental imagery intrusions at 1-week posttreatment and 3-month follow-up. Primary analysis was intention-to-treat. ***Results:*** Between November 27, 2018 and September 13, 2021, 91 patients were included and randomly assigned to intervention group (Cognitive Dual Task Add-on + TAU) ($n = 46$) or TAU-only ($n = 45$). Cognitive Dual Task Add-on + TAU had greater reductions in severity (mean difference, −15.50, 95% CI [23.81, −7.19]; $p < .001$, $d = 0.60$), and frequency (geometric mean difference, 0.47, 95% CI [0.29, 0.79]; $p = .004$) of suicidal intrusions over time than TAU-alone. Cognitive Dual Task Add-on + TAU patients also showed lower suicidal ideation over time ($p = .008$, $d = 0.42$). There were no significant group differences in reductions in depressive symptoms, rumination, or hopelessness. Four serious adverse events occurred (three Cognitive Dual Task Add-on + TAU; one TAU-only); all unlikely attributable to intervention/trial. ***Conclusions:*** Findings provide support for the effectiveness of adding a cognitive dual-task module to the treatment of psychiatric outpatients with elevated depressive symptoms in reducing suicidal intrusions and ideation and can be executed safely.

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continued

What is the public health significance of this article?
This study strongly suggests that adding a brief cognitive dual-task module to treatment as usual is efficacious in reducing suicidal intrusions and suicidal ideation in psychiatric outpatients with elevated depressive symptoms. This study highlights the importance of targeting distressing intrusive suicidal mental images as an important, novel approach in suicide prevention strategies.

Keywords: suicide, suicidal intrusions, cognitive dual tasks, suicidal ideation, eye movements

Supplemental materials: https://doi.org/10.1037/ccp0000874.supp

Suicide is a global public health problem with over 703.000 people taking their own life each year (World Health Organization [WHO], 2021). Suicide is characterized by the complex interplay of biological, psychological, and environmental factors, and prevention requires a multidimensional approach (O'Connor & Kirtley, 2018). Current suicide prevention strategies often focus on risk assessments or directly attenuating feelings of unrest/discomfort giving rise to suicidality (e.g., via pharmacotherapeutic approaches or behavioral approaches, such as learning to apply self-control procedures; Menon et al., 2018). More focus on studies examining the effects of suicide prevention strategies directly targeting underlying processes assumed to be involved in the development of suicidal behavior is needed.

One underlying psychological process that may play an important role in suicidal ideation and behavior is intrusive suicidal mental imagery (O'Connor & Kirtley, 2018). Suicidal imagery presents itself as vivid, uncontrollable, and compelling suicidal images (i.e., "suicidal intrusions"), such as imagining oneself during or right after suicide (e.g., imagining taking an overdose) or the consequences thereof (e.g., seeing your funeral). These images can be emotionally distressing but simultaneously comforting (Holmes et al., 2007). Paradoxically, comfort/relief associated with them may present a risk factor for acting on such imagery (cf. craving the imagined situation; Kavanagh et al., 2005). The intrusiveness of the imagery—that is, it occurring involuntarily and unexpectedly—adds to the emotional impact of suicidal cognitions (Crane et al., 2012). The pivotal distinction between suicidal daydreaming/cognitions and suicidal flashforwards/intrusions lies in the latter's predominantly involuntary and unwanted disruptive nature (Ng et al., 2016). The word intrusive refers to that they are both involuntary and "unwanted", that is, occur unwanted against the person's will (Berntsen, 2021). Recent studies have established their presence in various clinical populations such as patients with major depressive disorder (MDD; Holmes et al., 2007) or borderline personality disorder (Schultebraucks et al., 2020).

Reducing intrusive suicidal imagery could be an important target for suicide prevention. Studies showed that suicidal images are associated with more intense and longer durations of suicidal cognitions, and a higher likelihood of making a suicide plan or attempt, irrespective of depressive symptom severity (De Rozario et al., 2021; Lawrence et al., 2022; Ng et al., 2016). A recent meta-analysis on mental imagery of suicide and nonsuicidal self-injury reported high prevalence rates, whereby 73.6% of suicidal individuals reported suicidal mental imagery and 84.3% individuals reported nonsuicidal self-injury mental imagery (Lawrence et al., 2023).

As mental imagery drives the motivation to act on imagined behavior (Renner et al., 2019) and allows individuals to identify barriers to realizing a particular event, it could be theorized that effective treatment of intrusive suicidal mental imagery may promote suicide prevention. Thus, the severity and frequency of suicidal imagery (at least in part) may determine the actual risk of suicide and may be a crucial linking-pin between suicidal ideation and suicidal behavior (van Bentum et al., 2017). However, there is still little empirical evidence for the causal relationship between suicidal mental imagery and suicide attempts (in part due to the studies requiring substantial sample sizes to detect direct effects on suicide attempts or rates).

Targeting intrusive suicidal imagery may also indirectly impact associated symptoms with an elevated risk of suicide. Suicide-related intrusions have been found to evoke strong emotions and

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image preoccupation (e.g., Holmes et al., 2007). Thus, reducing suicidal thoughts may also decrease depressive symptoms, hopelessness, and rumination. As the frequency of the emotionally laden suicidal intrusions reduces, image preoccupation, the feeling of being overwhelmed by suicide-related images and associated negative emotions will dissipate as well. This is consistent with recent findings showing that a digital imagery-competing task intervention not only reduced the frequency of intrusive memories but also improved clinical symptoms, work functioning, and well-being among intensive care unit staff following COVID-19-related trauma exposure (Iyadurai et al., 2023).

Now, what treatment strategies can reduce the impact of distressing suicidal intrusive imagery? Previous attempts have been made, as part of wider approaches to treating problematic emotional imagery (using Functional Imagery Training; Di Simplicio et al., 2020) but this has not been tested in RCTs. From mental health science perspectives, another way to develop psychological treatments is to tackle underlying mechanisms (Holmes et al., 2018). Experimental and clinical studies showed that the vividness of intrusive mental images (of positive *and* negative emotional valence) may be reduced by dual-task interventions taxing working memory, such as eye movements (Houben et al., 2020; van den Hout & Engelhard, 2012). Since eye movements assumingly compete for cognitive resources with mental imagery, the image may be rendered less intense, even upon recall (van den Hout & Engelhard, 2012). Experimental research evidence indeed revealed how larger effects are related to dual tasks that load more on working memory compared with low loading tasks (Maxfield et al., 2008; van den Hout et al., 2011; van Schie et al., 2016).

