Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Dementia screening app development, feasibility and validation: March 2019 update

Richard Walker, Catherine Dotchin, Keith Gray, Stella Paddick, Damas Andrea

Newcastle University
UK | Malaysia | Singapore

Health Action by People

TUMAINI UNIVERSITY MAKUMIRA
KILIMANJARO CHRISTIAN MEDICAL UNIVERSITY COLLEGE

KING'S College LONDON

MONASH University
Malaysia

Northumbria Healthcare
NHS Foundation Trust

NHS

seaco

UNIVERSITY OF MALAYA

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

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Will a locally-validated paper and pencil test do?

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

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
- Potential to standardise advice and follow-up via automatic prompts and referral pathways
- 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.

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, Malaysia, Zambia

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

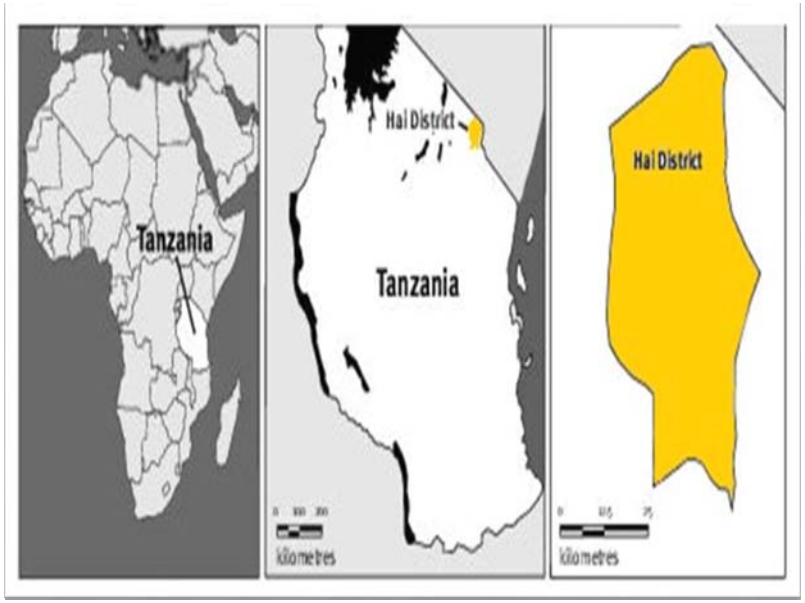
- Was the person like this last week?
- Fluctuation in hours or days
- Word recall, from 10 word list

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
- In Tanzania has been combined with a census in 12 villages with screening done by census enumerator
- (Aim- understand difference between those who do and do not present for screening).

