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SUPPLEMENTARY INFORMATION

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The unintended consequences of argument dilution in direct-to-consumer drug advertisements

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SUPPLEMENTARY INFORMATION

Supplementary Study 1

The objective of this study was to replicate our findings for overall severity of drug's side effects by demonstrating that identical results are obtained even when measurement items are framed in a positive direction. Specifically, instead of asking participants to report how serious are the drug's side effects, participants responded to an additional item judging the safety of consuming the drug. We also employed a different pharmaceutical drug to examine the reliability of the measure across different contexts.

Supplementary Methods 1

Participants. A total of four hundred US participants were recruited using Amazon Mechanical Turk (M_{age}=37.02; 55.00% female; response rate 95.69%). Similar to Studies 2-4, we recruited a large sample (≈200 per cell) to avoid any possibility of Type 1 error. Participants from other studies were excluded from partaking in this study.

Design and Procedure. Participants were randomly assigned to a major or a complete side effects information condition. In the *major side effects condition*, they were informed of only four major side effects of a hypothetical drug, Xylopinol, designed to aid insomnia, whereas in the *complete side effects condition*, they were alerted to both four major and two minor side effects. Participants read that sleep disorder continued to be a major concern in the developed world; and as a result, several pharmaceutical companies were actively working to develop drugs that could be effective in treating these sleep disorders. Following this, participants were either informed of the four major side effects (memory loss, depression, severe liver issues and suicidal thoughts) or both the four major and two minor side effects (headache and dry mouth). Specifically, they read:

One such company, Astrazin Pharmaceutical Ltd., has developed a drug, Xylopinol that treats sleep disorders. US Food and Drug Administration (FDA) has found the drug to be effective and have approved the drug for sale in the United States. However, as is the case with most drugs, Xylopinol may result in some unwanted side effects such as ***memory loss, depression, severe liver issues and suicidal thoughts (, headache and dry mouth).***

After reading about Xylopinol's side effects, participants were asked to rate the severity of side effects associated with the drug by answering three question on a 7-point Likert scale – *1) how safe would it be consume Xylopinol 2) how serious are Xylopinol's side effects, 3) how would you assess the overall risk factor of using this drug?*(α=.81). Similar to other studies, participants also rated their perception of drug attractiveness, tradeoff and their own symptoms/susceptibility to sleep disorder.

Results. We replicated our overall finding. It was found that participants assigned to the complete side effects condition, evaluated the drug as overall low on severity compared to those in the major side effects only condition ($F(1,398)=12.92$, $p=.0004$, $M_{Complete}=5.12$, $M_{Major}=5.49$, $d=.36$). However, more importantly we found similar effects for each of the items measuring the drug's severity, such that participants reported the drug to be significantly more safe ($F(1,398)=4.71$, $p=.03$, $M_{Complete}=3.40$, $M_{Major}=3.10$), containing less serious side effects ($F(1,398)=27.46$, $p<.001$, $M_{Complete}=5.54$, $M_{Major}=6.10$), and overall low in assessment of risk ($F(1,398)=4.69$, $p=.03$, $M_{Complete}=5.21$, $M_{Major}=5.47$) in the complete side effects condition compared to participants in the major side effects only condition. Consistent with other studies, we also found a significant indirect effect ($b = .12$, $p<.001$, *95% CI* [.06, .19]) of our manipulation on drug attractiveness via severity such that participants in the complete information condition evaluated the severity of the side effects to be lower, and thus found the drug to be more attractive compared to participants in the major

side effects condition. Further our effects remain consistent after controlling for trade-off (p<.001) and participants susceptibility to sleep disorder (p<.001). Overall, the study demonstrated that argument dilution effects are independent of the question and framing used to measure the drug's overall severity.