In addition to evidence-based therapies like exposure therapy, eye movement desensitization and reprocessing (EMDR) therapy is a treatment for posttraumatic stress disorder (PTSD) recommended in international guidelines (e.g., WHO Guideline: WHO, 2013). Results of a recent systematic review and meta-analysis supported these guidelines by concluding that EMDR seems effective in the treatment of PTSD, at least in the short term (Cuijpers et al., 2020).

Effectiveness of EMDR relies at least partly on benefits of dual tasks in reducing intrusive memories of traumatic events ("flashbacks") and their emotional evocative power (Engelhard et al., 2019). Dual tasks also decrease negative future-oriented/prospective imagery ("flashforwards"; Engelhard et al., 2010). A recent study among 70 Iranian inpatients with MDD who exhibited suicidal thoughts showed that eye movements decreased suicidal thoughts related to childhood traumatic events, suicidal ideation, and depressive symptoms (Fereidouni et al., 2019). No studies yet have targeted the treatment of distressing intrusions about suicide itself.

This study aimed to evaluate the safety and efficacy of a brief cognitive dual task using eye movements add-on module combined with treatment as usual (TAU) in reducing the severity and frequency of suicidal mental images and suicidal ideation. We also evaluated whether the add-on module would lead to reliable clinical changes (measured by a reliable change index [RCI]). Moreover, we hypothesized that targeting suicidal intrusions would indirectly reduce and target symptoms that are often associated with an elevated risk of suicide. A possible hypothesis is that reducing the frequency and emotional evocative power of suicidal intrusions may decrease depressive symptoms, hopelessness, and rumination by managing emotional reactivity. Therefore, we examined whether depressive symptoms, feelings of hopelessness, and rumination were also reduced by this add-on module.

Method

Design

A two-armed, single-blind, parallel randomized controlled trial (RCT) was conducted by the VU University Amsterdam at eight specialized mental health care centers spread across the Netherlands. The Medical Ethical Review Committee of the Amsterdam University Medical Centre (protocol No. 2017.237) approved the study protocol (van Bentum, Sijbrandij, Kerkhof, Huisman, et al., 2019) after small pilot study ($N = 6$) established safety and feasibility of the intervention (van Bentum, Sijbrandij, Kerkhof, van Schaik et al., 2019). The trial was prospectively registered in the Netherlands Trial Registry (No. NTR7563) and was overseen by an independent Data Safety Monitoring Board. All deviations from the preregistered protocol (such as intervention length, measures such as the Suicidal Intrusions Attributes Scale [SINAS], analyses etc.) can be found in Supplemental Material 4.

Procedure

Participants were adult (18 years or older) psychiatric outpatients with elevated depressive symptoms and experiencing distressing suicidal intrusions.

Inclusion criteria were: (a) suicidality in the past month (score ≥1 on Suicidal Ideation Attributes Scale [SIDAS]; van Spijker et al., 2014), (b) depressive symptoms in the past 2 weeks (score ≥20 on Beck Depression Inventory–II [BDI-II]; Beck et al., 1996), and (c) answer yes on at least one of two questions: "do suicidal intrusions hinder you in your daily life?" and "do you feel tormented by these suicidal intrusions?". There was a main focus on the presence of suicidal intrusions as a burden (see third inclusion criterion). This focus potentially resulted in higher sensitivity at the cost of specificity. Suicidal thoughts and behaviors, including suicidal intrusions, transcend diagnoses. We focused on a depressed population for this first trial evaluating the add-on module's effectiveness. However, patients did not have to meet full criteria for MDD but just to have moderate to high depressive symptoms per the BDI-II.

Exclusion criteria were (a) diagnosed with at least one of the following *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* disorders: psychotic disorder, depression with psychotic features, or bipolar disorder as confirmed by Mini International Neuropsychiatric Interview (van Vliet & de Beurs, 2007); (b) no internet access, since all questionnaires were administered online; and (c) a high dropout risk (i.e., poor response when contacting potential participant, such as failing to communicate throughout initial screening or have multiple no-shows for screening assessment). Other psychiatric comorbidities and medication use (as long as it was stabilized during the intervention period) were allowed.

Therapists referred patients with suicidal ideation, and self-referral was promoted by means of flyers in waiting rooms. The recruitment process consisted of two phases. In the screening phase, we assessed the presence and severity of suicidal intrusions (using the Intrusion Interview; Holmes et al., 2007). Next, patients indicating a presence of distressing suicidal intrusions were invited for the trial recruitment phase. They provided oral and written informed consent for participation in the RCT and completed the Clinical Interview for Suicidal Intrusions (CISI). The baseline assessment was administered with questionnaires regarding demographics, clinical measures, and outcome assessments. Next, patients were randomized on a 1:1 basis

into the intervention (Cognitive Dual Task Add-on + TAU) condition or control (TAU-only) condition using a stratified block randomization module in an electronic data capture system (Castor EDC; https://www.castoredc.com). Outcome assessors were blinded for condition during administration.

Participants were reassessed at 1-week posttreatment and 3-month follow-up (see Supplemental Figure S1, for overview). Participants received an online link to complete set of self-report questionnaires and were contacted for phone-administered intrusion frequency scores (see Appendix for additional information on data transparency).

Study Arms

Cognitive Dual Task Add-On Module

The Cognitive Dual Task Add-on module consisted of a minimum two and maximum six 60-min weekly sessions delivered at the patients' mental health care center by a trained therapist employed at the center. Therapists decided when to end treatment (often depending on the number of suicidal intrusions needed to treat); however, this was always in consultation with the participant. The module's protocol was developed in cocreation with people with lived-experience, practitioners, and experts in the field of dual tasks and suicidality. Focus groups, a pilot study evaluation (van Bentum, Sijbrandij, Kerkhof, van Schaik, et al., 2019), and expert review rounds were conducted to optimize the protocol.

