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Internet-based behavioural activation with lay counsellor support versus online minimal psychoeducation without support for treatment of depression: a randomised controlled trial in Indonesia

Retha Arjadi, Maaïke H Nauta, Willem F Scholte, Steven D Hollon, Neerja Chowdhary, Angela O Suryani, Cuno S P M Uiterwaal, Claudi L H Bockting

Summary

Background Depression is one of the leading contributors to the global burden of disease. However, treatment availability is often very poor in low-income and middle-income countries. In a randomised clinical trial, we investigated the efficacy of internet-based behavioural activation with lay counsellor support compared with online minimal psychoeducation without support for depression in Indonesia (a middle-income country).

Methods We did a community-based, two-group, randomised controlled trial in Indonesia. Eligible participants were aged 16 years or older, scored 10 or above on the Patient Health Questionnaire 9 (PHQ-9), met the criteria for major depressive disorder or persistent depressive disorder based on the Structured Clinical Interview for DSM-5, were proficient in Bahasa Indonesia, and could use the internet. Participants were randomly allocated (1:1) by a research assistant using a web-based randomisation program to online behavioural activation with lay support (termed Guided Act and Feel Indonesia [GAF-ID]) or online psychoeducation without further support. Randomisation was done within a random permuted block design and was stratified by sex and depression severity (ie, PHQ-9 10–14 vs ≥ 15). The primary outcome was self-reported PHQ-9 score at 10 weeks from baseline. Research assistants were masked to group allocation until after the assessment of the primary outcome. Interventions were described to participants during the consent procedure and after randomisation, but no indication was given as to which was the intervention of interest and which was the control. Analysis was by intention to treat. The trial was registered in the Netherlands Trial Register, number NTR5920. It is closed to new participants, and follow-up has been completed.

Findings Between Sept 6, 2016, and May 1, 2017, 313 participants were enrolled and randomly assigned, 159 to the GAF-ID group and 154 to the online psychoeducation group. At 10 weeks, PHQ-9 scores were significantly lower in the GAF-ID group than in the online psychoeducation group (mean difference -1.26 points [95% CI -2.29 to -0.23]; $p=0.017$), and participants in the GAF-ID group had a 50% higher chance of remission at 10 weeks (relative risk 1.50 [95% CI 1.19 to 1.88]; $p<0.0001$). An effect size of 0.24 for the GAF-ID group compared with the control group at 10 weeks was sustained over time (effect size 0.24 at 3 months, and 0.27 at 6 months). No adverse events were reported in either group.

Interpretation To our knowledge, ours is the first adequately powered randomised clinical trial of an internet-based intervention for depression in a low-income or middle-income country. Online behavioural activation with lay counsellor support efficaciously reduced symptoms of depression, and could help to bridge the mental health gap in low-income and middle-income countries.

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Introduction

Depression is a common mental health condition that not only impairs daily functioning, but also has negative effects on society and economic output.¹ Depression affects approximately 4.4% of the world's population and is one of the leading causes of the global burden of disease.^{1,2} In low-income and middle-income countries (LMICs), the prevalence of depression is reported to be around 4.2%.¹ However, treatment availability is far from ideal in many countries, and especially in LMICs—an issue known as the mental health gap.² LMICs often

have poor access to essential psychopharmacological treatments and have fewer mental health professionals available per inhabitant compared with high-income countries. Furthermore, the distance to mental health-care facilities can be large. According to a report³ published in 2016, India and China, the two most populous countries, have deficits of more than 90% in availability of mental health treatment.

The need to promote treatment availability for mental health problems in Indonesia is widely recognised, and Indonesia is one of the LMICs listed in WHO's mental

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Research in context

Evidence before this study

The main evidence base for this trial was a systematic review published in 2017 about all types of digital technology for treatment and prevention of mental disorders in low-income and middle-income countries. Of the 49 studies included in that narrative review, two were randomised controlled trials in which the internet was used for non-pharmacological treatment of depression (both were done in Romania). In one, online concreteness cognitive training was compared with waitlist (n=42; Cohen's d -0.16); in the other, online cognitive behavioural therapy was compared with treatment as usual (n=27; Cohen's d 0.49). To update this evidence base, we searched PubMed and PsycINFO with the medical subject heading terms "internet", "online therapy", "intervention", "psychotherapy", "randomized controlled trial", and "clinical trial", combined with free text "developing countr*", "LMIC", "LAMIC", "LAMI countr*", "LMI countr*", "low income countr*", "middle income countr*", "low-middle income countr*", "lower-middle income countr*", "upper-middle income countr*", and each country on the World Bank's list of low-income and middle-income countries, for articles published in any language between Sept 1, 2016, and Feb 28, 2018. We also did free-text searches with the terms "internet" or "online" or "web-based" or "electronic mail*" or "e-therapy" or "web" or "self-help" or

"website or computer*" or "e-health" or "e-mental health" in combination with "LAMIC" or "LMIC" or "LAMI countr*" or "LMI countr*" or "low income countr*" or "middle income countr*" or "low-middle income countr*" or "lower-middle income countr*", and "upper-middle income countr*", and searched the reference lists of papers identified by our searches. We identified no further relevant articles with this search.

