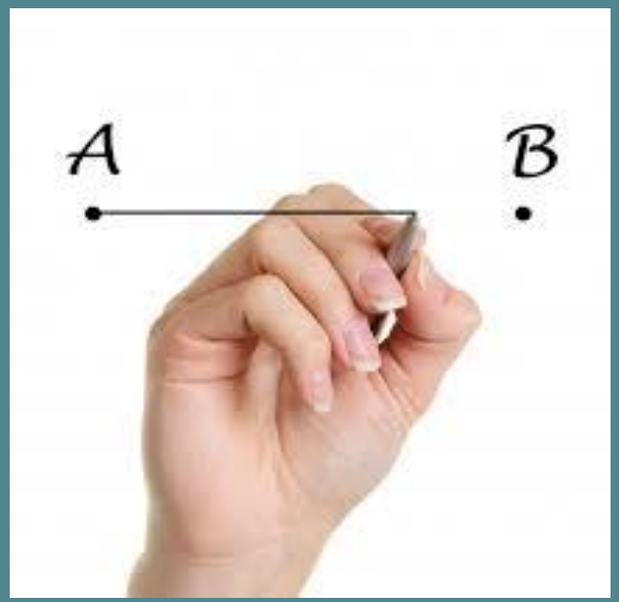
Making It Personal

Using Population Health Data and Incentives to Drive Behavior Change

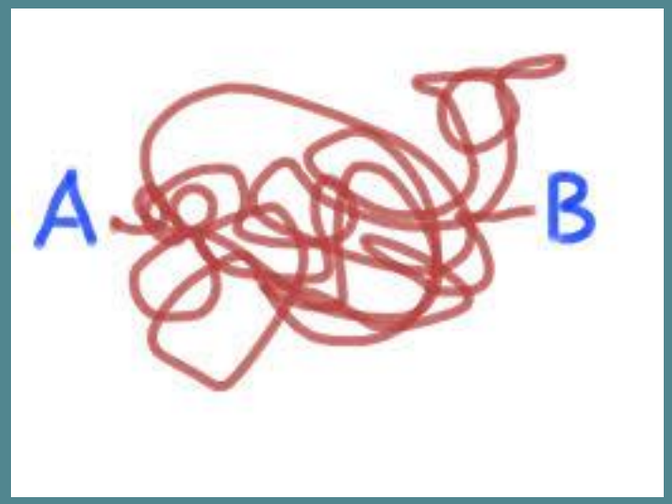
Chris A. Jones, D.Phil., M.Sc.
Assistant Professor of Surgery and Economics
Director, Global Health Economics Unit
Vermont Center for Clinical and Translational Science

Understanding Behavior



1. Early work
2. Data-driven personalized medicine
3. Reinforcing behavioral change

Understanding Behavior



1. Early work
2. Data-driven personalized medicine
3. Reinforcing behavioral change

Disclosures

1. Financial (consulting to public companies)
2. Corporate (ForMyOdds Inc, trUStr LLC)
3. Reputational (pro-clinical decision support)
4. Political (fundraising for presidential candidate)

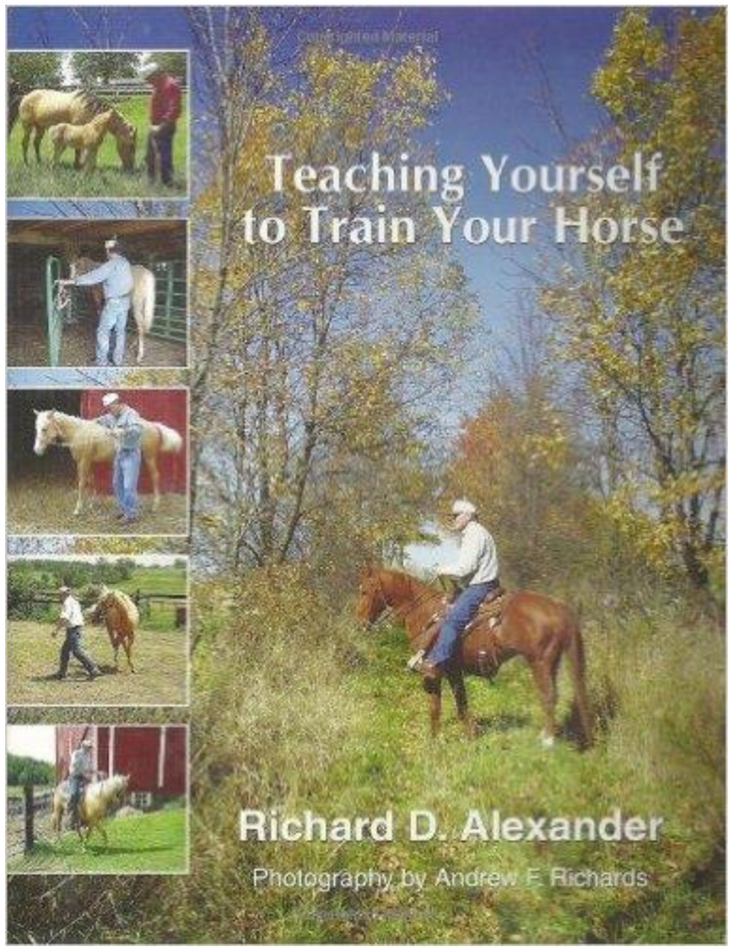
* Images adapted from Google and other sources

UMBS

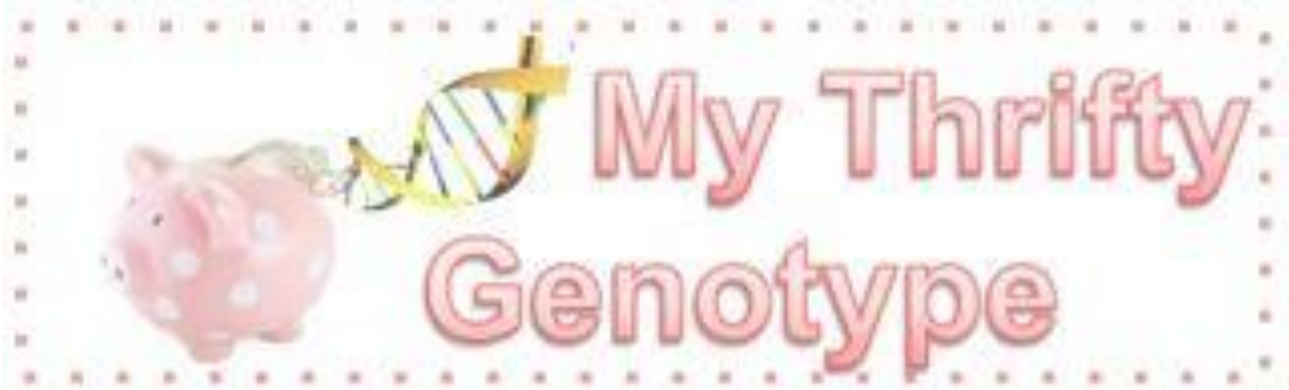

The University of Michigan
Biological Station
est. 1909

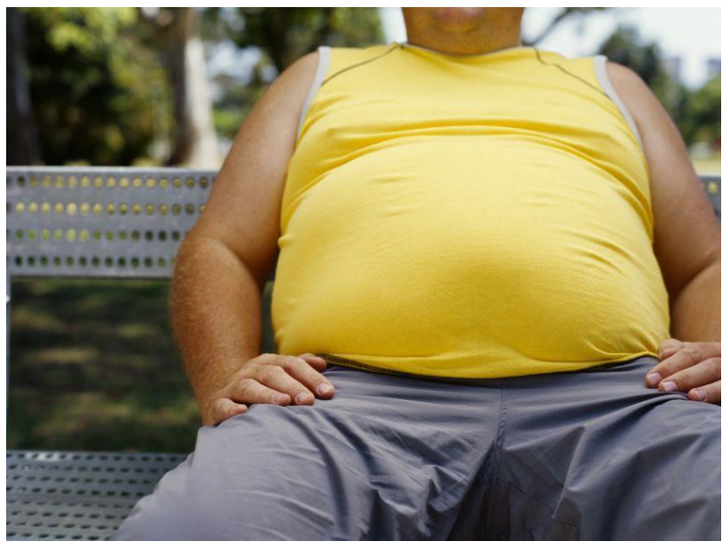

© Al Lemieux 2013

Richard D. Alexander (1925-)



James V. Neel (1915-2000)



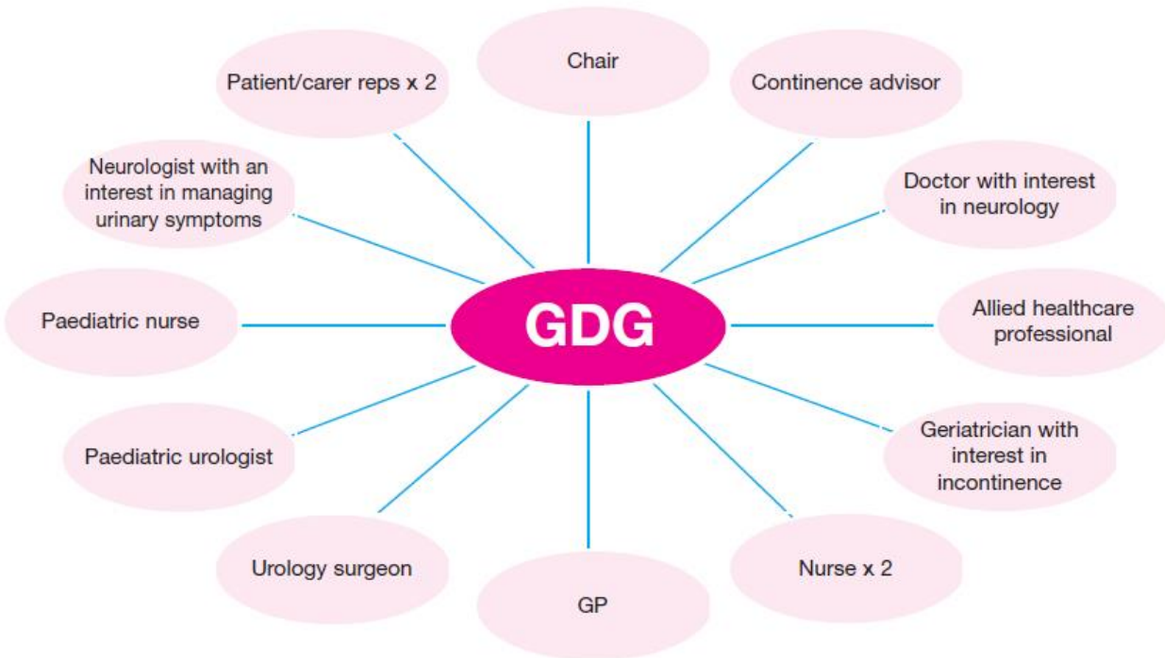


UNIVERSITY OF OXFORD

UTILITY WORK AHEAD

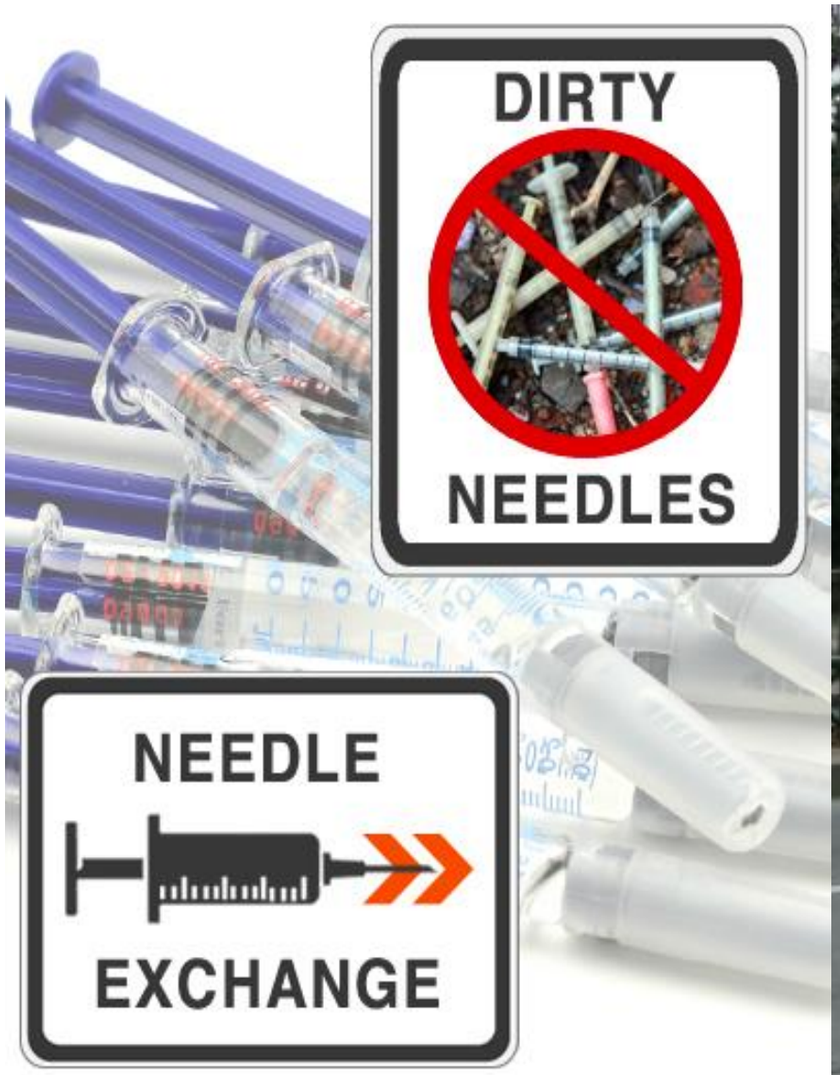
NHS

National Institute for Health and Clinical Excellence




Escalator
temporarily
stairs.
We apologize
for the
inconvenience.

