



The Effect of Everyday Safety Behavior on Intolerance of Uncertainty and Indecisiveness

Mona Hassan and Helmut Appel

Institute of Clinical Psychology and Psychotherapy, University of Cologne, Germany

Abstract: *Background:* Intolerance of uncertainty (IU) is a transdiagnostic risk factor. IU-related safety behaviors (IUSB) may reinforce IU and associated constructs such as indecisiveness. *Objective:* Two experiments tested whether increasing IUSB would lead to higher increases in IU and more indecisiveness. *Method:* In Study 1 ($N = 99$), participants either engaged in more IUSB for 1 week (Increase condition) or merely reported their IUSB (control condition). Study 2 ($N = 147$) replicated the procedure, but with a decreased IUSB condition. The effect on IU and indecisiveness was assessed. *Results:* Regarding preregistered analyses, the hypotheses were not supported. Changes in IU were independent of condition. Indecisiveness was unaffected by the manipulation. However, exploratory mediation analyses suggested that the Increase condition resulted in more IU indirectly through measured IUSB. *Conclusion:* The findings provide preliminary evidence of a causal link between IUSB and IU. If the findings can be replicated, they may have implications for IU-centered interventions.

Keywords: intolerance of uncertainty, indecisiveness, safety behavior, transdiagnostic factors

Der Effekt von Sicherheitsverhalten im Alltag auf Unsicherheitsintoleranz und Entscheidungsschwäche

Zusammenfassung: *Theoretischer Hintergrund:* Unsicherheitsintoleranz (UI) ist ein transdiagnostischer Risikofaktor. UI-bezogenes Sicherheitsverhalten (UISV) könnte UI und damit verbundene Konstrukte wie Entscheidungsschwäche verstärken. *Fragestellung:* Zwei Experimente untersuchten, ob eine Erhöhung von UISV UI und Entscheidungsschwäche verstärkt. *Methoden:* In Studie 1 ($N = 99$) führten Teilnehmende eine Woche lang entweder verstärkt UISV aus (Erhöhungs-Bedingung) oder dokumentierten lediglich ihr UISV (Kontrollbedingung). Studie 2 ($N = 147$) replizierte das Vorgehen mit einer Bedingung zur Reduktion von UISV. Der Effekt auf UI und Entscheidungsschwäche wurde gemessen. *Ergebnisse:* Die präregistrierten Analysen stützten die Hypothesen nicht. Veränderungen in UI waren unabhängig von der Bedingung, und Entscheidungsschwäche wurde nicht beeinflusst. Explorative Mediationsanalysen deuteten jedoch darauf hin, dass die Erhöhungs-Bedingung indirekt zu mehr UI führte, vermittelt über gemessenes UISV. *Schlussfolgerungen:* Die Mediationsbefunde liefern vorläufige Hinweise auf einen kausalen Zusammenhang zwischen UISV und UI. Falls die Ergebnisse repliziert werden, könnten sie Implikationen für UI-zentrierte Interventionen haben.

Schlüsselwörter: Unsicherheitsintoleranz, Entscheidungsschwäche, Sicherheitsverhalten, transdiagnostische Faktoren

Intolerance of uncertainty (IU) is a dispositional trait involving negative cognitive, emotional, and behavioral responses to uncertainty (Freston et al., 1994). Defined as the “incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information” (Carleton, 2016, p. 31), IU has been linked to symptoms across various mental disorders and is considered a transdiagnostic factor (for an overview, see McEvoy et al., 2019). IU is also thought to play a causal role in anxiety-related disorders, where feared outcomes typically involve uncertainty (e.g., uncertainty over the dangerousness of a strong heartbeat in a panic attack, or over the possibility of negative evaluation in social anxiety; Jacoby, 2020). Supporting this, studies have shown that IU longitudinally predicts emotional disorder symptoms (Hunt

et al., 2022), that IU inductions increase anxiety (Ladouceur et al., 2000), and that reductions in IU predict treatment gains (Boswell et al., 2013; for an overview, see Rosser, 2019). Understanding how IU can be altered is therefore of both theoretical and clinical interest.

Jacoby (2020) has proposed a cognitive behavioral model of IU, including certainty-seeking behaviors as a maintaining component. These behaviors resemble safety behaviors in anxiety disorders – costly strategies intended to alleviate fear but often sustaining it (Thwaites & Freston, 2005). For example, a person with panic disorder may only leave the house when accompanied, which reduces fear in the short term but erodes confidence and increases anxiety over time (Blakey & Abramowitz, 2016).

Similarly, IU is believed to drive uncertainty-reducing behaviors (Carleton et al., 2010) that ironically sustain IU (Jacoby, 2020). An example from the area of decision-making can illustrate this (Dugas & Robichaud, 2007). A person high in IU, when faced with an uncertainty-laden decision, may resort to uncertainty-reducing strategies such as excessive reassurance-seeking. However, while initially relieving uncertainty, excessive reliance on this type of behavior may weaken the ability to tolerate uncertainty, ultimately increasing IU (Jacoby, 2020). In the following, we refer to such behaviors as *IU-related safety behaviors* (IUSB).

Decision-making is particularly relevant here, as it often involves uncertainty (Kahneman & Tversky, 1982) and is central to psychological functioning (Heckhausen & Gollwitzer, 1987). IU is even considered a causal factor (Rassin, 2007) in indecisiveness, a “trait-like difficulty making decisions across time and situations” (Lauderdale & Oakes, 2021, p. 256). Empirically, IU and indecisiveness are robustly correlated (Koerner et al., 2017) and increased IU has been shown to cause more indecisiveness (Appel & Gerlach, 2025). Furthermore, Appel et al. (2024) recently showed that engaging in more safety behavior over 1 week predicted higher IU and indecisiveness in everyday decision-making. This is (correlational) evidence that IUSB may affect not only IU but also associated problems such as indecisiveness.

