THE LANCET Psychiatry

Supplementary appendix
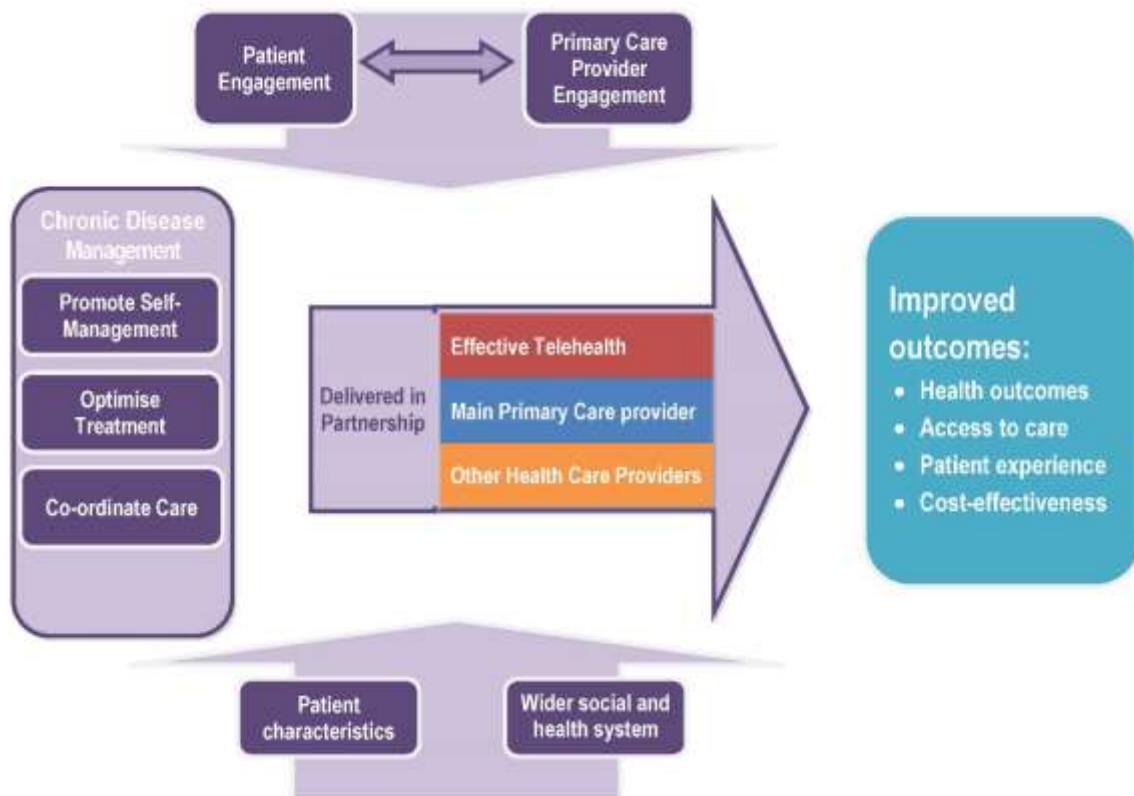
This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Effectiveness of an integrated telehealth service for patients with depression: a pragmatic randomised controlled trial of a complex intervention

Appendices

Appendix 1. Telehealth in chronic disease (TECH) model

Reproduced from Salisbury C, Thomas C, O'Cathain A, Rogers A, Pope C, Yardley L, *et al*. TElehealth in CHronic disease: mixed-methods study to develop the TECH conceptual model for intervention design and evaluation. *BMJ Open* 2015; 5:e006448. doi:10.1136/bmjopen-2014-006448 with permission from BMJ Publishing Group Ltd

Appendix 2 Use of the TECH model to design the Healthlines Service intervention for patients with depression

