



Does Increased Sexual Frequency Enhance Happiness?[☆]



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ABSTRACT

Prior research observing a positive correlation between happiness and sexual frequency has not been able to determine whether increased frequency leads, causally, to an increase in happiness. We present results from the first experimental study to address the question of causality. We recruited couples and randomly assigned half to double their frequency of intercourse. We find that increased frequency does not lead to increased happiness, perhaps because it leads to a decline in wanting for, and enjoyment of, sex.

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1. Introduction

Considerable scientific research has observed a link between sexual frequency and well-being. One analysis of a representative sample of 16,000 adult Americans found that sexual frequency was a strong positive predictor of self-reported happiness (Blanchflower and Oswald, 2004). Similar results were also obtained with a sample of 3800 adults from China (Cheng and Smyth, 2015): Increased frequency (as well as higher reported quality of sex) was associated with greater happiness. In another study of 1000 women who reported daily how they allocated time between activities and how much they enjoyed those activities, sex was rated as the activity producing the greatest amount of happiness (Kahneman et al., 2004; see, also Grimm et al., 2014). A nationally representative survey of 3432 Americans found that individuals with no sexual partners in the past 12 months had the lowest levels of happiness (Laumann et al., 1994). Individuals who report more active sexual relationships also report greater happiness within their relationship (Heiman et al., 2011; Rosen and Bachmann, 2008).

These and similar findings have led to numerous media recommendations to increase sexual frequency. Yet all of the work on the link between sexual frequency and happiness has been correlational, making it impossible to infer a causal link between the two, let alone determine which way the causality runs. Although it seems plausible that sex could have beneficial effects on happiness, it is equally plausible that happiness affects sex, or that some third variable, such as health, affects both. As Blanchflower and Oswald (2004, p. 394) note, “solving the endogeneity problem – working out whether sex causes happiness or causality runs in the reverse direction – will be particularly difficult here.”

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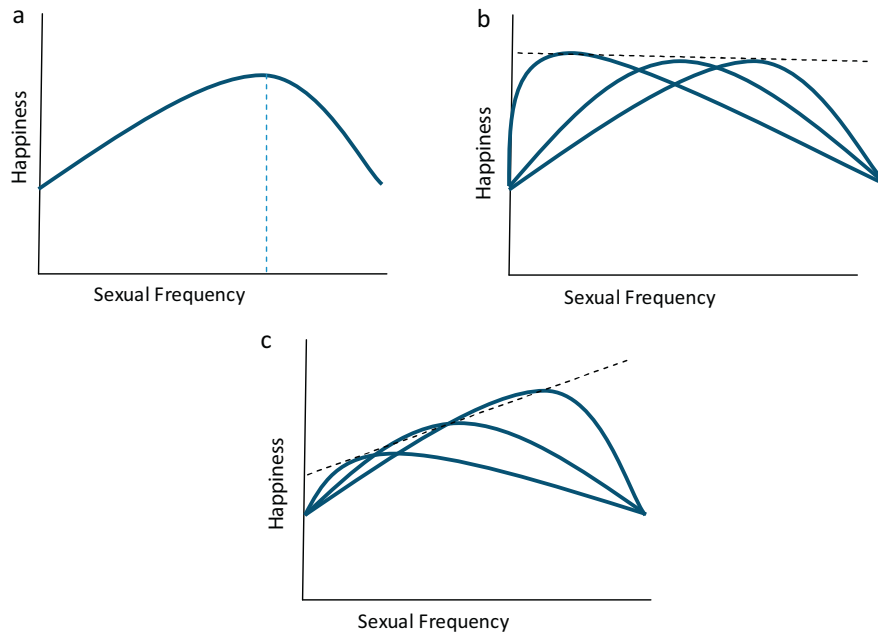


Fig. 1. (a) Hypothetical relationship between happiness and sexual frequency for a single couple. (b) No relationship between happiness-maximizing frequency and happiness. (c) Positive relationship between happiness-maximizing frequency and happiness.

We present findings from a study intended to meet the challenge posed by Blanchflower and Oswald – to test whether sexual frequency has a causal effect on happiness. We recruited couples who were willing to change their patterns of sexual behavior, and randomly assigned half to be asked to double their sexual intercourse frequency.

Although we were successful in increasing frequency among those asked to do so, we did not find that increasing sexual frequency improved happiness. We do not conclude, however, that there is no causal relationship running from sexual frequency to happiness. While there very well may be a causal relationship between sexual frequency and happiness, our experimental manipulation of frequency had an unintended adverse effect on the quality of sex. We exploit the richness of our dataset to explore possible reasons for this perverse and unintended effect.

1.1. Why increased frequency might or might not improve happiness

In making predictions about the relationship between frequency and happiness it is important to distinguish between endogenous (i.e., chosen by the couple) and exogenous (in this case induced by experimental instruction) variations in frequency. If couples choose their own frequency of intercourse in a fashion that maximizes their happiness (corresponding to the dotted line in Fig. 1a), then either a decrease or increase in frequency would lead to a decrease in happiness. Moving away from the chosen frequency of intercourse, according to the traditional account, should always be undesirable, even if happiness is increasing in frequency between 0 – i.e. never having sex – and the optimum. If couples choose their own frequency to maximize their utility, we should not expect a cross-sectional investigation of the relationship between sexual frequency and happiness (as examined in the studies just discussed) to uncover the causal relationship between sexual frequency and happiness. Instead, such a comparison examines only relative happiness levels at different self-determined optima – i.e., whether couples who enjoy more frequent sex are also happier overall. Fig. 1b and c illustrates situations in which one would observe either a flat (Fig. 1b) or (as observed in the literature) positive (Fig. 1c) relationship between happiness and frequency for couples that optimize happiness when determining intercourse frequency.