WWW.NEWS.CN


DIRTY
NEEDLES
NEEDLE
EXCHANGE

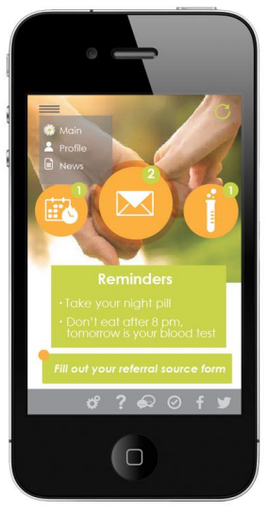

STOP the Silence
Make Noise
about AIDS
Clean
Needles
Save
Lives

HUMAN FERTILISATION & EMBRYOLOGY AUTHORITY

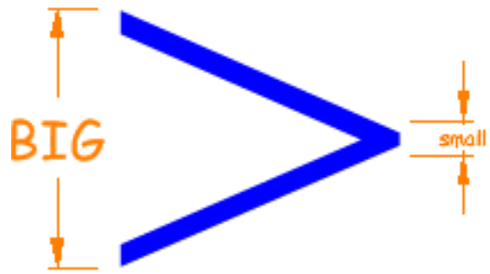
The NEW ENGLAND JOURNAL of MEDICINE

Blickstein, Jones and Keith (2003). Zygotic splitting rat es after single-embryo transfers in in vitro fertilization 3 48:2366-7.