The Cognitive Dual Task Add-on module mostly followed the EMDR procedure (Shapiro, 2001) as described in (de Jongh & ten Broeke, 2012), and in the study protocol, was referred to as an eye movement dual task (van Bentum, Sijbrandij, Kerkhof, van Schaik, et al., 2019). However, unlike EMDR, installing a positive cognition is not performed as research suggests it may be counter-effective (i.e., performing eye movements during activation of positive thoughts rendered these less vivid and positive; van den Hout & Engelhard, 2012).

Prior to the start of the intervention, in a brief introductory meeting between participant and therapist in which *all* suicidal intrusions present are discussed. Each session would consist of the following components: at the start of the session, the patient and the Cognitive Dual Task-therapist discuss and determine which suicidal intrusion will be treated. An example from a previous study includes: "My family identifying my body, which has gun-shot wounds" (Hales et al., 2011). Next, negative cognitions and emotions associated with the suicidal intrusion are acknowledged. Once an emotional target image of suicidal intrusion is identified, a cognitive dual-task component is performed: a consecutive set of eye movements of 30 s with 10 s breaks by following a light on a light bar for 5 min. While executing these eye movements, the patient simultaneously retrieves the target image (including all associated emotions). Between the sets, Subjective Unit of Distress Scale (SUDS) was administered to assess levels of distress during image retrieval. This procedure is repeated until the target image reaches a score of 0 on the SUDS or the SUDS-score stabilizes. Details about therapist training in the Cognitive Dual Task Add-on module and adherence to the protocol can be found in Supplemental Material 1.

Treatment as Usual

All patients received TAU. Treatment for depression and other psychological disorders within participating mental health care institutions typically consists of (evidence-based) psychotherapy and/or pharmacotherapy (Blais et al., 2013). In the present study, patients were open to receive any type of TAU that was currently provided in their mental health institution. The only treatment that was not allowed as TAU was EMDR therapy (de Jongh & ten Broeke, 2012). Both conditions allowed suicide risk management/assessments. Details regarding TAU were administered at posttreatment.

Measures

Suicidal Intrusions

Primary outcomes were the severity of suicidal intrusions as measured by the SIAS (van Bentum et al., 2023) and the frequency of suicidal intrusions as measured with the Clinical Interview for Suicidal Intrusions (CISI). Hereby, we deviated from the preregistered protocol, as the initial assessment tool (Suicidal Cognitions and Flashforwards Interview; Holmes et al., 2007) was missing a sum score to evaluate severity of suicidal intrusions over time (see Supplemental Material 4). Thus, both instruments (the interview and the SINAS) were further developed for this study, and the SINAS has been validated in a clinical sample (van Bentum et al., 2023). It assesses the distress, vividness, compulsiveness, frequency, nearness to a suicide attempt, and uncontrollability of the suicidal intrusions experienced, rated on an 11-point Likert scale (e.g., "how often did you experience mental images about your own suicide?" is scored as 0 = *not at all to* 10 = *constantly*, and "how intrusive were the mental images of suicide you experienced?" is scored as 0 = *not at all* to 10 = *extremely*). Higher scores indicate more severe suicidal intrusions (ranging from 0 to 100). The instrument has good convergent and divergent validity (van Bentum et al., 2023), and good overall internal reliability (Cronbach's α = .91). For this study, the Cronbach's α was .89.

To assess frequency of suicidal intrusions (using the CISI), patients were asked to recall and report the number of suicidal mental images experienced per day for the past week. The use of an intrusion diary is considered to be a valid instrument to provide symptom count data (Singh et al., 2023). Total frequency scores were a sum score of "all intrusions experienced in the past week."

To assess presence and characteristics of suicidal intrusions *prior* to participation in the RCT, patients were interviewed using the Intrusion Interview (Holmes et al., 2007). This semistructured interview consists of 21-items assessing the content of mental images and verbal thoughts about suicide.

Suicidal Ideation

Suicidal ideation was evaluated using the five-item Suicidal Ideation Attributes Scale (SIDAS; van Spijker et al., 2014), that assesses various attributes of suicidal ideation on 10-point scales over the past month. Total scores range between 0 and 50 and scores ≥21 indicate an elevated risk of suicidal behavior. The SIDAS demonstrated high internal consistency (Cronbach's α .91–.86; van Spijker et al., 2014).

Depressive Symptoms

Depressive symptoms were assessed with the Beck Depression Inventory-II (Beck et al., 1996), containing 21-items comprised of four self-evaluative statements about a particular symptom of

depression (scores range between 0 and 3). Total scores range from 0 to 63 (with subcategories: 0–13: minimal depression, 14–19: mild depression, 20–28: moderate depression, >29 severe depression). High internal consistency in a clinical population was found (Cronbach's α .91; Beck et al., 1996).

Hopelessness

Hopelessness was assessed with the Beck Hopelessness Scale (Beck Hopelessness Scale; Beck et al., 1974), consisting of 20 "true-false" statements covering positive and negative thoughts. The Dutch translation was internally consistent (Cronbach's α .68–.75; Kienhorst et al., 1990).

Rumination

Rumination was measured with the Ruminative Response Scale (Raes et al., 2009), a self-report measure that evaluates two aspects of rumination: brooding and reflective pondering. A total of 22-items are rated on 4-point scales (1 = *almost never* to 4 = *always*).

Add-On Module Checklist

Treatment fidelity was assessed by two independent assessors who scored a random selection of 52 videotaped sessions with a checklist developed for this study. This checklist comprised 28 items divided into three categories (see Supplemental Material 2). Scores were calculated by sum score of all items in each category, with higher scores indicating better adherence to the protocol. Mean scores were computed for sessions rated by the multiple raters.

Adverse Events

Adverse events, including serious adverse events, were reported by patients/professionals or examined during assessments.

Treatment Evaluation

Acceptability of the intervention was evaluated by patients in the intervention group at posttreatment. Patients rated aspects of the add-on module sessions on a 4-point scale (ranging from 0 = *completely disagree* to 4 = *completely agree*) and provided feedback and possible suggestions for improvement regarding the intervention. These aspects included: the perceived usefulness of the intervention, the likelihood of recommending the treatment to others, and the overall satisfaction with the treatment.

