AI and the Future of Psychiatry

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Disclosures

• I have received research grants from and/or served as an advisor or board member to health and tech businesses. I am a minor shareholder in start ups whose products are not discussed here.

• I will discuss off-label uses of software
Objectives

- Historical perspective
- Unmet needs
- Views of end users (clinicians, consumers)
- Evidence base
- Ethical framework
Pressing Unmet Needs in Mental Health

• ~400M people worldwide
  • Suicide #2 cause of death in youth
• $16 trillion by 2030
• Stigma
• Low funding, lack of parity
• Poor access to care
• Social factors
• Deep phenotyping

https://www.weforum.org/press/2019/07/how-to-use-technology-ethically-to-increase-access-to-mental-healthcare
Psychiatry shortage escalates as mental health needs grow

**Shortage of Psychiatrists**

A population of 100,000 people should be supported by 14.7 psychiatrists.

In the U.S., only five states and D.C. meet or surpass this goal, with the national average being 8.9 psychiatrists per 100,000 people.

- Severe Shortage
- High Shortage
- Moderate Shortage
- No Shortage

96% of counties in the U.S. had an unmet need for psychiatrists.

By 2025, there will be an estimated 12% decrease in the psychiatry workforce.

59% of active psychiatrists are close to retirement.

60% of adults with a mental illness did not receive mental health services last year.

**Shortage has led to...**

- Appointment wait times up to a month or longer.
- Sessions that last only 15 minutes on average.
- A marked increase in provider burnout due to more time spent working.

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SimSensei's gestures match what it's saying.

USC Institute for Creative Technologies
Empowering 8 Billion Minds
Enabling Better Mental Health for All via the Ethical Adoption of Technologies

https://www.weforum.org/press/2019/07/how-to-use-technology-ethically-to-increase-access-to-mental-healthcare/
Four Actions to Scale AI/ML Technology for Mental Health

1. **Create a governance structure** to support the broad and ethical use of new technology in mental healthcare (including the collection and use of big data), ensuring that innovations meet the five ethical imperatives listed above.

2. **Develop regulation** that is grounded in human rights law, and nimble enough to enable and encourage innovation while keeping pace with technological advances when it comes to ensuring safety and efficacy.

3. **Embed responsible practice into new technology designs** to ensure the technologies being developed for mental healthcare have people’s best interests at their core, with a primary focus on those with lived experience.

4. **Adopt a “test and learn” approach** in implementing technology-led mental healthcare services in ways that allow continual assessment and improvement and that flag unintended consequences quickly.

https://www.weforum.org/press/2019/07/how-to-use-technology-ethically-to-increase-access-to-mental-healthcare
How do patients view technology?

90% have access to a PC and 54% have access to smartphone. 60% have access to 2-3 devices.

N= 457 with Schizophrenia

- Personal computer: 89%
- Smartphone: 54%
- Landline phone: 52%
- Tablet: 35%
- Public computer: 32%
- Cell phone without applications or...: 31%

% Using 1 Device: 9%
% Using 2-3 Devices: 61%
% Using 4+ Devices: 29%

Over two thirds (68%) of those aged 18-34 with schizophrenia have access to a Smartphone compared to 48% of 35-46 year olds and 44% of 47-64 year olds with schizophrenia. Sixty eight percent of older adults (47-64) with schizophrenia are more likely to have access to a landline telephone than their younger counterparts (46% for 18-34, 47% for 35-46).
Will Technology help with Recovery?
Two-thirds anticipate that technology will become a bigger part of their recovery in the future.

“In the coming years, I anticipate technology will become a bigger part of my recovery.”

- **Strongly disagree**: 17%
- **Somewhat disagree**: 17%
- **44%**
- **22%**

18-46 year olds with schizophrenia are more likely to “strongly agree” that technology will become a bigger part of their recovery than their older counterparts (47-64).

Those who often use technology to cope with schizophrenia are more likely to agree with this statement than those who rarely use technology to cope.
How do Psychiatrists View AI/Future Technologies?

2019 Global Survey by Sermo with Duke and Harvard

- Online survey using Sermo’s global registered physician network and survey platform
- 791 Psychiatrists in 22 countries
- Age 20s to 65+; 1/3rd under 45 years
- Private practice 35.0%; Public clinics 52.0%, Academia 13.0%
In 25 years, of the following options, in your opinion what is the likely impact of artificial intelligence/machine learning on the work of PSYCHIATRISTS?

- No influence (jobs will remain unchanged): 6.70%
- Minimal influence (jobs will change slightly): 42.10%
- Moderate influence (jobs will change substantially): 47.41%
- Extreme influence (jobs become obsolete): 3.79%

In your opinion what is the likelihood that future technology will able to replace human doctors to perform these tasks as well as or better than the average psychiatrist?

Here, we look at Q1S1v1 split as unlikely vs likely. There are only two tasks (outside the ± 2.5% margin of error) that the majority of respondents feel technology is likely to replace, highlighted in teal.

