

# **PsyPredict: A Predictive Model for Mental Health Precision Medicine**

by  
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**From:** Sam Hillough <sam@forgecreative.com>  
**Sent:** Tuesday, February 16, 2045, 1:17 PM  
**To:** Alex C. Avery <avery.a.c@psypredict.org>  
**Subject:** RE: Introduction/PsyPredict Informational Video

**Attachment:** PsyPredict\_InfoVideoScript\_SHedits\_FINAL.pdf

Hello Dr. Avery,

I hope all is well with you! Please find attached our team's final proposed script for the PsyPredict informational video. We ended up going with a concept of a woman interested in the model going to discuss it with her doctor. The overall tone is informative and upbeat.

Throughout, we highlighted the benefits of the model as explained to us by your team. We chose to have the character of the patient present with long-term treatment-resistant depression, as it sounds like these are the individuals who stand to benefit the most from the PsyPredict model. She and the character of her doctor discuss how the field of mental health treatment has been revolutionized by the precision medicine that the model allows. We included the figures of the previous failure of 1/3 of patients to respond to intervention even after four different treatments<sup>10</sup> when treatment selection couldn't be tailored to individual patient in a data-driven way and the former \$326 billion economic burden of depression<sup>16</sup> to underscore how far the field has been advanced. We also included mention of how the model's output report in layman's terms allows for patients' increased agency in decisions about their care and the types of data (medical records, demographics, neuroimaging, etc.) that the model uses. The points about the model being covered by all major health insurances as a diagnostic tool and patients having the final decision on which data is shared also made it into the script, as I'm sure patients considering the model would be interested to know these logistics from a practical perspective.

Throughout, we emphasize that the model allows for more accurate treatment selection to reduce treatment duration and help patients recover faster. We delineate how the model came about from collaboration between scientists like yourself, public health officials, and computer scientists, and provide the context of how the model built upon past research studies.

We also wrote in some of the questions/concerns you'd mentioned that patients frequently asked about. The doctor reviews the privacy protection measures and security of the system on par with electronic medical records. We additionally had the character of the doctor affirm that the ultimate treatment decision still results from a conversation between doctor and patient to assuage potential patients who may feel a bit technology-hesitant. For patients with a history of past unsuccessful treatment, we incorporated information about the model ruling out previously unhelpful treatments and mentioned the beta feature of connecting patients with ongoing clinical trials as treatment options in addition to established evidence-based treatments, but let me know if it's too early to include that info in the video and we can write it out.

Let me know if there are any inaccuracies we should correct, or any other edits your team would like made, otherwise we'll go ahead and send the script over to production. We're so excited to be a part of helping you to disseminate information about this revolutionary system to patients in need.

Best regards,  
Sam Hillough  
Lead Screenwriter, Forge Creative

FADE IN:

INT. DOCTOR'S OFFICE. PATIENT ROOM. DAY

A middle-aged woman, dressed in a loose sweater and slacks, sits on a patient table draped in a disposable paper cover, looking nervous. A manilla folder stuffed with printouts and a notebook sit in her lap, and she rapidly clicks a pen in her hand as she flips through the contents of the folder. A knock at the door causes her to abruptly stop her compulsive clicking.

The door swings open to reveal DR. SMITH, wearing a white coat and a relaxed smile, who enters the room.

DR. SMITH

Hi, Kathleen, thanks for coming in. What can I help you with today?

The woman on the patient bed, KATHLEEN, returns the doctor's smile.

KATHLEEN

Hi Dr. Smith, thanks for seeing me. I wanted to talk about treatment options for my depression.

Dr. Smith settles onto a stool next to the patient bed Kathleen is sitting on and rests a tablet on her lap.

DR. SMITH

Well, you came to the right place. I had a look over your chart right before this. It says that you first sought treatment for your depression 13 years ago, does that sound about right?

KATHLEEN

Yes, that sounds right.

DR. SMITH

I see. I also saw that the last record of treatment you received was about... eight years ago?

KATHLEEN

Yes, that's true...

