

Addressing Adherence and Success Rates of a Digital Self-Help Intervention for Alcohol and Substance Use with Machine Learning



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Amsterdam Institute
for Addiction Research



Background

- Digital self-help interventions for reducing the use of alcohol, tobacco and other drugs
 - often positive results¹⁻⁵
 - low adherence⁶
- Different types of data can be used to predict adherence and success rates
 - Log data often shows high predictive value⁷
 - Machine Learning
- Ethical considerations

7. Sieverink, F., Kelders, S., Poel, M., and van Gemert-Pijnen, L. (2017a). Opening the black box of electronic health: collecting, analyzing, and interpreting log data. JMIR Res. Protoc.

Objectives



PREDICT

intervention adherence
and success



DETERMINE

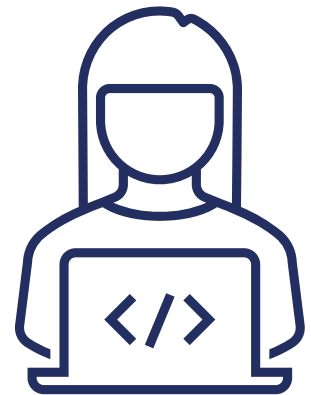
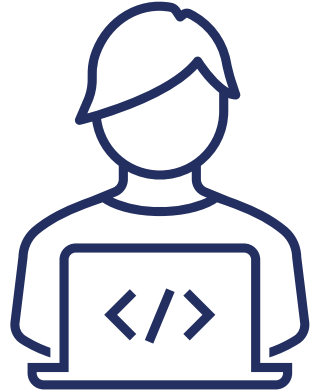
possible solutions to
improve these rates



EXPLORE

acceptability and ethical
issues in application
of ML in eHealth

Jellinek Digital Self-Help⁸



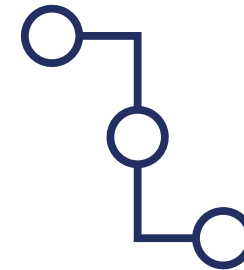
FASE 1	 START VIDEO	 VOOR- EN NADELEN	 AFSPRAKEN MAKEN	 JOUW AFSPRAKEN
FASE 2	 ONTWENNING	 MEMORY	 LEREN VAN TERUGVAL	 TERUGVALPLAN MAKEN
FASE 3	 HULP VAN ANDEREN	 RISICOSITUATIES	 JOUW RISICOSITUATIES	 QUIZ #1
FASE 4	 NEE ZEGGEN	 OMGAAN MET TREK	 PREVENTIEPLAN MAKEN	
FASE 5	 HELPEDE GEDACHTEN	 QUIZ #2	 GEDACHTEN	 GEDACHTEN OMBUIGEN

Methods – Predict through Machine Learning⁹

- Success
- Adherence



- Machine Learning models
 - Trained
 - Validated
 - Tested



9. Ramos L.A., Blankers M., van Wingen G., de Bruijn T., Pauws S.C. and Goudriaan A.E. (2021). *Predicting Success of a Digital Self-Help Intervention for Alcohol and Substance Use With Machine Learning*. *Front. Psychol.* 12:734633.

Results – Predict through Machine Learning⁹

ADHERENCE

>32.000
participants

± 20% completed
Module 1

SUCCESS

- Alcohol 30%
- Tobacco 24%
- Cannabis 22%

PREDICTORS

- Quitting substance use as a goal
- No drinking on weekends as a goal
- Initial daily consumption
- Intervention engagement

Ramos, Blankers, van Wingen, de Bruijn, Pauws, Goudriaan, 2021,
Frontiers in Psychology, special issue E-health and datascience



Methods – Determine possible solutions

- Focus group (n=5)
 - Intervention researchers
 - Clinicians



Results – Determine possible solutions

1

Promoting stopping rather than reducing

2

Sending daily emails to improve adherence

3

Abandoning the minimal 5 days of practice in a module before continuation

Results – Determine possible solutions

Er zijn twee mogelijkheden. Minderen of stoppen. Als je kiest voor minder en bepaal je zelf, per dag, het doel waar je naar toe wilt gaan werken. Kies je voor stoppen dan kan je er voor kiezen om geleidelijk of meteen te stoppen. Maak een keuze en ga naar de volgende stap.

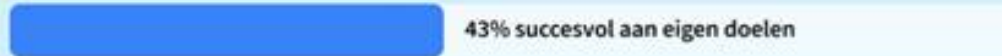


TIP

Deelnemers die in één keer (dit kan ook tijdelijk) stoppen met het drinken van alcohol hebben een grotere kans om hun doelen te behalen dan deelnemers die kiezen voor minder of voor geleidelijk stoppen.

Hoe ging het bij andere deelnemers?

Deelnemers die kiezen voor stoppen tijdens deelname



Deelnemers die kiezen voor minder



Deelnemers die kiezen voor geleidelijk stoppen tijdens deelname



Preliminary results: Log data study

Intervention adherence (drop-out at Module 2)

Before adjustments		After implementation 1		After implementation 2	
Dropout:					
Overall:	66.4%	57.2%	= -9.2%	37.9%	= -28.5%
Alcohol:	54.1%	44.1%	= -10.0%	31.8%	= -22.3%
Cannabis:	61.5%	52.6%	= -8.9%	42.5%	= -19.0%
Tobacco:	86.1%	77.0%	= -9.1%	45.1%	= -41.0%



Methods – Explore ethical issues



- Focus groups (n=10)
 - Jellinek Digital Self-Help participants
- Theoretical framework
 - Principles of biomedical ethics (Beauchamp & Childress, 2012)
 1. Autonomy
 2. Beneficence
 3. Nonmaleficence
 4. Justice

Preliminary Results – Explore ethical issues

AUTONOMY

- Tailoring
- Agency
- Liberty

I am confident that there is not only blind reliance on data and its interpretation by a machine, but also the human input.



Preliminary Results – Explore ethical issues

NONMALEFICENCE

- Transparency
- Privacy
- Trust in Machine Learning

That transparency about that you got that information from the algorithms [i.e., machine learning], I think that sometimes adds something, I think.

Conclusions

- Machine learning models better predicted drop-out than success rates
- Implementation of changes – based on focus group - enhances engagement:
- Ethical issues:

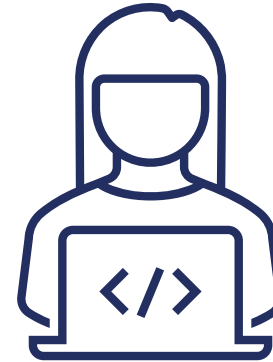
To be continued ...

Follow-up studies



QUANTITATIVE QUESTIONNAIRE

Ethical considerations



LOG DATA STUDY

Effects of changes to the
intervention on adherence
and success rates

Thank you! Any questions?



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>> www.aiar.nl <<



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9. Ramos L.A., Blankers M., van Wingen G., de Bruijn T., Pauws S.C. and Goudriaan A.E. (2021). Predicting Success of a Digital Self-Help Intervention for Alcohol and Substance Use With Machine Learning. *Front. Psychol.* 12:734633.
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