If IUSB indeed plays a causal role in maintaining IU and indecisiveness, this would have clinical implications. Given that IU is considered a risk factor for anxiety disorders, treatments have been developed that aim to reduce IU – particularly for generalized anxiety disorder (GAD; e.g., Hebert & Dugas, 2019) but also for other anxiety-related conditions such as obsessive-compulsive disorder (OCD; e.g., Grayson, 2003). Although there is evidence for the effectiveness of IU-based treatments (Miller & McGuire, 2023), the mechanism by which these treatments affect IU has not been directly tested (Näsling et al., 2024). One such mechanism could be preventing IUSB (e.g., Dugas et al., 2022), analogous to safety behavior prevention in anxiety treatment (e.g., Salkovskis, 1991). However, a direct causal effect of IUSB on IU has not yet been demonstrated through experimental evidence.

To address this gap, we conducted two online experiments testing the influence of IUSB on IU and indecisiveness. In Study 1, we tested whether participants instructed to increase their safety behaviors for 1 week would report higher increases in IU than those in a control condition (H1). Given the close link between IU and indecisiveness, we also hypothesized that indecisiveness would increase in the experimental group (H2). The methodology was closely modeled on preceding research showing the causal reinforcing effect of safety behaviors on mental

disorder symptoms (Deacon & Maack, 2008; Olatunji et al., 2011; Summers & Cogle, 2018), underlining the supposed analogy between IUSB and safety behavior in anxiety disorders.

Study 1

Method

Hypotheses and methods were preregistered (<https://www.aspredicted.org/krqv-ct75.pdf>). The protocols of both studies were approved by the university’s ethics board (ref. no. HAHF0184). Electronic Supplemental Material (ESM 1 and 2) is available at <https://osf.io/87stc>

Participants

Between March 14 and April 11, 2023, a German-speaking convenience sample was recruited, primarily via university mailing lists for psychology students earning course credit. Participants had to be at least 18 years old. Taking into account the smallest effect size of interest (SESOI; Lakens et al., 2018) and an anticipated dropout rate of 20%, we targeted a sample size of 96 participants. This sample size was calculated with G*Power (Version 3.1.9.6; Faul et al., 2007) to provide 80% statistical power for detecting a small to medium interaction effect (approximately $d = 0.32$) in the ANOVA, as specified in the preregistration. This calculation was applied to both studies. Of the 133 individuals who started, only those completing both the baseline and final questionnaire were included. They also had to pass an attention check and confirm they took the study seriously. After exclusions (see ESM 1, 1.1, for an overview), the final sample comprised $N = 99$ (82.8% female, 17.2% male), with a mean age of $M = 23.1$ ($SD = 4.8$). Education levels were high, with all participants either holding a university/college degree ($n = 13$, 13.1%) or having completed secondary education qualifying for university entry ($n = 86$, 86.9%). All participants were informed about the study and provided written consent.

Materials and Measures

German Version of the Intolerance of Uncertainty Scale (UI-18)

IU on a trait level was assessed using the UI-18 (Gerlach et al., 2008). It is based on the original scale by Freeston et al. (1994) and encompasses 18 statements reflecting emotional, cognitive, and behavioral responses to uncertainty. Each item is answered on a 5-point Likert scale ranging from 1 (*not at all characteristic of me*) to 5 (*very*

characteristic of me). The scale demonstrated excellent internal consistency (Table 1).

List of IU-Related Safety Behavior

A list of 16 overcompensating behaviors for handling uncertainty in daily life was compiled (IUSB, see ESM 1, 1.4). Only overcompensating strategies were included, as they seemed more tangible and easier to modify than under-engaging behaviors such as avoidance. The list served both as a reminder for participants and as a manipulation check to assess behavior frequency. Items were sourced from the Overprepare and Overengagement subscales of the Intolerance of Uncertainty Behaviours in Everyday Life (IUBEL; Clifford et al., 2015) and the Reassurance subscale of the Intolerance of Uncertainty Index (IUI; Carleton et al., 2010), and translated into German. Additional behaviors were adapted from safety behavior research (e.g., Cuming et al., 2009). Participants rated their engagement in each behavior over the past 7 days (baseline) or past 24 hours (daily/final surveys) on a 5-point Likert scale (1 = *never*, 5 = *very often*). While primarily a manipulation check, the checklist showed good reliability (Table 1).

Decision-Making Task and State Version of the Indecisiveness Scale

A decision task preceded the state indecisiveness measure. Participants were told they would take a short performance test and receive feedback on a specific cognitive skill. They had three cognitive skills to choose from (logical reasoning, spatial thinking, processing speed). This decision task had proven suitable in a pretest ($N = 264$; mean age = 32.2 years, $SD = 11.2$; 51.1% male, 47.3% female, 1.5% diverse), because it elicited a certain degree of indecisiveness (as measured by the same scale used in the present studies) with a roughly normal distribution and sufficient variance. Before deciding, participants indicated their indecisiveness regarding this pending decision on the 11-item Indecisiveness Scale (original long version: Frost & Shows, 1993; 11 items: Rassin et al., 2007). A German, situation-specific version referring to the specific decision was used (Appel & Gerlach, 2021). Responses were given on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). Reliability was excellent (Table 1).

Procedure

Participation was completely online. After giving informed consent, participants completed the baseline survey, providing demographics and filling in the UI-18. They then read about daily uncertainty, including examples, such as uncertainty about a job change. Also, they read about ways to handle uncertainty, including the IUSB list. For each

behavior, they indicated past-week frequency. Participants were randomly assigned to either the Increase condition, where they were instructed to maximize these IUSBs for the next 7 days, or the control condition, where they should merely observe them – maintaining their usual level of IUSB without intentionally modifying it. Instruction comprehension questions, mandatory for proceeding, concluded the baseline survey. Participants provided their email and, starting the next day, received daily emails prompting them to complete the IUSB list. The daily list controlled for instruction adherence and served as a reminder. The seventh daily survey was the final survey. It included the second UI-18 measurement and the state indecisiveness assessment. Finally, participants answered a memory check question and were debriefed.