(pause, then sheepishly)

...but I wouldn't say that my depression went away these past eight years.

(sigh)

I didn't feel like any of the treatments I'd tried had helped. I got discouraged and, well, stopped trying.

DR. SMITH

(sympathetically)

I'm sorry to hear that.

Kathleen nods her thanks.

KATHLEEN

My son encouraged me to come in today. He read about a new tool you're using to recommend treatments for patients with mental health difficulties that can help for people like me? The, uh-

Kathleen begins to shuffle through the folder of printouts in her lap, many of which bear the name 'PsyPredict', searching for the name of the tool. Dr. Smith saves her the trouble.

DR. SMITH

The PsyPredict model, yes. I'd be happy to tell you more about it. We have indeed used the system to help patients just like you who weren't able to find relief from their symptoms previously, which unfortunately used to be all too common and affect about half of patients<sup>1</sup>. You came in at the right time.

KATHLEEN

That would be great, thank you.

Kathleen puts her pen to her notebook in preparation to take notes and looks up attentively.

DR. SMITH

Perhaps I'll start by giving you a broad overview of the model, and then I can answer any specific questions you might have?

Kathleen murmurs her approval. Dr. Smith brightens even more than before. We can tell she's excited to tell Kathleen about the tool.

DR. SMITH

(excitedly monologuing)

PsyPredict is an integrative model that came about from applying machine learning advances to psychological and neuroscientific studies of neuropsychological disease. It used to be the case that clinical research studies of mental health had no real bearing on how clinicians treated mental health difficulties. Some scientists would find that a certain brain area was more highly activated in most, but not all, of the 30 patients with depression in their sample, and those same, say 20 patients, tended to get better faster, which was all well and good, but there wasn't much for us to do with that information in the clinic<sup>2</sup>-

Dr. Smith realizes she's speaking with increasing speed and takes a brief pause to ensure she isn't losing Kathleen. She's delighted to see that the other woman is looking as engaged as she is, so she continues.

DR. SMITH

(still excited)

So anyway, it used to be that we had little more than trial and error to whittle down the

treatment options available to patients. Which, as you know too well, didn't work well for most patients. But now with PsyPredict, we feed your patient data into the model, and it comes back with data-driven, individually tailored recommendations as to which treatment regimens are most likely to work for you.

Dr. Smith pauses with a self-satisfied smile. Kathleen looks cautiously optimistic.

KATHLEEN

That sounds... almost too good to be true. What makes this useful when the other research studies you mentioned weren't?

DR. SMITH

Actually, those types of studies are included in the model as training data. So, it's not that they weren't useful, in fact they've been quite useful, they were just a little too...

Dr. Smith trails off searching for the right word.

KATHLEEN

Circumscribed?

DR. SMITH

Yes, circumscribed! Research studies relying on volunteer human subjects usually only had the bandwidth to consider one disease of interest at a time, and if there was a treatment component it was typically limited to only a couple interventions per study at maximum<sup>3</sup>. Plus, the measures collected between studies varied so much that it was difficult to meaningfully combine the contributions from each<sup>4</sup>.

KATHLEEN

I see.

DR. SMITH

However, it eventually became the norm for studies like that to begin openly sharing their data<sup>5,6</sup>. Some funding agencies even began to require it<sup>7</sup>. After that, it was a matter of aggregating all of those individual studies along with rich individual patient data to form the comprehensive predictive model we have now.

KATHLEEN

So, the model came about from collaboration between research doctors and medical doctors?

DR. SMITH

An even wider collaboration than that. A big push toward initiating this step came from public health officials given the high lifetime prevalence of mental illness rates in the country - which is about half of all Americans<sup>8</sup>. And, of course, computer scientists who leveraged computing advances in machine learning to build the model itself. But yes, research and medical doctors provided the patient data.

KATHLEEN

What sort of patient data does it use, exactly?

Dr. Smith awakens the screen of the tablet resting in her lap. We see the PsyPredict logo fill the screen before being replaced by the home page. Dr. Smith swipes through a few pages that are not in focus to the camera as she answers.