Analyses

To our knowledge, no similar interventions reducing suicidal intrusions have previously been tested. Previous studies have shown that dual tasks such as the computer game Tetris may reduce the frequency of intrusive images and thoughts of a distressing film (with effect sizes ranging between d = 0.80–0.91; Horsch et al., 2017; Iyadurai et al., 2018). Therefore, we based power calculations on a more conservative effect size of d = 0.7 of the Cognitive Dual Task Add-on + TAU as compared to TAU-only at 3-month follow-up on the primary outcome (severity of suicidal intrusions). Simple power calculations analysis of variance using G*Power tool suggested minimum sample size of 38 patients per group (Cohen's d = 0.70, power = 0.85, α = .05, two-sided). Accounting for 15%–20% attrition, we aimed to include a total of 90 patients (45 patients per group).

Linear mixed models (LMMs) were used to evaluate the effect of the Cognitive Dual Task Add-on module on average over time (1-week posttreatment and 3-month follow-up). Analyses were intention-to-treat, and using mixed-model analysis for longitudinal data is considered the most appropriate way to account for missingness and is much more stable than any form of imputation (Twisk et al., 2018, 2020). When using multiple imputation (MI), predicted values of missing data are obtained from the observed data using a maximum likelihood approach. The regression coefficients are then obtained using another maximum likelihood approach. In contrast, the mixed-model analysis directly uses the observed data to obtain the regression coefficients. Both methods use the same information, but MI involves an additional step compared to the mixed-model analysis. Therefore, the mixed-model analysis is considered more stable than MI. According to Twisk et al. (2018), there is no apparent benefit in using MIs to handle missing data before performing a mixed-model analysis on longitudinal data. Furthermore, it is difficult to fully determine whether incomplete data are missing at random or missing not at random in real-life data (Enders, 2010; Kenward & Carpenter, 2007; Potthoff et al., 2006).

Log transformation was used for frequency scores (CISI) because data were positively skewed. After transforming, the same method as for severity scores (SINAS) could be applied. The model included two dummy variables for time (i.e., posttreatment and 3-month follow-up), two interaction terms for condition*time, and a random intercept on subject-level. As condition itself is not added to the model, intercept values reflect the baseline value for both conditions and thus adjusting for baseline differences between conditions (Twisk et al., 2020). The regression coefficients of the two interaction terms reflect the mean difference between the groups at the two different time-points. A random slope for the condition variable was not added to the model because this variable is time-independent. The difference in estimated marginal means (also called "least squares") are reported. Estimated marginal means refer to the average or predicted values of the dependent variable for each level of the independent variable, while taking into account the variability introduced by fixed and random effects. The same method was applied to investigate effects on the secondary outcomes.

Effect sizes (Cohen's d) were calculated by the difference between estimated means divided by raw pooled standard deviation at associated timepoint. Sensitivity analyses were conducted with a model nesting patients in mental health institutions, and by fitting the final model on study completers-only (i.e., assessments on all three time-points: n = 45). A simple regression was conducted to evaluate if number of intervention sessions (dose) was a predictor of the overall SINAS change scores. Due to complete collinearity with the TAU-only (control condition), we were unable to include dose-effect into the main model. Therefore, using change scores allowed us to interpret the overall effect of a dose in a simple regression. Additional information can be found in Supplemental Material 3.

The RCI for the SINAS (total scores) was calculated using the baseline SD for the full sample and baseline Cronbach's α as test–retest reliability coefficient (Jacobson & Truax, 1991). The Clinical Significant Change cut-off for the SINAS (total scores) was calculated by subtracting 2SD of the baseline M for the full sample. For a reliable change ("response"), a decrease of at least 18.73 points on the SINAS from baseline to posttreatment was needed and for a

clinically significant change ("recovered") as an absolute value of 34.12 points or less on the SINAS at posttreatment and/or 3-month follow-up was needed.

Analyses were performed using Stata/SE Version 17.0 for Mac (StataCorp LLC) and IBM SPSS Version 27 (IBM Corp., Armonk, New York, United States), and two-tailed tests were reported where $p < .05$ indicated statistical significance.

Results

Participants

Between November 27, 2018 and September 13, 2021, 610 patients were referred to our study, of whom 178 provided informed consent for the screening phase and were assessed for the presence and severity of suicidal intrusions (shown in the Consolidated Standards of Reporting Trials flow diagram in Supplemental Figure S2). Fifty-four individuals did not meet inclusion criteria (whereby 20 participants did not experience suicidal mental images, and 13 participants did not consider their suicidal intrusions as tormenting). Furthermore, 17 participants were excluded from participation as no therapists to perform the Cognitive Dual Task Add-on module were available at their mental health center, and 16 declined to participate, resulting in 91 consenting patients (46 to Cognitive Dual Task Add-on + TAU and 45 to TAU-only). In the intervention (Cognitive Dual Task Add-on + TAU) condition, five people did not receive the intervention and three people discontinued intervention. Thirteen patients were lost to follow-up assessment at 3-month follow-up. In the control (TAU-only) condition, four people withdrew from the study during the intervention period. Six patients were lost to follow-up assessment at posttreatment and an additional 15 patients at 3-month follow-up. Missing data on the primary outcome measure was 19.8% ($n = 18$) at posttreatment and 50.5% ($n = 46$) at 3-month follow-up.

Baseline demographic and clinical characteristics were well balanced between both conditions (see Table 1). Mean age at baseline for the total sample was 34.4 ($SD = 13.54$) and 62 participants (68%) were female. No relevant clinical and baseline characteristic differences were found between completers ($n = 73$) and drop-outs at posttreatment ($n = 18$; see Supplemental Table S1). Regarding TAU, patients reported to have received psychotherapy alone ($n = 16$), pharmacotherapy alone ($n = 8$), other treatment ($n = 19$) or a combination of psychotherapy and pharmacotherapy treatment ($n = 30$). See Table 1 for an overview of TAU received. Types of psychotherapy varied from cognitive behavioral therapy ($n = 26$), schema therapy ($n = 10$) to short intensive treatments at crisis unit ($n = 10$; Supplemental Table S2 provides a detailed overview of TAU received between treatment groups for completers-only). A chi-square test of independence was performed to examine the relation between condition and treatment as usual received. The relation was not significant, $\chi^2(2, n = 90) = 8.9$, $p = .23$, indicating no between-group differences regarding type of TAU and amount of treatment hours.

