LEARN OR REACT? AN EXPERIMENTAL STUDY OF PREVENTIVE HEALTH DECISION MAKING

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ONLINE RESOURCE

Appendix A: Prior adjustments in different risk environments

In this section, we further discuss the case where a given technology is introduced in different risk environments. If both the expectation and the variance of the initial distribution of prior are positively related to risk, the relationship between risk level and responses to prevention failures become ambiguous. We illustrate this by examining two cases: when individual distribution of prior follows a uniform distribution and when it follows a normal distribution. In the case of a uniform distribution $f_{i,0}(e) \sim U(0,p)$, adjustment to a prevention failure is: $\Delta\bar{e}_{i,1} = -p/6$, which is increasing in p. In the case of a normal distribution $f_{i,0}(e) \sim N(0.5p;1)$, adjustment to a prevention failure is: $\Delta\bar{e}_{i,1} = -2/p$, which is decreasing in p.

Assuming that the expectation of the initial prior is proportional to p, the denominator of equation (14) can be reduced to bp where b is a constant, the relationship between the risk level and adjustment to a negative event with prevention then depends on how the variance of the initial prior is related to p. For example, in the case the variance of the distribution can be written in the form $\sigma_{i,0}^2 = ap^x$ where a is a constant; if $x > 1$, adjustment is stronger in the high risk environment; if $x = 1$, adjustment is similar across environments; if $x < 1$, adjustment is weaker in the high risk environment. Intuitively, if the dispersion of prior varies greatly across risk environments, we expect the effect of variance to dominate; otherwise the effect of risk level dominates.

However, over time, agents update their prior based on previous outcomes with prevention. Adjustments to the expectation of prior distribution are described by equations (13) and (16). It is easy to see that adjustments to the expectation are increasing in the initial variance. Adjustments to the variance of the distribution are as follows:

$$\begin{aligned}\Delta\sigma_{i,t+1}^2 &= \sigma_{i,t+1}^2 - \sigma_{i,t}^2 = \left[E_{i,t+1}(e^2) - \bar{e}_{i,t}^{\,2}\right] - \left[E_{i,t}(e^2) - \bar{e}_{i,t}^{\,2}\right] \\ &= \left[\sum_j e_j^2 f_{i,t+1}(e_j) - \left(\sum_j e_j f_{i,t+1}(e_j)\right)^2\right] - \left[E_{i,t}(e^2) - \bar{e}_{i,t}^{\,2}\right] \end{aligned} \quad (28)$$

In the case of a prevention failure, plugging in $f_{i,t+1}(e_j)$ from equation (11) and rearranging terms we have:

$$\Delta\sigma_{i,t+1}^2 = -\left(\frac{\sigma_{i,t}^2}{p - \bar{e}_{i,t}}\right)^2 - \frac{E\left(e - \bar{e}_{i,t}\right)^3}{p - \bar{e}_{i,t}} \quad (29)$$

In the case of a prevention success:

$$\Delta\sigma_{i,t+1}^2 = -\left(\frac{\sigma_{i,t}^2}{1 - p + \bar{e}_{i,t}}\right)^2 + \frac{E\left(e - \bar{e}_{i,t}\right)^3}{1 - p + \bar{e}_{i,t}} \quad (30)$$

The right hand term of this expression captures the skewness of the distribution. The term of the left hand side increases with the initial variance. For this reason, we expect large downward adjustments in the variance in high risk environments. Once the mean and the variance of the distribution of priors converge, prior adjustments to a prevention failure will be negatively related to the overall risk level (equation 13).