Added value of this study

To our knowledge, ours is the first well powered randomised clinical trial in which the efficacy of a psychological intervention for depression was assessed in a low-income or middle-income country, with participants recruited from the community. Internet-based behavioural activation with lay counsellor support was significantly more efficacious than online psychoeducation without support at reducing symptoms of depression as measured by the Patient Health Questionnaire 9.

Implications of all the available evidence

Internet-based behavioural activation intervention with non-specialist support could be used to bridge the mental health gap in low-income and middle-income countries, and have the potential to reach populations with little or no access to mental health care.

health Gap Action Program.² The point prevalence of depression in Indonesia is approximately 3.7%,¹ but the availability of mental health workers is low—3.1 per 100 000 people.⁴ This availability is in line with that in most other LMICs, but substantially lower than that in high income countries (eg, 45.7 per 100 000 in the Netherlands, 125.2 per 100 000 in the USA, and 318.9 per 100 000 in the UK).⁴ Furthermore, because Indonesia is an archipelago with five big islands and more than 1000 smaller islands, mental health facilities are unequally distributed. Therefore, innovative strategies to address the mental health gap and increase access to treatment in Indonesia might be useful—eg, use of technology to facilitate access, in combination with delivery by non-specialists.⁵

Guided Act and Feel Indonesia (GAF-ID) is an internet-based intervention for depression that is guided by trained lay counsellors and based on a treatment protocol of behavioural activation that has been adapted for the Indonesian context.⁶ Behavioural activation is an effective treatment for depression compared with control conditions (ie, waitlist and other non-treatment options, including minimal contact and placebo) according to the results of a meta-analysis,⁷ which showed a standardised mean differences effect size of 0.78. It can be feasibly delivered via the internet in high-income countries.⁸ However, a 2018 meta-analysis⁹ showed that, when corrected for biases (ie, risk of bias, publication bias, and exclusion of waitlist control group), the effect size

(Hedges' g) of psychological interventions for depression ranged from 0.24 to 0.38 compared with care as usual and other non-waitlist control conditions. The deployment of lay counsellors to deliver behavioural activation was feasible in India in a study¹⁰ in which the addition of behavioural activation delivered by lay counsellors to enhanced usual care was more efficacious than enhanced usual care alone. The use of lay counsellors is particularly noteworthy in view of the scarcity of available resources.²

The internet has been successfully used as the delivery medium for behavioural activation in high-income countries.¹¹ However, its potential is still neglected in LMICs, although access is growing, which makes internet-based interventions increasingly feasible. 132.7 million people in Indonesia (roughly 50% of the population) use the internet,¹² and the number is increasing. The authors of a narrative systematic review¹³ identified 49 studies in which digital technologies (mobile, online, or other technology including mobile phones, smart phones, internet-based programs, tele-psychiatry, text messaging, remote sensing, wearable devices, and mobile applications) were used in the context of mental health care in LMICs: 13 studies of support for clinical care and education of health workers, four studies of assessment, 13 studies of treatment adherence and support for recovery, 13 studies of self-help, and six studies of treatment and prevention of substance use. In terms of internet-based intervention

studies specifically, the review included two small randomised controlled trials^{14,15} of treatment of depression or depressive symptoms, both done in Romania. In one (n=42),¹⁴ online concreteness cognitive training was compared with waitlist (Cohen's d -0.16); in the other (n=27), online cognitive behavioural therapy was compared with treatment as usual (Cohen's d 0.49). In general, study quality and the mental health problems that were targeted varied substantially among included articles, and the authors of the review concluded that continued research is needed to rigorously assess the effectiveness of digital innovations in LMICs.¹³

In this randomised clinical trial, we examined the efficacy of GAF-ID compared with online psychoeducation delivered without support. We hypothesised that, compared with online psychoeducation, GAF-ID would more efficaciously reduce depressive symptoms (our primary outcome).