Model element	Strategies included in intervention
Engagement	
Patient	Provide a 'Welcome Pack'. Emphasise that support with technology will be provided.
	Healthlines advisors provide technical support e.g. with getting logged in to websites.
	Promote the advantages to patients of using Healthlines, based on perceived advantages identified in qualitative research and other literature, and address perceived disadvantages.
	Encourage sense of personal care through seeking to maximise continuity of care from named Healthlines advisor.
	Regular positive reinforcement through monthly telephone calls from Healthlines advisor.
	Encourage sense of partnership between patient, Healthlines Service and GP through frequent communication.
Health professional	All communications seek to reinforce the message that the Healthlines Service is supporting and delivered alongside primary care.
	Regular communication with primary care.
	Messages to primary care continually emphasise evidence-based nature of interventions and guidance.
Promoting self-management	
Behaviour change techniques	Telephone encounters support use of the Living Life to the Full cognitive behaviour course, with additional modules relating to alcohol, exercise, relapse prevention. Intervention is tailored to patient's needs and goals.
Self-monitoring	Depression: Patients using Living Life to the Full regularly monitor their progress with self-assessment modules.
Feedback	Telephone encounter scripts provide positive reinforcement of progress.
Provide patient information	Healthlines advisor works with patients to identify goals and then emails them links to further resources available on the Internet which have been quality assessed (e.g. alcohol advice, patient forums).
Promote self-efficacy	Using motivational interviewing approach, identify motivating factors, encourage action plans and goal setting.
Motivational interviewing	All Healthlines advisors undertake motivational interviewing training.
Shared decision making	Provide information about advantages and disadvantages of treatments, encourage patients to discuss options with GP, share letters to GPs with patients.
Personal support from health professionals	As far as possible, provide continuity of care from one named Healthlines advisor rather than an anonymous 'call-centre' approach.

Peer support	Patients are offered option to access Big White Wall, an online forum for patients with depression.

Treatment optimisation

Risk stratification	Assessment using PHQ-9 and advice about treatment in relation to severity. Also used to assess suicidal risk with use of a protocol for escalation and more detailed risk assessment for patients at significant risk
Treatment intensification	Regular review of progess and intensification of treatment if no improvement
Evidence-based guidelines and protocols	Healthlines advisors' scripts all based on careful review of national guidelines. Encourage compliance with guidelines by sending GPs a simple flow chart summary with each treatment recommendation.
Regular review	Healthlines advisors telephone patients monthly, based on scripts which raise new topics each month and review progress against goals
Promote medication adherence	Monthly review of medication adherence, scripts use evidence based strategies to improve adherence, advice to GPs by email if patients are non-adherent
Share recommendations with patients	Patients are given online access to guidelines and treatment recommendations sent to GPs.

Care co-ordination

Multi-component interventions	Intervention combines interactive patient web portal, self-monitoring, self-management behavioural strategies and telephone support from health advisor.
Shared records	At onset, Healthlines receives information about patients from primary care records. All treatment recommendations shared with both primary care provider and patient.
Communication between the telehealth provider and primary care	Regular progress reports sent to patient's GP.
Regular monitoring of system performance	Reporting module which allows monitoring of management program (e.g. of number of patients who have been telephoned, number actively participating in on line cognitive behaviour therapy).
Support rather than duplicate primary care	All communications with primary care providers and patients reiterate the message that Healthlines Service is designed to support GPs in their role of managing patients. All treatment recommendations are made to GPs and copied to patients.

Partnership

	All communications are shared between Healthlines Service, patient and GP.
	GPs and service managers involved in designing the Healthlines intervention

Context

	The nature and intensity of the intervention is tailored to the nature and severity of the patient's health condition.
	Patients are only invited to participate if they are above a specified severity threshold.

Recognising that patients in the NHS have an enduring relationship with their GP, which reinforces the importance of supporting rather than duplicating or undermining that role

Not all patients have access to reliable Internet connections, so this intervention is only likely to be relevant to a proportion of those in need. Provide technical support to help patients, for example, log in to web portal. In evaluation, it is important to describe the characteristics of patients who take part.