Appendix B: Instructions for experimental subjects

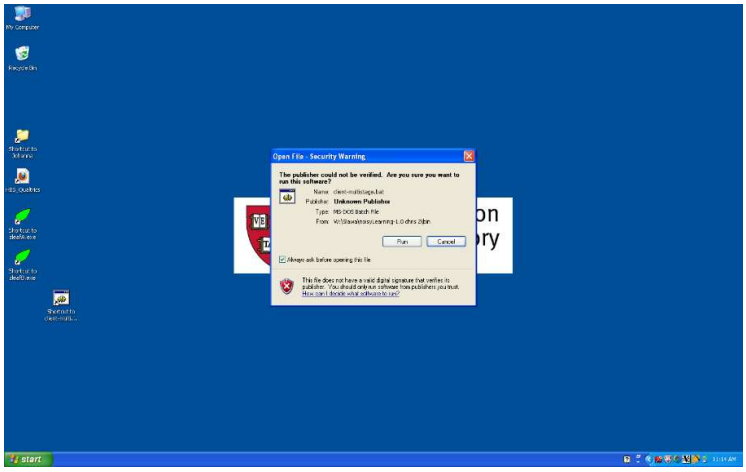
Before the experiment started, subjects were given a presentation on the structure of the game and how to proceed with it. This part presents the instructions given to all subjects during the presentation. The actual risk level and message displayed on subjects' computer screen in the experiment varied across treatments.

 # Welcome to SSEL
Welcome to the Harvard Decision Sciences Lab, and thank you for participating in today's experiment.
Place all of your personal belongings away, so we can have your complete attention.
It is very important that you do not touch the computer until you are instructed to do so. When you are told to use the computer, please use it only as instructed. In particular, do not attempt to browse the web or use programs unrelated to the experiment.
Raise your hand if you need a pencil.

 # The experiment
The experiment you will be participating in today is an experiment in decision making. At the end of the experiment you will be paid for your participation in cash. Each of you may earn different amounts. The amount you earn depends on your decisions and chance.
You will be using the computer for the entire experiment, and all interaction between you and others will be through computer terminals. Do not socialize or talk during the experiment.

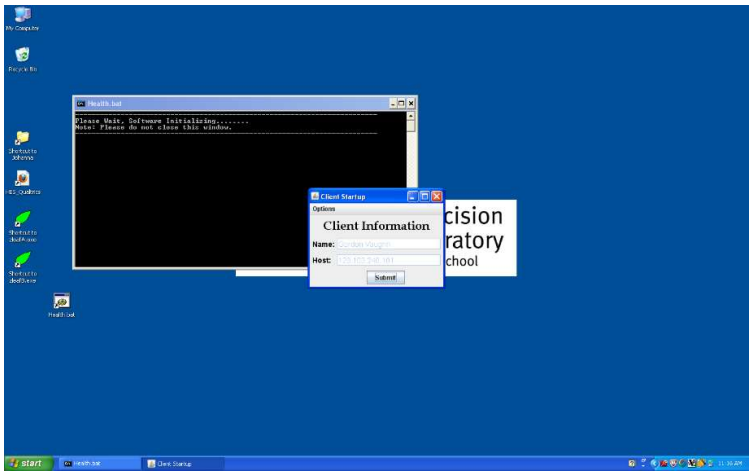
 # To start the program
Please double click on the icon labeled "Health."

Then, click “Run”.



 # Log on screen

The computer will give you a name. Please write down your name as you will use it to collect your payment.
Then click “Submit” to confirm.

