

Internet-based personalized cancer risk assessment tools: Opportunities and pitfalls

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Agenda

- What is risk and what are risk perceptions?
- Evaluating the efficacy of an existing tool
- Expanding to a wellness-oriented approach
- Bridging the intention-behavior gap
- Conclusion



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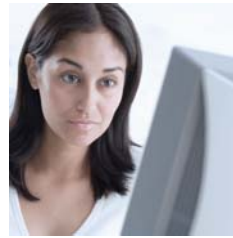
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Translation is critical but difficult



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What is risk?



- Objective
 - RR
 - RRR
 - odds
 - OR
 - HR
 - NNT
 - NNH
 - AR
 - ARR
- Attributable risk



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What is risk?



Subjective
 Danger
 Hazard
 Uncertainty
 Certainty
 All-or-nothing
 Frightening
 Severe

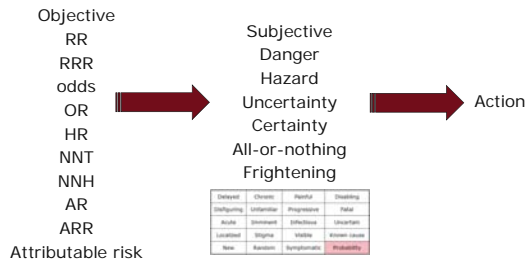
Han et al., *Health Expectations*, 2009
 Holmberg, *Health, Risk & Society*, 2010
 Reyna, *Medical Decision Making*, 2008
 Slovic, *The Perception of Risk*, 2000

What is risk?

Delayed	Chronic	Painful	Disabling
Disfiguring	Unfamiliar	Progressive	Fatal
Acute	Imminent	Infectious	Uncertain
Localized	Stigma	Visible	Known cause
New	Random	Symptomatic	Probability

Slovic, *The Perception of Risk*, 2000
 Weinstein, *Society of Behavioral Medicine*, 2003

The challenge



What does it mean and what should I do?



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Internet-based cancer risk assessment tools

Waters et al., *Journal of Medical Internet Research*, 2009
www.yourdiseaserisk.wustl.edu
www.cancer.gov/bcrisktool/
<http://www.chiprehab.com/CVD/index.php>
www.halls.md/breast/risk.htm

...but their output varies

5 Year Risk

This woman (age 52) 1.4%
Average woman (age 52) 1.4%

Explanation

Based on the information provided (see below), the woman's estimated risk for developing invasive breast cancer over the next 5 years is 1.4% compared to a risk of 1.4% for a woman of the same age and race/ethnicity from the general U.S. population. This calculation also means that the woman's risk of NOT getting breast cancer over the next 5 years is 98.6%.

Calculate Results

using NSABP model 2
click for Gail Model and NSABP Female info.

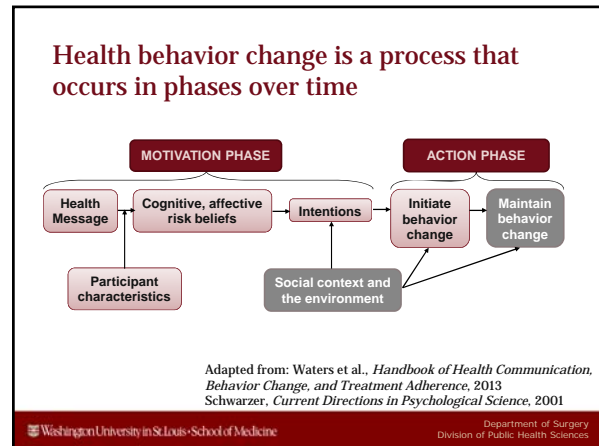
Your chance of being diagnosed with breast cancer is **estimated** to be **22.5%** within lifetime (to age 90).

4.8% within 5 years	15.4% within 20 years
8.4% within 10 years	22.5% within 30 years

Your risk could be somewhere within a range around these estimates.

French et al., *Annals of Behavioral Medicine*, 2017

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Study aim

What is the effect of a personalized breast cancer risk assessment tool on key cognitive and affective precursors of physical activity, when optimal risk communication strategies are used?

Provide graph, risk reduction information, and tips for reducing risk, but no numbers.