Appendix 3. Details of model for imputation of missing data

Missing data were imputed using the multiple imputation by chained equation procedure, implemented using the 'ice' command in Stata (StataCorp, version 13.1). Missing data for both clinical outcomes and economic analysis variables were imputed within the same model. The imputation model followed recommended practice[1] by including allocation, demographic variables and cost variables without missing data, alongside outcome, cost and utility variables with missing data. The imputation model included past history of depression and depression status measured by the CIS-R at baseline and data on the following variables at baseline and all subsequent follow-up time-points: PHQ-9 score, GAD-7 score and whether participants were currently being prescribed antidepressants.

The imputation model was stratified by trial arm and the number of imputations was set to 60, which ensured that the number of imputations was greater than the proportion of missing data. Predictive mean matching was used to account for non-Gaussian distributions in variables, particularly in the cost and utility variables included in the imputation model. Passive imputation was performed for categorical outcome models that were functions of imputed variables, such as binary variables indicating PHQ-9 responders. Finally, analysis was performed on the imputed data set in a way that reflected the variation within and between the imputed datasets in accordance with 'Rubin's rules'.[1]

Appendix 4 Primary and sensitivity analyses of primary outcome

	Usual care % (n/total)	Intervention % (n/total)	Adjusted odds ratio	95% confidence interval	*P*-value
Primary analysis					
PHQ-9 response to treatment	19% (50/270)	27% (68/255)	1·7	1·1 to 2·5	0·019
Sensitivity analyses					
1.PHQ-9 response to treatment: simple imputation (assuming missing binary outcome is non-response)	17% (50/302)	22% (68/307)	1·5	1·0 to 2·2	0·063
2. PHQ-9 response to treatment: multiple imputation	19% (56/302)	28% (86/307)	1·7	1·1 to 2·6	0·010
3. PHQ-9 response to treatment: not including GP practice as a random effect	19% (50/270)	27% (68/255)	1·7	1·1 to 2·5	0·019
4. PHQ-9 response to treatment: adjusted by days since randomisation to completion of the primary outcome	19% (50/270)	27% (68/255)	1·7	1·1 to 2·5	0·018
5. PHQ-9 response to treatment: adjusted by days since randomisation to completion of the primary outcome and baseline outcomes[a]	19% (50/270)	27% (68/255)	1·9	1·2 to 3·0	0·005

a Binary or categorical baseline outcomes: work (binary: no work/work), highest qualification (categorical: none, GCSE, A-level, Degree), accommodation (binary: do not own house/own house), CIS-R (categorical: mild, moderate, severe), antidepressant use (binary: not currently antidepressants/currently taking antidepressants).

All analyses are adjusted by site (Bristol, Sheffield or Southampton) and baseline PHQ-9 (Patient Health Questionnaire) score. GP practice is included as a random effect unless otherwise specified. Analyses are further adjusted by other covariates if specified.

Appendix 5 Use of technologies for health purposes

Use of technologies for health purposes at least every 2 weeks[a]	Usual care % (n)	Intervention % (n)	Adjusted odds ratio[b]	95% confidence interval	*P*-value
NHS Direct phone services					
4 months	<1% (1/248)	4% (8/226)			
8 months	1% (3/231)	3% (6/213)			
12 months	<1% (1/239)	2% (4/222)	4·0	0·4, 36·5	0·216
Online searching					
4 months	19% (47/247)	26% (60/227)			
8 months	24% (55/231)	27% (57/213)			
12 months	22% (53/237)	23% (51/223)	1·0	0·6, 1·7	0·964
Online forum or group					
4 months	6% (15/249)	10% (23/225)			
8 months	7% (16/231)	7% (15/212)			
12 months	8% (18/235)	4% (10/223)	0·5	0·2, 1·1	0·072

a Scale dichotomised as 0 = used less than once a month, 1 = every 2 weeks or more.

b All analyses are adjusted by site (Bristol, Sheffield or Southampton), baseline PHQ-9 score and baseline outcome. GP practice is included as a random effect.