SCREENING PROGRESS

NHS
National Institute for
Health Research

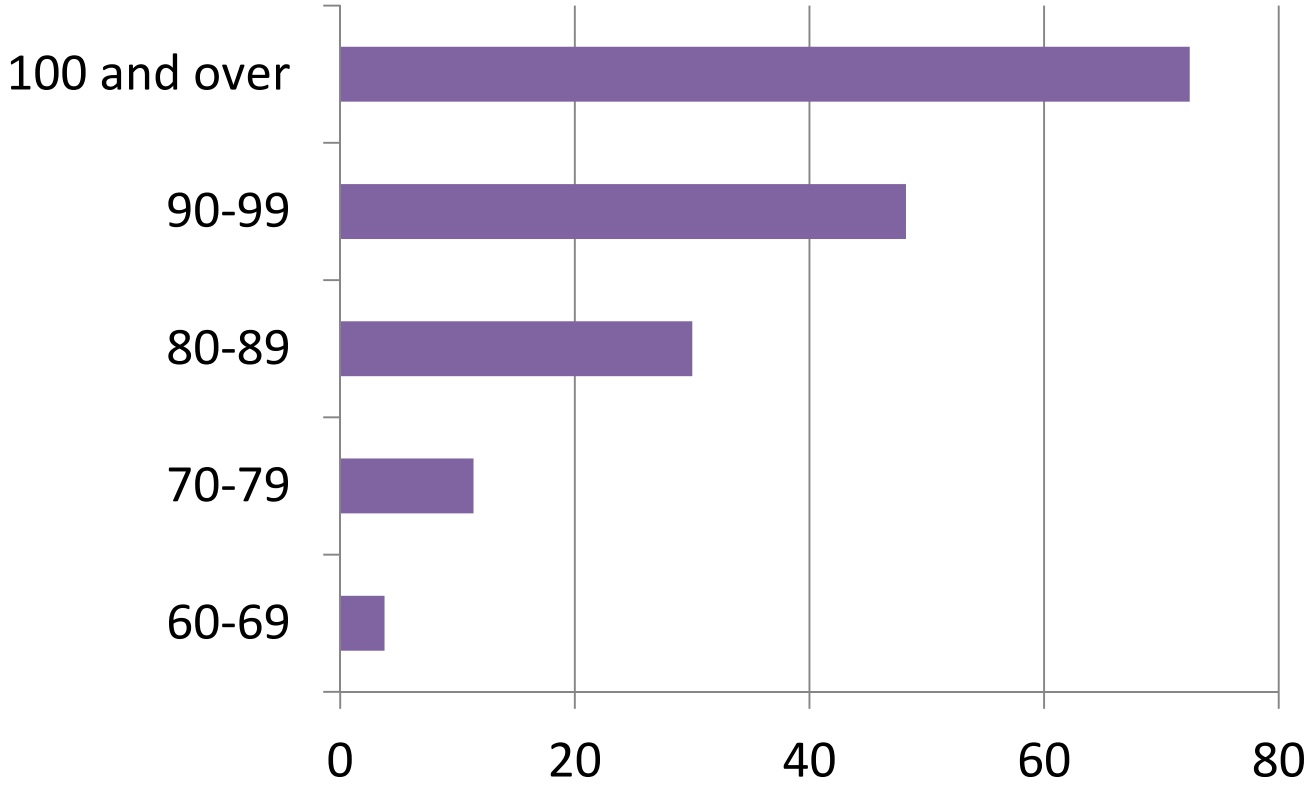


Screening

- Screening completed on census population of 28,236 people of whom 3122 (11.1%) aged 60 years and over

