

Dementia screening app development

Richard Walker, Catherine Dotchin,
Keith Gray, Stella Paddick



Challenge of cognitive screening in LMIC countries

- Few specialist clinicians
- Screening tools therefore need to be as accurate and brief as possible (more than HICs)
- If not accurate or too complex – primary care workers won't use them (remember task shifting involves all other health areas)
- How do we arrange safe referral pathways – can't refer everyone/need to avoid treatable false positives

Will a locally-validated paper and pencil test do? (even if culturally, educationally appropriate and accurate)



Reasons for mHealth approach rather than paper and pencil test

- Increase/widen access to tools – not relying on printed copies
- Allow screening tools to be improved/developed continually
- Allows for different cut-off values depending on background education and setting
- Allows healthcare stakeholders to estimate number of people with dementia locally – plan and lobby for services
- Potential to standardise advice and follow-up
- NB: 1 billion active mobile phones in SSA (and smartphone access increasing rapidly)

Overall aim

- To design a dementia screening app and decision support aid for non-specialists to use in LMIC settings.
- Initial development in Tanzania, but designed as toolkit adaptable to other LMIC settings following further (efficient and resource conscious) validation.

How to make an accurate decision support aid? (statistical modelling)



Statistical methods

- 1. Logistic regression (used for development of IDEA 6 item screen)
- 2. Bayesian models/approaches based on prevalence (HIV testing)
- 3. Machine learning (based on many decision trees)
- Goals – to see which is the best/most accurate method – (may be able to use machine learning to improve logistic regression)
- Determine sample sizes needed for validation in different settings (with different prevalence, educational level etc)

Decision support aids - Example from UK medicine

Can be very useful!

Help non-specialists decide on
treatment.

Based on very large epidemiological
datasets

(may not be practical in LMIC settings)

Estimate likelihood of event

(rather than already having condition)

Assume some background knowledge

The screenshot shows the FRAX Fracture Risk Assessment Tool interface. The header is red with the text "FRAX® Fracture Risk Assessment Tool". Below the header is a navigation bar with links for "Home", "Calculation Tool", "Paper Charts", "FAQ", and "Referenc". The main content area is titled "Calculation Tool" and contains the following text: "Please answer the questions below to calculate the ten year probability of fracture with BMD." Below this text is a form with the following fields: "Country: UK", "Name/ID: [input field]", and "About the risk factors" link. The form is titled "Questionnaire:" and contains 12 questions: 1. Age (between 40 and 90 years) or Date of Birth (Age: [input field], Date of Birth: Y: [input field], M: [input field], D: [input field]), 2. Sex (Male/Female radio buttons), 3. Weight (kg) [input field], 4. Height (cm) [input field], 5. Previous Fracture (No/Yes radio buttons), 6. Parent Fractured Hip (No/Yes radio buttons), 7. Current Smoking (No/Yes radio buttons), 8. Glucocorticoids (No/Yes radio buttons), 9. Rheumatoid arthritis (No/Yes radio buttons), 10. Secondary osteoporosis (No/Yes radio buttons), 11. Alcohol 3 or more units/day (No/Yes radio buttons), 12. Femoral neck BMD (g/cm²) (Select BMD dropdown, [input field]). There are "Clear" and "Calculate" buttons at the bottom right of the questionnaire.

App based cognitive screening in Tanzania

Update on progress to 20th April 2018



The app

IDEA cognitive screen – six items 4 taken from
CSI-D, CERAD 10 word list, praxis task

- What is a bridge? (0-2)
- Animals named in 1 minute (0-2)
- Name of village chairman (0-1)
- Day of the week (0-2)
- Number of words recalled (0-5)
- Matchstick test (0-3)



Validated in Tanzania, Nigeria, pilot study Malaysia

The app

- Combines IDEA cognitive screen, IDEA-IADLs questionnaire and delirium screen
- Developed using Open Data Kit (ODK) software
- For use on Android-based tablets
- Currently being trialled in Tanzania and Nigeria
- In Tanzania has been combined with a census in 12 villages with screening done by census enumerators