Appendix 6 Secondary outcomes at 4, 8 and 12 months follow-up

	Usual care		Intervention	
	Unadjusted mean (SD)	N	Unadjusted mean (SD)	N
Generalised anxiety (GAD-7)[2]				
4 months	10·5 (5·9)	250	10·5 (5·7)	227
8 months	10·2 (5·7)	230	9·1 (5·4)	212
12 months	9·2 (5·8)	237	8·7 (5·5)	223
Quality of life (EQ-5D-5L)				
4 months	0·534 (0·29)	233	0·559 (0·29)	220
8 months	0·541 (0·30)	227	0·556 (0·28)	210
12 months	0·564 (0·30)	227	0·569 (0·30)	219
Satisfaction with treatment [a,b]				
4 months	3·2 (0·9)	196	3·5 (0·9)	207
8 months	3·3 (0·9)	182	3·6 (0·9)	172
12 months	3·3 (0·9)	184	3·7 (0·9)	193
Difficulties with obtaining access to care [a,b]				
4 months	3·9 (2·0)	244	4·4 (1·9)	226
8 months	4·2 (1·9)	224	4·5 (1·8)	206
12 months	4·2 (1·9)	232	4·5 (1·9)	216
Satisfaction with amount of support received [a,b]				
4 months	2·1 (0·9)	191	2·5 (0·9)	200
8 months	2·2 (0·8)	170	2·5 (0·8)	170
12 months	2·1 (0·9)	177	2·6 (0·8)	185
Self-management skills and self- efficacy (heiQ)[3]				
Physical activity [a]				
4 months	2·4 (0·9)	250	2·4 (0·9)	228
8 months	2·4 (0·9)	228	2·3 (0·9)	213
12 months	2·4 (0·9)	235	2·5 (0·9)	221
Self-monitoring and insight [a]				
4 months	2·8 (0·4)	249	2·9 (0·4)	229

8 months	2·8 (0·5)	231	2·9 (0·4)	212
12 months	2·4 (0·9)	237	3·0 (0·5)	221
Constructive attitudes and approaches [a]				
4 months	2·5 (0·6)	250	2·6 (0·6)	229
8 months	2·5 (0·6)	232	2·6 (0·6)	231
12 months	2·6 (0·6)	238	2·7 (0·6)	221
Skill and technique acquisition [a]				
4 months	2·6 (0·5)	250	2·6 (0·5)	228
8 months	2·6 (0·5)	232	2·7 (0·5)	212
12 months	2·6 (0·5)	239	2·8 (0·5)	221
Health services navigation[a]				
4 months	2·7 (0·6)	250	2·8 (0·6)	228
8 months	2·8 (0·6)	232	2·9 (0·6)	212
12 months	2·8 (0·6)	238	2·9 (0·6)	220
Adherence to anti-depressant medication (Morisky)[4] [a]				
4 months	3·2 (1·0)	204	3·2 (1·1)	192
8 months	3·4 (0·9)	181	3·3 (1·0)	163
12 months	3·4 (0·9)	179	3·2 (1·1)	173
Health literacy (eHEALs)[5] [a]				
4 months	3·6 (0·9)	243	3·7 (0·8)	225
8 months	3·7 (0·9)	229	3·8 (0·8)	212
12 months	3·7 (0·8)	235	3·9 (0·8)	220
Care coordination (Haggerty)[6]				
Role clarity and co-ordination [a]				
4 months	2·7 (0·8)	193	2·7 (0·7)	194
8 months	2·8 (0·6)	183	2·8 (0·6)	171
12 months	2·8 (0·5)	174	2·8 (0·6)	181
Evidence of a care plan [a]				
4 months	2·9 (2·1)	199	3·3 (2·1)	197
8 months	3·0 (2·2)	185	3·3 (2·1)	165
12 months	3·1 (2·2)	176	3·5 (2·4)	179
Overall experience of organisation of healthcare [a]				

4 months	2·9 (1·0)	251	3·1 (1·0)	227
8 months	3·0 (1·0)	232	3·1 (1·1)	213
12 months	3·1(1·0)	236	3·2 (1·0)	219
Self-organisation of healthcare [a]				
4 months	2·9 (1·2)	239	3·1 (1·3)	215
8 months	3·1 (1·2)	224	3·1 (1·1)	204
12 months	3·2 (1·2)	230	3·1 (1·2)	210

a Higher score is more positive (less access difficulties, greater satisfaction)

b Based on scales generated prior to the main trial analysis using principal components analysis and incorporating questions taken from existing validated questionnaires or constructed for this research.