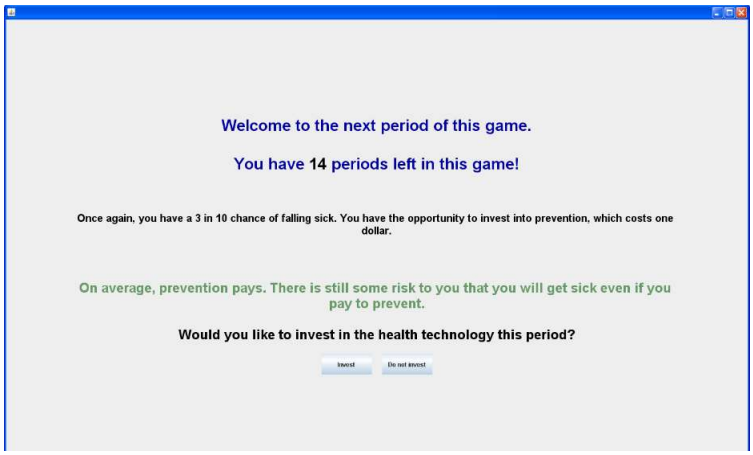


 # Experimental interface

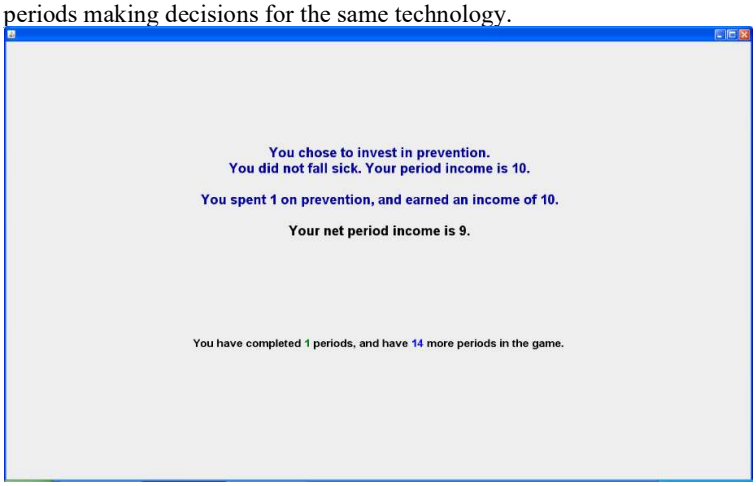
You should now see the introduction page.

You are playing a “health game” where the objective is not to get sick.
If you stay healthy you get $10 and if you fall sick you get $0.
There is a 30% chance of falling sick.

 # Experimental interface
If you stay healthy you get $10 and if you fall sick you get $0.
In each period you may choose to invest in a preventative health technology.
If you invest you will lower the probability of falling sick.
Investing in prevention costs $1.
Click “Invest” to invest and “Do Not Invest” not to invest.



 # Experimental interface
After each period you will find out whether or not you fell sick.
And how much you earned in that period.
You will play 15 periods making decisions for the same technology.



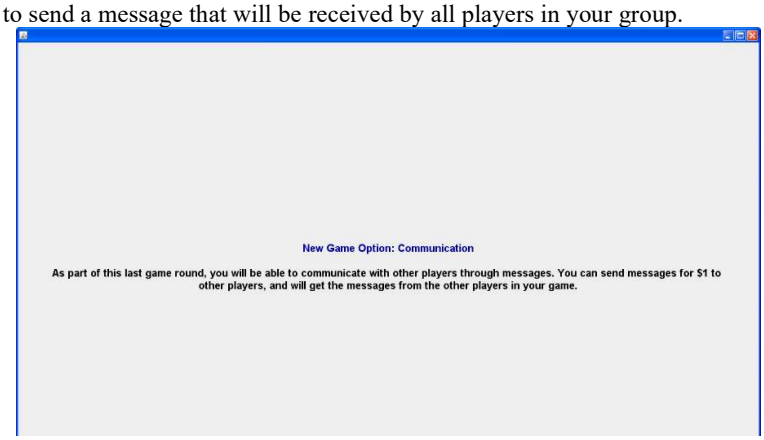
 # Quick survey
After the 15 periods of the game are done you will complete a four question mini-survey.

 # Experimental interface
Over the course of the experiment you will play three games. The probability of getting sick and the costs of investing in prevention will stay the same.
In each round you will have a new preventative technology (Technology A, B and C). Each technology may reduce the likelihood of getting sick by a different amount.

 # Communication

In round 3 you will have a new option. You will be able to communicate with other players in your group. Each group has a total of 4 members.

You can pay $1 to send a message that will be received by all players in your group.



 # Communication

Type your message in the box and click “Send”

If you do not wish to pay to send a message click “Don’t Send”

 # Communication
You will then see the messages from any player who choose to send them.
If no one sent a message you will be informed that no messages were sent.
Click on "OK" when you are finished reading the messages.

 # Your payoffs
Your payoffs in a period are determined as follows:

If you do not invest and don't fall sick you will receive $10.
If you do not invest and do fall sick you will receive $0.
If you invest and don't fall sick you will receive $9.
If you invest and fall sick you will receive $-1.