Point-of-Care Predictive Algorithms



Personalized
Predictive
Power



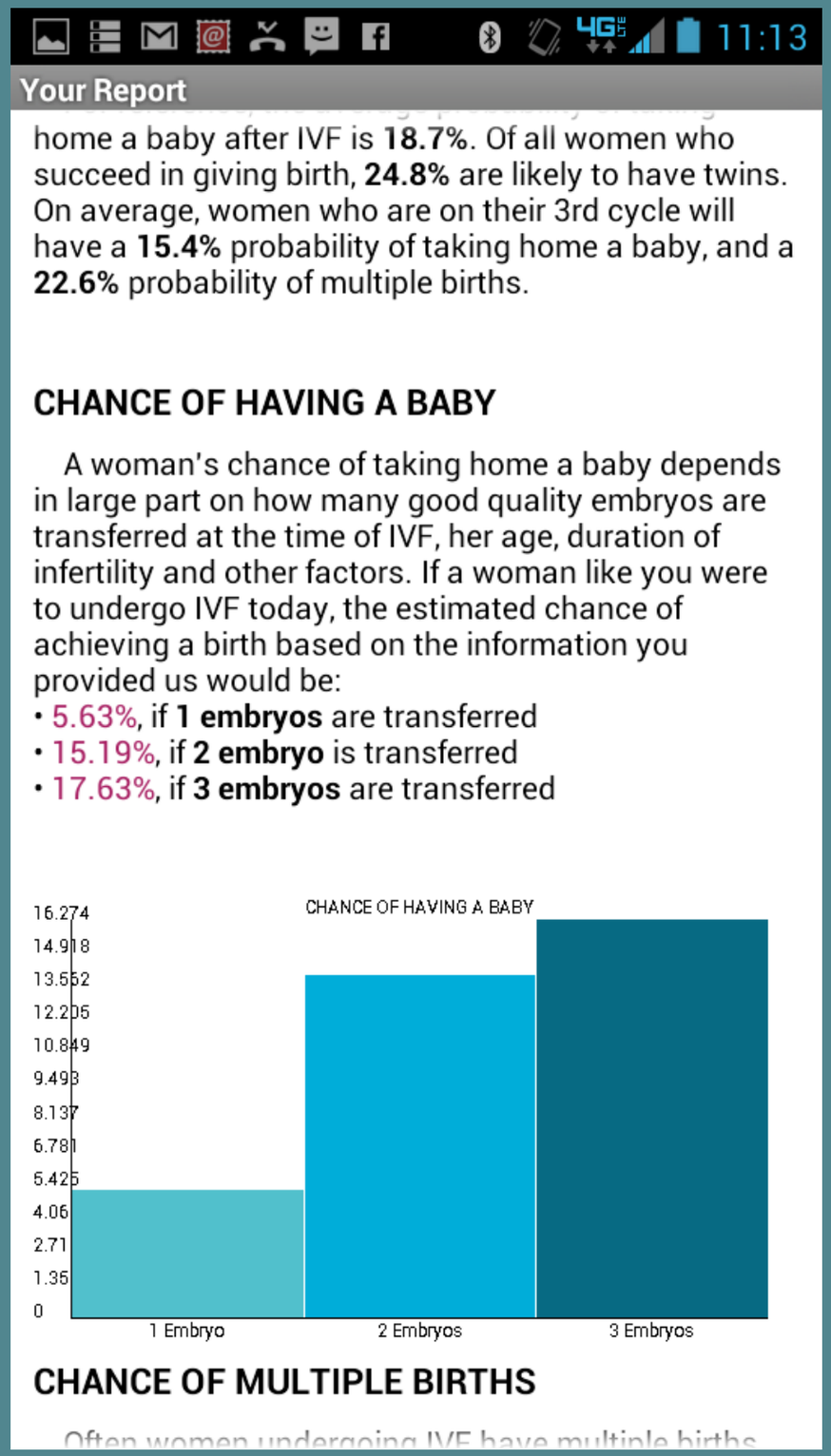
Improved
Clinical
Outcomes

Improved
Cost Savings

Improved
Patient
Satisfaction

Personalized IVF Report

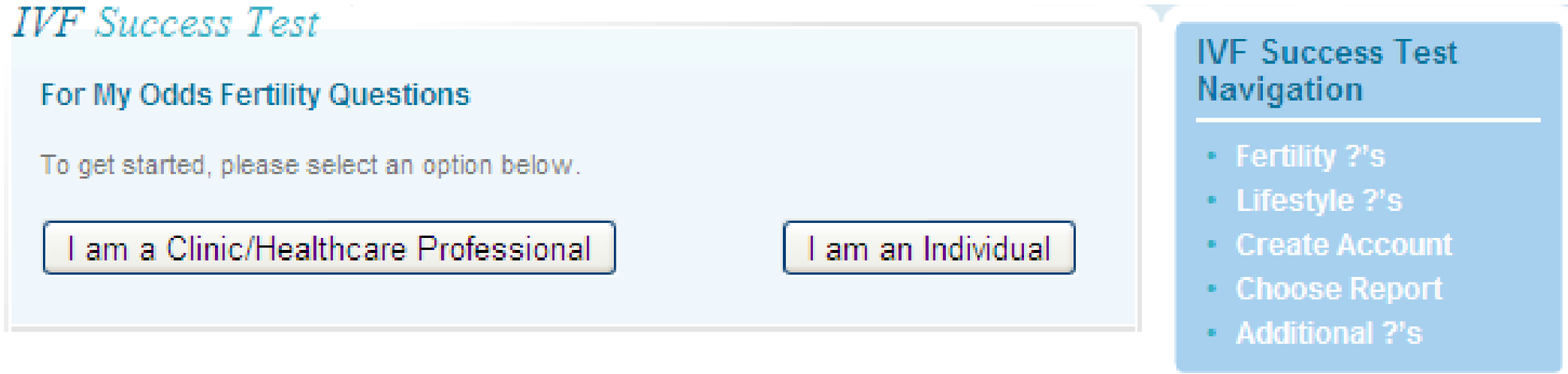
ForMyFertility.com



How It Works

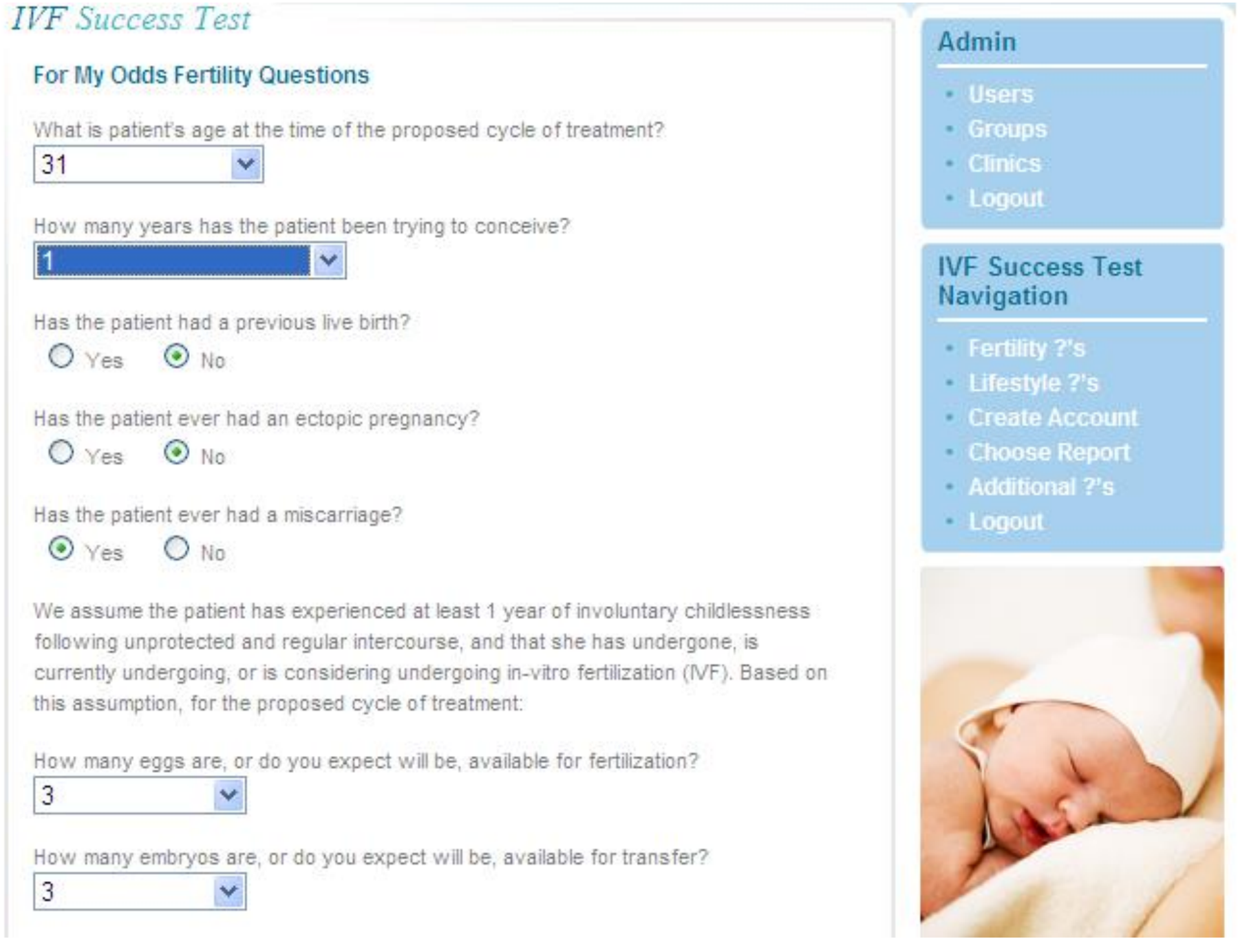
The Functionality 1/4

- Step 1



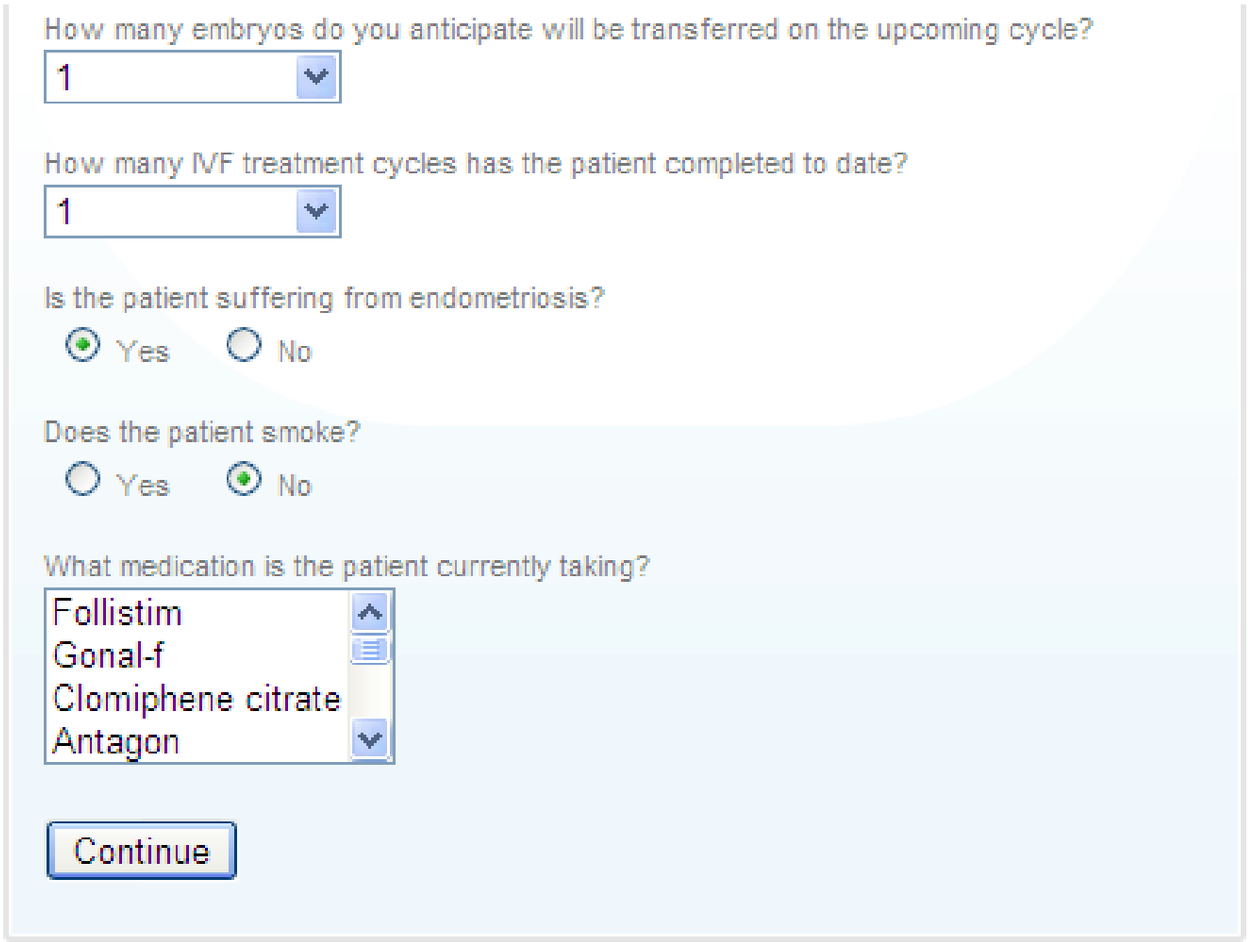
The Functionality 2/4

- Step 2



The Functionality 3/4

- Step 2 …cont'd



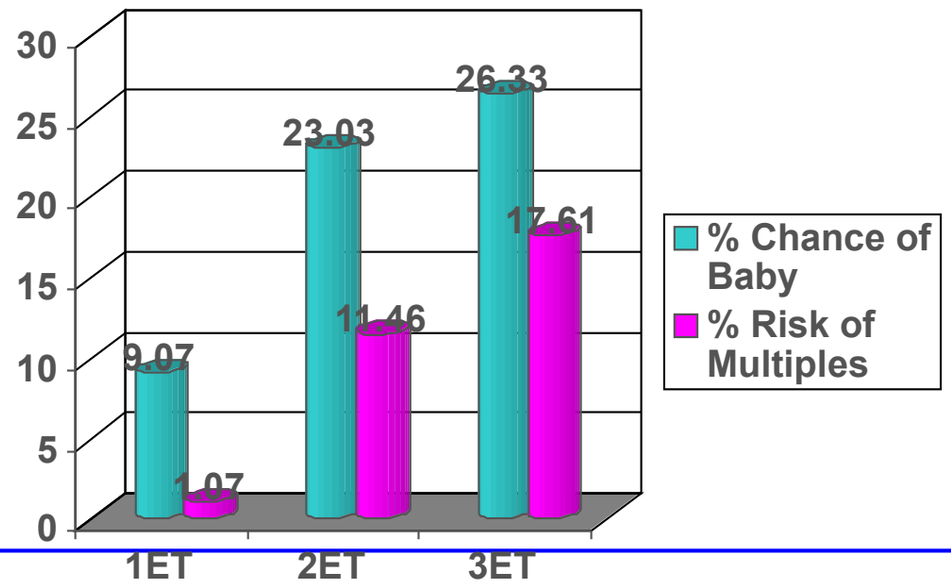
The Functionality 4/4

❑ Step 3 Sample Output (excerpt)

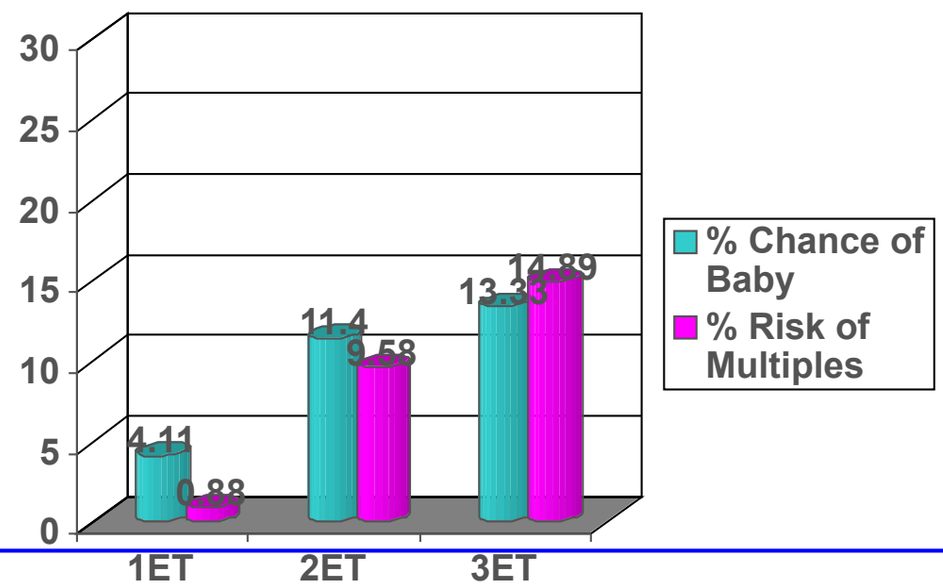
We calculated the probability of the patient taking home a baby following in-vitro fertilization (IVF). The probability of a successful cycle of IVF was calculated based on the assumption that the patient's chances of success are comparable to others in similar circumstances.
For reference, the average probability of taking home a baby after IVF is **18.7%**. Of all women who succeed in giving birth, **24.8%** are likely to have twins. On average, women who are on their 2nd cycle will have a **16.2%** probability of taking home a baby.

CHANCE OF HAVING A BABY
A woman's chance of taking home a baby depends in large part on how many good quality embryos are transferred ("**ET**") at the time of IVF, her age, duration of infertility and other factors. If a woman like you were to undergo IVF today, the estimated chance of achieving a birth based on the information you provided us would be:

Chances Starting Treatment Now



***Fast Forward: ch*ances if Treatment Delayed by 5 years**



The Confirmation

- Doctor Verification

  - **Agree with treatment algorithm?**
  - Recommend a different treatment algorithm?

Real Example: Our Fertility Algorithm
What does this mean
in terms of cost savings?

Society is Paying for Downstream Consequences:

✓Treatments…

✓Reducing just one ineffective cycle of treatment will save patients $15,000.

Reducing this risk to just 17% of the annual IVF patients who might otherwise receive sub-optimal care would realize a worldwide cost savings of over $1 billion per year.

- *[15,000 *50 patients per clinic of average size (equal to 300) *500 US fertility clinics = $375 million in savings for the US alone. Another $375 million in savings for Europe and another $375million for ROW].*

✓Outcomes…

✓Eliminating risk of twins also means an avg. savings of over $15,000 that would otherwise be needed in the first 5 years of life, relative to singleton babies. Eliminating this risk to just 10 families per clinic per year would realize cost savings of $225 million year.

- [*10*500*15,000 = $75 million in the US, $75million in Europe, and $75 million for ROW]*

Users/Contributors

UNFPA

University of Michigan Medical School

Northwestern University Feinberg School of Medicine

Sims IVF

Duke-NUS Graduate Medical School Singapore

USF University of South Florida

LSE The London School of Economics and Political Science

Stanford School of Medicine

Johns Hopkins Medicine

The Testimonials

HUMAN FERTILISATION & EMBRYOLOGY AUTHORITY

Dr. Christopher Jones
Senior Research Associate,
Centre for study of Multiple birth,
Suite 10.15
680 North Lake Shore Drive,
Chicago,
Illinois
60611
USA

21 May 2007

Dear Christopher,

Re: Analysis of HFEA Data

Thank you for taking the time to visit myself and Dr. Christopher Barratt at the HFEA during the Easter break. I am happy to re-affirm the comments previously sent by email.

In the coming weeks the HFEA will take the time to compare the raw data used in your dissertation to the current Register. As you know the HFEA does not have the resources to check the accuracy of the calculations and assumptions, so is unable to vouch for the accuracy of the output. We do however thank you for the work that you are doing, look forward to reading your published work and appreciate you providing a copy of your dissertation as well as the original data set that we gave to you in 1999.

I was very pleased to hear that your presentation to CDC went well and appreciate the contact details which you forwarded.

Yours sincerely,

David Tellis

David Tellis
Director of Information Management & Technology

David.Tellis@HFEA.GOV.UK

The Testimonials

February 8, 2011

Dear Dr. Jones,

Thank you for taking the time to present the modeling capabilities of Formyodds.com. We were actually able to use your software for predicting individual chances of taking home a baby following treatments with assisted conception, and can see how this technology can be easily expanded to other disease states for which data are available. We are even more interested in your plans to expand into research, such as research into chronic diseases that plague in both the developed and developing worlds.

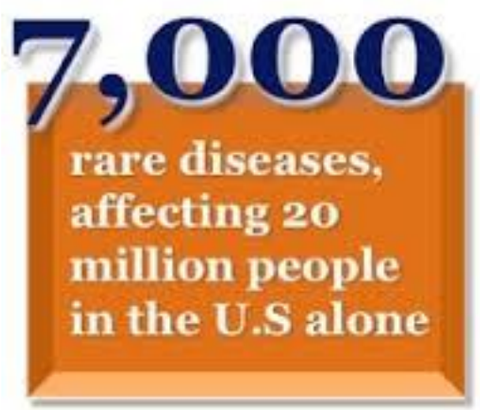
Furthermore, it seems that Formyodds.com could assist lesser-trained staff, some of which are in the field, to identify and treat those who are most at need. Formyodds.com could also be useful to other service corps (such an volunteer forces, national armed services, etc.) for predicting individualized chances of disease, and individualized chances of recovery.

In summary, your software service is entirely unique and I believe it will change treatment practice for the better. I have discussed it with Dr. Aleksandar Bodiroza, the head of the Reproductive Health unit for the Arab States at UNFPA and we look forward to collaborating in the months ahead.

Sincerely,

Dr. Srdjan Stakic
Senior Technical Advisor
United Nations Population Fund
605 Third Avenue
New York, New York 10158
United States

ORPHAN DRUG ACT OF 1983



The UNIVERSITY of VERMONT

DEPARTMENT of SURGERY

VERMONT CENTER for CLINICAL & TRANSLATIONAL SCIENCE

EXAMPLES: DATA-DRIVEN TOOLS

1. Mammography
2. Aneurysm Repair

Mammography Options

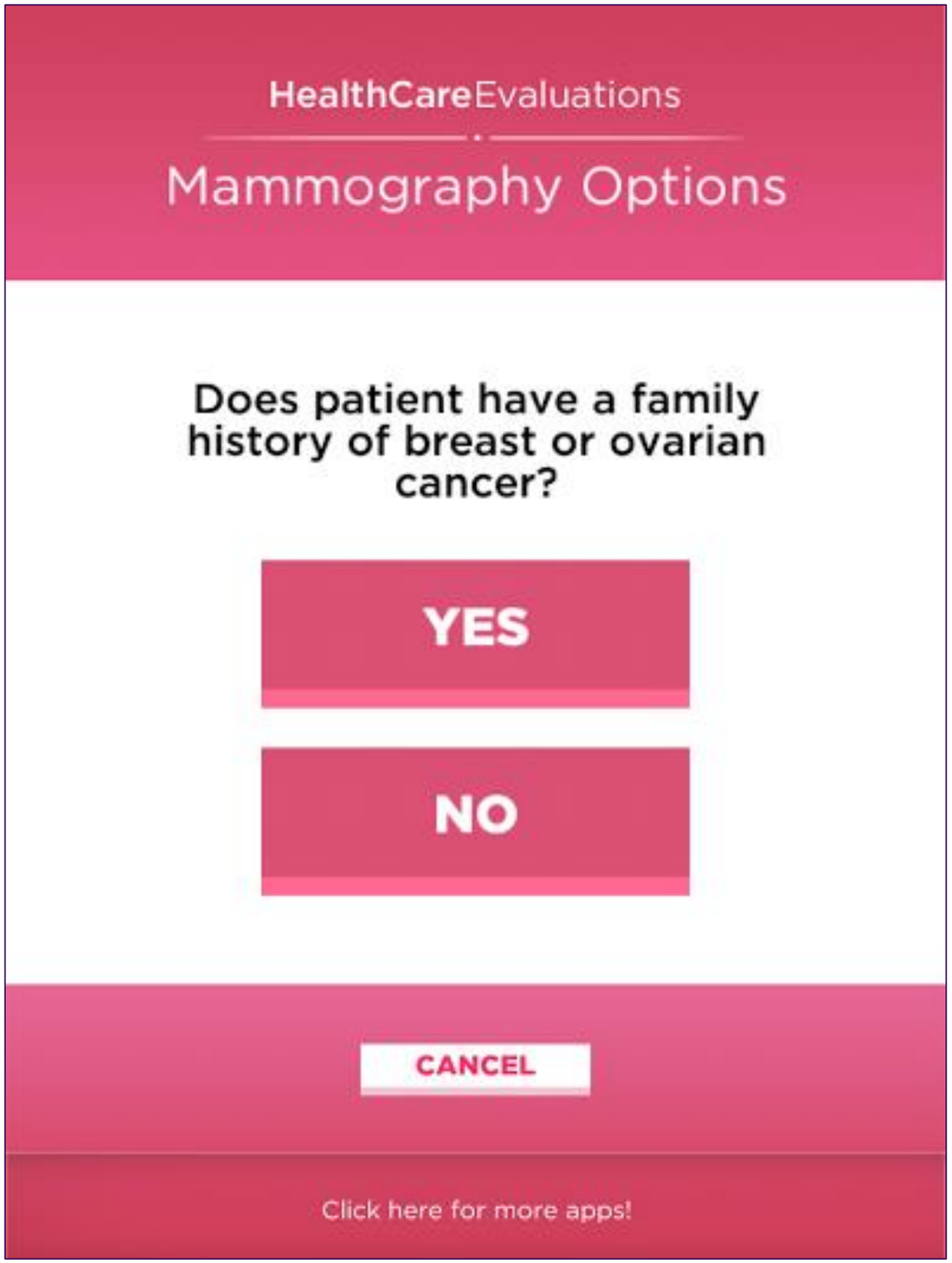
Ready to Start?

Let's Begin

Tracking data anonymously.

Click here for more apps!