Data Analysis

Statistical analyses were conducted using IBM SPSS v. 28. Sum scores were formed for the UI-18 and the Indecisiveness Scale. For IUSB, a mean score was calculated from all items (baseline) or all items and time points (Days 2–8). Across measures, there were no missing values except for daily surveys skipped entirely. Mean scores were based on the available surveys (available case analysis, always ≥ 3 , details are provided in ESM 1, 1.1). Changes in IUSB (manipulation check) and IU (H1) from baseline to follow-up were compared between conditions via mixed ANOVAs with time point as a within-subjects factor and condition as a between-subjects factor. Post hoc t tests with Bonferroni correction further examined within-condition changes in IUSB and IU. Differences in state indecisiveness between conditions were analyzed using independent t tests. Exploratorily, we tested whether post-manipulation IUSB (Days 2–8) mediated the effect of condition (dummy-coded: 0 = control, 1 = Increase) on IU and indecisiveness at final measurement. Mediation models were run in PROCESS v. 4.0 (Hayes, 2017) with 5,000 bootstraps. The robustness of the results was tested by repeating analyses after excluding participants (1) whose Mahalanobis distance relative to all study variables was so unlikely ($p \leq .001$) that they were considered multivariate outliers, or (2) who indicated they did not believe the decision regarding the three performance tests was actually carried out (see ESM 1, 1.3, for details).

Results and Discussion

The total analysis sample consisted of 44 participants (44.4%) in the Increase condition and 55 participants (55.6%) in the control condition. No significant dissimilarities emerged between the conditions in baseline IU and IUSB, education, age, and whether participants

Table 1. Descriptive values, reliability, and correlations for variables of Study 1

| Variable | <i>M (SD)</i> Total | <i>M (SD)</i> Increase | <i>M (SD)</i> Control | α | 1 | 2 | 3 | 4 |
|-------------------|------------------------|---------------------------|--------------------------|----------|--------|--------|--------|-----|
| 1. IU baseline | 49.13 (12.30) | 49.27 (12.40) | 49.02 (12.34) | .91 | — | | | |
| 2. IU final | 50.83 (12.13) | 50.84 (11.14) | 50.82 (12.97) | .90 | .80*** | — | | |
| 3. IUSB baseline | 3.08 (0.57) | 3.10 (0.54) | 3.05 (0.60) | .82 | .62*** | .56*** | — | |
| 4. IUSB Days 2–8 | 2.86 (0.69) | 3.14 (0.61) | 2.64 (0.68) | .97 | .34*** | .39*** | .50*** | — |
| 5. Indecisiveness | 26.80 (9.67) | 26.93 (10.12) | 26.69 (9.40) | .92 | .41*** | .43*** | .16 | .20 |

Note. $N_{\text{Total}} = 99$; $n_{\text{Increase}} = 44$; $n_{\text{Control}} = 55$; IU = intolerance of uncertainty; IUSB = IU-related safety behavior; correlations were calculated across the total sample. Cronbach's α for IUSB at Days 2–8 was calculated across all items and measurements. *** $p < .001$.

thought the decision between the performance tests was real ($ps > .05$). Table 1 displays the descriptive statistics for the study variables and the correlations among them.

The preregistered manipulation check specified that an interaction between time and condition on IUSB would indicate a successful manipulation – specifically, a stronger increase in IUSB in the Increase relative to the control condition. An interaction was observed, $F(1,97) = 13.03$, $p < .001$, $\eta^2_{\text{partial}} = .12$. However, post hoc t tests showed that in the Increase condition, IUSB did not change from baseline to Days 2–8, $t(43) = 0.34$, $p = .999$, whereas a significant decrease occurred in the control condition, $t(54) = 5.36$, $p < .001$, $d = 0.72$. While the expected increase in the Increase condition and stability in the control condition were, thus, not achieved, the manipulation nevertheless resulted in more IUSB in the Increase than in the control condition across Days 2–8, $t(97) = 3.75$, $p < .001$, $d = 0.76$.

The ANOVA testing for a higher IU increase in the Increase condition compared to the control condition (H1) revealed a significant main effect of time, $F(1,97) = 4.63$, $p = .034$, $\eta^2_{\text{partial}} = .05$, but no significant main effect of condition, $F(1,97) = 0.00$, $p = .953$, or interaction, $F(1,97) = 0.02$, $p = .883$. Across the whole sample, IU significantly increased at the final measurement compared to baseline (see Table 1). Therefore, H1 was not supported, as the experimental condition did not interact with time. Testing changes in IU within conditions revealed no significant differences between baseline and final measurement for either the Increase condition, $t(43) = 1.35$, $p = .368$, or the control condition, $t(54) = 1.72$, $p = .182$. Comparing state indecisiveness levels between the conditions revealed no significant difference, $t(97) = 0.12$, $p = .451$, contradicting the prediction of greater indecisiveness in the Increase condition (H2).

Although the manipulation did not affect the dependent variables in the main analyses, an indirect effect via post-manipulation safety behavior was revealed in exploratory mediation models. More specifically, the Increase condi-

tion led to more IU at the final measurement via augmented safety behavior, indirect effect: $\beta = .32$, 95% CI = [.13, .53], and the same was true of indecisiveness, indirect effect: $\beta = .16$, 95% CI = [.02, .34]. A detailed model description is provided in ESM 1, 1.2. The indirect effect on indecisiveness was not robust in the sensitivity analyses (see ESM 1, 1.3).