The app

IDEA-IADL questionnaire – three questions

- Engage in small works around the house (0-2)
- Give advice (0-2)
- Preside over feasts and ceremonies (0-2)

Delirium rule out

- Was the person like this last week?
- Fluctuation in hours or days
- Word recall, from 10 word list

Screening to date

- Combined with census of 8281 to date (total expected around 30,000)
- 912 (11.0%) aged 60 and over and screened
- Of 376 (41.2%) with an informant, 88 (23.4%) screen positive
- Of 636 without an informant, 53 (8.3%) screened positive

Agreement or IDEA-IADL with IDEA cognitive screen

	IDEA only +ve	IDEA only -ve	Total
Combined +ve	81	7	88
Combined -ve	2	286	288
Total	83	293	376

Role of age

	Positive		Total
	No	Yes	
Age			
60-64	204	7 (3.3%)	211
65-69	183	7 (3.7%)	190
70-74	142	20 (12.3%)	162
75-79	125	27 (17.8%)	152
80-84	54	30 (35.7%)	84
85+	63	50 (44.2%)	113
Total	771	141	912

Role of sex and education

		Positive		Total
		No	Yes	
sex	Female	435	96 (18.1%)	531
	Male	336	45 (11.8%)	381
Total		771	141	912

		Positive		Total
		No	Yes	
School	No	158	83 (34.4%)	241
	Yes	608	56 (8.4%)	664
Total		766	139	905

Predictors of positive score

	Sig.	Odds ratio	95% C.I. for odds ratio	
			Lower	Upper
60-64 years	<.001			
65-69 years	.966	.977	.333	2.862
70-74 years	.011	3.217	1.307	7.915
75-79 years	.001	4.187	1.733	10.119
80-84 years	<.001	11.881	4.848	29.115
85+ years	<.001	13.607	5.724	32.346
No School	<.001	3.580	2.360	5.429

Next steps – started Autumn 2017

- Assess feasibility and user-friendliness of smartphone based dementia screening (acceptability, ease of use, time taken for assessment).
- Further pilot validation in OPD/primary care as combined assessment (NB combined delirium/dementia assessment only internally validated at present (vs gold standard specialist diagnosis))
- Depression screening/validation work and identification of best questions to use.

Depression

- Which are the best questions for ruling out severe depression?
- Hai identification of depression (pilot study)
- Adaptation of 30 item GDS using Delphi process (translation, adaptation and removal of inappropriate questions)
- Questions developed from lay focus groups (81 older rural people, using case vignettes).

Method (currently in progress)

- Adapted GDS and focus group questions used as screening tool—in older people (60+) attending Hai District Hospital medical OPD.
- Sampling – every third person presenting in order of arrival (target 120).
- All have detailed psychiatric/mental state and neurological examination for depression by ICD/DSM criteria+ IDEA cognitive screen blinded to screening questions

Planned analysis

- Factor analysis and logistic regression – identify most predictive questions for depression.
- Consider role of cognitive impairment
- Development of pilot depression screen
- Further validation study 2019 – with aim of including best 2 depression questions in a later version of the app.

How to develop app further?

- Aim is case finding (use in primary care and chronic disease clinics by non specialists as recommended by WHO).
- Accuracy – use large data sets to adjust cutoffs for different age groups etc (nb high rate of positive screens in 85+ group)
- Use of modelling techniques to increase accuracy without further large validation studies.

How to adapt to other settings?

- Aim for a toolkit (basic app) that can be adapted to Malaysia/India but also elsewhere.
- Modelling could inform sample size needed for validation elsewhere (and estimated accuracy if not formally validated due to resource issues).
- ‘Toolkit’ of shared experiences on adaptation of questions/activities of daily living/amount of training required.

Integrated follow-up and advice

- Use of technology to increase access and equity in health advice.
- Educational resources for healthcare workers, patients and carers which could be sent directly to those with dementia.
- Would ensure standardisation of care and advice
- Method of follow-up (currently few attend follow-up appointments)