Each trained therapist treated between one and four patients ($SD = 1.78$) and provided on average 3.83 Cognitive Dual Task Add-on sessions per patient. A total of 106 videos of 39 patients were available. Seventeen (37%) Cognitive Dual Task Add-on + TAU participants completed six add-on sessions, four (8.7%) participants did not start the intervention, and three (6.5%) participants discontinued intervention. Remaining participants completed two ($n = 6$, 13%), three ($n = 9$, 19.6%), four ($n = 3$, 6.5%), or five ($n = 4$, 8.7%) add-on sessions. The number of intervention sessions (dose) received was as not a significant predictor for the change score in severity of suicidal intrusions, $B = 3.75$, $SE = 1.98$, $p = .067$.

Adherence to the Cognitive Dual Task Add-on module protocol as rated with the Add-on Module Checklist varied from good-to-very good on logistics ($M = 2.96$, $SD = 0.77$, $n = 38$), poor-to-moderately good on the category "identifying target image" (1.47, $SD = 0.69$, $n = 37$), and good-to-very good for "not adding additional EMDR techniques" (1.47, $SD = 0.69$, $n = 37$). Intraclass correlation scores between independent raters can be found in Supplemental Material 1.

Primary Outcome

LMMs showed an overall positive intervention effect (see Table 2). Condition had a significant moderate effect on suicide intrusion severity (SINAS total score) over time adjusted for baseline, with lower scores for treatment group (Cognitive Dual Task Add-on + TAU) compared to the control condition (TAU-only). At 1-week post assessment, the estimated marginal mean was 27.68 for the intervention group and 44.89 for the control group, giving a mean difference of −17.21 (95% CI [−26.72, −7.69]; $p < .001$; effect size $d = 0.72$). At 3-month follow-up, the estimated marginal mean was 23.91 for intervention group and 36.28 for control group, giving an adjusted mean difference of −12.37 (95% CI [−24.30, −0.44]; $p < .001$; effect size $d = 0.43$; see Figure 1).

Results also showed an effect in favor of Cognitive Dual Task Add-on + TAU for *frequency* (CISI) scores over time with back-transformed geometric mean difference of 0.47 (95% CI [0.29, 0.79]; $p = .004$; see Supplemental Figure S3).

RCI-scores and clinically significant change scores showed that at posttreatment in the intention-to-treat sample, 24 Cognitive Dual Task Add-on + TAU participants (52.17%) had a reliable change on SINAS total scores of which 20 (43.48%) were clinically significant (i.e., recovered). In TAU-only condition, nine participants (20%) had reliable change of which seven (15.6%) were recovered and two (4.44%) deteriorated. At 3-month follow-up, 17 Cognitive Dual Task Add-on + TAU participants (36.96%) had a reliable change on SINAS total scores of which 15 (32.61%) recovered and one (2.17%) deteriorated. In the TAU-only condition, six participants (13.33%) had reliable and clinically significant changes (i.e., recovered). See Table 3 for RCI-scores of the completers-only.

Secondary Outcomes

LMM also showed an overall greater reduction for Cognitive Dual Task Add-on + TAU in suicidal ideation (SIDAS) over time (−5.82; −10.10 to −1.54, $p = .008$; $d = 0.42$). Observed means of total scores on SIDAS per condition over time can be seen in Figure 2. There were no significant overall effects of condition on depressive symptoms (BDI-II; $p = .06$; $d = 0.28$), hopelessness (Beck Hopelessness Scale; $p = .93$; $d = -0.01$), or rumination (Ruminative Response Scale; $p = .13$; $d = 0.24$). However, the reduction for Cognitive Dual Task Add-on + TAU in depressive symptoms over time were close to significant, and more importantly recovery in terms of dereduction in depression scores was faster in intervention condition than control condition but disappeared at 3-month follow-up (Supplemental Figure S4).

Table 1
Sociodemographic Characteristics of the Intention-to-Treat Sample at Baseline

Baseline characteristic	Add-on + TAU		TAU-only		Total sample		χ^2	*T* test
	n	%	*n*	%	*n*	%	*p*	*p*
Gender							.29	
Female	29	63	33	73	62	68		
Male	17	37	12	27	29	32		
Educational attainment[a]								
Low	0	0	5	11	5	5.5		
Middle	25	54	26	58	51	56		
High	21	47	14	31	35	38.5		
Currently employed	31	67	24	53	55	60	.17	
Country of birth							.98	
Netherlands	32	70	31	70	63	69		
Other	1	2	1	2	2	2.2		
Missing data	13	29	13	28	26	29		
In a relationship	21	46	17	38	38	42	.99	
Clinical characteristics	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*
Number of comorbidities[b]	3.4	1.7	3.5	2.2	3.4	1.9		.27
Suicidal intrusions (SINAS)	57.8	18.8	50.7	21.2	54.3	20.2		.28
Suicidal ideation (SIDAS)	32.9	8.5	30.7	8.3	31.8	8.5		.60
Depressive symptoms (BDI-II)	39.7	8.7	37.5	8.4	38.6	8.6		.65
Rumination (RRS)	36.9	9.6	35.8	11.6	36.4	10.6		.23
Hopelessness (BHS)	15.8	2.8	14.6	4.5	15.2	3.8		.003**
Treatment as usual[c]	*n*	%	*n*	%	*n*	%	*p*	*p*
Psychotherapy	22	47.8	21	46.7	43	47.6	.17	
Missing	11	23.9	7	15.6	18	19.8		
Pharmacotherapy	21	45.7	17	37.8	38	41.8	.98	
Missing	22	47.8	25	55.6	47	51.6		
Other type of treatment	5	10.9	6	13.3	11	12.1	.99	
Missing	11	23.9	7	15.6	18	19.8		
Combined treatment	16	34.8	14	31.1	30	33	.29	
Missing	11	23.9	7	15.6	18	19.8		

Note. $N = 91$ ($n = 46$ for Add-on + TAU condition; $n = 45$ for TAU-only condition). Participants were on average 32.7 years old ($SD = 12.33$), and participant age did not differ by condition. BDI-II = Beck Depression Inventory–II; SIDAS = Suicidal Ideation Attributes Scale; SINAS = Suicidal Intrusions Attributes Scale; TAU = treatment as usual; RRS = Ruminative Response Scale; BHS = Beck Hopelessness Scale.
[a] Low educational attainment is defined as having no formal education or having completed special lower education, primary school, or practical training school; middle educational attainment is defined as having completed lower general secondary education, higher general secondary education, or intermediate vocational education; higher educational attainment is defined as having completed higher vocational education, preuniversity education, or a university degree. [b] Comorbid Axis I disorders were established with the use of the Mini International Neuropsychiatric Interview. [c] Reflects the number and percentage of participants answering "yes" to this question.
** $p < .01$.