When exploratorily looking at correlations between study variables (Table 1), safety behavior was positively associated with both IU measurements, both at baseline (large effect) and during the manipulation phase (moderate effect). Also, state indecisiveness showed moderate positive relationships with both IU measurements.

Given the unexpected manipulation check outcome, we analyzed participants' free comments from the closing survey. Their feedback indicated that some found the instructions on uncertainty-reducing behaviors unclear or overwhelming. As a result, we decided to replicate Study 1 with clearer behavior descriptions. We also replaced the control condition with one where IUSB was explicitly reduced, since the original control condition unintentionally decreased IUSB. Similar to Study 1, we predicted that increasing IUSB over 1 week would lead to an increase in IU (H1) and more indecisiveness (H2) compared to decreasing IUSB.

Study 2

Method

Methods were similar to Study 1 except for the modifications detailed below. The preregistration can be found at <https://www.aspredicted.org/vyjk-8kq5.pdf>

Participants

Data collection took place between May 11 and June 14 2024 and resulted in 241 individuals who gave informed consent to participate. After applying the preregistered

Table 2. Descriptive values, reliability, and correlations for variables of Study 2

| Variable | <i>M</i> (<i>SD</i>) Total | <i>M</i> (<i>SD</i>) Increase | <i>M</i> (<i>SD</i>) Decrease | α | 1 | 2 | 3 | 4 |
|-------------------|---------------------------------|------------------------------------|------------------------------------|----------|--------|--------|------|-----|
| 1. IU baseline | 52.50 (15.23) | 53.77 (14.70) | 51.38 (15.69) | .94 | — | | | |
| 2. IU final | 49.16 (13.34) | 51.06 (13.57) | 47.49 (12.99) | .92 | .83*** | — | | |
| 3. IUSB baseline | 3.61 (0.72) | 3.55 (0.66) | 3.65 (0.77) | .44 | .53*** | .82*** | — | |
| 4. IUSB Days 2–8 | 2.59 (0.94) | 3.35 (0.63) | 1.91 (0.59) | .96 | .21* | .32*** | .18* | — |
| 5. Indecisiveness | 26.29 (9.71) | 27.06 (8.99) | 25.62 (10.31) | .92 | .32*** | .39*** | .13 | .15 |

Note. $N_{\text{Total}} = 147$; $n_{\text{Increase}} = 69$; $n_{\text{Decrease}} = 78$; IU = intolerance of uncertainty; IUSB = IU-related safety behavior; correlations were calculated across the total sample. Cronbach's α for IUSB at Days 2–8 was calculated across all items and measurements. * $p < .05$. *** $p < .001$.

exclusion criteria (e.g., answering at least three daily surveys; for an overview, see *ESM 2, 2.1*), the final sample for analysis comprised 147 participants (88.4% female, 10.9% male, 0.7% n/a) with a mean age of $M = 29.6$ ($SD = 9.1$). Education levels were more varied than in Study 1 but generally high, with most participants either holding a university/college degree ($n = 33$, 22.4%) or having completed secondary education qualifying for university entry ($n = 74$, 50.3%). Some participants ($n = 37$, 25.2%) had completed vocational (non-academic) training, and three (2.0%) had obtained an intermediate-level secondary school certificate.

Materials and Measures

Materials were identical to Study 1 (reliabilities are provided in Table 2). The only difference was a substantially reduced list of IUSB. Only four broader categories of behaviors were retained: information-seeking, reassurance through others, careful reflecting, controlling. An explanation and examples were provided; for instance, for information-seeking: "I found out as much as I could about the situation (e.g., through Internet research, academic literature, social media, or personal accounts)". The response format was the same as in Study 1.

Procedure

Participants underwent the same procedure as in Study 1 with the following exceptions: First, participants received a more thorough explanation of IUSB at baseline (e.g., reading about two sample situations, providing own examples). Second, while the Increase IUSB condition remained unchanged, a Decrease condition asking participants to *reduce* their IUSB was implemented instead of a control condition.

Results and Discussion

The Increase condition comprised 69 participants (46.9%) and the Decrease condition, 79 participants (53.7%). The

experimental groups did not differ regarding baseline IU and IUSB levels, education, age, or whether participants believed the decision would actually be implemented ($ps > .05$). Table 2 provides descriptive values and correlations.

As in Study 1, the preregistered interaction between time and condition was observed in the manipulation check, $F(1,145) = 152.37$, $p < .001$, $\eta^2_{\text{partial}} = 0.51$. However, post hoc tests found that while in the Decrease condition, IUSB was significantly reduced as intended, $t(77) = 19.50$, $p < .001$, $d = 2.21$, a small but significant reduction contrary to the intended effect also occurred in the Increase condition, $t(68) = 2.41$, $p < .038$, $d = 0.29$. Consequently, and similar to Study 1, the expected pattern of an IUSB increase in the Increase condition and a decrease in the Decrease condition was not achieved. Nevertheless, the desired higher IUSB levels across Days 2–8 in the Increase condition were found, $t(145) = 14.24$, $p < .001$, $d = 2.35$.

Regarding the increase in IU in the Increase compared to the Decrease condition (H1), results first showed a significant main effect of time, $F(1, 145) = 21.01$, $p < .001$, $\eta^2_{\text{partial}} = .13$. As is apparent in Table 2, the effect reflects a significant decrease in IU across the entire sample after the manipulation week. However, no significant main effect of condition was found, $F(1, 145) = 1.75$, $p = .187$, $\eta^2_{\text{partial}} = .01$, nor was there a significant interaction between time and condition, $F(1, 145) = 0.68$, $p = .412$, $\eta^2_{\text{partial}} = .01$. Thus, as in Study 1, H1 was not supported. Post hoc paired-samples t tests revealed a significant reduction in IU before and after the manipulation week in both the Decrease condition, $t(77) = -4.01$, $p < .001$, $d = -0.45$, and the Increase condition, $t(68) = -2.54$, $p = .007$, $d = -0.31$.