- 3011 (96.4%) consented to screening of whom 1337 (44.4%) had an informant

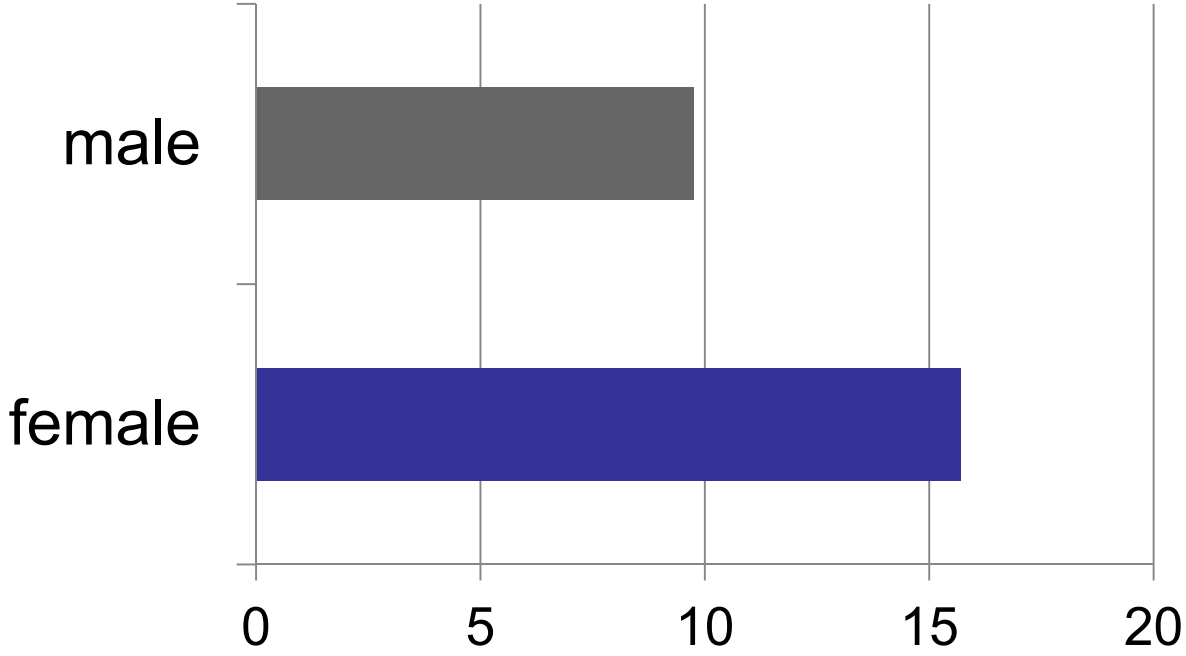
Role of age



Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

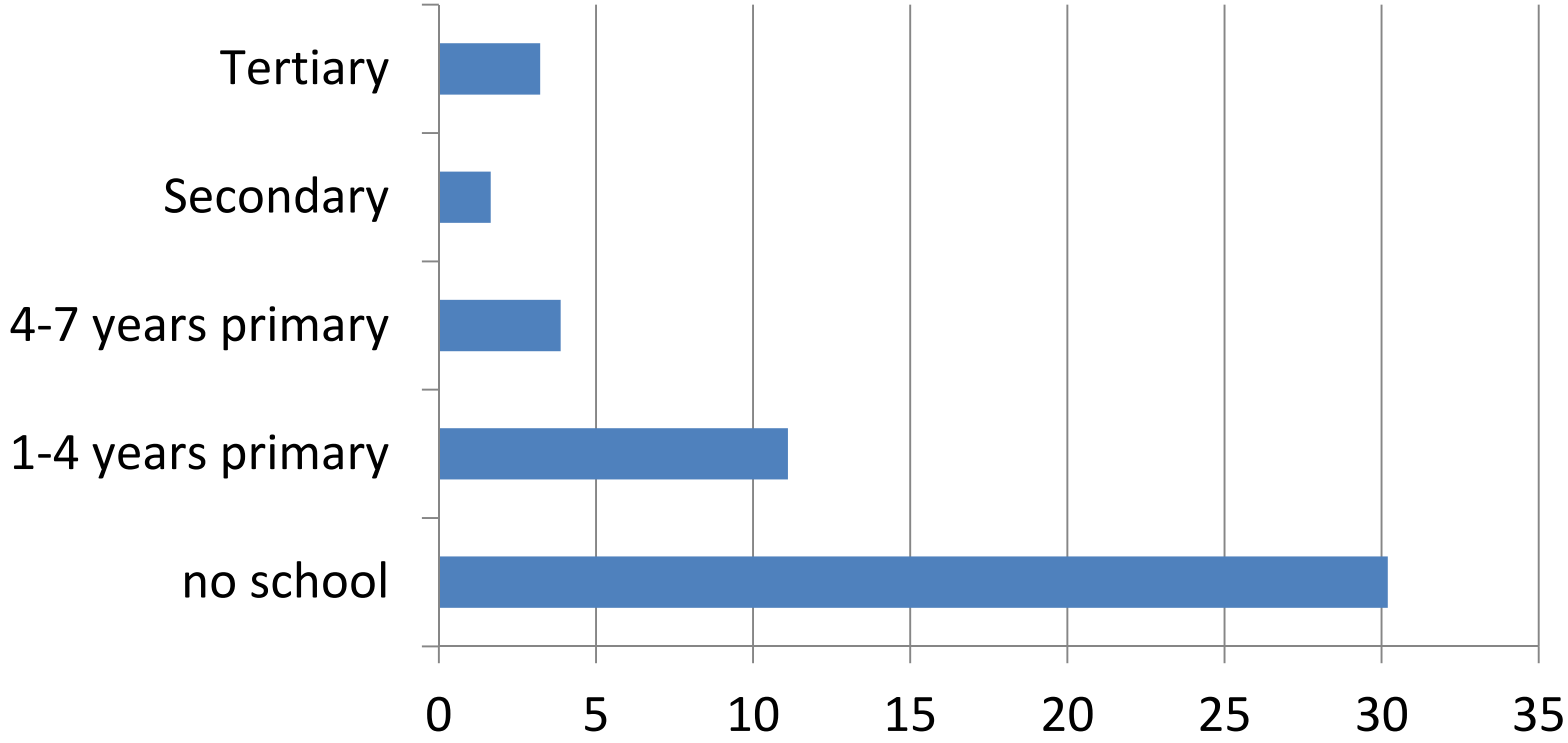
Role of sex



Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Role of education



Predictors of positive score

	Sig.	Odds ratio
60-69 years		1
70-79 years	<0.001	2.371
80-89 years	<0.001	6.992
90-99 years	<0.001	12.466
100 years and over	<0.001	29.475
Male	.323	.877
No education		1
0-4 years primary	<0.001	.384
5-7 years primary	<0.001	.200
Secondary	0.001	.091
Tertiary	0.134	.212

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Interim results - to 1st March 2019

- Population 3122 (60 and over) 3011 screened

	Frequency	Percentage	Approximate number selected for screening
No dementia	2374	78.8	238
Possible dementia	227	7.5	114
Probable dementia	410	13.6	410
Total screened	3011	100.0	762
Refused	111		
Total aged 60+ +	3122		

Validation

Aims

- To see all screen-probable dementia, 50% of screen possible dementia and 5% of ‘no dementia’ for blinded gold-standard dementia diagnosis.
- Understand differences between those who do and do not self-present for screening.

Confirmatory Diagnosis - Hai