In congruence with intention-to-treat analyses, results of a post hoc sensitivity analysis (completers-only; $n = 45$) showed an effect in favor of Cognitive Dual Task Add-on + TAU over time with an adjusted mean difference of −16.83 (95% CI [−26.39, −7.27]; $p = .001$; $d = 0.65$). Similar results were found for the completers-only ($n = 34$) analysis for frequency (CISI) scores (adjusted geometric mean difference: 0.37; 95% CI [0.20, 0.68]; $p = .002$). Furthermore, a statistically significant positive association was found between the change scores of the SINAS and SIDAS with Pearson correlation coefficient = .49, $p < .001$, indicating a firm association between suicidal intrusions and suicidal ideation.

In total, four serious adverse events were reported (three Cognitive Dual Task Add-on + TAU; one TAU-only), including three suicide attempts, and one voluntary hospitalization related to a suicide attempt. Two adverse events (one voluntary hospitalization and one suicide attempt) were from the same participant. All were reported to Ethics Committee according to protocol, and Data Safety Monitoring Board was informed. All were assessed as unlikely related to trial procedures/intervention (as discussed with and confirmed by the patients).

Acceptability of Cognitive Dual Task Add-on Module

Overall, treatment evaluation scores ($N = 32$) indicated that participants who received the treatment deemed the intervention acceptable. In response to the item "I was satisfied with the intervention," 78.1% agreed to completely agreed, 18.8% were neutral, and 3.1% disagreed to completely disagreed. Next, on the item, "I would recommend the treatment to others," 71.9% agreed to completely agreed, 18.8% were neutral, and 9.4% disagreed to completely disagreed. Finally, for the item, "I found the treatment useful," 81.3% agreed to completely agreed, 9.4% were neutral,

Table 2
Adjusted Mean Differences (95% CI) or Back-Transformed Geometric Means Between Conditions for All Outcome Measures in the Intention-to-Treat Sample

Mixed model analysis	Difference in LS	95% CI		p	Cohen's d[a]
		LL	*UL*		
Primary outcomes					
SINAS					
Overall effect[b]	−15.50	−23.81	−7.19	<.001***	0.60
Posttreatment	−17.21	−26.72	−7.69	<.001***	0.72
Follow-up	−12.37	−24.30	−0.44	.042*	0.43
CISI[c]					
Overall effect[b]	0.47	0.29	0.79	.004**	NA
Posttreatment	0.50	0.27	1.08	.027*	NA
Follow-up	0.44	0.24	0.84	.012**	NA
Secondary outcomes					
SIDAS					
Overall effect[b]	−5.82	−10.10	−1.54	.008**	0.42
Posttreatment	−5.46	−10.49	−0.43	.033*	0.50
Follow-up	−6.41	−12.58	−0.23	.042*	0.43
BDI-II					
Overall effect[b]	−4.05	−8.25	0.15	.058	0.28
Posttreatment	−6.66	−11.42	−1.90	.006**	0.49
Follow-up	0.40	−5.40	6.19	.89	0.03
BHS					
Overall effect[b]	−0.06	−1.53	1.41	.93	0.01
Posttreatment	−0.87	−2.52	0.79	.30	0.18
Follow-up	1.39	−0.66	3.44	.18	−0.30
RRS					
Overall effect[b]	−2.92	−6.76	0.91	.13	0.24
Posttreatment	−2.33	−6.71	2.04	.29	0.20
Follow-up	−3.96	−9.32	1.40	.15	0.32

Note. $N = 91$ ($n = 46$ for Add-on + TAU condition; $n = 45$ for TAU-only condition). CI = confidence interval; LS = least squares; *LL* = lower limit; *UL* = upper limit; SINAS = Suicidal Intrusions Attributes Scale; CISI = Clinical Interview for Suicidal Intrusions; NA = not applicable; SIDAS = Suicidal Ideation Attributes Scale; BDI-II = Beck Depression Inventory–II; BHS = Beck Hopelessness Scale; RRS = Ruminative Response Scale; TAU = treatment as usual.
[a] Effect sizes were calculated using the difference in least square means between the add-on + TAU and TAU condition divided by the pooled standard deviation at that assessment. [b] This is the overall effect of condition on average over the two follow-up assessments. [c] Back-transformed geometric means were provided for log-transformed primary outcome variable Clinical Interview of Suicidal Intrusions; add-on + TAU = Cognitive Dual Task module in addition to treatment as usual.
* $p < .05$. ** $p < .01$. *** $p < .001$.

9.4% disagreed to completely disagreed. Important to note, nine participants did not complete this questionnaire.