Methods

Study design and participants

We did a community-based, country-wide, two-group randomised controlled trial in Indonesia. Eligible participants were aged 16 years or older, scored 10 or above on the Patient Health Questionnaire 9 (PHQ-9; the standard cut-off recommended in the PHQ-9 manual, with sensitivity of 88% and specificity of 88% for major depression¹⁶), met the criteria for major depressive disorder or persistent depressive disorder based on the Structured Clinical Interview for DSM-5 (SCID-5), were proficient in Bahasa Indonesia, and could use the internet. Exclusion criteria (all based on SCID-5) were current substance use disorder, current or previous manic or hypomanic episodes or psychotic disorder, and acute suicidality (defined as a suicide plan with preparatory behaviour). People who were currently being seen at least weekly for psychological interventions were also excluded. Current medication treatment for mental health problems was allowed, and was checked at enrolment and again during the final interview.

The trial protocol is publicly available,⁶ and the trial was preregistered. The Tarumanagara University Human Research Ethics Committee (PPZ20152002), and the Research Ethics Committee at the Institute of Research and Community Service, Atma Jaya Catholic University of Indonesia (942/III/LPPM-PM.10.05/09/2016) provided ethical approval for the study. Active written informed consent was obtained online before randomisation from all participants via Qualtrics. For participants younger than 18 years, online active written informed consent was also provided by their legal guardians.

Randomisation and masking

Participants were recruited from the Indonesian community through mass media advertisements (banners placed in various websites and places throughout the country), social media (online communities, forums,

and pages about mental health), and referral from mental health institutions or mental health professionals (both flyers and word of mouth). Potential participants could access extensive information on the trial website, and, if they were interested, could complete the screening assessment (PHQ-9) via a linked Qualtrics online survey platform. No face-to-face screening methods were used. Those who scored 10 or higher were then contacted via email to make sure that they understood all aspects of the trial and, if so, were invited to join a clinical interview, in which SCID-5 was administered via phone calls by trained clinical interviewers with a minimum of a Bachelor's degree in psychology.

Participants were randomly allocated (1:1) by a research assistant to GAF-ID or online psychoeducation via a web-based randomisation program built by an independent developer for this trial. Randomisation was done within a random permuted block design stratified by sex and depression severity (score 10–14 vs score ≥15 on PHQ-9). The stratification variables were chosen a priori as possible moderators of treatment effects. Within each of the four sex–severity strata, randomisation was done in random sized blocks of 8–16 participants. None of the research assistants, including the assistant who did the randomisation, were informed about the random size of the blocks and exact strata, to ensure that the underlying algorithm remained unpredictable.

The two interventions were described to participants during the consent procedure, but no indication was given as to which was the intervention of interest and which was the control. After randomisation, participants were given more detailed descriptions of the group to which they were assigned, but still no indication of which was the intervention of interest and which was the control.

The research assistants who did the clinical interviews after randomisation were not involved in the intervention process and were masked to participants' treatment condition (participants were also asked not to reveal their treatment condition during the interviews). At the end of the final interview (10 weeks after baseline), research assistants were asked to guess the treatment allocation of each participant they interviewed, and were then no longer blinded to allocation. All subsequent assessments were self-reported.

Procedures

Participants in the GAF-ID group received an internet-based behavioural activation intervention supported by lay counsellors. The intervention was made available via a secure online platform, which was built by an independent professional intervention website developer in the Netherlands. Each participant was provided with a personal username and password to log in to the program, which could be accessed on a tablet, mobile phone, or computer (the interface display worked best on a computer). The GAF-ID program was adapted from the original Dutch version of an online behavioural activation

For the trial website see
www.actandfeel.com

For the secure online platform
see www.actandfeelindonesia.com

intervention, *Doe en Voel* (which translates as Act and Feel).¹⁷ The content was based on Lewinsohn's theory¹⁸ that depression results from low rates of response-contingent positive reinforcement. It focuses on monitoring of daily mood and activities, followed by encouraging users to do pleasurable, mood-independent, pre-planned activities.¹⁸ The program consists of a series of eight weekly structured modules that can be completed in 30–45 min per module, including psychoeducation about depression and the basic background of behavioural activation, monitoring mood and behaviour or activities, expansion of potential mood-independent pleasurable activities and overcoming the difficulties during the process, getting insight into the effect of avoidance behaviour, and building a strategy for relapse prevention.⁶

After discussions within the research team and suggestions from the Indonesian clinical psychologists and lay counsellors who worked on this study, we made some practical and cultural adaptations to the program before the start of the study, although these changes did not affect the sequence or basic content of the modules. Because of the low speed of Indonesian internet connections, we replaced therapist video clips and client example videos with a series of illustrations. We changed the examples of assignments used to make them fit better with Indonesian culture (eg, going to the market instead of walking your dog in the park). Text fragments were shortened as much as possible and were sometimes replaced with cartoons. People of various ages, sexes, and education levels tested the adapted version for acceptability and usability. Based on their feedback, we made additional adaptations to the wordings, shortened texts further, and added more cartoons. All participants in the GAF-ID group used this final version.