Fowler et al., *Medical Decision Making*, 2017
Waters et al., *Journal of Medical Internet Research*, 2009
Zikmund-Fisher et al., *Med Care Res Rev*, 2013

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Study design

2-arm pilot RCT with 1 month follow-up
N=132 women with no prior cancer history
Recruited via registry and community advertisements

Fowler et al., *Medical Decision Making*, 2017

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Results: Breast Cancer

Your risk is **Above Average** compared to a typical woman your age.

Above average risk doesn't mean you'll definitely get breast cancer. It's just an estimate based on your risk factors. Some of which you may not be able to change. If you have any concerns, talk to a doctor.

Lower Your Risk

You have 3 things you can do to lower your risk. To see what your risk could be, click on a box and watch your risk drop.

- Avoid both control pills. Ask a doctor about the risks and benefits.
- Drink less than 1 serving of alcohol a day.
- Increase your physical activity. Work towards at least 30 minutes a day.

What makes up my risk?
What does my risk mean?

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Results—Participant characteristics

Participant characteristic	n	%	Participant characteristic	n	%
Educational attainment			Objective risk (personalized condition only)		
Less than high school	1	0.8	Very much below average	0	0.0
High school degree	41	31.1	Much below average	1	2.3
Associate's or technical degree	13	9.8	Below average	16	27.3
Some college	38	28.8	Average	7	13.6
Bachelor's degree	17	12.9	Above average	33	47.7
Master's or doctorate degree	21	15.9	Much above average	5	9.1
Missing	1	0.8	Very much above average	0	0.0
Race					
Non-Hisp White	98	74.2			
Non-White	34	25.8			
Age	55.8	9.1			

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Results—Main hypotheses

Outcome			Non-personalized (n=66)		Personalized (n=59)	
	F	p	Mean	SE	Mean	SE
Intentions	11.5	0.001	4.0	0.1	4.5	0.1
Self-efficacy	5.2	0.02	3.4	0.1	3.8	0.1
Response efficacy	7.2	0.01	3.5	0.1	3.9	0.1

Covariates included: education, race/ethnicity, family history of breast cancer, and stage of physical activity (i.e., "I already [engage in the recommended amount of activity]" v. all others).

Results—Main hypotheses

Outcome			Personalized condition	
	F	p	Mean	SE
Perceived risk change	15.2	.001	-	-
• Initially underestimated risk (n=31)	4.4	.001	0.7	0.2
• Initially overestimated risk (n=14)	-2.6	.02	-1.1	0.4
• Initially made accurate risk estimate (n=14)	-2.2	.05	-0.5	0.2

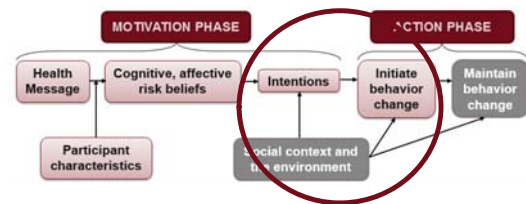
Results—Mediators of effect of condition on intentions

- Multiple mediation model
- SAS %INDIRECT
 - 5000 bootstrapped resamples with bias-corrected confidence intervals
 - Self-efficacy: $b = 0.26$, 95% CI = 0.05-0.51
 - Response efficacy: $b = 0.07$, 95% CI = 0.01-0.17
 - Perceived risk: N/A

Hayes AF. <http://www.afhayes.com/spss-sas-and-mplus-macros-and-code.html>
Hayes AF, Scharkow M. Psychol Sci. 2013

Results—Behavior

OR = 0.9, 95% CI 0.4-0.9, $p = .64$

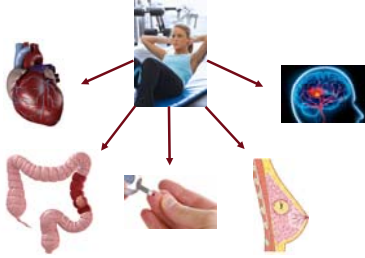


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Traditional disease-focused communication

Wellness-focused communication



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Study aim 1

What is the best communication format for showing people personalized risk estimates for multiple diseases, as well as how behavior change can reduce risk?

Diseases:

- Colon cancer
- Breast cancer (women only)
- Diabetes
- Heart disease
- Stroke

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Study design

3-arm RCT with 3 month follow-up

N= 489 men and women with limited chronic disease history and who obtain < 150 mins moderate intensity physical activity weekly.