DR. SMITH

Well, all sorts. It integrates your past health data from your medical record with any additional data we might decide to obtain for better prediction. Neuroimaging data and symptom questionnaires seem to be particularly helpful for the model. In general, the more data we input, the more accurate the output.

KATHLEEN

Neuroimaging like an MRI?

DR. SMITH

Yes exactly. MRI and EEG scans are two types of neuroimaging commonly collected for this purpose. If you've had either before, we can add them in, or if not, we can always order them.

On the last two words, Dr. Smith gestures at her tablet to insinuate that ordering neuroimaging for this purpose can happen with the click of a button.

KATHLEEN

I don't think I've had either before..

DR. SMITH

I'll order them then. They're very safe, non-invasive, and will only take a couple hours. Plus adding in brain data can make predictions about five times more accurate than if we only used clinical data<sup>9</sup>.

Kathleen raises her eyebrows at the figure of a fivefold improvement in accuracy.

KATHLEEN

And just how accurate is the model?



DR. SMITH

Quite accurate. In the past trial and error-type approach, about a third of patients still didn't achieve remission even after four different treatments<sup>10</sup>. With individualized recommendations from the model, about 75% of patients experience significant success with the first treatment they try, and if the first one doesn't work, almost all patients are helped by their second treatment.

Kathleen considers this for a moment.

KATHLEEN

...So the model's predictions aren't right all of the time then?

DR. SMITH

No, not all of the time. It's very unlikely that a model could ever be right 100% of the time, but it is a substantial advance from how we selected treatments before. Matching a patient with the treatment most likely to benefit them based on objective data helps patients to improve much more quickly. In turn, the model also continues to improve the more patients that use it.

KATHLEEN

Meaning that it's still changing?

DR. SMITH

More like it's still fine-tuning itself. We would continuously provide it with information about how the treatment it recommends works for you, and that data would help it to evaluate how accurate its initial recommendation was for

you, further tailor its predictions if a second course of treatment were needed, and make more accurate predictions for future patients that had similar symptoms and biomarkers to you.

KATHLEEN

Would it ever fail to come up with predictions for patients?

Dr. Smith's face dims a bit at this question, but her tone remains upbeat, and her serene smile slowly reemerges throughout the course of her answer.

DR. SMITH

In a way. Unfortunately, for some individuals with treatment resistant mental health struggles, the model may find that current treatment options have low probabilities of success. A new feature we're beta testing now attempts to rectify that by indexing all available clinical trials ongoing for a given patient's illness. That would give you the option to try something novel if no current evidence-based treatment seems suitable. Quite a lot of patients do benefit from novel therapies<sup>11,12</sup> though, so even if that scenario were the case, there's still reason to be hopeful.

Kathleen looks somewhat relieved to hear this, but still wears a look of hesitation leading in to her next question.

KATHLEEN

I guess I'm asking because I'm still feeling a bit worried from my past unsuccessful attempts at trying different treatments. I'm worried the model would come up with the same treatments my doctor recommended previously.

DR. SMITH

(reassuringly)

By including your medical record as part of the data we provide to the model, we'll ensure that can't happen. Just like a doctor wouldn't prescribe the same ineffectual treatment twice, the model will see that those treatments didn't work for you and rule them out, probably in addition to ruling out some closely related ones.

KATHLEEN

Well, that's relieving to know. Is it safe to share my medical record like that though? I wouldn't want that information to fall into the wrong hands. I sometimes even feel weird using the face unlock feature on my iPhone...

Kathleen gestures to her cell phone and lets out a soft chuckle at herself.

DR. SMITH

That is a valid concern<sup>13</sup>, but there are of course steps taken to protect your privacy<sup>14</sup>. Your health data is anonymized, meaning that none of it is associated with personally identifying information like your name or date of birth. In the PsyPredict system, your data would be encrypted and assigned an alphanumeric code to track your individual progress, but it couldn't be tied back to you. Only you and your doctors would know that the data for patient...

Dr. Smith looks down at a tablet and quickly punches in a few entries into the screen. She then angles the screen toward Kathleen. Pan in to the tablet screen to see that the only

information visible at the top of the page is the identifier 'NDFI2837'. The rest of the fields on the page are empty.