All of this assumes that couples do engage in sex at their happiness-maximizing level of frequency, which, as discussed in Loewenstein (1996, p. 287), may not be the case. When couples are first together, the simple sight of, or physical contact with, the partner produces arousal, so it takes no stretch of the imagination to recognize how pleasurable sex would be. Very likely for that reason, frequency tends to be high in the early stages of a relationship (Michael et al., 1994). As couples spend time together, however, they naturally tend to adapt to one-another's presence, so that visual and tactile contact results in reduced levels of desire.¹ Combining this decline in desire with the difficulty that people have in bridging emotional states (Loewenstein, 1996) – in imagining what it would be like to be in an affective state different from the one they are in – it is

¹ Such a diminishment in arousal can be understood in evolutionary terms, and may be related to the instant rejuvenated caused by the prospect of sex with a new partner known as the “Coolidge Effect” (see, e.g., Dewsbury, 1981), which has been observed in species as primitive as the pond snail (Koene and Ter Maat, 2007).

quite possible that couples would fail to engage in sex even if doing so would be both pleasurable and happiness-enhancing. Wanting, as Kent Berridge discusses in an insightful line of research (e.g. Berridge, 2009), does not always correspond to liking.

If couples who have been together for an extended period tend to have sex at a frequency below that which maximizes happiness, then the cross-sectional relationship between happiness and (endogenous) sexual frequency might well be positive, since couples who had more sex for whatever reason (e.g., because they had less hectic lives) might end up closer to their happiness-maximizing peak. Likewise, in this situation, an exogenously induced increase in frequency, such as that produced by our experiment, should have a positive impact on happiness – as long as it does not propel the couple beyond their happiness-maximizing frequency.

All of this discussion assumes that there is a simple function relating frequency to happiness, and that manipulating the level of frequency produces a corresponding change in happiness, which might not be the case. There are reasons unrelated to frequency itself for why a directive to increase sexual frequency could lead to a decline in happiness. The most obvious of these is that an external inducement to have more sex could lead to a decline in couples' intrinsic motivation to have sex. Substantial research has found that introducing extrinsic incentives for engaging in an activity can undermine preexisting intrinsic motivation to engage in the activity (Deci et al., 1999; Gneezy and Rustichini, 2000; Lepper, 1981). Although we did not offer explicit incentives for having sex, but only for participating in the experiment (with an unincited request for some couples to increase their sexual frequency), couples in the increased sex treatment may, nonetheless, have perceived themselves as being paid, or felt pressured, to have more sex. Even absent considerations of payment, the increased-sex treatment could lead a couple to change their construal of why they are having sex. If they are choosing their own frequency of sex, then the fact that they are having sex will naturally be attributed to enjoying it. However, if they are instructed to have sex, there will no longer be an obvious connection between frequency and enjoyment, which may lead to the excitement-dampening inference that they are only having sex because they are instructed to do so.

Given that we find that the experimental treatment does not increase happiness (and, indeed, marginally decreases it), and also diminishes desire for, and enjoyment of, sex, it is fortunate that the richness of the data collected from couples permits a test of these two accounts of why a directive to have more sex might backfire. If the over-the-peak account is the explanation for the observed effect – i.e., if the directive to have sex leads couples to have more sex than is best for them – then we should observe a decline in desire, enjoyment, and happiness that is most pronounced for couples in the increased-sex condition who do, in fact, increase their frequency. If the intrinsic motivation/self-perception account is correct, on the other hand, the decline in desire, enjoyment and happiness should be observed regardless of the change in activity. Indeed, it is possible that couples in the increase-sex condition who fail to achieve the targeted amount of sex might feel inadequate and experience the greatest decline in happiness.

Instructing a couple to have more sex could also, potentially, lead to tension if one member of the couple was more interested in complying with the experimental directive than the other. In that case, the directive to have more sex could expose fault-lines in the couple's relationship that might not otherwise be evident. It is also possible that the intervention could throw the couple off of their natural rhythm of interaction. The richness of our data set, with its daily logins by both members of participating couples, enabled tests of these two predictions, and led to the discovery of an unexpected effect of the intervention: a disruption in the synchronicity of the two members of the couples' feelings toward one-another.

2. Method

Participant couples were recruited from a pool of previous participants in university research and through local newspaper ads and flyers. Recruitment materials specified that participants might be asked to alter their usual pattern of sexual behavior. We were deliberately vague in describing what participants would be asked to do, so that couples would be unlikely to drop out following assignment to conditions.

To participate, both members of a couple had to be between the ages of 35 and 65, the couple had to be legally married, consist of one male and one female, and be free of health conditions such as diabetes and high blood pressure. Exclusion criteria were tension in the relationship surrounding sex and/or physical discomfort during intercourse. Finally, given that our goal was to double the frequency of intercourse in the treatment group, we only included couples who reported frequency of intercourse of at least once a month (so that an increase would be meaningful) but no more than three times per week (because we suspected that double this – i.e., more than 6 times per week – might pass the point of diminishing returns). To avoid strategic responding to these screening questions, respondents were not informed about the exclusion criteria ahead of time, and each member of the couple was screened separately and informed that their answers would not be shared with their partner. If either couple member's responses indicated exclusion (e.g., one member reported an exclusionary health condition), then both members of the couple were excluded.

Couples who signed consent forms and demonstrated proof of age and marital status were then stratified by age and sexual frequency before being randomized to one of two groups: the control group, who received no instructions on sexual frequency during the 90-day experimental period, and the treatment group, who were asked to double their baseline weekly frequency of sexual intercourse. If a range was given at baseline, or if the two members of the couple provided discrepant frequency estimates, the maximum of the range was used as the recommended frequency.