Lay counsellors provided guidance to each participant in the GAF-ID group. Lay counsellors were supervised by a licensed clinical psychologist during their work. A detailed description of the recruitment and training of the lay counsellors and clinical psychologists is provided in the trial protocol.⁶ Lay counsellors provided more explanation about the assignments if needed, gave feedback on assignments for each module (approximately 30–60 min per week for each participant), and reminded participants weekly to log in to the program regularly (via online messaging, chat, or email). Contact was made mainly via the intervention platform's messaging facility, but other methods outside the platform could be used (eg, chat, email) if participants preferred. To encourage adherence, lay counsellors also made several pre-planned brief contacts (20 min maximum) via phone calls during the intervention process (weekly during the first 4 weeks, at week 6, and at week 8). No face-to-face contact took place. The lay counsellors sent weekly reports about participants' progress to the supervising clinical psychologists. They discussed difficulties and

challenges in supporting participants—for instance, issues of low motivation and suicidality—with the supervising psychologists during regular supervision meetings (approximately 30–60 min per week per counsellor). Lay counsellors could also contact clinical psychologists via email or chat for brief discussions when necessary.

Participants in the online psychoeducation group were provided with a personal username and password to access a different platform comprising basic psychoeducation about depression and simple tips on how to handle the condition in general. The same psychoeducation was also integrated into the first module of GAF-ID. The online psychoeducation platform was compiled from freely accessible online sources, which we translated into Bahasa Indonesian. No lay support was provided to the participants in this group. Reimbursement for the cost of internet access was provided to participants in both groups, when necessary.

All participants underwent identical self-report assessments at baseline and every 2 weeks thereafter up to the main post-test assessment at week 10, with follow-up 12 weeks and 24 weeks after baseline. All assessments were done online via Qualtrics, with a private link emailed to participants at each timepoint. Additionally, clinical interviews to assess remission via phone call were done at baseline and at 10 weeks. Adverse events, including suicidality and serious deterioration (ie, an increase in PHQ-9 scores of at least 5 points and a total score of at least 15 points that persists 2 weeks later), were also assessed. Clinical psychologists did suicide-risk assessments in all participants who reported two consecutive increased scores on the PHQ-9 suicide item "Thoughts that you would be better off dead or of hurting yourself in some ways". In case of acute suicidality and serious deterioration, participants were provided with appropriate referral information to mental health professionals, but asked to continue with the intervention and the assessments.

Outcomes

The primary outcome was the self-reported level of depressive symptoms 10 weeks after baseline, as measured by the PHQ-9, which consists of nine items with scores ranging from 0 to 27.⁶ Secondary outcomes were PHQ-9 scores at 3 months and 6 months; remission of a depressive episode based on the SCID-5 at 10 weeks;¹⁹ and depressive symptoms measured by the Indonesian version of the Inventory of Depressive Symptomatology Self Report,²⁰ fear and avoidance level as measured by the Fear Questionnaire,²¹ perceived social support as measured by the Multidimensional Scale of Perceived Social Support,²² and quality of life as measured by the brief version of the WHO Quality of Life²³ at 10 weeks, 3 months, and 6 months. A detailed description of the assessments is available in

the trial protocol;⁶ mediation analyses of potential mechanisms will be reported elsewhere.

Statistical analysis

Statistical power was calculated to detect differences between two independent groups, in a two-sided test with an α of 0.05 and a power of $1-\beta=0.80$, for an effect size of 0.35 (we chose a small-to-medium effect size because this study was done in a unique target population with insufficient information from similar previous studies). Allowing for 20% attrition, we aimed to recruit 312 participants at baseline. Analyses were done on an intention-to-treat basis. Range and mean of the total number of log-in encounters were calculated to represent participants' engagement in the online program. We did linear mixed modelling analysis with the restricted maximum likelihood estimation method for fixed (treatment and time) and random (participant) effects to examine the treatment effect by looking at the difference between the two groups in primary and secondary outcomes based on estimated marginal means from baseline. We analysed longitudinal within-participant data with missing values by linear mixed modelling because this method incorporates all available data to prevent complete-case bias.²⁴ We reported relative risk (RR) and 95% CIs for the number of patients who recovered from depressive disorder in the GAF-ID compared with the control group. We also used linear mixed modelling analysis for sensitivity analyses of treatment completers (ie, participants who finished at least five of the eight modules of the GAF-ID program, a cutoff commonly used in previous studies²⁵). Effect sizes (Cohen's *d*) were calculated by dividing the estimated mean difference (from baseline to 10 weeks, 3 months, and 6 months) reported from the linear mixed model results by the pooled SD at baseline.