The t test comparing state indecisiveness levels between conditions found no significant differences, $t(145) = -0.90$, $p = .370$, thus contradicting the higher indecisiveness levels in the Increase condition predicted in H2.

We conducted the same exploratory mediation analyses as in Study 1. Again, despite the absent effect of the condition on changes in IU, we found that the Increase condition led to more IU at the final measurement *indirectly* through augmented safety behavior, indirect effect: $\beta = .78$, 95 % CI = [.42, >.99]. However, contrary to Study 1, this mediated effect was not observed for indecisiveness, indirect effect: $\beta = .31$, 95 % CI = [-.14, .76]. A detailed model description is provided in ESM 2, 2.2. Exploratory correlation analyses between study variables replicated the results of Study 1 (see Table 2). Robustness checks confirmed the results of the main analyses (ESM 2, 2.3).

General Discussion

In two studies, we tested whether a 1-week increase in IUSB would lead to more IU (H1) and indecisiveness (H2) compared to a neutral control condition (Study 1) and a 1-week decrease in IUSB (Study 2). An experimental design was used to examine causal relationships, with high external validity by setting the studies in participants' everyday life.

The manipulation check did not show the intended pattern of within-group change: IUSB did not increase in the Increase condition in either study, and it even decreased in the control (Study 1) and Increase (Study 2) conditions. Accordingly, the manipulation must be considered unsuccessful in achieving its exact within-group effect. This suggests that deliberately increasing safety behavior may be difficult – or undesirable – for many participants. Unlike other safety behaviors used in similar previous studies (e.g., carrying hand sanitizer; Deacon & Maack, 2008), IUSBs can only be performed in situations of uncertainty. Participants may have had fewer such opportunities in daily life. Participants may also have suspected that increasing IUSB was not advisable and may have disregarded the instruction. The decrease observed in the control group (Study 1) and even in the Increase group (Study 2) supports this possibility. However, across both studies, the Increase condition consistently exhibited higher post-manipulation IUSB compared to the other conditions. This relative pattern is consistent with the experimental logic.

The main results showed that IU increased (Study 1) or decreased (Study 2) across both conditions, rather than specifically in the respective intended condition. Indecisiveness was unaffected by the manipulation. Therefore, both hypotheses were not supported. The unexpected changes in IU across the whole sample (a general increase in Study 1 and a general decrease in Study 2) cannot be

causally attributed to the manipulation, as time point was not experimentally manipulated and other influences may have played a role. It should therefore not be overstated, especially considering that in Study 1, the IU increase was only significant across but not within conditions.

However, exploratory mediation analyses revealed an indirect effect of the manipulation on IU via IUSB. This exploratory finding suggests support for the assumed mechanism wherein the Increase condition caused more IUSB, and in turn, more IU. Importantly, testing an indirect effect is informative even without a total effect, as including a mediator can increase statistical power (O'Rourke & MacKinnon, 2018).

The same indirect effect on indecisiveness was found in the main analyses of Study 1, but not in the respective robustness check, and not in Study 2 either. The absence of a main effect of the manipulation on indecisiveness, along with the lack of a reliable indirect effect, may reflect reduced reliability in the indecisiveness measurement compared to IU. Indecisiveness was measured based on a single decision, while IU was assessed as a general trait.

There were some notable additional findings. Consistent correlations between the frequency of IUSB and IU at both time points support the notion that individuals with high IU engage in safety behaviors more than those with low IU (cf. Bottesi et al., 2019). This finding has also been demonstrated for IU and more specific forms of safety behavior such as looking for health-related information (e.g., Fergus, 2013; Rosen & Knäuper, 2009). Additionally, IU scores at both measurements were correlated, further supporting IU as a stable trait (e.g., Ladouceur et al., 2000). IU also correlated with state indecisiveness, providing additional evidence for the link between IU and indecisiveness (e.g., Koerner et al., 2017; Rassin et al., 2007). Results also converge with findings that dispositional trait IU predicts indecisiveness in specific decisions (Appel et al., 2024; Appel & Gerlach, 2021).

Given these correlations, it is worth considering why IU and IUSB did not show comparable responses to the manipulation. However, IUSB was the immediate target of the manipulation, whereas IU was conceptualized as a more distal outcome. Subtler effects on IU were therefore to be expected. This applies even more strongly to indecisiveness, which, in turn, is considered a more distal construct compared to IU when it comes to uncertainty and uncertainty management (Rassin, 2007). IU, by contrast, has been described as a higher-order vulnerability factor for more specific symptoms (Carleton, 2016). Furthermore, correlations typically provide greater statistical power than group comparisons, as they capitalize on the full variance of the variables rather than on mean differences between conditions. This may explain why robust correlations – and, by the same logic (cf. O'Rourke

& MacKinnon, 2018), an indirect effect, at least on IU – were detectable, even in the absence of a group effect.

Limitations

Some limitations of this study should be acknowledged. Despite power analysis ensuring an adequate sample size, there were substantial sample size differences between conditions due to dropout and exclusions, which may have complicated the detection of an effect. Also, owing to methodological constraints, the sample consisted of mainly young women with high educational levels, limiting generalizability and, thus, external validity. More representative samples would therefore be preferable in future research. Similarly, only an unselected convenience sample could be recruited. It is possible that the hypothesized effects would be more pronounced in individuals with elevated IU, who are more likely to be at risk of clinically relevant patterns. Future studies should therefore consider recruitment of high-IU participants.