All participants were asked to complete a 10-min online survey each morning of the three-month experimental period. Several incentive payments were included to encourage submission of questionnaires. Each day that both couple members

submitted their questionnaires by noon, they were individually entered into a lottery with a 1 in 10 chance of winning \$10 and a 1 in 100 chance of earning \$100. Participants who completed all 90 questionnaires received a \$100 bonus payment at the end of the study. To avoid creating incentives for misreporting, particularly of sexual activity, payments were contingent on response and not on adherence to instructions regarding increasing sexual frequency.

3. Measures

Both members of each participating couple independently completed questionnaires before beginning the study (baseline), daily during the study period (with additional questions on Sunday), and immediately following completion of the study (exit).² Baseline measures comprised a 44-item scale measuring the ‘Big 5’ personality traits (John and Srivastava, 1999), a 19-item trait anxiety inventory asking participants questions about how they “generally feel,” and including a single question asking explicitly about happiness” (Spielberger, 2010), a 21-item Beck depression inventory (Beck et al., 1988), the first 7 of 10 items from the “General Self-Efficacy Scale” (Schwarzer and Jerusalem, 1995), various demographics, ‘SF-12’ measures of physical and mental health (Ware and Sherbourne, 1992), a 5-item scale measuring libido, created from items culled from the Sexual Desire Inventory (Spector et al., 1998), a scale measuring relationship quality, and a scale measuring liking for sex (see Krishnamurti and Loewenstein, 2012). Measures taken daily included various positive and negative health behaviors (such as smoking and exercise), a 14-item positive and negative affect scale (PANAS) asking participants “How are you feeling today?” with items reflecting a wide range of positive (e.g., “happy,” “cheerful”) and negative (e.g., “sad,” “tense”) emotions, items measuring the occurrence, type and enjoyableness of sex, as well as whether it resulted in orgasm, wanting for sex (using the scale since reported in Krishnamurti and Loewenstein, 2012), and the same scale measuring relationship quality included in the baseline survey. The exit survey included all items from the entrance survey that would have been likely to change over the three-month period.

The main dependent measure of the study was a positive mood scale composed of the summation of positive and (reverse-coded) negative emotion items from a subset of the PANAS scale (reverse-coded items indicated with an asterisk): Happy, tired*, sad*, peppy, on edge*, cheerful, tense*, at ease, and unhappy*. The scale derived from these items (Cronbach’s Alpha = .87) was averaged over all of the days on which a respondent logged in and completed the scale. Researchers often divide the PANAS into positive and negative mood subscales; doing so produced parallel results for us, and diminished statistical power, so we report the results from the omnibus scale.

4. Results

4.1. Sample

Randomization occurred prior to the baseline survey, but couples were not given any instructions regarding their sexual activity until after they completed the baseline survey. One couple in the control group and none in the increased-sex treatment condition failed to complete the intake survey. Two more in the control group failed to provide sufficient data for their responses to be usable. Finally, in one wave of recruitment we ended up with two more treatment group than control couples in part due to the stratified randomization scheme (which balanced numbers within strata but not across the larger sample). As a result, we ended up with six fewer couples who provided usable data in the control group than in the treatment group.

Table 1 presents a comparison of the control ($n = 58$) and treatment ($n = 70$) group demographic characteristics at baseline. The samples are well-balanced in terms of age and sexual frequency (which should be expected, since randomization was stratified on these variables), and also on race and income. However, the treatment group is significantly more educated and, somewhat imbalanced in terms of number of years married. In most of our key analyses presented in the results section, we control for demographics, including these two imbalanced variables.

Table 2 presents a comparison of control and treatment groups on different scales elicited at baseline. Here, we find that the treatment group is significantly less extroverted, significantly higher in anxiety, and significantly lower (worse) on the SF-12 mental health composite score.

4.2. Baseline relationships between variables

Table 3 presents correlations between selected measures at baseline. The first row shows that sexual frequency was correlated with the libido scale, and with sexual liking, but not with a single-item measure of happiness (from the anxiety scale), nor with scales one would expect to be associated with happiness, such as anxiety, depression and mental health. Nor was frequency significantly correlated with the scale measuring partner closeness. The second row shows that the happiness item was correlated with various measures that one would expect to be associated with happiness: anxiety, depression, efficacy and mental health. Happiness was also significantly associated with partner closeness ($r = .27$) and significantly and

² See online appendix for a detailed presentation of all measures. Some of the measures collected are not reported in the current paper but will be used in future planned papers, and are available for usage by other researchers.

Table 1
Demographic characteristics of control and treatment groups at baseline.

	Control <i>n</i> = 58	Increased-sex treatment <i>n</i> = 70
Mean age	46.8 (7.6)	44.7 (8.8)
Race, ethnicity		
White non-Hispanic	90% (<i>n</i> = 52)	93% (<i>n</i> = 65)
Non-white or Hispanic	8% (<i>n</i> = 6)	7% (<i>n</i> = 5)
Household income		
\$40,000 and below	7% (<i>n</i> = 4)	11% (<i>n</i> = 8)
\$41,000–\$100,000	58% (<i>n</i> = 34)	44% (<i>n</i> = 31)
Above \$100,000	35% (<i>n</i> = 20)	44% (<i>n</i> = 31)
Education*		
High school or less	16% (<i>n</i> = 9)	1% (<i>n</i> = 1)
Some college to bachelor's degree	65% (<i>n</i> = 38)	66% (<i>n</i> = 46)
Master's degree or more	19% (<i>n</i> = 11)	33% (<i>n</i> = 23)
Mean intercourse/month at baseline	5.8 (3.5)	5.3 (2.9)
Mean number of years married*	17.5 (10.2)	13.7 (9.3)
Mean number of children	2.2 (1.1)	1.8 (1.3)
First marriage	76%	73%

* $p < .05$.