Appendix 7. Use of anti-depressants by trial arm

	Usual care		Intervention		Adjusted Odds ratio	95% confidence interval	P-value
	%	n/N	%	n/N			
Taking antidepressant at baseline[a]	90%	258/288	87%	251/289		Not applicable	
Taking anti-depressants at 12 month follow-up[a]	78%	174/224	81%	172/213	1·6	0·9 to 2·8	0·103
Anti-depressants prescribed during the trial[b]	90%	273/302	90%	277/307	1·0	0·5 to 1·9	0·934
Had one or more changes in anti-depressant medication or dose[b]	47%	141/302	49%	150/307	1·1	0·8 to 1·5	0·545

[a] Based on patient questionnaires

[b] Based on medical records

All analyses are adjusted by site, baseline use of antidepressants and baseline PHQ-9 score. GP practices is included as a random effect.

Appendix 8 Adverse events

Diagnostic category	Intervention	Usual care	Total
Cancer	3	5	8
Cardiovascular	2	5	7
Dermatology	1	0	1
Eyes	2	0	2
Gastrointestinal	3	2	5
Mental health	7	4	11
Musculoskeletal	9	8	17
Neurology	3	2	5
Respiratory	1	5	6
Unclear	1	2	3
Urology/renal	2	3	5
Total	34	36	70

Appendix 9 Meta –review methods

We searched Medline, Embase/AMED, PsycInfo, Web of Science, DARE (Database of Abstracts of Reviews of Effects) and The Cochrane Library for the period 1 January 2005 to 31 March 2010 for systematic reviews of telehealth and long term conditions. Our search terms included "meta-review or meta review", "quantitative review or overview", "systematic review or systematic overview", "methodologic* review or methodologic* overview", "review" "quantitative synthes*", "clinical trial" "randomized or randomised controlled trial" "controlled trial" and "telemedicine", 'telehealth or tele-health", "telenursing", "telemonitoring", "Ehealth or e-health", ""telehomecare", "telehealthcare", "home healthcare", "assisted homecare".

These were combined with terms relating to long term conditions. Our definition of long term conditions was guided by the NHS National Service Framework for LTCs[7] and other healthcare guidance.[8-10] The list of long-term conditions included in the meta-review are listed below.

Long-term conditions included in the meta-review

- Chronic illness or chronic disease

- Asthma

- Coronary heart disease (CHD) or heart failure or coronary heart failure

- Cardiovascular disease (CVD)

- Stroke and transient ischaemic attack (TIA)

- Hypertension

- Diabetes mellitus

- Chronic obstructive pulmonary disease (COPD)

- Epilepsy

- Thyroid disease (hypo or hyper)

- Cancer

- Dementia

- Depression (& anxiety)

- Mental health, including schizophrenia/psychosis/paranoia/obsessive compulsive disorder/post-traumatic stress disorder/agoraphobia

- Chronic kidney disease (CKD)

- Atrial fibrillation

- Obesity

- Spinal cord injury

- Multiple sclerosis

- Motor neurone disease

- Parkinson's disease

- Learning disabilities

- Arthritis

- Skin disease

- Hearing difficulty

- Headaches and migraine

- Visual problems

- Chronic liver disease

- Endocrine disorders (e.g. Addison's disease, Cushing's syndrome)

- Bronchiectasis

- Cardiomyopathy

- Crohn's disease/ulcerative colitis

- Glaucoma

- Haemophilia

- Hyperlipidaemia

- Systemic lupus erythematosus and other systemic autoimmune diseases

- Smoking (in relation to specific long-term conditions)

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