Although the focus on participants' own everyday uncertainties was deliberately chosen to increase ecological validity, this choice also represents a possible limitation: Despite specific examples, especially in Study 2, participants in both studies stated some insecurity as to which uncertainties to reference. Focusing on a more specific area of uncertainty (e.g., decision-making, Appel et al., 2024) could be more tangible for participants in future research. In a similar vein, we cannot be certain whether the behaviors referenced by participants met the criteria for problematic safety behavior we were aiming for (Helbig-Lang & Petermann, 2010; Thwaites & Freeston, 2005). For example, we did not control whether these behaviors were in fact driven by uncertainty or incurred costs. Future studies should assess these criteria. The naturalistic setting also required conducting the studies online, limiting experimental control. Despite rigorous quality assurance measures – such as detailed instructions with comprehension questions, attention checks, comment inspections, and predefined exclusion criteria – it is ultimately uncertain whether participants genuinely engaged with the IUSBs as instructed. This point is all the more important, as the manipulation phase had to be relatively long. Although the daily surveys reminded participants to stay engaged, external distractions undermining manipulation effectiveness cannot be ruled out. This could explain the absence of the anticipated effects. In sum, adjustments that increase standardization and control over the manipulation could further improve internal validity in future research. For example, participants could attend a standardized introductory session in person, or provide examples of their uncertain-

ties and IUSBs. This would allow for clarification of misunderstandings or post hoc filtering. Laboratory-based IUSB manipulations, although less realistic and more resource-intensive, would ensure even higher experimental control and potentially be more likely to sustain participants' attention.

The chosen control condition of monitoring safety behavior in Study 1 may have had involuntary side effects such as raising constant awareness of uncertainty, thus affecting IU. The fact that, contrary to instructions, participants reduced their safety behavior is a hint that the control condition may not have been as neutral as intended. Focusing on a different behavior in the control condition instead (cf. Summers & Cogle, 2018) might have been preferable in order to distract attention away from uncertainty. Moreover, due to limited resources, only one other condition than the Increase condition could be realized in each study. Following the approach of Summers and Cogle (2018), an ideal future replication of the current study could be designed with three conditions: one for increasing safety behavior, one for decreasing safety behavior, and a control condition unrelated to safety behavior. This combination would allow us to distinguish whether any effects stem from increased and/or reduced safety behavior.

Clinical Implications

Some clinical implications may cautiously be considered. If future research corroborates a causal role of safety behavior in maintaining IU and indecisiveness, clinical interventions targeting IU could be refined. Treatments based on this rationale have already been developed. For example, in the treatment of OCD, Grayson (2003) advises against common cognitive strategies such as evaluating the likelihood of feared outcomes. He argues that patients' need for absolute certainty is the actual core of their anxiety. Instead, uncertainty tolerance should be promoted. In fact, providing uncertainty-reducing information (e.g., exact choice probabilities) does not alleviate uncertainty or distress in OCD patients (Jacoby et al., 2023). Such findings highlight the limited efficacy of excessive uncertainty reduction.

Similarly, in the treatment of GAD, Dugas and Robichaud (2007) advocate for reducing safety behaviors, such as reassurance-seeking prior to decisions. This enables patients to experience and adapt to uncertainty. A GAD therapy program building on this principle has recently been tested (Dugas et al., 2022). The program consists of behavioral experiments designed to actively seek out uncertainty while avoiding safety behaviors. The

treatment produced significant reductions in GAD symptoms and IU compared to a waitlist control group.

However, the causal effect of safety behavior implicitly targeted in these approaches has not yet been tested explicitly, and the present studies could provide only tentative evidence. The preregistered hypotheses predicting an immediate (i.e., total) effect of IUSB on IU and indecisiveness were not supported. Thus, the clinical implications discussed here primarily rest on exploratory findings, particularly the indirect effect of the experimental manipulation on IU via safety behavior. This preliminary evidence requires replication in future studies with improved designs and more diverse samples.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1026/1616-3443/a000807>

ESM 1. Additional analyses regarding Study 1.

ESM 2. Additional analyses regarding Study 2.