 # Final survey
At the end of the experiment you will complete a survey which will take approximately 15 minutes.

 # Final payoff
After the survey is completed the computer will randomly choose only one period from each of the three games for payment.
You will be paid the sum of your earnings in those 3 randomly chosen periods plus $10.

 # Your earnings
You will be paid in cash. You need not tell any other participant how much you earned.

Appendix C: Survey questions asked

 # Questions after game 1
Did you try out the preventive technology A?
Overall, how effective would you say technology A was?
Would you recommend investing in technology A?

 # Questions after game 2
Did you try out the preventive technology B?
Overall, how effective would you say technology B was?
Would you recommend investing in technology B?

 # Questions after game 3
Did you try out the preventive technology C?
Overall, how effective would you say technology C was?
Would you recommend investing in technology C?
What do you think this game was about?

 # Prevention
Are you currently taking multivitamins?
Did you get a flu shot over the past 12 months?
Do you believe that all children should get vaccinated?
How many times have you been to the dentist in the past year?
How often do you use sunscreen?

 # Attention and financial literacy
A hamburger and a soda cost $1.10 in total. The hamburger costs $1.00 more than the soda. How much does the soda cost? (in cents)

If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease?

If the interest rate falls, what should happen to bond prices?
(i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Don't know; (vi) I would rather not answer

If 5 people all have the winning number in the lottery and the prize is 2 million dollars, how much will each of them get?

Say you have 200 dollars in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years?

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? (minutes)

In the ocean, there is an oil slick. Every day, the oil slick doubles in size. If it takes 48 days for the oil slick to cover the entire ocean, how long would it take for the oil slick to cover half of the ocean? (days)

True or false? Buying a company stock usually provides a safer return than a stock mutual fund.
(i) True; (ii) False; (iii) Don't know; (iv) I would rather not answer

When an investor spreads his money among different assets, does the risk of losing money:
(i) Increase; (ii) Decrease; (iii) Stay the same; (iv) Don't know; (v) I would rather not answer

 # Holt and Laury risk aversion
Would you rather have…
Lottery A which pays you US$ 2 with 10% probability and US$ 1.6 with 90% probability
Lottery B which pays you US$ 3.85 with 10% probability and US$ 0.1 with 90% probability

Would you rather have…
Lottery A which pays you US$ 2 with 20% probability and US$ 1.6 with 80% probability
Lottery B which pays you US$ 3.85 with 20% probability and US$ 0.1 with 80% probability

Would you rather have…
Lottery A which pays you US$ 2 with 30% probability and US$ 1.6 with 70% probability
Lottery B which pays you US$ 3.85 with 30% probability and US$ 0.1 with 70% probability

Would you rather have…
Lottery A which pays you US$ 2 with 40% probability and US$ 1.6 with 60% probability
Lottery B which pays you US$ 3.85 with 40% probability and US$ 0.1 with 60% probability

Would you rather have…
Lottery A which pays you US$ 2 with 50% probability and US$ 1.6 with 50% probability
Lottery B which pays you US$ 3.85 with 50% probability and US$ 0.1 with 50% probability

Would you rather have…
Lottery A which pays you US$ 2 with 60% probability and US$ 1.6 with 40% probability
Lottery B which pays you US$ 3.85 with 60% probability and US$ 0.1 with 40% probability

Would you rather have…
Lottery A which pays you US$ 2 with 70% probability and US$ 1.6 with 30% probability
Lottery B which pays you US$ 3.85 with 70% probability and US$ 0.1 with 30% probability

Would you rather have…
Lottery A which pays you US$ 2 with 80% probability and US$ 1.6 with 20% probability
Lottery B which pays you US$ 3.85 with 80% probability and US$ 0.1 with 20% probability

Would you rather have…
Lottery A which pays you US$ 2 with 90% probability and US$ 1.6 with 10% probability
Lottery B which pays you US$ 3.85 with 90% probability and US$ 0.1 with 10% probability