Mammography Options



Mammography Options

Breast cancer only?

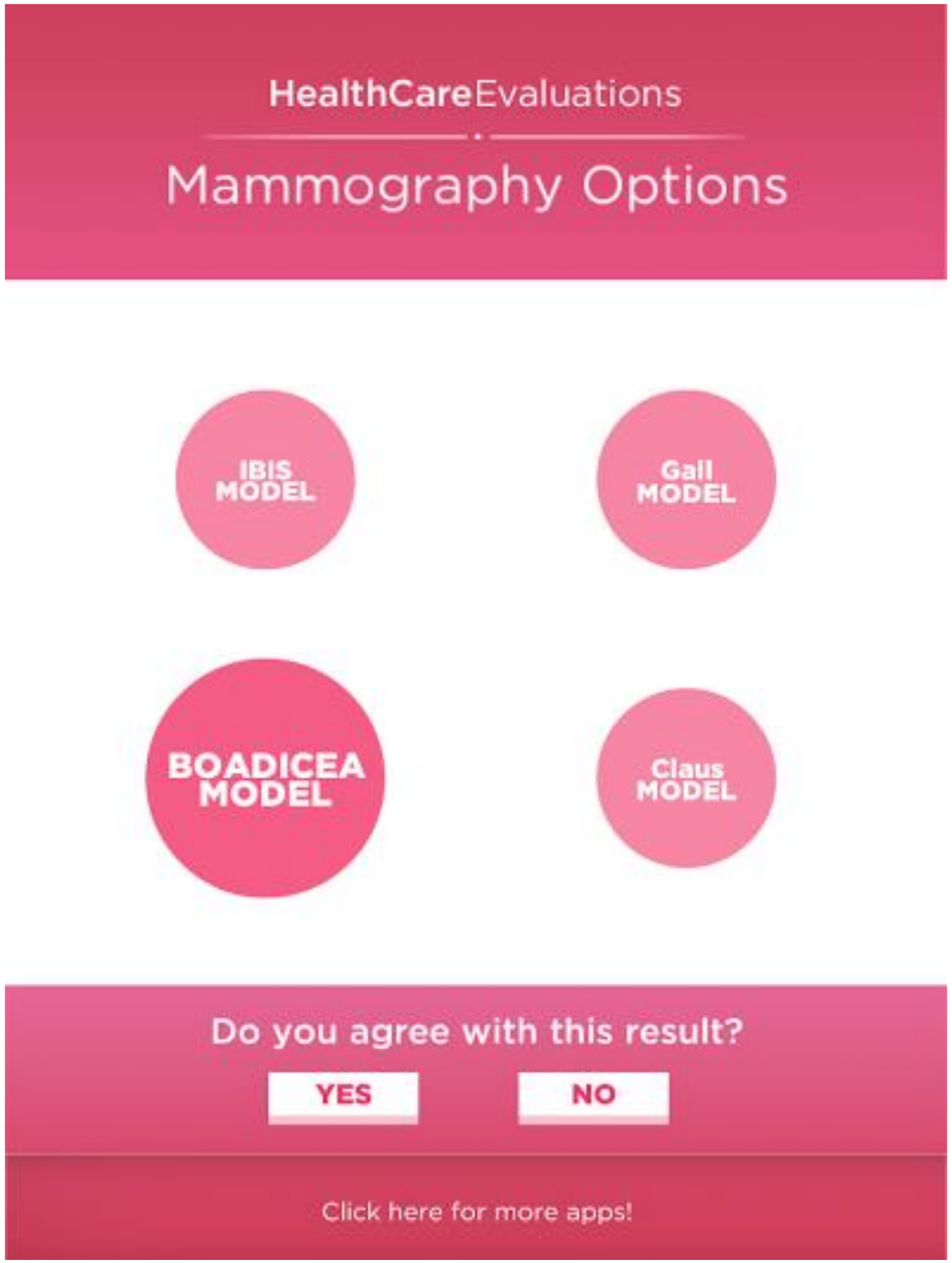
YES

NO

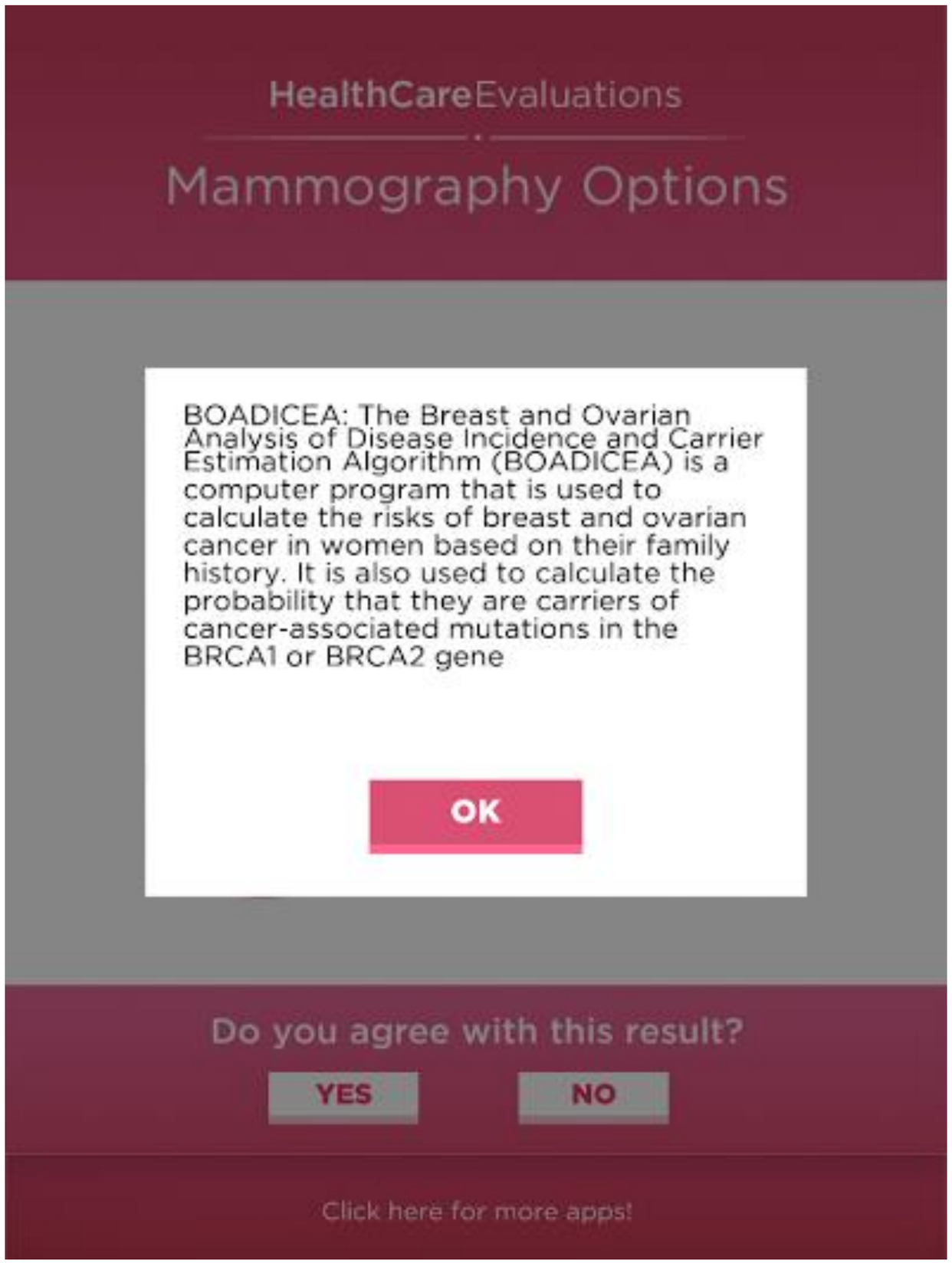
CANCEL

Click here for more apps!

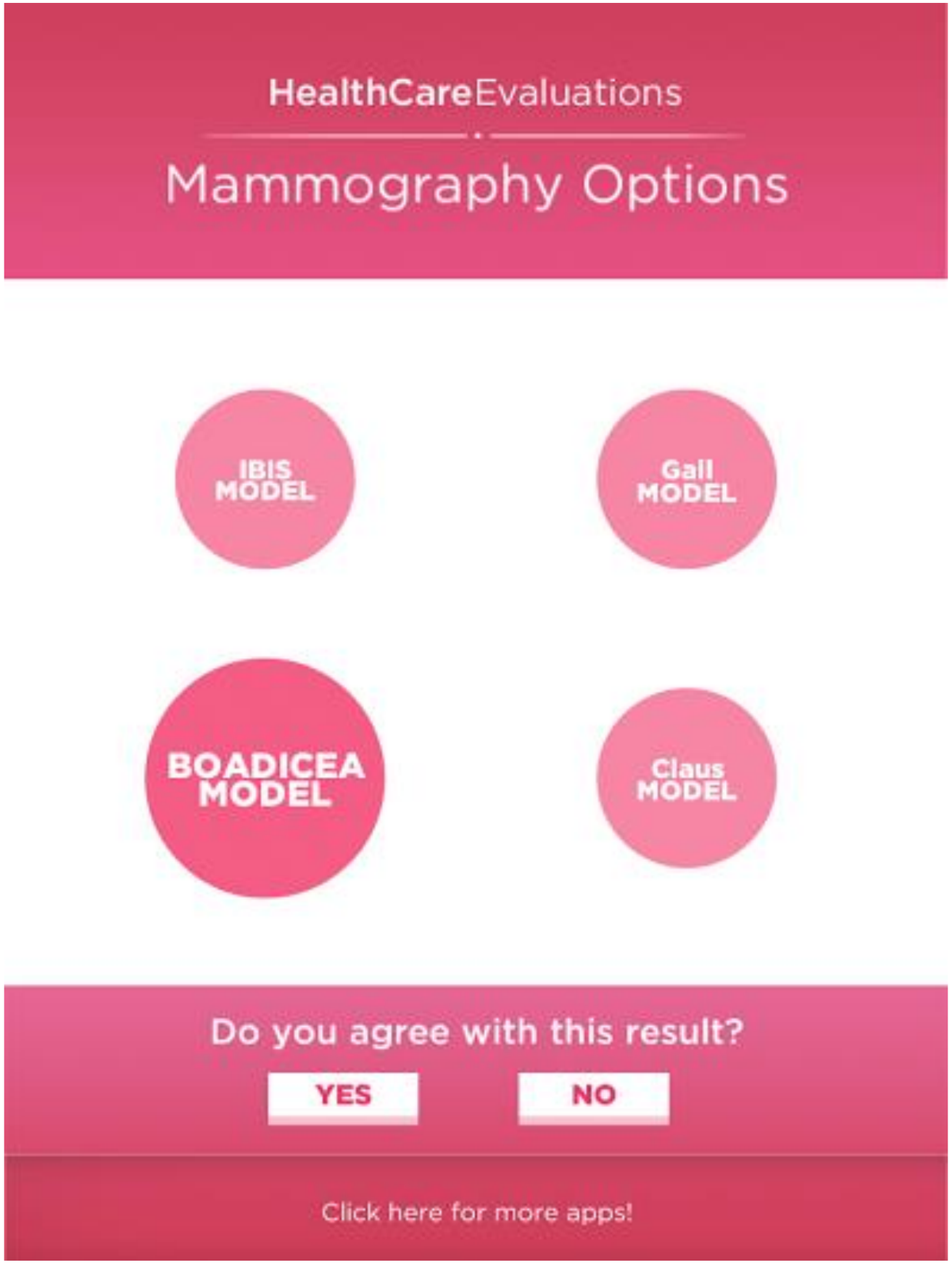
Mammography Options



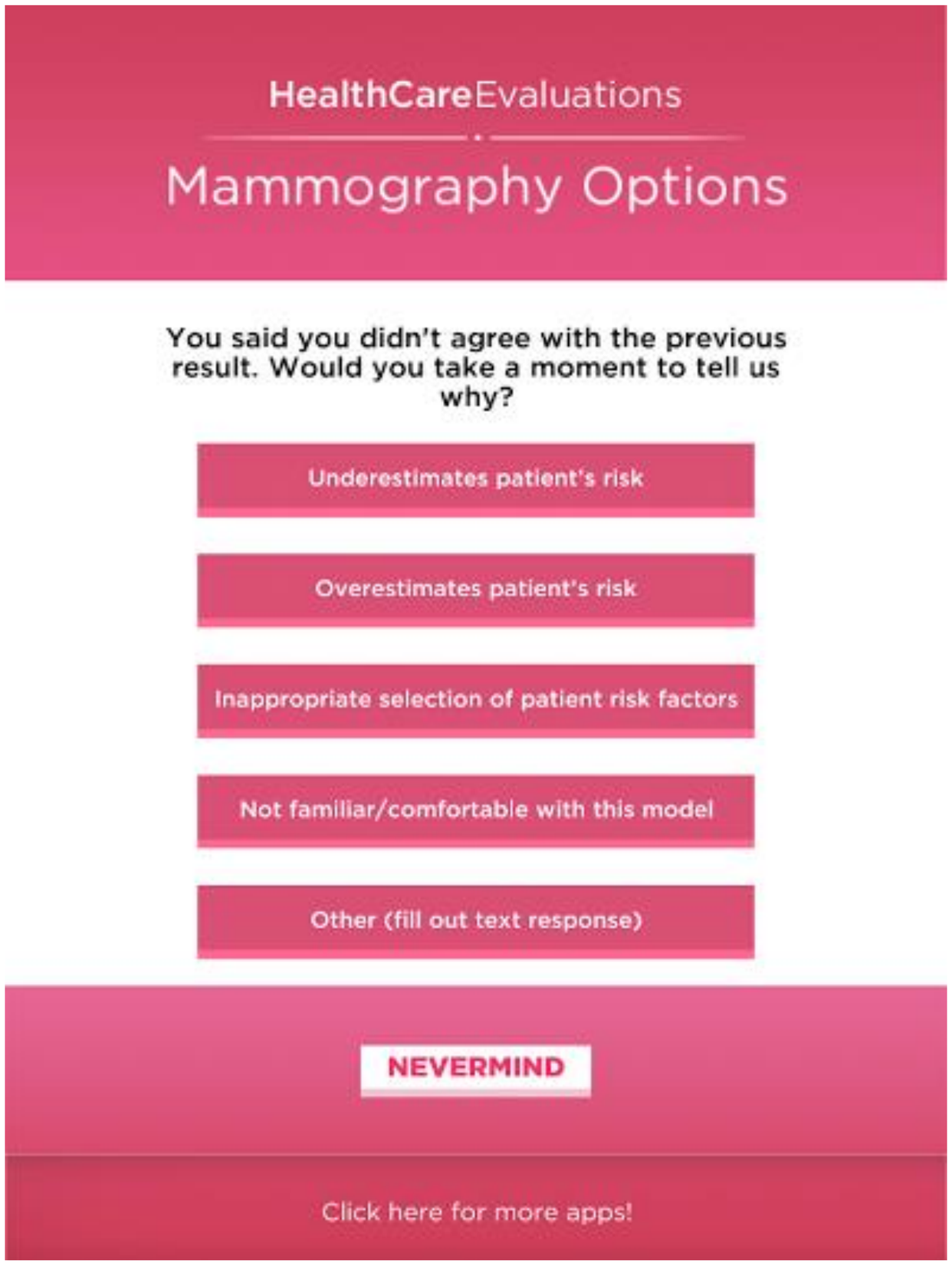
Mammography Options



Mammography Options



Mammography Options



Next Scenario : More Granular

Ready to Start?