We did additional post-hoc subgroup analyses for all potential moderators (ie, number of previous depressive episodes, current post-traumatic stress disorder, negative life events, ethnic group, and connection to ethnic groups). Each moderator was investigated separately by including patient-by-treatment interaction terms and testing their significance with the Hayes Process tool (model 1).²⁶ The results of these analyses should be interpreted with caution, however, because the study was not powered to test for moderation. The two-sided level of significance was set at 0.05, with 95% CIs for all analyses. All linear mixed modelling analyses were done with SPSS (version 23.0). This trial was registered in the Netherlands Trial Register, number NTR5920.

Role of the funding source

The study funders had no role in study design; data collection, analysis, or interpretation; or writing of the report. RA, MHN, CSPMU, and CLHB had full access to all study data. All authors had final responsibility for the decision to submit for publication.

Figure 1: Trial profile

PHQ-9=Patient Health Questionnaire 9. SCID-5=Structured Clinical Interview for DSM-5. GAF-ID=Guided Act and Feel Indonesia.

	Guided Act and Feel Indonesia (n=159)	Online psychoeducation (n=154)
Mean age (SD)	24.45 (4.93)	24.52 (5.22)
Sex		
Male	31 (19%)	29 (19%)
Female	128 (81%)	125 (81%)
Ethnicity		
Java	69 (43%)	64 (42%)
Tionghoa	30 (19%)	18 (12%)
Sunda	21 (13%)	22 (14%)
Batak	8 (5%)	15 (10%)
Minangkabau	8 (5%)	6 (4%)
Other (19 ethnicities)	23 (14%)	29 (19%)
Place of residence		
Java	138 (87%)	140 (91%)
Sumatra	10 (6%)	6 (4%)
Kalimantan	3 (2%)	2 (1%)
Sulawesi	3 (2%)	2 (1%)
Bali	3 (2%)	1 (1%)
Overseas	2 (1%)	3 (2%)
Area		
Urban	93 (58%)	96 (62%)
Suburban	65 (41%)	57 (37%)
Rural	1 (1%)	1 (1%)
Marital status		
Not married	141 (89%)	135 (88%)
Married	17 (11%)	16 (10%)
Divorced or widowed	1 (1%)	3 (2%)
Education level		
Junior high	3 (2%)	2 (1%)
Senior high	61 (38%)	59 (38%)
Vocational	6 (4%)	12 (8%)
Bachelor's degree	76 (48%)	73 (47%)
Master's degree	13 (8%)	8 (5%)
Socioeconomic status*		
Low	32 (20%)	27 (18%)
Middle	98 (62%)	100 (65%)
High	29 (18%)	27 (18%)

(Table 1 continues in next column)

Results

Between Sept 6, 2016, and May 1, 2017, 1814 people took the screening PHQ-9 and 517 completed the clinical interview based on the SCID-5 (figure 1). Of the 382 people who were eligible for inclusion, 313 were enrolled and randomly allocated, 159 to the GAF-ID group, and 154 to the online psychoeducation group (figure 1). Baseline characteristics of enrolled participants were similar in both intervention groups (table 1). No participants were taking medications for mental health problems at enrolment or at their final interviews. At the final interview 10 weeks from baseline, the allocations of 179 (68%) of 265 participants (120 in the GAF-ID and 145 in the online psychoeducation group) were correctly guessed by the research assistants.

	Guided Act and Feel Indonesia (n=159)	Online psychoeducation (n=154)
(Continued from previous column)		
Occupation		
Unemployed	18 (11%)	6 (4%)
Professional	3 (2%)	7 (5%)
Private employee	56 (35%)	48 (31%)
Civil employee	6 (4%)	3 (2%)
Entrepreneur	4 (3%)	4 (3%)
Freelancer	13 (8%)	17 (11%)
Student	57 (36%)	63 (41%)
Housewife	2 (1%)	6 (4%)
Patient Health Questionnaire 9		
Mean score (SD)	17.92 (5.38)	18.01 (5.05)
Category		
Mild (10–14)	46 (29%)	39 (25%)
Moderate (15–19)	45 (28%)	55 (36%)
Severe (20–27)	68 (43%)	60 (39%)
Comorbidity with post-traumatic stress disorder†		
Yes	22 (14%)	30 (19%)
No	137 (86%)	124 (81%)
Comorbidity with anxiety‡		
Yes	67 (42%)	75 (49%)
No	92 (58%)	79 (51%)