Table 2
Scale scores of control and treatment groups at baseline.

	Possible score range	Control <i>n</i> = 60	Increased-sex treatment <i>n</i> = 70
Big 5 personality test			
Mean Extroversion*	8–40	29.72	26.83
Mean Agreeableness	9–45	36.43	34.60
Mean Conscientiousness	9–45	37.23	36.20
Mean Neuroticism	8–40	18.90	20.56
Mean Openness	10–50	38.63	37.06
Mean Trait Anxiety Inventory*	20–80	30.68	34.17
Mean Beck Depression Inventory	0–63 (below 10 normal)	4.07	4.84
Mean General Self-Efficacy Scale	10–40	23.92	23.06
Mean SF-12 Physical Health Composite Score	Norm-based scoring; mean-50, SD = 10 for general population; higher score indicates better health	54.71	54.81
Mean SF-12 Mental Health Composite Score*		54.09	51.82
Mean Sexual Drive	0–35	18.95	19.50
Mean Relationship Quality	9–63	59.63	60.04
Mean Partners-Specific Sexual Liking	10–50	32.27	33.50

* Significant difference at .05 level.

strongly correlated with enjoyment of sex (sexual liking; $r = .46$). This is the first hint that, in this sample, happiness is related to the quality but not the frequency of sex. Moving down the table, partner closeness was strongly related to sexual liking, and physical health was not correlated with any other baseline measure.

An obvious question is why the positive correlation between sexual frequency and happiness observed in prior data was not replicated in ours. One possibility is that we were under-powered to observe it. Another possibility is that the self-selected nature of our sample may have reduced the range of our relatively crude baseline happiness measure: 90% reported being happy either “often” or “almost always.” In the daily surveys, we did include a far more sensitive measure of happiness (or, actually, mood) based on the PANAS). Yet a third possibility is that the positive correlations found in earlier studies were driven by a third variable, with a plausible candidate being liking for sex (which was not measured in any of the studies reviewed above, to the best of our knowledge). In our data set, sexual frequency is strongly correlated with liking for sex ($r = .55$, $p < .01$), and liking for sex is, in turn, strongly correlated ($r = .46$, $p < .01$) with happiness. Given these strong correlations it is surprising that sexual frequency and happiness are so weakly correlated with one another.

Table 3
Correlations of Baseline Measures.

	Sexual frequency	Happiness item	Trait Anxiety Scale	Beck Depression Inventory	Efficacy Scale	Libido Scale	Partner Closeness Scale	Sexual Liking Scale	SF-12: Physical Component Score	SF-12: Mental Component Score
Sexual frequency/month	1	.074	-.062	.024	.109	.322**	.161	.553**	-.106	-.021
Happiness item	.074	1	-.716**	-.428**	.231**	.094	.272**	.461**	.053	.510**
Trait Anxiety Scale	-.062	-.716**	1	.576**	-.412**	-.138	-.352**	-.357**	-.151	-.641**
Beck Depression Inventory	.024	-.428**	.576**	1	-.230**	-.190	-.266**	-.227*	-.151	-.627**
Efficacy Scale	.109	.231**	-.412**	-.230**	1	.246*	.302**	.234	-.042	.196
Libido scale	.322**	.094	-.138	-.190	.246*	1	.078	.220	.016	.097
Partner Closeness Scale	.161	.272**	-.352**	-.266**	.302**	.078	1	.565**	.024	.153
Sexual Liking Scale	.553**	.461**	-.357**	-.227*	.234	.220	.565**	1	-.009	.171
SF-12: Physical Component Score	-.106	.053	-.151	-.151	-.042	.016	.024	-.009	1	-.034
SF-12: Mental Component Score	-.021	.510**	-.641**	-.627**	.196	.097	.153	.171	-.034	1

* $p < .05$.

** $p < .01$.

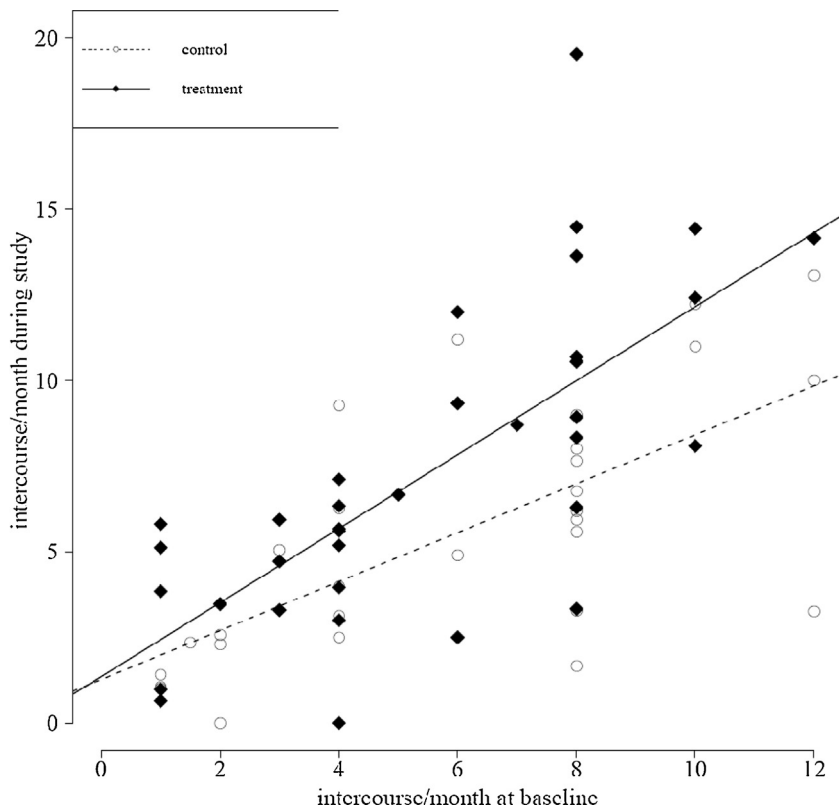


Fig. 2. Impact of treatment on sexual frequency.