HealthCareEvaluations

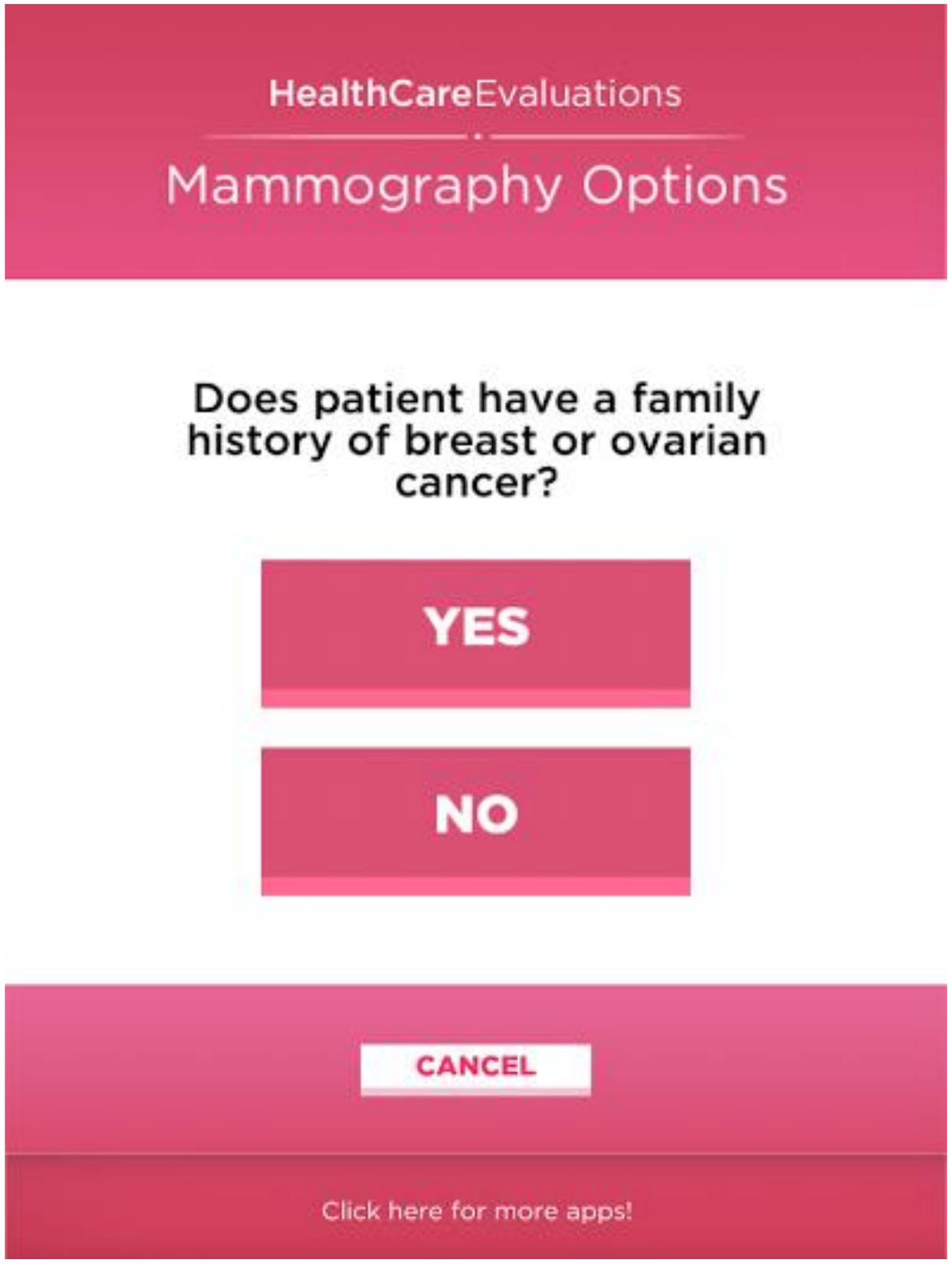
Mammography Options

Ready to Start?

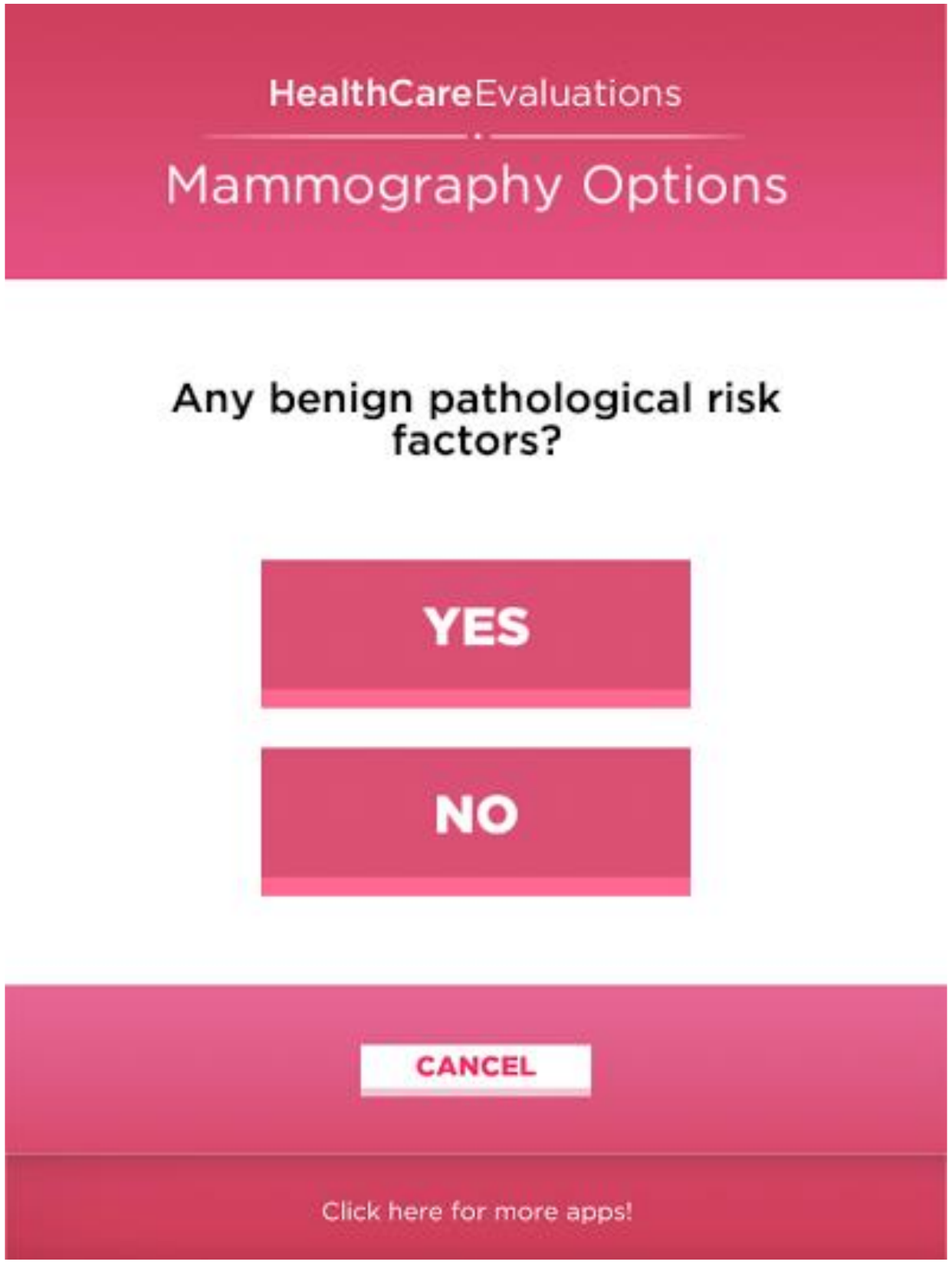
Let's Begin

Tracking data anonymously.

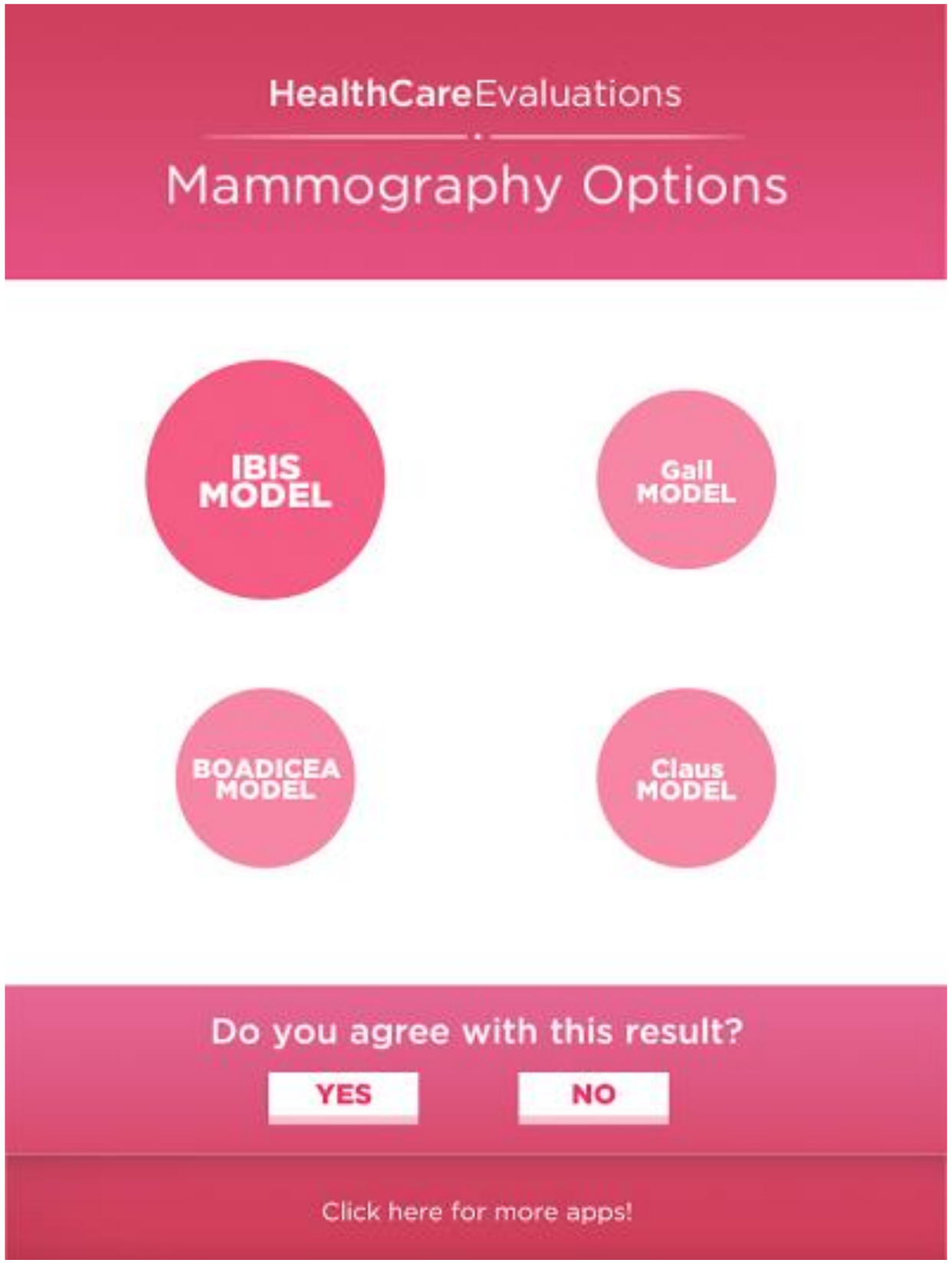
Click here for more apps!