Data are n (%), unless otherwise specified. *Socioeconomic status was based on monthly household expenditure.²⁷ †Diagnosed with Structured Clinical Interview for the DSM-5. ‡Diagnosed with the Fear Questionnaire (cutoff for anxiety=30).²⁸

Table 1: Baseline characteristics

Men and boys tended to decline participation in the study more often than females, but we noted no differences in terms of enrolment or declining to participate by age or depression level (appendix). 39 (25%) participants dropped out of the GAF-ID group and nine (6%) from the control group; thus 120 participants received the GAF-ID intervention and 145 participants received online psychoeducation. The frequency of dropouts differed significantly between groups (χ^2 21.03; $p < 0.0001$). Participants who dropped out were significantly less depressed at baseline than those who remained in the study, but we noted no significant differences in terms of age or sex between those who remained in the study and those who left (appendix).

Participants in the GAF-ID group logged into the program a median of 13 times (IQR 14; range 1–52; mean 13.93 [SD 10.92]), completed a mean of five modules, and received a mean of 150 min telephonic support from lay counsellors. In the online psychoeducation group, participants logged in a median of two times (IQR 2; range 1–10; mean 2.36 [SD 1.74]).

At 10 weeks, self-reported depressive symptoms as measured by PHQ-9 were lower in the GAF-ID group than in the online psychoeducation group (estimated mean difference -1.26 [95% CI -2.29 to -0.23];

See Online for appendix

Cohen's d 0.24; $p=0.017$; table 2). The mean PHQ-9 score at 10 weeks was 8.50 (SD 5.75) in the GAF-ID group and 10.83 (6.21) in the online psychoeducation group. Scores on the Indonesian version of the Inventory of Depressive Symptomatology Self Report were also substantially lower in the GAF-ID group than in the control group at 10 weeks (estimated mean difference -2.48 [95% CI -4.74 to -0.22 ; Cohen's d 0.24; $p=0.031$; table 2).

The GAF-ID group had a 50% higher chance of remission from a depressive episode based on SCID-5 interview than the control group at 10 weeks (78 [65%] of 120 vs 63 [43.4%] of 145; RR 1.50 [95% CI 1.19–1.88]; $p<0.0001$). The number needed to treat was 4.6 in the GAF-ID group compared with the control group. Quality of life as measured by the brief version of the WHO Quality of Life at 10 weeks was also higher in the GAF-ID group than in the control group (estimated mean difference 3.02 [95% CI 0.81–5.23]; Cohen's d 0.30; $p=0.008$; table 2). Results on the Fear Questionnaire and the Multidimensional Scale of Perceived Social Support did not differ significantly between groups at 10 weeks. Sensitivity analyses done in the 92 treatment completers who completed at least five GAF-ID modules had similar findings (appendix).

Treatment response was not moderated by any baseline patient characteristics (appendix). 47 (15%) participants reported increased suicide scores from baseline, but none reported serious deterioration on the self-report measures throughout follow-up. Based on our clinical psychologists' assessments, no one was acutely suicidal and therefore no participants were referred to mental health professionals.

Depressive symptoms as measured by PHQ-9 were reduced in the GAF-ID group compared with the online psychoeducation group at 3 months (estimated mean difference -1.24 [95% CI -2.29 to -0.19]; Cohen's d 0.24; $p=0.021$) and 6 months (-1.39 [-2.40 to -0.39]; 0.27; 0.007; figure 2; table 3). Sensitivity analyses for follow-up measures were done in 92 treatment completers; findings were largely similar to those of the main analyses (appendix).