4.3. Success of treatment

Fig. 2 shows the relationship between intercourse frequency (times per month) for each couple, as reported by the female member (both members' reports tended to line up closely) over the course of the study (*y*-axis) as a function of self-reported baseline frequency (again times per month, as reported by the female member of the couple) on the *x*-axis. Those in the control group are represented by open circles, and those in the treatment group by solid diamonds. Although the slope of the solid line is not double that of the dashed line, as would be observed if treatment couples had truly doubled their sexual frequency, it is obviously substantially higher, and fans out as we would expect if couples were attempting to comply with experimental instructions.

The solid and dashed lines represent the OLS fit of study frequency on baseline frequency for the two groups. They show that the treatment group did have proportionately more sex (relative to their baseline frequency) than the control group, although they did not, on average, double their frequency. In fact, the figure suggests that sexual frequency in the treatment group was just above frequency at baseline, whereas sexual frequency in the control group was below baseline. While we have great confidence that frequency was elevated in the treatment group, given that both members of the couple provided independent indications of whether they had engaged in intercourse on each day, it is possible that the discrepancy between baseline and study frequency of sex in the control condition might simply reflect that baseline reports of sexual frequency overstated the actual frequency of sex. Given that the frequency during the study was computed from daily self-reports provided independently by each member of the couple, we assume that these provide a more accurate measure of actual frequency than do retrospective self-reports summarizing frequency over a longer historical period. The first panel of Fig. 3 shows that the difference in sexual frequency between the control and increased-sex groups was maintained over the three month period of the study.

Table 4 presents an over-dispersed Poisson regression analysis of the impact of the treatment on average daily sexual frequency, which is the most appropriate method of analysis because the dependent variable is a rate. This is a generalized linear model with a log link function (similar to using logistic regression for binary data), and as such, is comparable to simply running ordinary least squares on the log of the dependent variable. However, this method correctly handles the occasional reports of "no sex." Given that it is most appropriate to conduct the regression on only males, or only females, but there are occasional discrepancies between the members of a couple as to whether they had sex, for completeness we included both regressions.

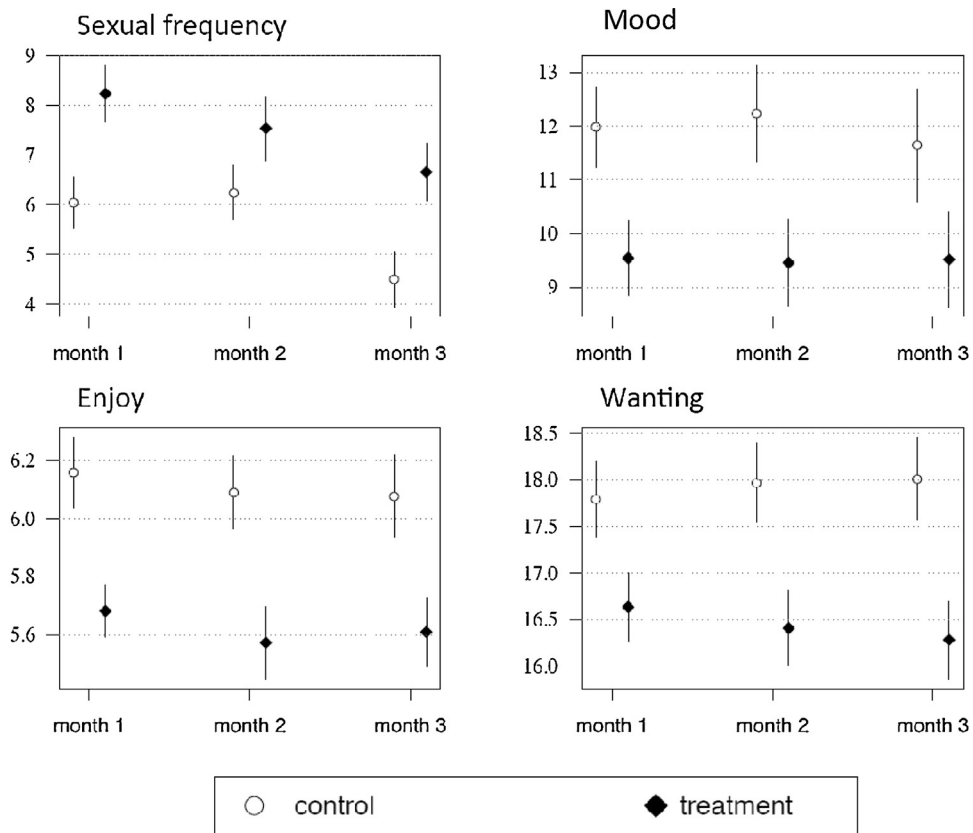


Fig. 3. Mean values of key variables the three months of the study (error bars = 1 S.E.).

The first set of regressions shows that sexual frequency during the study was, not surprisingly, related to baseline sexual frequency, and, more importantly, that the treatment condition increased sexual frequency by about 40% on average, a difference significant at the .01 level. The second set of specifications shows that, controlling for baseline sexual frequency and treatment condition, age had no impact on sexual frequency, but that those married longer had greater sexual frequency during the study period. This is not the typical pattern, but may reflect the fact that long-time married couples who agree to participate in a study on sexual behavior, and who are not excluded for insufficient frequency, are not representative

Table 4

Poisson regression of sexual frequency during the study period (sex per day) on baseline frequency and experimental condition.