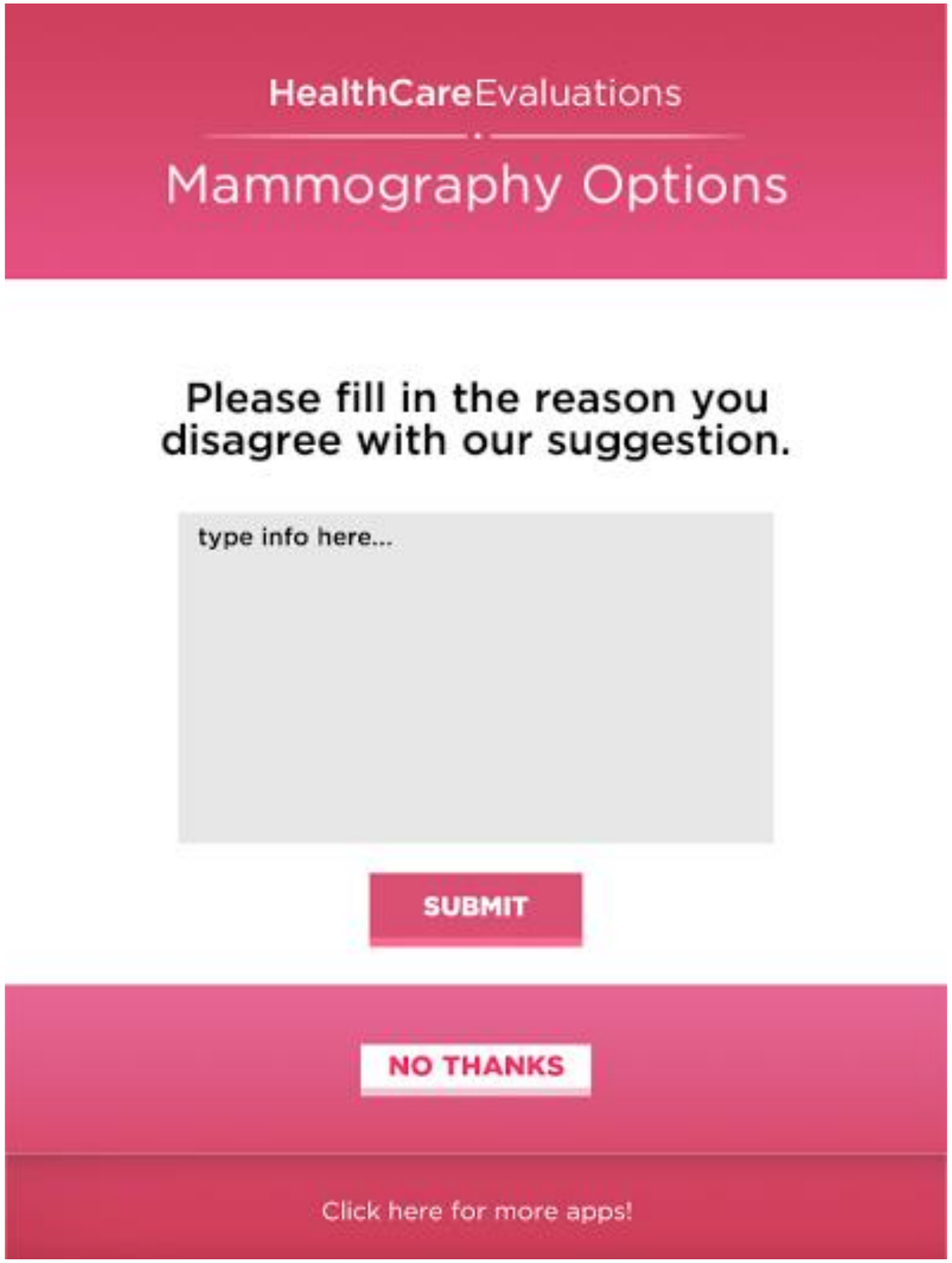

HealthCareEvaluations
Mammography Options
Does patient have a family history of breast or ovarian cancer?
YES
NO
CANCEL
Click here for more apps!

Pathological Risk Factors

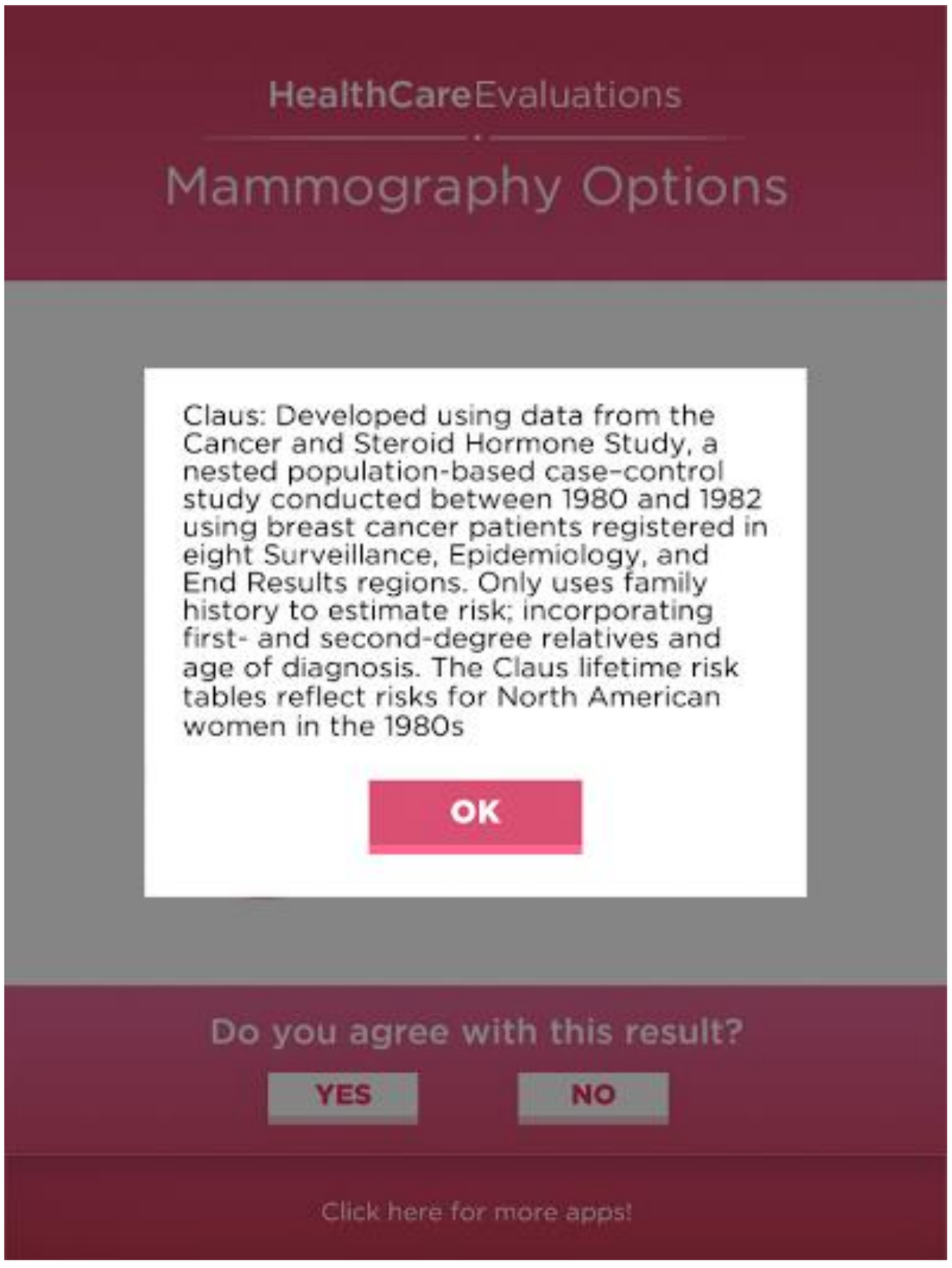


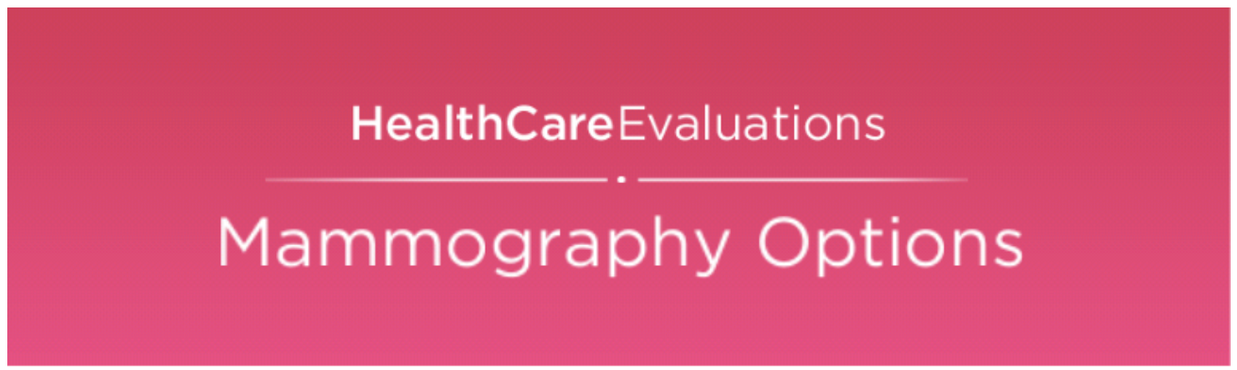
Mammography Options




HealthCareEvaluations
Mammography Options
Please fill in the reason you disagree with our suggestion.
type info here...
SUBMIT
NO THANKS
Click here for more apps!

Mammography Options





Review the latest research on this topic.

CLICK HERE

To be redirected to a list of the most up to date, relevant articles and findings on this subject.

CANCEL

Endovascular versus Open Aneurysm Repair

Patient's age?

54

NEXT

CANCEL

Click here for more apps!

Was the patient transfered to this hospital?

YES

NO

CANCEL

Click here for more apps!

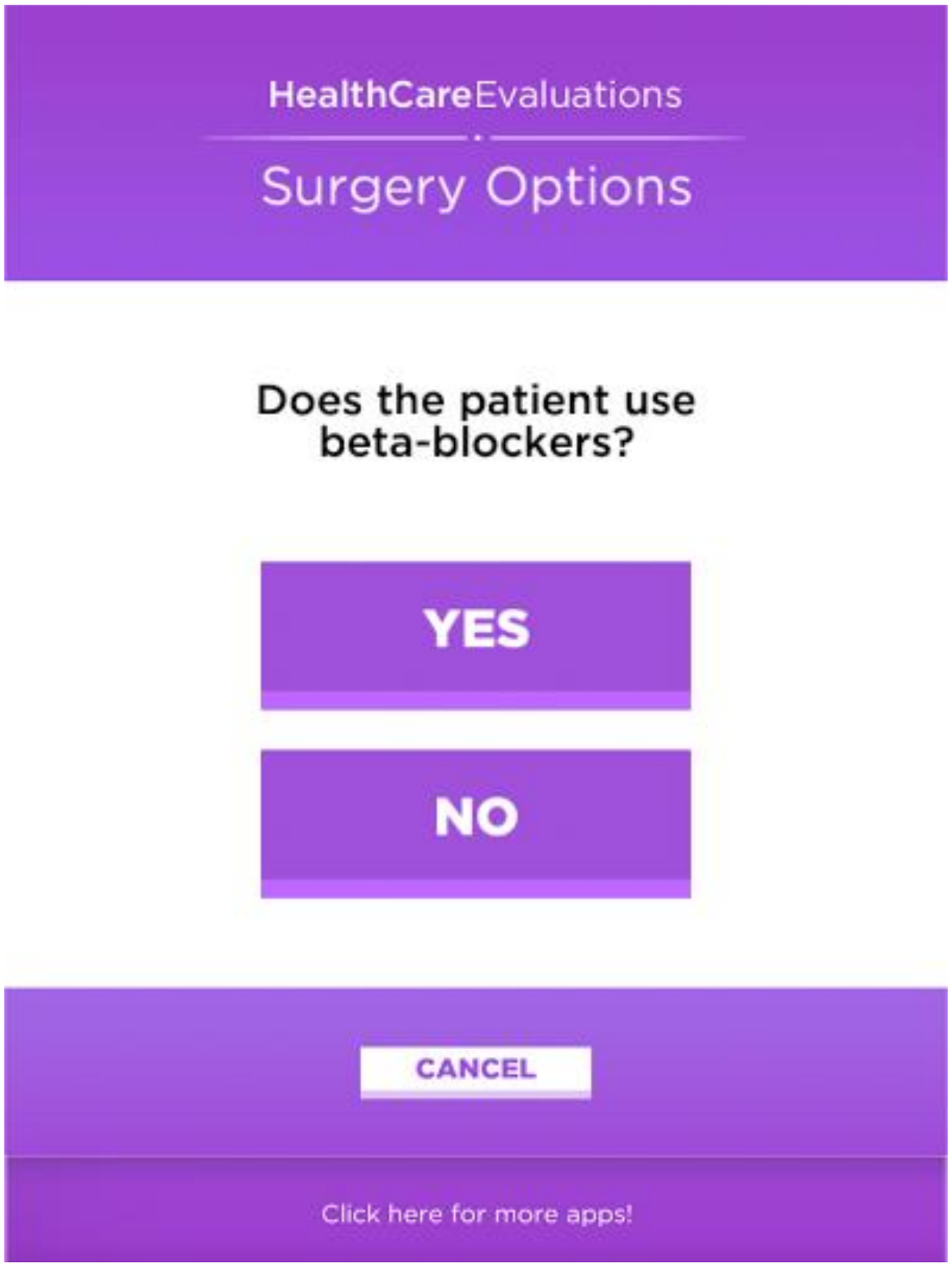
Does the patient have a history of COPD?

YES

NO

CANCEL

Click here for more apps!