Discussion

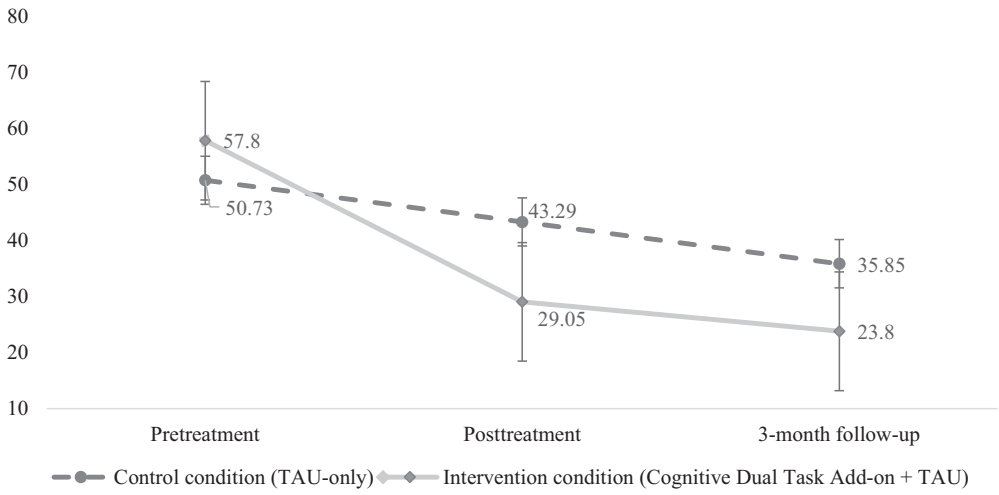
Despite the growing evidence that suicidal intrusions—that is, suicide-related mental imagery—may promote suicidal behavior (Crane et al., 2012; Holmes et al., 2007; Lawrence et al., 2021), no research has targeted these image-based intrusions as a potential suicide prevention intervention strategy. Our multicenter randomized trial demonstrated that the addition of a brief cognitive dual-task module (using eye movements) to treatment as usual reduced the severity and frequency of suicidal intrusions and suicidal ideation significantly in a mean of four sessions within 6 weeks, and the treatment appeared well tolerated. Importantly, these effects of the add-on module were maintained over time (at 3-month follow-up).

Directly after treatment, more than half (52.17%) of participants in the intervention condition had reliable change in severity of suicidal intrusions. Namely, almost half had recovered from their distressing suicidal intrusions while less than one fifth (15.6%) in the control condition had recovered, indicating it was not just a natural course of improvement. At 3-month follow-up still more than half of the individuals in the intervention group recovered. Recovery in this case meant that patients no longer had any suicidal intrusions at all, after having had them repeatedly. No significant reductions in depressive symptoms, rumination, or hopelessness were found, suggesting that changes on our other measures were not simply due to demand effects but to the focal symptom the intervention targets in line with a mental health science mechanistic approach (van Bentum et al., 2017).

Throughout this trial, four adverse events were reported and after evaluating with participants and their therapists, there was most likely no direct relation to the trial/intervention. Furthermore, during the intervention only one participant (and therapist) indicated elevated levels of distress due to the Cognitive Dual Task Add-on module session, but no direct critical incidents related to execution of treatment were reported. In another case, the therapist indicated a minor deterioration toward more severe suicidality due to external environmental stressors, and not as result of the intervention. This

Figure 1

Observed Means of Total Scores on the Suicidal Intrusions Attributes Scale (SINAS) per Condition Over Time



Note. For illustrative purposes, the *y*-axis starts at SINAS = 10. TAU = treatment as usual.

target group remains a high-risk group and a 2% deterioration is to be expected, as is portrayed in the control condition with two participants deteriorating. Overall, patients reported that the cognitive dual task did not increase their suicidality/suicidal intrusions, as reflected in the findings.

In line with the earlier studies, we found that suicidal intrusions occur frequently among suicidal patients with symptoms of depression (Holmes et al., 2007; Schultebraucks et al., 2020); the more depressed, the more suicidal intrusions (van Bentum et al., 2023). Patients reported that these intrusions were disturbing and caused suffering. Thus far, limited research exists on effects of dual-task interventions on suicidal ideation and has mostly been done informs of preliminary trials or included suicidal ideation as a secondary outcome. One study found that EMDR significantly reduced suicidal ideation and depressive symptoms in Iranian inpatients with MDD (Fereidouni et al., 2019). However, causes of the suicidal thoughts were mostly related to traumatic memories, whereas in our study, we addressed suicide-related future-oriented intrusions directly. Interestingly, their findings showed reductions in depressive symptoms while we only found a trend toward an overall effect on depressive symptoms. This might be because, in this study, the power may have been too low to demonstrate this effect, as more factors than suicidal intrusions influence depression. Another reason might be because treatments using dual tasks such as EMDR, when used to address traumatic memories, usually take much longer and lead to clinical improvements in depression in addition to PTSD (Lee & Cuijpers, 2013). In contrast, our treatment was only a maximum of six sessions (M = 4) and had distressing suicidal

Table 3

Reliable Change Index (%) at Posttreatment and 3-Month Follow-Up on the Suicidal Intrusions Attributes Scale (SINAS) With Observed Values (Completers-Only)

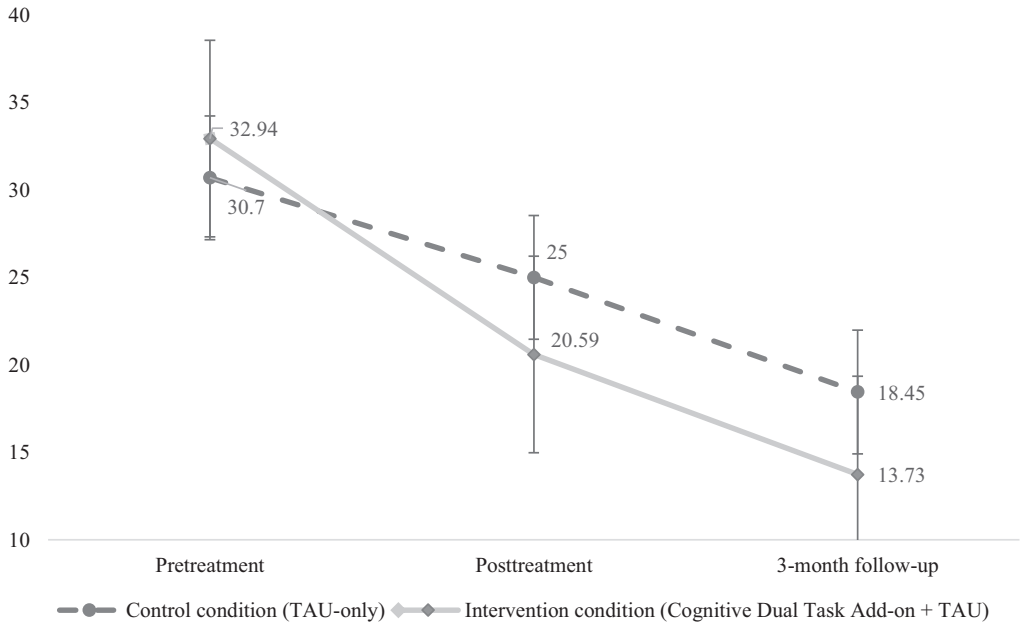
	Posttreatment				3-month follow-up			
	Add-on + TAU		TAU-only		Add-on + TAU		TAU-only	
RCI[a, b]	*n*	%	*n*	%	*n*	%	*n*	%
Recovered	20	52.6	7	20	15	60	6	30
Improved without recovery	4	10.5	0	0	1	4	0	0
Deteriorated	0	0	2	5.7	1	4	0	0
No change	14	36.8	26	74.3	8	32	14	70