	Dependent variable: mean sex per day			
	Male I	Female I	Male II	Female II
Increased-sex treatment	0.414 ^{***} (0.130)	0.371 ^{***} (0.120)	0.437 ^{***} (0.138)	0.416 ^{***} (0.124)
Baseline sex	3.850 ^{***} (0.575)	4.208 ^{***} (0.557)	3.929 ^{***} (0.597)	4.383 ^{***} (0.574)
Age			-0.003 (0.009)	-0.015 (0.010)
Years married			0.006 (0.008)	0.017 [*] (0.008)
Intercept	-2.501 ^{***} (0.171)	-2.645 ^{**} (0.169)	-2.497 ^{**} (0.428)	-2.317 ^{***} (0.419)
F-Stat	25.0	32.2	12.3	17.8
p-Value	.000	.000	.000	.000
Observations	64	64	64	64

^{*} $p < .1$.
^{**} $p < .05$.
^{***} $p < .01$.

Table 5

Determinants of mood, three-month study period.

	Dependent variable: mean daily mood scale (sum of all feeling variables from PANAS with appropriate signs)								
	I	II	III	IV	V	VI	VII	VIII	IX
Increased-sex treatment	-2.6*	-2.1+	-2.4+	-1.9	-2.4	-1.9	-2.0	-1.24	-.94
	(1.25)	(1.14)	(1.28)	(1.24)	(1.58)	(1.24)	(1.26)	(1.20)	(1.19)
Baseline happiness (single item)		4.0***							
		(.67)							
Female				-.39	-.93	-.38	-.15	.67	.26
				(.87)	(.94)	(.87)	(.90)	(.82)	(.82)
Years married				.19*	.19*	.19*	.19*	.17*	.14*
				(.087)	(.087)	(.087)	(.090)	(.089)	(.081)
Female * Treatment					1.00				
					(1.69)				
Sexual frequency						.26			
						(4.1)			
Discrepancy between target and actual sexual frequency							2.42		
Wanting							(4.6)		
								.69**	
								(.17)	
Enjoyment									2.33***
									(.62)
Constant	12.0***	-1.4	5.7	7.9*	8.1*	7.8*	7.6*	-6.0	-6.1
	(1.02)	(2.32)	(4.05)	(4.23)	(4.3)	(4.4)	(4.24)	(5.15)	(5.65)
Demographic controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	.038	.217	.048	.097	.091	.090	.091	.138	.178
F	6.1*	18.6***	2.6*	3.3**	2.8**	2.8**	2.8**	3.9**	4.8***
Bayes factor	0.297	0.548	0.497	1.052	1.023	1.071	0.981	2.337	3.311

OLS regression with random effects for couple.

Demographic controls include age, college, income > \$40k.

Standard errors in parentheses.

+ $p < .1$.* $p < .05$.** $p < .01$.*** $p < .001$.

exemplars of their group. In any case, both sets of regressions support the conclusion that the experimental treatment had a strong, significant impact on sexual frequency in the intended direction.

4.4. Effects of the treatment

4.4.1. Mood

The second panel of Fig. 3 compares the self-reported levels of mood by the control and increased-sex groups, measuring mood by the multi-item PANAS elicited from both members of the couple on a daily basis. The figure reveals the unexpected effect that self-reported mood was lower in the increased-sex group than in the control group, and that the effect persisted over all three months of the study.

Table 5 presents nine OLS regression analyses, clustering standard errors at the couple level to account for potential non-independence between the two members of a couple, of the determinants of mood (using the multi-item PANAS). The PANAS is sometime analyzed separating items into positive and negative mood subscales, which tend to form distinct factors (as was somewhat the case in our data set). However, we found that the results from the two subscales were very similar, so, rather than doubling the number of reported analyses, we report regressions on the composite mood scale, which, as noted, exhibited a high degree of internal reliability. The first specification shows that the treatment did affect mood, but not in the expected direction; those induced by the experimental condition to have more sex displayed a *lower* mood during the course of the experiment than those in the control group. The point estimate of the negative impact of treatment condition on mean mood was 0.2 S.D.s. Examining the individual components that made up the PANAS, we observed that 13 of the 14 items differed in a direction that indicated reduced mood in the treatment group than the control group. However, the most significant differences between the conditions, by far, were on items that indicated energy and excitement or a lack thereof (e.g., peppy, tired and fatigued).

Specification II shows that the effect remains significant when we control for self-reported happiness (measured by the single item) at baseline. Specification III shows that the effect remains significant after controlling for age, having a college degree and earning income greater than \$40k (a cut-off we chose because it provided the greatest explanatory power in a variety of analyses). Only the latter effect was statistically significant (and improved mood by an estimated 0.15 S.D.). Specification IV controls for years married, a key variable which was imbalanced between the two groups. With the addition of this control, the coefficient on treatment is still negative, but no longer significant at the 0.1 level. The impact of years

Table 6
Determinants of wanting.

	Dependent variable: mean daily wanting scale (sum of think + lookat + contact)				
	I	II	III	IV	V
Treatment	-1.18 ⁺ (.63)	-1.18 ⁺ (.63)	-1.17 ⁺ (.62)	-1.55 ⁺ (.71)	-1.4 ⁺ (.63)
Female		-1.42 ^{**} (.45)	-1.55 ^{**} (.48)	-1.96 ^{**} (.69)	-1.49 ^{**} (.48)
Age			-.04 (.046)	-.04 (.047)	-.04 (.044)
Years married			.03 (.040)	.03 (.040)	.03 (.039)
Female × Treatment				.76 (.91)	
Sexual frequency					3.80 ⁺ (2.12)
Constant	17.78 ^{***} (.48)	18.48 ^{***} (.46)	20.09 ^{***} (1.97)	20.26 ^{***} (2.01)	19.08 ^{***} (1.99)
Adjusted R ²	.027	.070	.065	.061	.087
F	4.5 ⁺	5.8 ^{**}	3.2 ⁺	2.7 ⁺	3.4 ^{**}

OLS regression with random effects for couple.