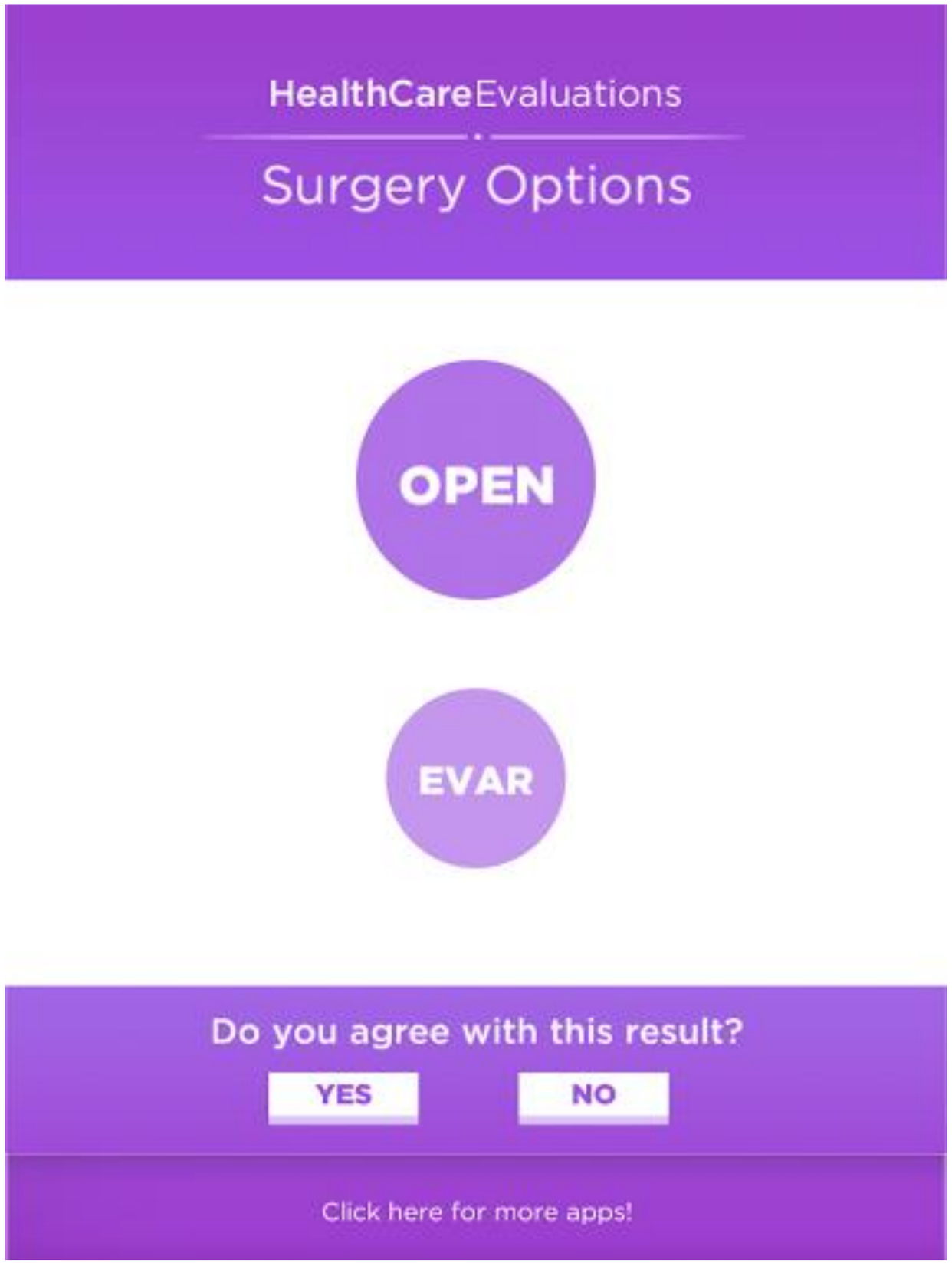

HealthCareEvaluations
Surgery Options
Does the patient use beta-blockers?
YES
NO
CANCEL
Click here for more apps!


HealthCareEvaluations
Surgery Options
Does the patient have creatinine levels greater than 1.5?
YES
NO
CANCEL
Click here for more apps!

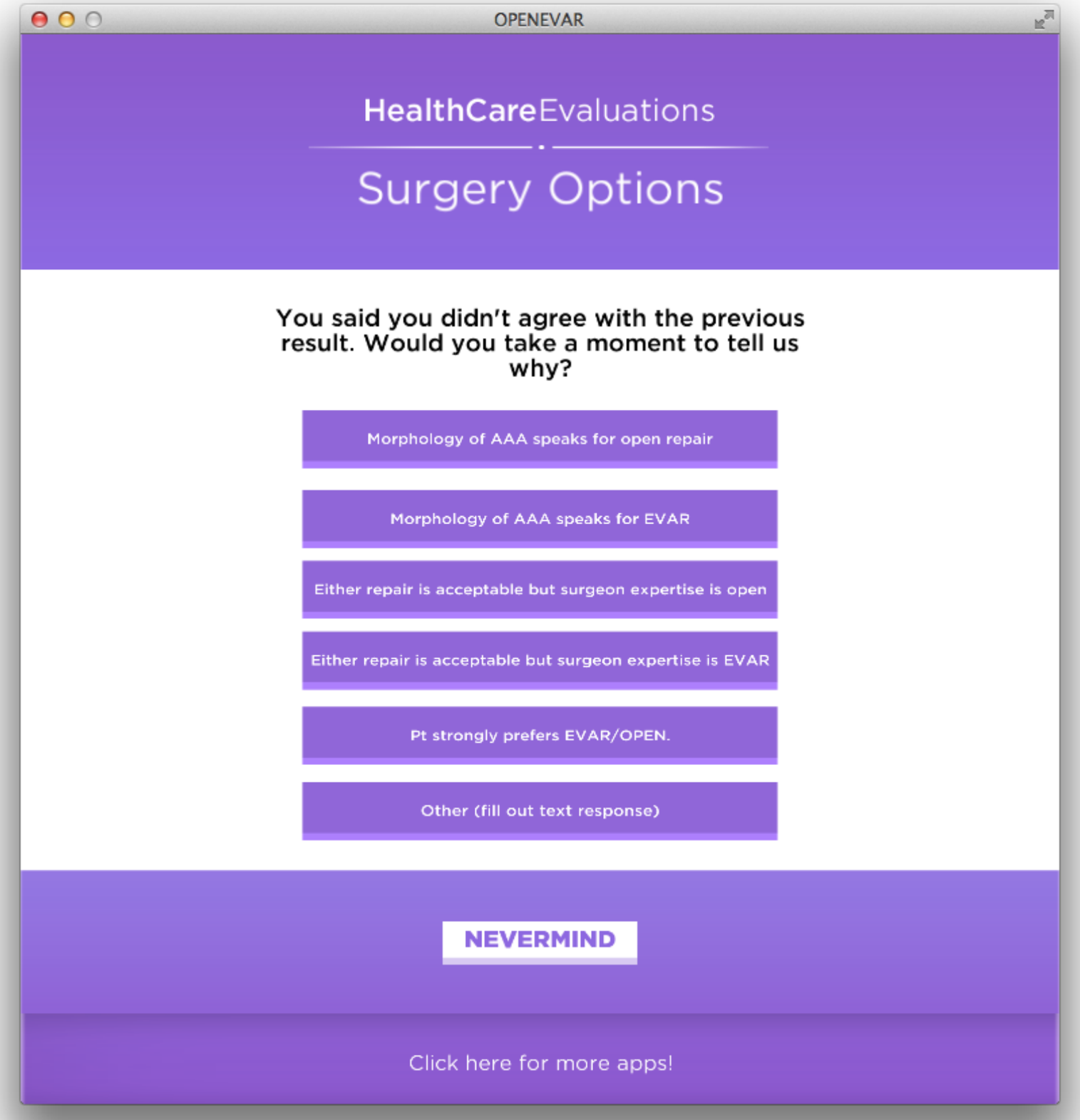

HealthCareEvaluations
Surgery Options
Does the patient have an Iliac Aneurysm?
YES
NO
CANCEL
Click here for more apps!

Surgery Options

Surgery Options



Surgery Options



MASLOW'S HIERARCHY OF NEEDS

ABRAHAM MASLOW

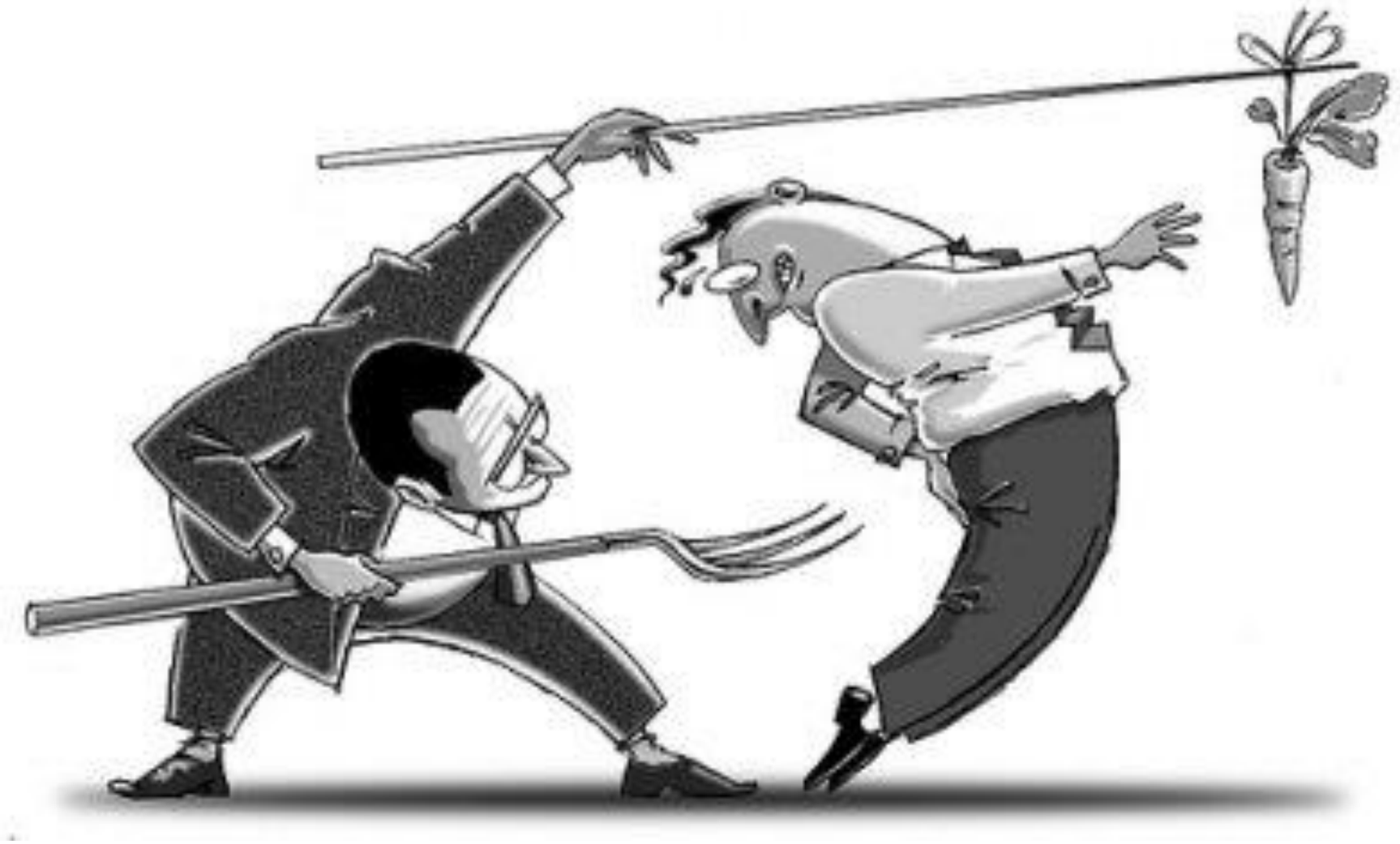
Abraham Harold Maslow (April 1, 1908 - June 8, 1970) was a psychologist who studied positive human qualities and the lives of exemplary people. In 1954, Maslow created the Hierarchy of Human Needs and expressed his theories in his book, Motivation and Personality.

Self-Actualization - A person's motivation to reach his or her full potential. As shown in Maslow's Hierarchy of Needs, a person's basic needs must be met before self-actualization can be achieved.