Would you rather have…
Lottery A which pays you US$ 2 with 100% probability and US$ 1.6 with 0% probability
Lottery B which pays you US$ 3.85 with 100% probability and US$ 0.1 with 0% probability

 # Kirby discounting
Would you rather have…
US$ 30 tonight
US$ 85 in 14 days

Would you rather have…
US$ 40 tonight
US$ 55 in 25 days

Would you rather have…
US$ 67 tonight
US$ 85 in 35 days

Would you rather have…
US$ 34 tonight
US$ 35 in 43 days

Would you rather have…
US$ 15 tonight
US$ 35 in 10 days

Would you rather have…
US$ 32 tonight
US$ 55 in 20 days

Would you rather have…
US$ 83 tonight
US$ 85 in 35 days

Would you rather have…
US$ 21 tonight
US$ 30 in 75 days

Would you rather have…
US$ 48 tonight
US$ 55 in 45 days

Would you rather have…
US$ 40 tonight
US$ 65 in 70 days

Would you rather have…
US$ 25 tonight
US$ 35 in 25 days

Would you rather have…
US$ 65 tonight
US$ 75 in 50 days

Would you rather have…
US$ 24 tonight
US$ 55 in 10 days

Would you rather have…
US$ 30 tonight
US$ 35 in 20 days

Would you rather have…
US$ 53 tonight
US$ 55 in 55 days

Would you rather have…
US$ 47 tonight
US$ 60 in 50 days

Would you rather have…
US$ 40 tonight
US$ 70 in 20 days

Would you rather have…
US$ 50 tonight
US$ 80 in 70 days

Would you rather have…
US$ 45 tonight
US$ 70 in 35 days

Would you rather have…
US$ 27 tonight
US$ 30 in 35 days

Would you rather have…
US$ 16 tonight
US$ 30 in 35 days

 # Subject background and SES
What year were you born?
What is your gender?
What is the highest education level you completed?
What is your current marital status?
How many children do you have? (Put "0" if none)
Which of the following ethnicities best describes you?
What has been your primary occupation during the last 12 months? [Primary occupation is defined as the type of occupation where you spend most of your working time.]
What is your total annual personal income in US$?
How many cigarettes have you smoked today?
How many cigarettes did you smoke over the past 7 days?
How tall are you (feet and inches)?
What is your weight (in pounds)?
How many drinks did you have over the past 48 hours?
How many drinks did you have the last time you were drinking?
Have you ever been diagnosed with or treated for hypertension?

Appendix D: Main results without $p = 0.7$ condition

Table 6a: Effects of messages

VARIABLES	Rounds 1-5 (1)	Rounds 6-15 (2)	All rounds (3)	Match 1 (4)	Match 2 (5)	Both matches (6)
Any message	0.070**	0.064**	0.071**	0.093***	0.039	0.091***
	(0.029)	(0.029)	(0.032)	(0.030)	(0.030)	(0.030)
Any message*Round			-0.001			
			(0.002)			
Round			-0.002			
			(0.002)			
Any message*Match 2						-0.050**
						(0.023)
Match 2	0.013	0.012	0.013			0.046**
	(0.014)	(0.013)	(0.011)			(0.019)
Observations	*5,040*	*10,080*	*15,120*	*7,560*	*7,560*	*15,120*
R-squared	*0.029*	*0.041*	*0.035*	*0.037*	*0.040*	*0.035*

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses clustered at the individual level. All estimations control for subject characteristics (age group: 17-25, 18-40, 41-60, 61 and above, sex, ethnicity, education, whether the subject is a student, marital status, whether the subject is a parent, attention score, financial literacy score, risk aversion score, Kirby discounting score), and include fixed effects for risk levels and technology effectiveness (not reported).