50% no college experience

50% racial/ethnic minority background

Recruited via registry and community advertisements

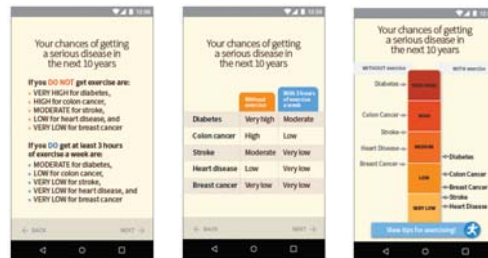
Current N= 148

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Risk communication strategies

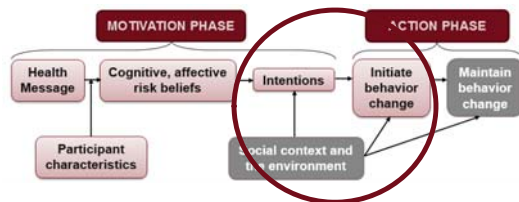


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Intentions-behavior gap



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Study aim 2

Use a mental imagery-based self-regulation intervention to increase physical activity behavior



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Mental imagery-based self-regulation intervention with SMS cues for action

Self-regulation: The mental and physical activities that people use to "stay on track" when pursuing a goal

- Strategic planning is key: what, when, where, how
- When I get home, I will walk the dog around the park for 20 minutes.

Schwarzer, *Current Directions in Psychological Science*, 2001

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Mental imagery-based self-regulation intervention with SMS cues for action

Mental simulation and imagery: prepare the mind for pursuing goals.

- Helps identify cues for action, potential challenging situations, and strategies to overcome barriers.
- Lessens contextual and environmental impacts
- Used in sports
- When I get home, I will walk the dog. If it rains, we will wear rain coats. If it's very hot, I will bring a bottle of water and a water bowl.

Chan & Cameron, *J Behavioral Medicine*, 2012
Loft & Cameron, *Annals of Behavioral Medicine*, 2013
Schwarzer, *Current Directions in Psychological Science*, 2001
Schwarzer, *Applied Psychology*, 2008

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Study design

2-arm RCT attached to the end of the risk communication study with 4 weekly follow-up surveys administered by text messaging.

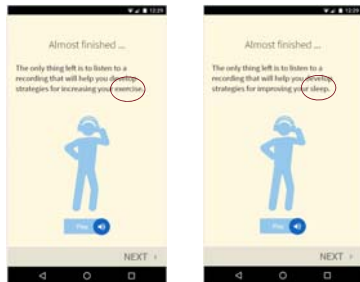
Same 489 men and women as in the risk communication study

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Self-regulation audiorecording



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Pocket goal card

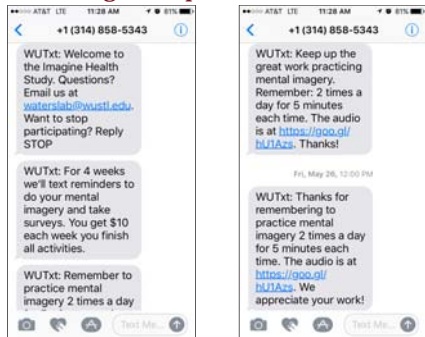
DESCRIBE PROBABLY <ul style="list-style-type: none">- Doing a specific exercise- Getting the benefits of exercising- Changing as you reach your goal- Solving problems that prevent exercising	SET YOUR GOALS <p>Please write down a goal that is specific, realistic, challenging, and include all the details listed.</p> <p>Type of exercise will perform: _____</p> <p>When I will exercise: _____</p> <p>Where I will exercise: _____</p> <p>How often I will exercise: _____</p> <p>Some problems I might run into: _____</p> <p>What will do instead: _____</p>
YOUR GOALS <p>Remember to practice the mental images from your audio recording at least 2 times a day for the next 2 weeks. When you practice your imagery, make sure the images in your mind are very clear and vivid, as if you were really there.</p>	

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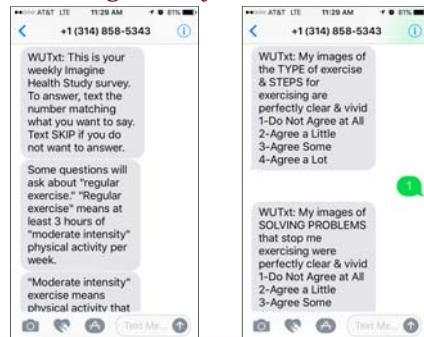
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Text message component



Text message survey



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Thank you!

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