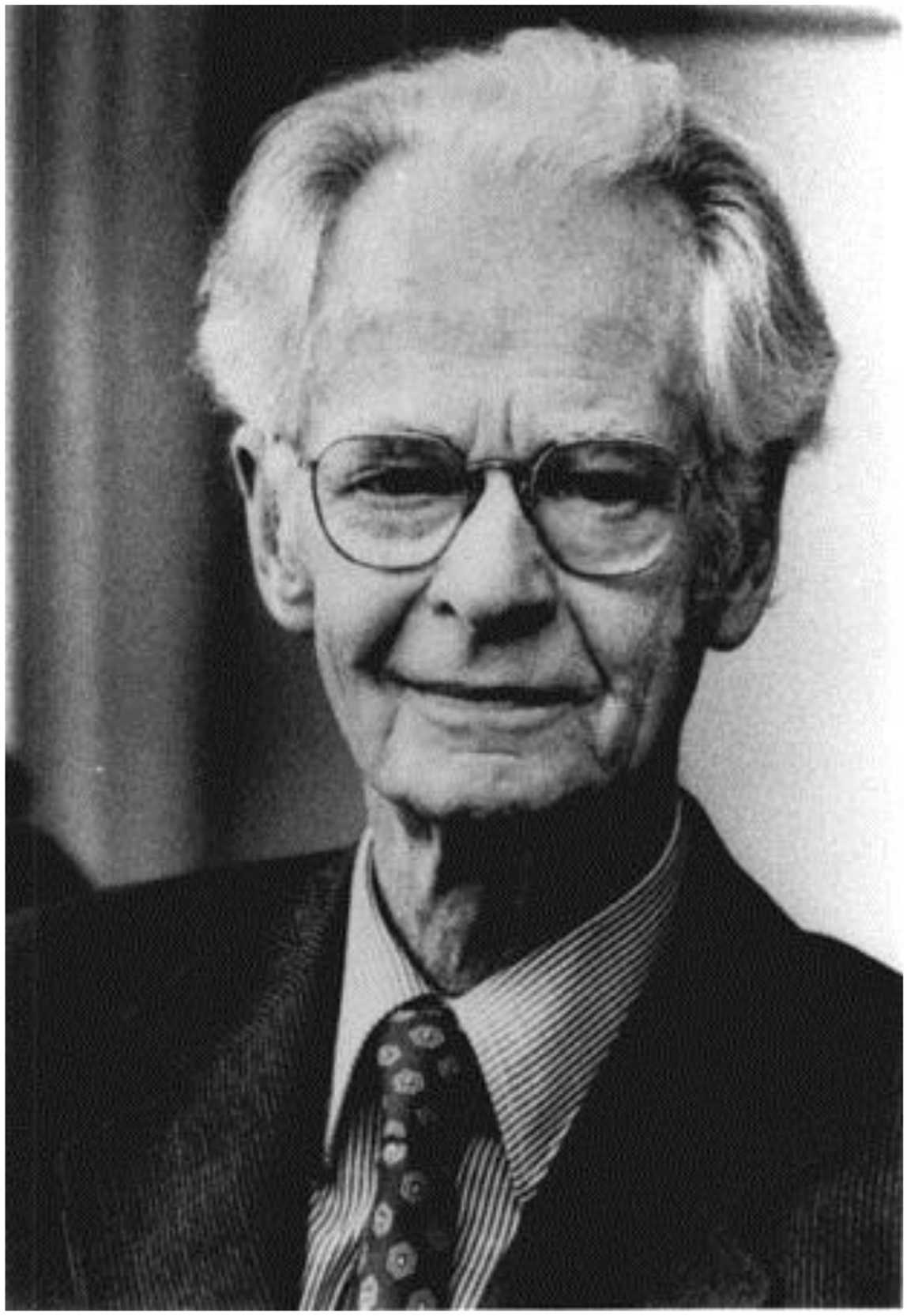
Motivating Healthy Change

Incentives are great for short-term, simple change:

https://www.youtube.com/watch?v=iRb94IbL138



http://empoweringthematuremind.com/austin-votes-sticks-vs-carrots-w-zero-step-ordinance/



Burrhus. F. Skinner (1904-1990)

https://www.youtube.com/watch?v=vGazyH6fQQ4

Journal of Personality and Social Psychology,
1973, 28, 129-137.

Undermining Children's Intrinsic Interest with Extrinsic Reward: A Test of the "Overjustification" Hypothesis

Mark R. Lepper and David Greene
Stanford University

Richard E. Nisbett
University of Michigan

A field experiment was conducted with children to test the "overjustification" hypothesis suggested by self-perception theory—the proposition that a person's intrinsic interest in an activity may be decreased by inducing him to engage in that activity as an explicit means to some extrinsic goal. Children showing intrinsic interest in a target activity

3 Groups of Kids
Promised Good Drawing Award
Unexpected Good Drawing Awa
rd
No Award

s were exposed to one of three ed-award condition, subjects t activity in order to obtain an xpected-award condition, sub- he reward until after they had nd in the no-award condition, ior received the reward. The n that subjects in the expected- ow less subsequent intrinsic than subjects in either of the

eks to of ever and explain the behavior of others of central concern to social psych (e.g., Brunswik, 1934; Heider, 195 only in the past few years have p themselves with the process by wh understands his own actions and th 1967, 1972; Jones & Davis, 1965; Jones, Kanouse, Kelley, Nisbett, Valins, & Weiner, 1972; Kelley, 1967). Recently, theoretical analyses of the process of self-perception or self-attribution by Bem (1965, 1967) and by Kelley (1967) have suggested that processes of self-perception have a common ground with those of other-perception.

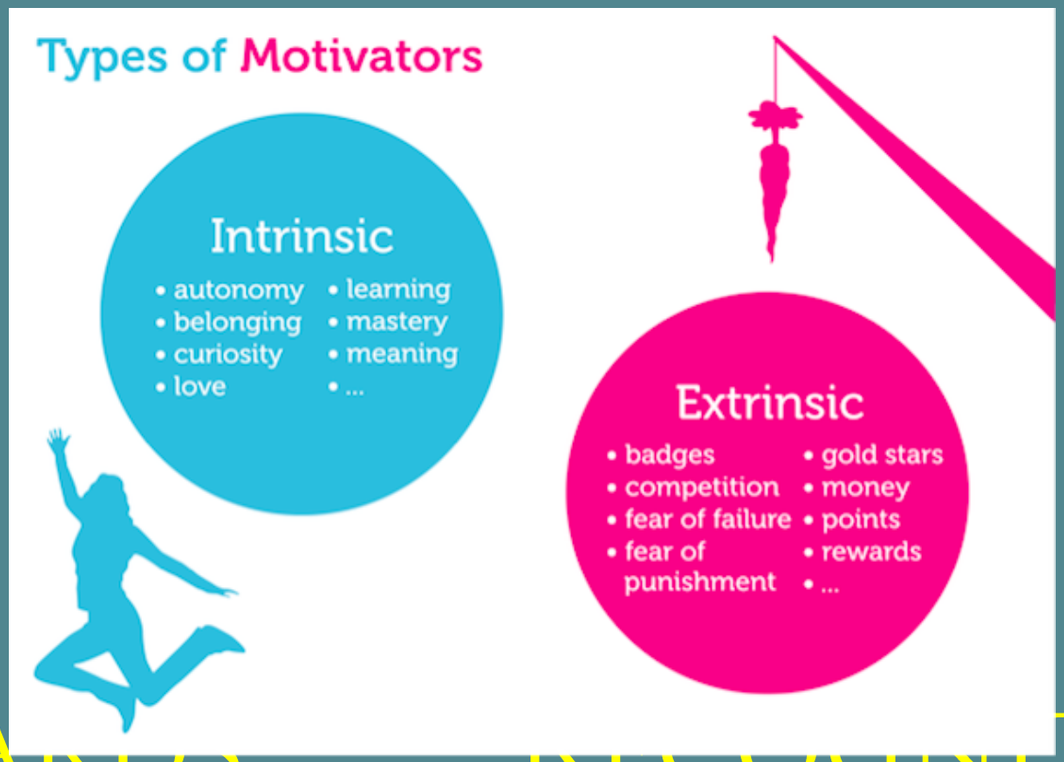
When an individual observes another person engaging in

actions were intrinsically motivated. In a self-perception analysis, this outcome is simply the result of a self-directed inference process. In the low-justification conditions, the subject infers from his behavior and the lack of apparent external pressure that he must have wished to act as he did; while in the high-justification conditions, the subject infers that his behavior was determined by the external pressures in the situation.

Besides its application to many classic dissonance paradigms, self-perception theory has a number of heuristic

activity itself. In short, a person induced to undertake an inherently desirable activity as a means to some ulterior end should cease to see the activity as an end in itself.

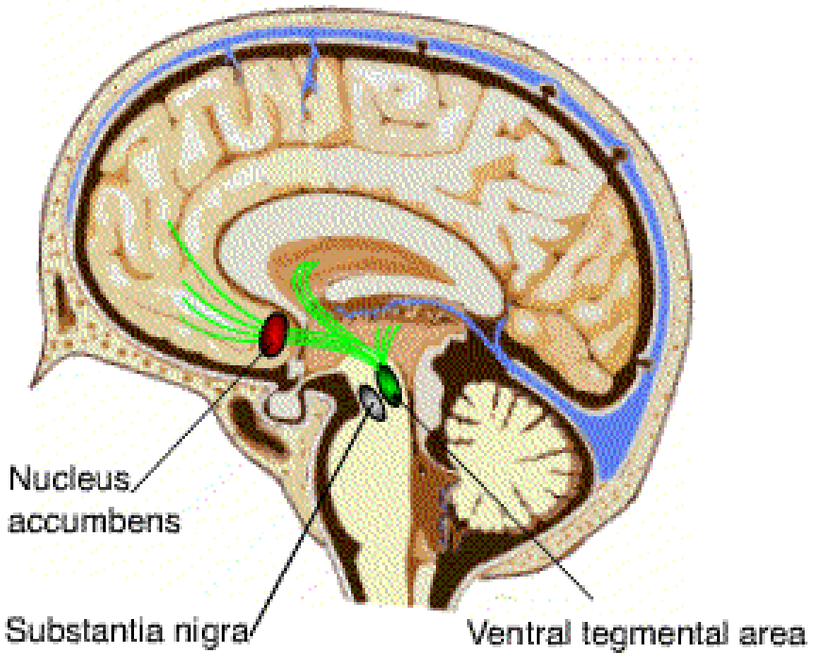
While the existence of such an overjustification effect has been postulated by a number of authors (DeCharms, 1968; Deci, 1971; Kruglanski, Friedman, & Zeevi, 1971; Lepper, 1973; Nisbett & Valins, 1971), this proposition

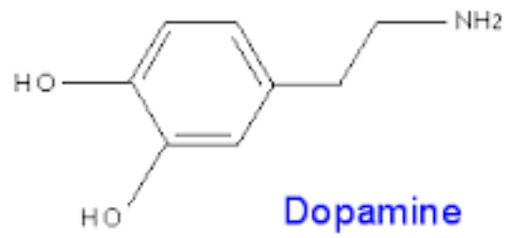


Rewards ≠ Recognition ≠ Incentives

Rewards and recognition are given when you've done something, incentives are given *so that you do* something

Pleasure Reward Pathway





MESOLIMBIC DOPAMINERGIC SYSTEM

trUStr rewards

A fitness-rewarding smartphone app

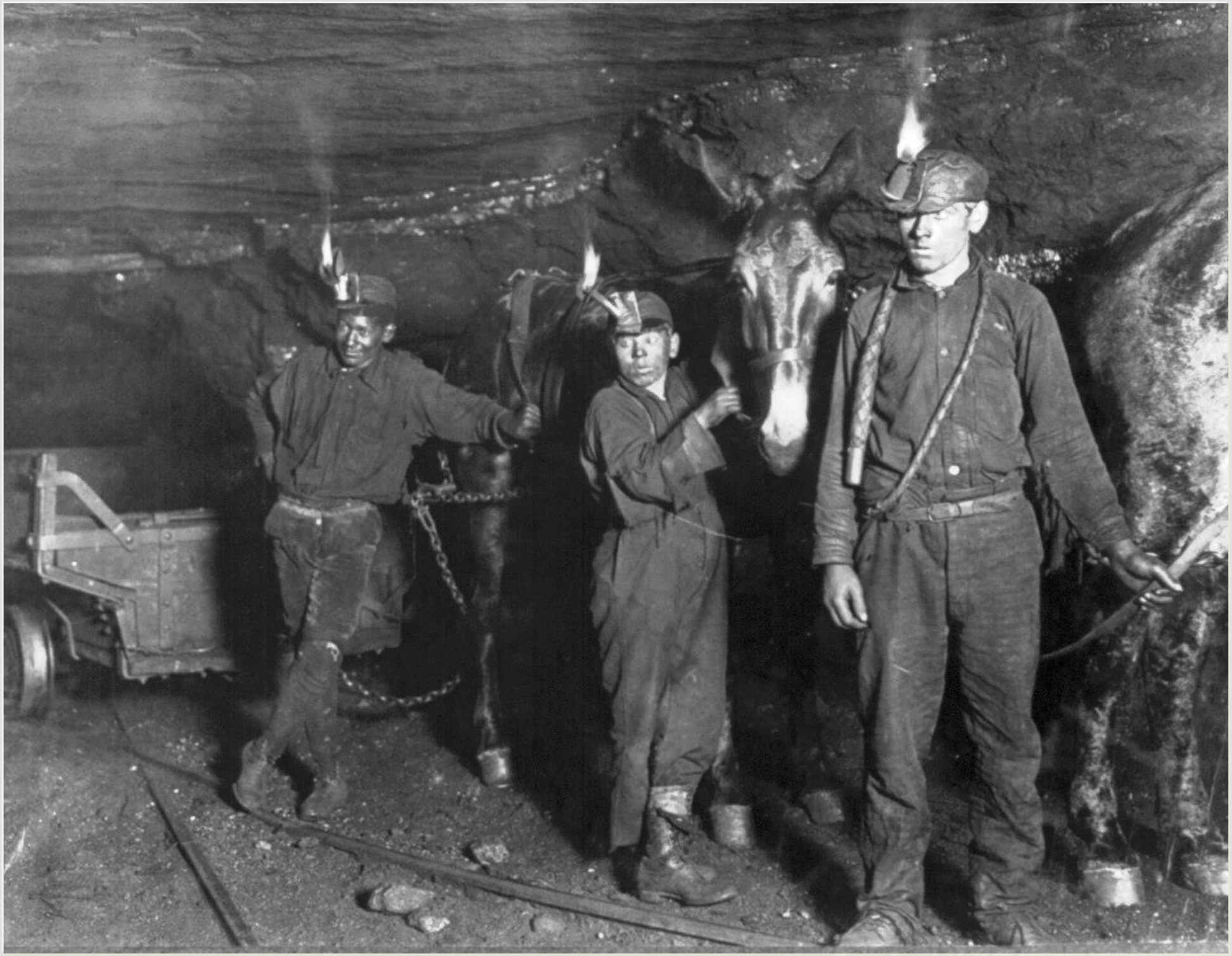
Premise: Rewards can be personalized

http://stockproject1.deviantart.com/art/Pocket-Watch-3663976-182511090

Found on www.etsy.com

www.iphone.com

www.iphone5cases.com



Coal mining, West Virginia (1908):
https://en.wikipedia.org/wiki/History_of_coal_mining_in_the_United_States

Downloaded 25 Aug 2015--http://siliconangle.com/blog/2012/04/04/your-guide-to-choosing-a-business-intelligence-tool/data-mining-big-data/

Logging

www.fs.fed.us

http://mashable.com/2014/03/20/lifelogging-experiment/

Thank You

Department of Surgery
Department of Economics
Global Health Economics Unit
Computational Story Lab
University of Vermont