Supplementary Study 2

The objective of Study S2 was to demonstrate the impact of argument dilution primarily on a behavioral measure - participants' willingness to pay (WTP) for the drug. We hypothesized that participants will be willing to pay more for drugs they perceive to have less serious side effects. Second, in all our prior studies, complete side effects condition contained greater number of side effects compared to major side effects only condition, thus an alternate mechanism driving our results could be information overload. To rule out information overload as an alternate psychological mechanism, we included a third condition where we provided information of only minor side effects equivalent in number to that of the major side effects condition. If information overload is the mechanism then one should see no difference between the major and minor side effects conditions, however, if argument dilution is the psychological process driving the effect, participants should express greater willingness to pay in the minor and complete side effects condition compared to the major side effects condition. Finally, by examining the effect of our manipulation on a downstream behavioral variable (WTP), this study demonstrates that argument dilution directly influences the attractiveness of the drug, which in previous studies might have been suppressed by asking participant the drug's overall severity and attractiveness simultaneously.

Supplementary Methods 2

Participants. Consistent with our rationale for sample size, and similar to Studies 2a-c and Study 3 using a text based stimuli, we aimed to recruit roughly 200 US participants per cell (N= 585; M_{age}=36.06; 45.81% female; response rate 94.4%).

Design and Procedure. Similar to Study 3, participants read about a hypothetical drug, Xylopinol, which treats sleep disorder. This was a 3-condition between-subject design, whereby participants were randomly assigned to either a *major*, a *complete* or a *minor side effects* condition. In the *major side effects condition*, they were informed of four major side effects, whereas in the *complete side effects condition*, they were alerted to both four major and four minor side effects. In the *minor side effects* condition, participants read about four minor side effects. After reading the scenario, all participants responded to two questions assessing their WTP. Participants were informed, among other things the price of a drug depends on severity of side effect, such that drugs with minimal side effects are priced higher compared to drugs higher in severity of side effects. Participants then responded to two items. First, participants were asked *what percentage price above or below, the average market price should Astrazin Pharmaceutical price Xylopinol*? Second, in order to get a dollar value for WTP, participants were informed drugs with minimal or no side effects costs about $8, drugs with strong side effects costs about $2 and those in the middle are priced around $5. With that as reference, participants were asked, *assuming you are in the market for a sleep drug, how much would you be willing to pay for Xylopinol between $2-$8*. The two measures were combined to create a composite willingness to pay after zscore transformation (α=.53). Identical to prior studies, participants also rated their perceptions of tradeoff and their own susceptibility to sleep disorder.

Results. A one-way ANOVA with willingness to pay as the dependent variable resulted in a significant main effect across the three experimental conditions ($F(2,582)=7.93$, $p<.001$; *see Supplementary Table 1*). As predicted, participants were willing to pay more in the complete side effects condition than major side effects condition ($t(394)=1.98$, $p=.047$, $d=.20$). However, more importantly we also found that participants willingness to pay was significantly higher in the minor side effects condition than in the major side effects

condition ($t(386)=4.02$, $p<.001$, $d=.41$). This provides further evidence of argument dilution as the cognitive process driving the varied assessment of severity in willingness to pay, as opposed to information overload account. Further, complete side effects condition was also significantly different from minor side effects condition ($t(384)=2.00$, $p=.047$, $d=.20$) such that participants expressed greater willingness to pay in the later condition, providing further support for an averaging account for dilution. Finally, our results remain identical when controlling for symptoms of sleep disorder and trade-off ($p<.05$). Despite these results, an important note of caution is to note that one of our WTP item, by presenting a tradeoff between side-effects and pricing, could have biased participant's responses, producing inflated differences between conditions. This is a valid concern for the differences between the *major* and *minor* side effects condition. However, this potential flaw is unable to account for the difference between the *complete* and *major* side effects condition. Further, our results hold if we analyze the data only using the average percentage price item (i.e., no reference to tradeoff) instead of the composite. However, we acknowledge the above limitation and suggest that results of this study be interpreted with this limitation in mind. Taken together, this study not only helps to rule out another alternate account, but further demonstrates the downstream impact of argument dilution on WTP, an important behavioral measure for consumers and producers of pharmaceutical drugs.

Supplementary Table 1: Descriptive summary of results from Supplementary Study 2 with means and standard deviation in parentheses.

	Supplementary Study 2		
	Complete side effects	*Major side effects*	*Minor side effects*
N	197	199	189
Willingness to pay	.01 (.83)	-.16 (.87)	.17 (.74)

Note. Each cell in the row denoted by willingness to pay represents mean value followed by standard deviation in parentheses.