References

- Appel, H., & Gerlach, A. L. (2021, May 12). *Too much at stake – testing when intolerance of uncertainty predicts indecisiveness*. 38th Symposium Clinical Psychology and Psychotherapy, Mannheim, Germany.
- Appel, H., & Gerlach, A. L. (2025). Intolerance of uncertainty causally affects indecisiveness. *British Journal of Clinical Psychology*. <https://doi.org/10.1111/bjc.12534>
- Appel, H., Krasko, J., Luhmann, M., & Gerlach, A. L. (2024). Intolerance of uncertainty predicts indecisiveness and safety behavior in real-life decision making: Results from an experience sampling study. *Journal of Research in Personality*, *110*, 104490. <https://doi.org/10.1016/j.jrp.2024.104490>
- Blakey, S. M., & Abramowitz, J. S. (2016). The effects of safety behaviors during exposure therapy for anxiety: Critical analysis from an inhibitory learning perspective. *Clinical Psychology Review*, *49*, 1–15. <https://doi.org/10.1016/j.cpr.2016.07.002>
- Boswell, J. F., Thompson-Hollands, J., Farchione, T. J., & Barlow, D. H. (2013). Intolerance of uncertainty: A common factor in the treatment of emotional disorders. *Journal of Clinical Psychology*, *69*(6), 630–645. <https://doi.org/10.1002/jclp.21965>
- Bottesi, G., Carraro, E., Martignon, A., Cerea, S., & Ghisi, M. (2019). “I’m uncertain: What should I do?”: An investigation of behavioral responses to everyday life uncertain situations. *International Journal of Cognitive Therapy*, *12*(1), 55–72. <https://doi.org/10.1007/s41811-019-00040-y>
- Carleton, R. N. (2016). Into the unknown: A review and synthesis of contemporary models involving uncertainty. *Journal of Anxiety Disorders*, *39*, 30–43. <https://doi.org/10.1016/j.janxdis.2016.02.007>
- Carleton, R. N., Gosselin, P., & Asmundson, G. J. G. (2010). The Intolerance of Uncertainty Index: Replication and extension with an English sample. *Psychological Assessment*, *22*(2), 396–406. <https://doi.org/10.1037/a0019230>
- Clifford, M., Hardcastle, R., Lambert, E., Beckwith, H., Bottesi, G., Wilkins, F., Mclean, F., & Freeston, M. H. (2015). *Development of a measure of Intolerance of Uncertainty Behaviours in Everyday Life (IUBEL)*. Technical report, Newcastle University (available from mark.freeston@newcastle.ac.uk).
- Cuming, S., Rapee, R. M., Kemp, N., Abbott, M. J., Peters, L., & Gaston, J. E. (2009). A self-report measure of subtle avoidance and safety behaviors relevant to social anxiety: Development and psychometric properties. *Journal of Anxiety Disorders*, *23*(7), 879–883. <https://doi.org/10.1016/j.janxdis.2009.05.002>
- Deacon, B., & Maack, D. J. (2008). The effects of safety behaviors on the fear of contamination: An experimental investigation. *Behaviour Research and Therapy*, *46*(4), 537–547. <https://doi.org/10.1016/j.brat.2008.01.010>
- Dugas, M. J., & Robichaud, M. (2007). *Cognitive-behavioral treatment for generalized anxiety disorder: From science to practice* (pp. xiii, 247). Routledge.
- Dugas, M. J., Sexton, K. A., Hebert, E. A., Bouchard, S., Gouin, J.-P., & Shafran, R. (2022). Behavioral experiments for intolerance of uncertainty: A randomized clinical trial for adults with generalized anxiety disorder. *Behavior Therapy*, *53*(6), 1147–1160. <https://doi.org/10.1016/j.beth.2022.05.003>
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). GPower 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. <https://doi.org/10.3758/BF03193146>
- Fergus, T. A. (2013). Cyberchondria and intolerance of uncertainty: Examining when individuals experience health anxiety in response to internet searches for medical information. *Cyberpsychology, Behavior, and Social Networking*, *16*(10), Article 10. <https://doi.org/10.1089/cyber.2012.0671>
- Freeston, M. H., Rhéaume, J., Letarte, H., Dugas, M. J., & Ladouceur, R. (1994). Why do people worry? *Personality and Individual Differences*, *17*(6), 791–802. [https://doi.org/10.1016/0191-8869\(94\)90048-5](https://doi.org/10.1016/0191-8869(94)90048-5)
- Frost, R. O., & Shows, D. L. (1993). The nature and measurement of compulsive indecisiveness. *Behaviour Research and Therapy*, *31*(7), 683–692. [https://doi.org/10.1016/0005-7967\(93\)90121-A](https://doi.org/10.1016/0005-7967(93)90121-A)
- Gerlach, A. L., Andor, T., & Patzelt, J. (2008). Die Bedeutung von Unsicherheitsintoleranz für die Generalisierte Angststörung – Modellüberlegungen und Entwicklung einer deutschen Version der Unsicherheitsintoleranz-Skala [The significance of intolerance of uncertainty for generalized anxiety disorder – Model considerations and development of a German version of the Intolerance of Uncertainty Scale]. *Zeitschrift Für Klinische Psychologie und Psychotherapie*, *37*(3), 190–199. <https://doi.org/10.1026/1616-3443.37.3.190>
- Grayson, J. (2003). *Freedom from obsessive-compulsive disorder – a personalized recovery program for living with uncertainty*. Berkley Publishing Group.
- Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis, second edition: A regression-based approach*. Guilford Publications.
- Hebert, E. A., & Dugas, M. J. (2019). Behavioral experiments for intolerance of uncertainty: Challenging the unknown in the treatment of generalized anxiety disorder. *Cognitive and Behavioral Practice*, *26*(2), 421–436. <https://doi.org/10.1016/j.cbpra.2018.07.007>
- Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motivation and Emotion*, *11*(2), 101–120. <https://doi.org/10.1007/BF00992338>
- Helbig-Lang, S., & Petermann, F. (2010). Tolerate or eliminate? A systematic review on the effects of safety behavior across anxiety