<table>
<thead>
<tr>
<th>Task</th>
<th>Unlikely</th>
<th>Likely</th>
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</thead>
<tbody>
<tr>
<td>Interview psychiatric patients in a range of settings to obtain medical history.</td>
<td>58%</td>
<td>42%</td>
</tr>
<tr>
<td>Perform a mental status examination.</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>Synthesize patient information to reach diagnoses.</td>
<td>46%</td>
<td>54%</td>
</tr>
<tr>
<td>Analyze patient information to detect suicidal thoughts.</td>
<td>52%</td>
<td>48%</td>
</tr>
<tr>
<td>Analyze patient information to detect acute homicidal thoughts.</td>
<td>58%</td>
<td>42%</td>
</tr>
<tr>
<td>Analyze patient information to establish prognoses.</td>
<td>49%</td>
<td>51%</td>
</tr>
<tr>
<td>Evaluate when to refer patients to outpatient versus inpatient treatment.</td>
<td>55%</td>
<td>45%</td>
</tr>
<tr>
<td>Formulate personalized medication and/or therapy treatment plans for patients.</td>
<td>53%</td>
<td>47%</td>
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<tr>
<td>Provide empathetic care to patients.</td>
<td>83%</td>
<td>17%</td>
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<tr>
<td>Provide documentation (e.g., update medical records) about patients.</td>
<td>25%</td>
<td>75%</td>
</tr>
</tbody>
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Possible Benefits:

• “Eliminate the human error; Less medical errors, more standardized protocols, better outcomes.”
• “The patient can answer more truthfully to artificial intelligence and to accept the encouragement-support more objectively.”
• “Making standardized plans and doing standard assessments.”
• “Less bias due to race or gender, can use big data more efficiently than humans.”
• “It will be of great benefit in areas where there is shortage of psychiatrists. Scalability of treatment.”
• “Providing practical guidance for beginners psychiatrists.”
• “AI will also help us elucidate etiologies of brain diseases that are currently opaque to us.”
Brief comments by psychiatrists about the potential harms of AI/ML in psychiatry

Risks/Disadvantages:

- “Lack of empathy/no humanity would jeopardize therapeutic process.”
- “AI won’t be able to assess patient’s mental status comprehensively, and therefore will lead to diagnostic and treatment errors.”
- “There is a possibility that the process for the machine to reach a diagnosis could turn into a black box process.”
- “There is a stigma associated with mental health treatment already and am not sure how talking to an AI would help.”
- “Less privacy and more fatalism in general.”
- “If time saved is used (by administrators) to increase psychiatrists' patient loads, it might lead to greater burnout.”
- “Risks of worsening dehumanization”, “worsening psychotic symptoms with avatars”
- “Physicians will forsake creative clinical thinking.”
Stigma: Can Virtual Human Interviewers Breaking Down Barriers?

N=29, After 1 yr deployment to Afghanistan

Lucas et al. Frontiers in Robotics & AI, 2017
Can AI detect Alzheimer’s disease 5 years before diagnosis?

- MCI subjects at risk for Alzheimer’s
- >30 baseline and longitudinal variables
  - Demographics
  - Cognitive testing
  - ADLs
  - Brain MRI variables
  - Beta-amyloid and Tau
  - FDG PET scan
- Unbiased multilayer clustering algorithm
- Validation in second dataset

Gamberger et al. Scientific Reports 7, 2017
Can AI/ML Predict a Future Depressive Episode?

A  Prediction of Depression in NHANES 2013-2014

B  Estimation of Depression in K-NHANES through a model trained with NHANES

Oh J et al. J Affective Dis 2019
Effect of Wearable Digital Intervention for Improving Socialization in Children With Autism Spectrum Disorder
A Randomized Clinical Trial

Catalin Voss, MS¹; Jessey Schwartz, BA²; Jena Daniels, BS³; et al


Faurholt-Jepsen M¹, Frost M², Christensen EM¹, Bardram JE³, Vinberg M¹, Kessing LV¹.

Abstract

BACKGROUND: Recently, the MONARCA I randomized controlled trial (RCT) was the first to investigate the effect of smartphone-based monitoring in bipolar disorder (BD). Findings suggested that smartphone-based monitoring sustained depressive but reduced manic symptoms. The present RCT investigated the effect of a new smartphone-based system on the severity of depressive and manic symptoms in BD.

METHODS: Randomized controlled single-blind parallel-group trial. Patients with BD, previously treated at The Copenhagen Clinic for Affective Disorder, Denmark and currently treated at community psychiatric centres, private psychiatrists or GPs were randomized to the use of a smartphone-based system or to standard treatment for 9 months. Primary outcomes: differences in depressive and manic symptoms between the groups.

RESULTS: A total of 129 patients with BD (ICD-10) were included. Intention-to-treat analyses showed no statistically significant effect of smartphone-based monitoring on depressive (B = 0.61, 95% CI -0.77 to 2.00, p = 0.38) and manic (B = -0.25, 95% CI -1.1 to 0.59, p = 0.56) symptoms. The intervention group reported higher quality of life and lower perceived stress compared with the control group. In sub-analyses, the intervention group had higher risk of depressive episodes, but lower risk of manic episodes compared with the control group.
LARGER SCALE PUBLIC-PRIVATE EFFORTS WILL BE REQUIRED
Remote Assessment of Disease and Relapse (RADAR-CNS)

PUBLIC RELEASE: 26-APR-2016

Smartphones and wearables could revolutionize medical care for people with brain disorders
New collaborative research program will explore potential of wearable devices to help prevent and treat depression, multiple sclerosis and epilepsy

RADAR-CNS is jointly led by King's College London and Janssen Pharmaceutica NV, funded by the Innovative Medicines Initiative (a Public Private Partnership established between the European Federation of Pharmaceutical Industries and Associations (EFPIA) and the European Union) and includes 24 organizations from across Europe and the US. The program brings together experts from diverse fields including clinical research, engineering, computer science, information technology, data analytics and health services.

5 years, ~22M Euros
Empowering 8 Billion Minds through Ethical Adoption of Technology

Video

https://vimeo.com/user100349956