Demographic controls include age, college, income > \$40k.

Standard errors in parentheses.

⁺ $p < .1$.

^{*} $p < .05$.

^{**} $p < .01$.

^{***} $p < .001$.

married on mood is positive; people who are married longer have more positive mood (or people with positive mood remain married longer). Specification V adds an interaction between Female and Treatment to see if men's and women's mood reacts differently to a directive to increase sexual frequency. Some prior research (e.g., [Dunn et al., 2000](#); [Smith et al., 2011](#)) has found that men in heterosexual couples are more likely than women to express greater dissatisfaction with the (in)frequency of sex. The small and insignificant coefficient on the interaction suggests that elevating sexual frequency in our study did not have differential effects on male and female members of the couple. This provides evidence against the idea that different responses by males and females to the directive to have more sex created tension in the couple, leading to the decline in happiness. Specification VI adds sexual frequency to the equation. If the treatment is having its effect on happiness via its impact on sexual frequency, then adding a term for frequency to the equation should diminish the impact of the experimental manipulation; it does not. This suggests that, even though the treatment was successful in increasing frequency, it is not the increased frequency per se that led to the decline in happiness.

If overly great sexual frequency is not responsible for the decline in happiness in the increased-sex treatment group, perhaps something akin to the opposite is responsible; perhaps those in the increased-sex treatment who fail to achieve the sexual frequency target they are given feel inadequate and unhappy. To test for such a possibility, we created a variable equal to zero for the control group and equal to the discrepancy between target and actual sex for the increased-sex treatment group. In specification VII, we add this variable to the regression. Controlling for other variables, it can be seen, this discrepancy variable does not significantly predict mood (and, in fact, the sign is wrong). Moreover, restricting the sample to the increased-sex condition alone, the simple correlation between mood and the discrepancy variable does not approach statistical significance: $r = -.01$ ($p = .93$).

Specifications VIII and IX add, respectively, terms for wanting sex with the partner (based on the sum of three items) and enjoying sex with the partner (based on response to a single item). Both of these terms have a very large and significant impact on mood (the Adjusted R² approximately doubles) and inclusion of either term substantially decreases the magnitude and significance of the impact of the treatment on mood. These regressions point to the hypothesis that increased sexual frequency does not enhance (and in fact detracts from) mood because it decreases desire for, and enjoyment of, sex.

To gauge the strength of the conclusion that increased frequency does not enhance mood, we include a Bayes factor in the bottom row of the table which measures the strength of evidence for the model where the treatment is ignored relative to the model which includes a treatment effect. The calculation assumes a normal linear model with a weak prior that the estimated coefficients are independent normal with mean zero and large variance. This prior is least favorable toward the null model: that the treatment can be ignored. Values of the Bayes factor less than one indicate evidence that the treatment is important in explaining happiness, while values greater than one indicate the opposite. Most values are between one and three in this case, which indicates little evidence in favor of either model. It is important to mention again that, even if we include the treatment effect, the point estimate is negative indicating that increased sex leads to lowered mood.

The bottom two panels of [Fig. 3](#) summarize the daily measures of enjoyment of, and wanting for, sex, averaging the data for each of the three study months across all participants (male and female) in each of the two groups. The figure provides further evidence of perverse effects of the increased sex treatment on both variables, and over all three months of the study.

Table 7
Determinants of enjoyment.

	Dependent variable: mean daily enjoyment of sex				
	I	II	III	IV	V
Treatment	-.46** (.17)	-.46** (.17)	-.41* (.18)	-.49* (.20)	-.51** (.19)
Female		-.26* (.12)	-.25* (.12)	-.34* (.15)	-.24* (.12)
Age			.00 (.011)	-3.79 (.011)	.00 (.010)
Years married			.01 (.011)	.01 (.011)	.01 (.011)
Female* treatment				.16 (.23)	
Sexual frequency					1.36* (.58)
Constant	6.1*** (.14)	6.2*** (.14)	6.01*** (.47)	6.05*** (.48)	5.63*** (.50)
Adjusted R ²	.066	.082	.091	.086	.134
F	9.8*	6.5**	4.11**	3.33**	4.83***

OLS regression with random effects for couple.

Demographic controls include age, college, income > \$40k.

Standard errors in parentheses.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

**** $p < .001$.

Tables 6 and 7 present a series of OLS regressions, again clustering errors at the couple level, examining the impact of the experimental treatment as well as other variables on wanting for and enjoyment of sex, respectively. Both tables tell a consistent story: the instruction to have more sex leads to a decline in wanting for sex and in enjoyment of sex. Women in the sample also display lower levels of wanting for and enjoyment of sex than do men. In specification V of both tables we introduce Sexual Frequency as an explanatory variable. The coefficient is positive which, we suspect, is picking up reverse causation: Those who want and enjoy sex more, have more of it.

Although not an original planned analysis, taking advantage of the fact that we had daily reports on a wide range of variables for each member of each couple, we created measures of temporal coordination by correlating variables across time for each couple, only including couples from whom we could measure the correlation from at least 5 shared data points. Measuring coordination over time within each couple by this correlation, we compared coordination on wanting for sex, enjoyment of sex, feelings of each member of the couple toward the other (the relationship quality scale), happiness measured by the single item and mood measured by the PANAS. Given that the correlations are identical for each member of the couple, we only used female correlations in the analysis. As can be seen in Table 8, the correlations are all positive and range from a low of .08 to a high of .34 (for enjoyment of sex in the increase sex condition).