DR. SMITH (CONT'D)

...NDFI2837 came from you. It comes with even less risk than common electronic medical records.

KATHLEEN

(nodding slowly)

Okay, that sounds like something I'd be comfortable with.

DR. SMITH

Patients also have absolute say over which of their data they feel comfortable providing the model, so we can provide as much or as little as we'd like - or none at all if you decide you wouldn't like to try it. It's completely your choice.

KATHLEEN

But using the model would give me a higher chance of treatment success than consulting with you as my doctor, right?

DR. SMITH

Oh! I'll still select the treatment with you as your doctor, it just gives me more objective data to help guide that decision. Think of it as any other diagnostic tool. For instance, if you were to come in with flu-like symptoms, I'd run a test to give me more information to conclude whether anti-viral or antibiotic medication would be more likely to help you. This is similar, except we're employing machine learning based on your symptoms and brain data, since there isn't a throat

culture equivalent for mental health difficulties. You can be more involved in the process too with the addition of PsyPredict.

KATHLEEN

(confused)

I can?

DR. SMITH

Certainly. The output of the model is a simple report that's easy to understand even if you don't have a medical background. It will tell us something like Treatment A has an 86% chance of working well for you, with Treatment B as a runner up with a 75% chance of working well for you. It will even provide information about what factors led it to those conclusions, and links to relevant research publications that it's basing the prediction on so that I, and you if you'd like, can learn more about each option.

KATHLEEN

Well, I like that I could read up on the background of the treatments from scientific papers - I like to do my research.

Kathleen gestures to the stuffed folder on her lap as evidence of this.

KATHLEEN (CONT'D)

But, in that case everyone would probably just choose the treatment with the higher likelihood!

DR. SMITH

Most of the time, yes. But say in that same scenario that Treatment A was a pharmaceutical intervention and Treatment B was a

behavioral therapy. If you felt averse to starting a new psychoactive medication, then we could opt for Treatment B instead. The recommendations are just that - recommendations. The decision we ultimately come to on which course of treatment to pursue will come out of conversations between you and your doctor that can weigh factors like those.

KATHLEEN

I didn't realize I could have a role like that. I think I'd really like having a say in my treatment.

DR. SMITH

Most patients do. Being involved with decisions about your care also tends to be associated with better recovery<sup>15</sup>, so it's really a win-win.

KATHLEEN

This all sounds great. I think I'd be open to trying the system. Will it be expensive?

DR. SMITH

Not at all. Precision medicine for mental health has saved the healthcare system a lot of money by reducing the number of treatments patients need before they recover. Depression alone used to have a national economic burden of 326 billion dollars<sup>16</sup>, and the implementation of PsyPredict has decimated that number. So, private and public health insurances fully cover the use of the tool as a diagnostic test, as it ends up saving all parties a lot of money in the long run.

Kathleen's eyebrows raise in surprise both at the enormity of the figure that Dr. Smith cited and the fact that the model will be covered by her insurance.

KATHLEEN

That's not what I was expecting -  
how great!

DR. SMITH

Yes, the system has truly revolutionized mental health care. It's also alleviated the shortage of mental health professionals<sup>17</sup> since patients require shorter duration of care with this more tailored approach. You really did choose to come back at the right time.

KATHLEEN

It certainly seems so. Okay, I'd like to give the system a try.

DR. SMITH

Great, let's get started.

The two women lean over the tablet together and begin interacting with the PsyPredict interface. They continue chatting (without audio) and smiling while manipulating the interface throughout the voiceover.

NARRATOR (V.O.)

(1.5x normal speaking speed)

PsyPredict is designed as a diagnostic tool for use by mental health professionals and is not a substitution for seeking medical care. Output reports from the PsyPredict model are not considered medical advice and should be discussed with your doctor. This video is provided for informational purposes only for patients considering use of PsyPredict. The subjects of this

video are paid actors. Individual  
results may vary.

FADE OUT.



## References:

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