Note. At posttreatment n = 38 for Add-on + TAU condition; n = 35 for TAU-only condition and at 3-month follow-up n = *25* for Add-on + TAU condition; n = 20 for TAU-only condition. RCI = Reliable Change Index; TAU = treatment as usual.

[a] The Clinical Significant Change cut-off for the SINAS (total scores) was calculated by subtracting 2 *SD* of the baseline Mean for the full sample. [b] The RCI for the SINAS (total scores) was calculated using the baseline standard deviation for the full sample and baseline Cronbach's α as test–retest reliability coefficient (Jacobson & Truax, 1991). Recovered = clinical significant reliable change; improved without recovery = no clinical significant reliable change; deteriorated = reliable change with worsening of symptoms; no change = no reliable change.

Figure 2

Observed Means of Total Scores on the Suicidal Ideation Attributes Scale (SIDAS) per Condition Over Time



Note. For illustrative purposes, the y-axis starts at SIDAS = 10. TAU = treatment as usual.

intrusions as a focus/target of the intervention. Other intervention approaches for suicidal imagery are explored, as part of wider approaches to treating problematic emotional imagery (Di Simplicio et al., 2020) but have not been tested in RCTs.

A major strength of this study was the nationwide multicenter design with few exclusion criteria. Several limitations should be considered. First, an active comparator arm was absent, similar in format and length to the cognitive dual-task add-on module sessions. To an extent, this may limit concluding whether effects were solely driven by the targeted method (eye movement) or by nonspecific aspects of receiving additional treatment sessions focused on suicide as well. Unfortunately, our data regarding details of TAU received is limited. Second, the study had a high dropout on assessments (50%) at 3-month follow-up. Part of the data collection occurred during the COVID-19 pandemic and assessments were transferred online, which may have affected the completeness of the data. Although multilevel modeling with restricted maximum likelihood estimation does account for missing data. Third, our study was not designed to detect differences in actual suicidal behavior. Studies would require substantial sample sizes (approximately several thousand participants; Nordentoft, 2007) to detect direct effects of intervention strategies on suicidal behavior such as (repeated) attempts or suicide rates, which is a huge challenge for suicide prevention. Fourth, the main focus of the treatment was intrusive suicidal mental images and thus cannot be directly translated to preventing suicide. Fifth, while the number of intervention sessions (dose) received did not predict change scores in the severity of suicidal intrusions, the present study may have been underpowered to detect noticeable effects. Last, the CISI relied on the participants' memory of recalling the number of intrusive suicidal images experienced each day of the week and may have been subject to recall bias.

Our findings have important clinical implications as this Cognitive Dual Task Add-on module seems to provide a brief, safe, and novel way to approach suicide prevention by alleviating the burdensomeness of these suicidal intrusions and reducing suicidal ideation. Clinicians should actively integrate asking about suicidal mental imagery in their routine clinical assessments. Moreover, a particular advantage of the Cognitive Dual Task Add-on module is that it is a therapist-guided, brief session (around four to six) treatment, and clinicians within institutions can be trained with 3, 5–4 hr trainings, enhancing easy implementation and applicability for mental health systems.

While the add-on module is deemed efficacious targeting suicidal intrusions in patients with elevated depressive symptoms and distressing suicidal imagery, the safety and efficacy in other patient groups await further research. Future research should continue to evaluate its effects by including other target groups with problems with suicidal thinking (e.g., people with bipolar disorder, Hales et al., 2011, and people with borderline personality disorder, Schultebraucks et al., 2020). Future replication studies could include larger trials evaluating the Cognitive Dual Task Add-on module considering suicidal behavior as an outcome measure and have longer follow-up assessments. Using complex statistical methods, such as predictive modeling, future research could evaluate how factors associated with suicidal ideation and attempts (such as rumination, working memory) may influence presence of suicidal intrusions. Furthermore, future cost-effective analyses will have to show to what extent the add-on sessions have an added value in terms of reducing suicidal intrusions/ideation and Quality Adjusted Life Years gains, given the additional treatment costs.

In sum, this study demonstrated that a brief Cognitive Dual Task Add-on module, using eye movements, targeting mental imagery

related to suicide combined with TAU seems to be an efficacious, safe, and promising treatment strategy in reducing severity and frequency of suicidal images and ideation in patients with elevated depressive symptoms.

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(*Appendix follows*)

Appendix

Narrative Description Data Transparency

The data reported in this article have been previously published and were collected as part of a larger data collection (at more points in time). Findings from the data collection have been reported in a separate article. Manuscript 1 (published) focuses on variables childhood maltreatment, and suicidal intrusions; while Manuscript 2 (published) focuses on variables suicidal intrusions, response to intrusions, and depressive symptoms in context of validating the following instrument: Suicidal Intrusions Attributes Scale. Manuscript 3 (the present article) focuses the effects of a cognitive dual-task add-on module on the severity and frequency of suicidal intrusions, suicidal ideation, depressive symptoms, rumination, and hopelessness.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author (Jaël S. van Bentum; j.s.vanbentum@uu.nl). The intervention manual can be obtained upon request by from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants. The individual participant data that underlie the results reported in the RCT's published article after deidentification can be obtained upon reasonable request by emailing a proposal to the principal investigator (Marit Sijbrandij; e.m.sijbrandij@vu.nl). To gain access, data requestors will need to sign a data access agreement.

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