Discussion

To our knowledge, ours is the first study of internet-based behavioural activation for depression in Indonesia. Our study showed that internet-based behavioural activation supported by lay counsellors can reduce depressive symptoms and induce remission from a depressive episode more efficaciously than unsupported online psychoeducation in people with depression who live in LMICs. Our findings are in line with those of a previous study²⁹ in a high-income country (Germany), in which an internet-based psychological intervention was superior to psychoeducation alone in reducing depression. In a previous small study¹⁵ in another LMIC (Romania), an internet-based intervention produced

	Mean difference (95% CI) or relative risk (95%) of GAF-ID vs online psychoeducation (95% CI)	p value
Primary outcome		
Patient Health Questionnaire 9	-1.26 (-2.29 to -0.23)	0.017
Secondary outcomes		
Structured Clinical Interview for DSM-5	1.50 (1.19 to 1.88)	<0.0001
Inventory of Depressive Symptomatology Self-Report	-2.48 (-4.74 to -0.22)	0.031
Fear Questionnaire	-1.32 (-4.60 to 1.95)	0.427
Multidimensional Scale of Perceived Social Support	1.79 (-1.32 to 4.89)	0.258
Brief version of WHO Quality of Life	3.02 (0.81 to 5.23)	0.008

GAF-ID=Guided Act and Feel Indonesia.

Table 2: Treatment effect of GAF-ID vs online psychoeducation from linear mixed model 10 weeks after baseline

Figure 2: Change from baseline to end of follow-up in PHQ-9 scores with GAF-ID vs online psychoeducation
PHQ-9=Patient Health Questionnaire 9. GAF-ID=Guided Act and Feel Indonesia.

greater reduction in depression symptoms than did treatment as usual.

The effect size of 0.24 at 10 weeks for GAF-ID versus online psychoeducation in this study is lower than reported effect sizes in meta-analyses of face-to-face behavioural activation interventions⁷ and more general internet-based interventions for depression.¹¹ However, it is similar to the reported effect size in a meta-analysis⁹ of face-to-face interventions after adjustment for biases, and the effect size was sustained for at least 6 months. Furthermore, comparisons to waitlist usually yield larger effects than comparisons to other interventions, ranging from 0.74 to 1.81 for face-to-face behavioural activation⁷ and from 0.61 to 1.13 for internet-based interventions.¹¹ In our study, we compared GAF-ID with online psychoeducation, with identical assessment in both groups. The number needed to treat suggests that, relative to online psychoeducation, GAF-ID generated one additional remission for every five people treated.

Our findings suggest the potential of online behavioural activation interventions combined with task shifting by

	3 month follow-up		6 month follow-up	
	Mean difference GAF-ID vs online psychoeducation (95% CI)	p value	Mean difference GAF-ID vs online psychoeducation (95% CI)	p value
Primary outcome				
Patient Health Questionnaire 9	-1.24 (-2.29 to -0.19)	0.021	-1.39 (-2.40 to -0.39)	0.007
Secondary outcomes				
Inventory of Depressive Symptomatology Self-Report	-2.55 (-4.93 to -0.17)	0.036	-3.18 (-5.51 to -0.86)	0.007
Fear Questionnaire	-1.48 (-4.72 to 1.75)	0.369	-1.08 (-4.23 to 2.07)	0.500
Multidimensional Scale of Perceived Social Support	2.02 (-1.03 to 5.07)	0.194	1.84 (-1.20 to 4.89)	0.235
Brief version of WHO Quality of Life	2.48 (0.20 to 4.76)	0.033	2.35 (0.09 to 4.62)	0.042

The mean differences are based on estimated marginal means. GAF-ID=Guided Act and Feel Indonesia.

Table 3: Treatment effect of GAF-ID vs online psychoeducation from linear mixed model at 3-month and 6-month follow-up

lay counsellor support as recommended by WHO³⁰ to bridge the mental health gap in LMICs.³¹ However, we cannot rule out the possibility that the additional effect of GAF-ID could be explained by the support added to GAF-ID. Future studies should examine whether the effects recorded could be attributed to the additional support given to the GAF-ID group rather than the content of the GAF-ID intervention.

Our study has several limitations. Participants anecdotally reported that some features of the GAF-ID program were not fully accessible from mobile phones (eg, embedded slide shows were not appropriately displayed), so they had to use computers or tablets interchangeably with their mobile phone to finish the program. Because 72% of web traffic in Indonesia is via mobile phone,³² we recommend that future studies assess programs that are fully accessible on mobile phones or that are built as apps. With regard to blinding procedures, research assistants were no longer blinded to allocation after the final interviews at 10 weeks. Unblinding could have influenced the ratings on the clinical interviews. However, because the results were in line with self-report data at 10 weeks, we think that such bias is unlikely.