Table 7a Risk levels and prior updating

	Low risk	Medium risk	Low and medium risk		
	Rounds 2-15	Rounds 2-15	Rounds 2-5	Rounds 6-15	Rounds 2-15
VARIABLES	(1)	(2)	(3)	(4)	(5)
Prevention average of previous rounds	0.763***	0.711***	0.597***	0.798***	0.754***
	(0.024)	(0.041)	(0.037)	(0.023)	(0.021)
Technology failure rate in previous rounds	-0.263***	-0.231***	-0.133***	-0.378***	-0.264***
	(0.026)	(0.033)	(0.036)	(0.040)	(0.026)
Technology failure rate in previous rounds*Medium risk			-0.033	0.108*	0.042
			(0.051)	(0.062)	(0.039)
Medium risk			0.013	0.007	0.007
			(0.019)	(0.022)	(0.015)
Effective	-0.010	0.008	-0.003	-0.012	-0.006
	(0.011)	(0.020)	(0.014)	(0.011)	(0.010)
Any message	0.021	0.027	0.057***	0.010	0.023**
	(0.013)	(0.023)	(0.018)	(0.013)	(0.012)
Observations	*8,861*	*3,946*	*3,361*	*9,446*	*12,807*
R-squared	*0.292*	*0.235*	*0.164*	*0.312*	*0.274*

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses clustered at the individual level. All estimations control for subject characteristics (age group: 17-25, 26-40, 41-60, 61 and above, sex, ethnicity, education, whether the subject is a student, marital status, whether the subject is a parent, attention score, financial literacy score, risk aversion score, Kirby discounting score), and include fixed effects for matches 1-2 (not reported).

Table 8a Weighting of outcomes

VARIABLES	All individuals (1)	Individuals preventing in the last 2 rounds (2)
Technology failure in the preceding round (adjusted for number of previous rounds where prevention chosen)	-0.360***	
	(0.047)	
Technology failure rate in previous rounds	-0.130***	
	(0.031)	
Technology failure in the preceding round		-0.105***
		(0.013)
Technology failure 2 rounds before		-0.067***
		(0.011)
Prevention average of previous rounds	0.655***	0.584***
	(0.034)	(0.043)
Medium risk	0.016	0.001
	(0.013)	(0.012)
Effective	-0.004	-0.005
	(0.010)	(0.009)
Any message	0.016	0.013
	(0.011)	(0.011)
Observations	*9,006*	*7,636*
R-squared	*0.196*	*0.136*

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses clustered at the individual level. All estimations control for subject characteristics (age group: 17-25, 26-40, 41-60, 61 and above, sex, ethnicity, education, whether the subject is a student, marital status, whether the subject is a parent, attention score, financial literacy score, risk aversion score, Kirby discounting score), and include fixed effects for matches 1-2 (not reported).

Table 9a Non-prevention outcomes and assessment

VARIABLES	Both matches (1)	Both matches (2)	Match 1 (3)	Match 2 (4)
Number of rounds where prevention chosen and sickness experienced	-2.053***	-2.123***	-2.231***	-2.133***
(adjusted for total number of rounds where prevention chosen)	(0.251)	(0.207)	(0.283)	(0.289)
Number of rounds where prevention not chosen and sickness experienced	0.169	0.134	0.407**	-0.096
(adjusted for total number of rounds where prevention not chosen)	(0.152)	(0.150)	(0.195)	(0.215)
Number of rounds where prevention chosen	0.096***	0.096***	0.097***	0.091***
	(0.011)	(0.011)	(0.016)	(0.016)
Effective	-0.060	-0.068	-0.132	-0.026
	(0.076)	(0.075)	(0.111)	(0.109)
Any message	-0.062	-0.062	0.017	-0.151
	(0.084)	(0.085)	(0.109)	(0.117)
Medium risk	-0.067			
	(0.106)			
Match 2	0.108*	0.109*		
	(0.063)	(0.063)		
Observations	*609*	*609*	*307*	*302*
Sample mean	*3.383*	*3.383*	*3.345*	*3.421*
R-squared	*0.374*	*0.374*	*0.373*	*0.396*

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses clustered at the individual level. All estimations control for subject characteristics (age group: 17-25, 26-40, 41-60, 61 and above, sex, ethnicity, education, whether the subject is a student, marital status, whether the subject is a parent, attention score, financial literacy score, risk aversion score, Kirby discounting score).