- disorders. *Clinical Psychology: Science and Practice*, 17(3), 218–233. <https://doi.org/10.1111/j.1468-2850.2010.01213.x>
- Hunt, C., Exline, J. J., Fletcher, T. L., & Teng, E. J. (2022). Intolerance of uncertainty prospectively predicts the transdiagnostic severity of emotional psychopathology: Evidence from a Veteran sample. *Journal of Anxiety Disorders*, 86, 102530. <https://doi.org/10.1016/j.janxdis.2022.102530>
- Jacoby, R. J. (2020). Intolerance of uncertainty. In J. S. Abramowitz & S. M. Blakey (Eds.), *Clinical handbook of fear and anxiety: Maintenance processes and treatment mechanisms*. (pp. 45–63). American Psychological Association. <https://doi.org/10.1037/0000150-003>
- Jacoby, R. J., Szkutak, A., Shin, J., Lerner, J., & Wilhelm, S. (2023). Feeling uncertain despite knowing the risk: Patients with OCD (but not controls) experience known and unknown probabilistic decisions as similarly distressing and uncertain. *Journal of Obsessive-Compulsive and Related Disorders*, 39, 100842. <https://doi.org/10.1016/j.jocrd.2023.100842>
- Kahneman, D., & Tversky, A. (1982). Variants of uncertainty. *Cognition*, 11(2), 143–157. [https://doi.org/10.1016/0010-0277\(82\)90023-3](https://doi.org/10.1016/0010-0277(82)90023-3)
- Koerner, N., Mejia, T., & Kusec, A. (2017). What's in a name? Intolerance of uncertainty, other uncertainty-relevant constructs, and their differential relations to worry and generalized anxiety disorder. *Cognitive Behaviour Therapy*, 46(2), 141–161. <https://doi.org/10.1080/16506073.2016.1211172>
- Ladouceur, R., Gosselin, P., & Dugas, M. J. (2000). Experimental manipulation of intolerance of uncertainty: A study of a theoretical model of worry. *Behaviour Research and Therapy*, 38(9), 933–941. [https://doi.org/10.1016/S0005-7967\(99\)00133-3](https://doi.org/10.1016/S0005-7967(99)00133-3)
- Lakens, D., Scheel, A. M., & Isager, P. M. (2018). Equivalence testing for psychological research: A tutorial. *Advances in Methods and Practices in Psychological Science*, 1(2), 259–269. <https://doi.org/10.1177/2515245918770963>
- Lauderdale, S. A., & Oakes, K. (2021). Factor structure of the Revised Indecisiveness Scale and association with risks for and symptoms of anxiety, depression, and attentional control. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 39(2), 256–284. <https://doi.org/10.1007/s10942-020-00372-1>
- McEvoy, P. M., Hyett, M. P., Shihata, S., Price, J. E., & Strachan, L. (2019). The impact of methodological and measurement factors on transdiagnostic associations with intolerance of uncertainty: A meta-analysis. *Clinical Psychology Review*, 73, 101778. <https://doi.org/10.1016/j.cpr.2019.101778>
- Miller, M. L., & McGuire, J. F. (2023). Targeting intolerance of uncertainty in treatment: A meta-analysis of therapeutic effects, treatment moderators, and underlying mechanisms. *Journal of Affective Disorders*, 341, 283–295. <https://doi.org/10.1016/j.jad.2023.08.132>
- Näsling, J., Åström, E., Jacobsson, L., & Ljungberg, J. K. (2024). Effect of psychotherapy on intolerance of uncertainty: A systematic review and meta-analysis. *Clinical Psychology & Psychotherapy*, 31(4), e3026. <https://doi.org/10.1002/cpp.3026>
- Olatunji, B. O., Etzel, E. N., Tomarken, A. J., Ciesielski, B. G., & Deacon, B. (2011). The effects of safety behaviors on health anxiety: An experimental investigation. *Behaviour Research and Therapy*, 49(11), 719–728. <https://doi.org/10.1016/j.brat.2011.07.008>
- O'Rourke, H. P., & MacKinnon, D. P. (2018). Reasons for testing mediation in the absence of an intervention effect: A research imperative in prevention and intervention research. *Journal of Studies on Alcohol and Drugs*, 79(2), 171–181. <https://doi.org/10.15288/jsad.2018.79.171>
- Rassin, E. (2007). A psychological theory of indecisiveness. *Netherlands Journal of Psychology*, 63(1), 1–11. <https://doi.org/10.1007/BF03061056>
- Rassin, E., Muris, P., Franken, I., Smit, M., & Wong, M. (2007). Measuring general indecisiveness. *Journal of Psychopathology and Behavioral Assessment*, 29(1), 60–67. <https://doi.org/10.1007/s10862-006-9023-z>
- Rosen, N. O., & Knäuper, B. (2009). A little uncertainty goes a long way: State and trait differences in uncertainty interact to increase information seeking but also increase worry. *Health Communication*, 24(3), 228–238. <https://doi.org/10.1080/104230902804125>
- Rosser, B. A. (2019). Intolerance of uncertainty as a transdiagnostic mechanism of psychological difficulties: A systematic review of evidence pertaining to causality and temporal precedence. *Cognitive Therapy and Research*, 43(2), 438–463. <https://doi.org/10.1007/s10608-018-9964-z>
- Salkovskis, P. M. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural and Cognitive Psychotherapy*, 19(1), 6–19. <https://doi.org/10.1017/S0141347300011472>
- Summers, B. J., & Cogle, J. R. (2018). An experimental test of the role of appearance-related safety behaviors in body dysmorphic disorder, social anxiety, and body dissatisfaction. *Journal of Abnormal Psychology*, 127(8), 770–780. <https://doi.org/10.1037/abn0000387>
- Thwaites, R., & Freeston, M. H. (2005). Safety-seeking behaviours: Fact or function? How can we clinically differentiate between safety behaviours and adaptive coping strategies across anxiety disorders? *Behavioural and Cognitive Psychotherapy*, 33(2), 177–188. <https://doi.org/10.1017/S1352465804001985>

Published online August 5, 2025

Acknowledgments

We would like to express our gratitude and pay tribute to Birte English, who inspired the research presented here and contributed important ideas during her tenure as a professor at the University of Cologne. Sadly, she passed away prematurely. We thank Gina Haußmann for her decisive contribution to Study 2.

Publication Ethics

Written informed consent was obtained from all survey participants. The research project was approved as ethically unobjectionable by the responsible ethics committee.

Authorship

Conceptualization: MH, HA; Data curation: MH; Formal analysis: MH; Investigation: MH; Methodology: MH, HA; Project administration: MH; Resources: HA; Supervision: HA; Writing – original draft: MH, HA; Writing – review & editing: HA.

Open Science

Open Data: Electronic Supplemental Material is available at <https://osf.io/87stc>

Preregistration: The preregistration can be found at <https://www.aspredicted.org/vyjk-8kq5.pdf>

Funding

This work was supported by the Deutsche Forschungsgemeinschaft (DFG; grant number 27465870).


Open access publication was enabled by the University of Cologne.

ORCID

Mona Hassan

 <https://orcid.org/0009-0004-3497-5751>

Helmut Appel

 <https://orcid.org/0000-0003-4233-6090>

Dr. Helmut Appel

Institute of Clinical Psychology and Psychotherapy

University of Cologne

Pohligstr. 1

50969 Köln

Germany

helmut.appel@uni-koeln.de

https://econtent.hogrefe.com/doi/pdf/10.1026/1616-3443/a000807 - Monday, March 02, 2026 3:13:31 AM - Universitäts- und Stadtbibliothek Köln IP Address: 2a00:a200:0:e00::b1