We did not aim to recruit participants with specific demographic characteristics. Most participants lived on Java, yet came from and represented various cultural backgrounds in Indonesia (table 1). However, our sample consisted largely of relatively young, highly educated individuals who were likely to be internet literate and could have been more aware of mental health than older or less well educated people. 99% of participants lived in urban or suburban areas of Indonesia, compared with 54% of the Indonesian population overall.³³ Internet penetration in Indonesia is 72.41% in urban areas, 49.49% in suburban areas, and 48.25% in rural areas.³⁴ Therefore, our findings might not be generalisable to non-urban populations or to people who do not yet have internet access. To counter such limitations, and in line with WHO's recommendation to increase access and dissemination through the mental health Gap Action Program,² more effort should be made in future studies

to make internet-based interventions accessible for a broader swathe of the population, including people of low socioeconomic status who live in rural areas and have restricted internet access. The potential of internet-based interventions for remote populations can be maximised by reaching local community health centres—which was done for a face-to-face intervention in LMICs³⁰—whereby information about depression and available internet-based intervention could be delivered, and a computer with internet access along with technician support could be provided. Such an intervention could also be combined with structured phone call support from lay counsellors, as was done in our study. In a global context, replication of our study in other LMICs, preferably including cost-effectiveness analyses, is recommended as a next step to reduce the global mental health gap.

In our study, depressive symptoms decreased in both groups, but decreased significantly more in the GAF-ID group than in the control group (appendix). Because we did not include an inactive control group (ie, waitlist or treatment as usual), we cannot be sure whether symptom reduction in the control group was because of the passage of time or regression to the mean, the effect of screening and assessments throughout the study, or the psychoeducation content. This uncertainty has implications for future studies and potentially for implementation. Replication of our study with an additional control arm (waitlist or treatment as usual) is recommended. Studies could also be done in which unsupported psychoeducation is compared with waitlist or treatment as usual to establish whether online psychoeducation alone can produce substantial improvements in mental health in LMICs. Both GAF-ID and online psychoeducation could be delivered online to bridge the mental health gap in LMICs. Alternatively, a stepped-based approach of psychoeducation followed by GAF-ID (in case of non-response to online psychoeducation) could be considered.

The drop-out rate was higher in the intervention group than in the control group, a pattern that is frequently reported in studies of internet-based

interventions.¹¹ The increased frequency of dropout in the intervention group in our study was probably because of the greater demands put on participants in the GAF-ID group compared with those in the psychoeducation group. Some participants in the GAF-ID group anecdotally reported a burden with regard to the demand to login into the program and do the assignment every week, whereas no such requirement applied to the online psychoeducation group. Although rates of participant engagement in this study might seem low, they were actually relatively high for a study of internet-based interventions, with reported drop-out rates of up to 43% for the active intervention and an average of 8% for active control interventions in other studies.¹¹ Some possible explanations for the relatively low frequency of dropouts in our study are related to access, cost, and the intervention's ability to hold engagement.³⁵ We introduced internet-based intervention as a source for mental health services with no face-to-face contact and at zero cost (although no one accepted our offer to reimburse the costs of internet access). We also made the program as attractive as possible and provided human supports (lay counsellors), who were available to help throughout. Future studies and implementation should look for ways to increase participant engagement.

In conclusion, our internet-based intervention with support from lay counsellors has large potential for widespread dissemination, and could help to bridge the mental health gap in LMICs. Our study is a crucial first step towards empirical evidence for delivery via the internet of easy accessible minimal interventions, which have the potential to reach a broad population with little or no access to mental health care.⁵

Contributors

RA, MHN, and CLHB designed the trial, developed the intervention content, and oversaw trial conduct. RA, MHN, AOS, and CLHB chose the data collection instruments. RA managed the database. RA, MHN, CSPMU, and CLHB were responsible for data analyses. RA drafted the Article, which was reviewed and approved by all other authors.

Declaration of interests

MHN reports grants from the Indonesia Endowment Fund for Education (the grant was awarded to RA to do her PhD at the University of Groningen) during the study, and developed and translated cognitive behavioural therapy treatment manuals, including a blended internet-based treatment program unrelated to the current project, for which she receives no direct payments. MHN also reports travel expenses, some subsistence, and speaker honoraria for lectures or clinical training workshops paid for by mental health centres. CLHB developed the intervention used in this study, but does not receive any direct payment from it. She reports grants from the Indonesia Endowment Fund for Education (the grant was awarded to RA to do her PhD at the University of Groningen) during the study, is a member of the Dutch multi-disciplinary guideline for anxiety and depression (non-remunerated), a co-editor of *PLoS One* and *European Psychology* (non-remunerated), and a member of the scientific board in the Dutch national statutory insured package, for which she receives an honorarium. She has received honoraria for keynote addresses at the European Association for Behavioural and Cognitive Therapies, the European Psychiatry Association, and the European Conference Association, and for clinical training workshops (paid by mental health centres), and receives book royalties. All other authors declare no competing interests.

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