Although the comparisons are admittedly post hoc, the treatment appeared to exert a dramatic effect, reducing the coordination of feelings when it came to wanting for sex and happiness (and marginally for feelings about the quality of the relationship). Surprisingly, however, the correlation for enjoyment of sex was significantly and substantially greater in the increased-sex condition than in the control. Note, however, that these correlations are based on only about a quarter the number of observations as other correlations, since we only measured enjoyment of sex when the couple actually had sex.

Although we measured a wide range of other variables during the course of the study, our key variables were sexual frequency, mood, and enjoyment of sex. We observed very few other significant differences in variables between the two treatment groups. Other researchers are free to explore our data in search of other interesting relationships between the many variables we collected; we chose to limit the analyses, mainly, to testing our primary predictions.

Table 8
Temporal correlations of selected variables across members of the couple.

	Control mean correlation	Increased-sex treatment mean correlation	t-Statistic	p value	Mean n of observations	Minimum n of observations	Maximum n of observations
Wanting	0.25	0.17	1.29	.2	80.3	5	124
Enjoy	0.13	0.34	-2.34	.02	17.1	5	48
Relationship quality scale	0.20	0.08	1.86	.07	79.9	5	124
Happy (single item)	0.22	0.09	2.21	.03	80.5	5	124
Mood (multiple item scale)	0.27	0.23	0.75	.45	76.8	5	120

5. Discussion

The current study suffers from significant limitations – most notably the lack of balance between the treatment arms and the non-representative nature of couples in the sample (given that they were recruited with the stipulation that they should be ready to alter their patterns of sexual behavior). However, it is the first study, to the best of our knowledge, to attempt to solve the endogeneity problem lamented by [Blanchflower and Oswald \(2004\)](#) in their study examining the positive relationship between sexual frequency and happiness – i.e., to assess whether increased frequency really does lead to greater happiness. Moreover, the main finding is surprising: Contrary to what one would expect if the causal story running from sexual frequency to happiness were true, we observed a weak negative impact of inducing people to have more sex on mood.

Why did the increased-sex treatment have a negative impact on wanting, liking and mood? The fact that the greatest negative effect was on mood items relating to energy might seem to suggest that couples were more tired out, but if this were the case then we should have observed a negative relationship between mood and frequency, which we did not. Nor did controlling for frequency reduce the estimated effect of the experimental manipulation on mood or wanting or liking for sex; it was the experimental manipulation that had an adverse impact, and this negative impact did not operate through its actual effect on couples' behavior. None of this supports the idea that the perverse effect of the increased-sex manipulation on happiness resulted from it pushing people beyond their happiness-maximizing level of frequency. Nor do the data support the idea that it was the burden of the expectation that one should have more sex – unmet by some couples – that had a negative impact on individuals' happiness and desire for and enjoyment of sex.

Rather, the evidence presented here seems to be most consistent with the idea that the directive, in the treatment condition, to have more sex affected the couples' intrinsic motivation to have sex. Perhaps being in the experimental treatment changed couple members' construal of sex, from a voluntary activity engaged in for pleasure to a duty, engaged in at the behest of the experimenter. Consistent with the latter account, numerous studies (e.g., [Pepe and Byrne, 1991](#)) have found declines in sexual satisfaction among couples engaged in infertility treatment. With the focus on timing sex to match the ovulation cycle, infertility treatment may transform sex from an activity driven by desire to an instrumental activity driven by the desire to procreate.

Although field experiments are often lauded as achieving high levels of external validity, the current experiment helps to shed light on ways that they can fall short. Consider, for example, the Moving to Opportunity study (e.g., [Ludwig et al., 2013](#)) in which families living in poor neighborhoods were induced, by contingent rental subsidies, to move to higher income neighborhoods. Many prior correlational studies had observed a strong positive relationship between neighborhood affluence and economic, educational and social outcomes. Randomly assigning people to change neighborhoods, it seemed, could determine whether the relationship was causal. However, that study, like the current study, produced an unexpected finding: boys were adversely affected by the move. It would be a mistake to conclude from this, however, that advantaged neighborhoods are bad for boys. The Moving to Opportunity study ultimately answered a different and narrower question than the one it set out to answer, namely, the effect of uprooting families living in poor neighborhoods and relocating them to more affluent neighborhoods. Similarly, this study answered a different question from the one it set out to address; it addresses how requesting a couple to have more sex affects happiness, wanting and enjoyment, but not whether the naturalistically occurring relationship between sexual frequency and these variables is causal.

This narrower question is not without interest. Several popular self-help books (e.g. *Just Do It: How One Couple Turned Off the TV and Turned On their Sex Lives for 101 Days (No Excuses!)* and *365 Nights: a Memoir of Intimacy*) and even religious leaders (see: <http://www.nytimes.com/2008/11/24/us/24sex.html>) have issued public challenges to couples to increase their sexual frequency based on the assumption that doing so would improve relationship quality (and presumably happiness). If couples feel pressured by such directives to increase their sexual frequency, it is quite possible that doing so would have quite a different effect on their happiness and relationship quality than that assumed by the advocates of increased sex. In contrast, interventions that lured couples into having more sex, e.g., by providing travel to new locations that broke routines, babysitting, or retreats in elegant hotel rooms, rather than directives to have more sex, might have a higher chance of producing the hoped-for positive causal relationship between frequency, happiness and relationship quality.

The current paper contributes to an area of research that is difficult to explore, due to difficulties of funding, recruitment, and the general sensitivity of the topic. The question of whether increased sexual frequency leads to increased happiness still lacks a definitive answer, but the key to answering it has been identified for future researchers: Sexual frequency needs to be increased via experimental manipulations that increase wanting for sex, rather than via a direct request to do so.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.jebo.2015.04.021>.

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