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Confirmatory Diagnosis - Hai

Confirmatory diagnosis - progress

- History, examination and written case summary
- Research doctor then consensus diagnosis from case summary review (Dr Damas, Dr Paddick (psychiatry) Dr Dotchin, Prof Walker (geriatrics)
- To date - 277 confirmed diagnoses in 7 of 12 villages. **(369 now assessed**)
- Completion 1-2 months
- Combined population 60 years and over - 1,792, (1703 screened with app).

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Diagnostic Accuracy (interim)

	No dementia	Possible dementia	Probable dementia	Total
Total screened /7 villages	**1365**	**128**	**210**	**1,703**
People assessed	**105 (7.7%)**	**37 (28.9%)**	**135 (64.3%)**	**277**
People with dementia	**3 (2.9%)**	**2 (5.4%)**	**49 (36.3%)**	**54**
Est dementia cases in screened population	**39**	**7**	**76**	**122**

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

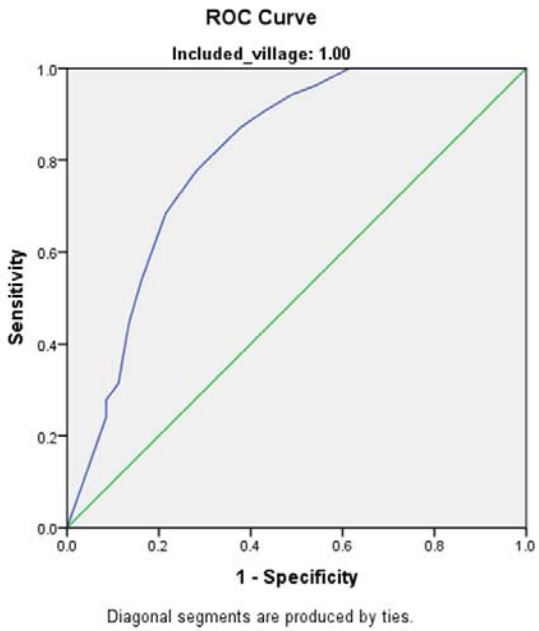
Prevalence – 7 villages

- 122 dementia cases from population 1,703
- Est unadjusted prev. 7.2%
- Unadjusted prevalence 7.5% in people aged 70 years and over (2009-2010 prevalence study).
- Of 54 with dementia, 37 (68.5%) were female..

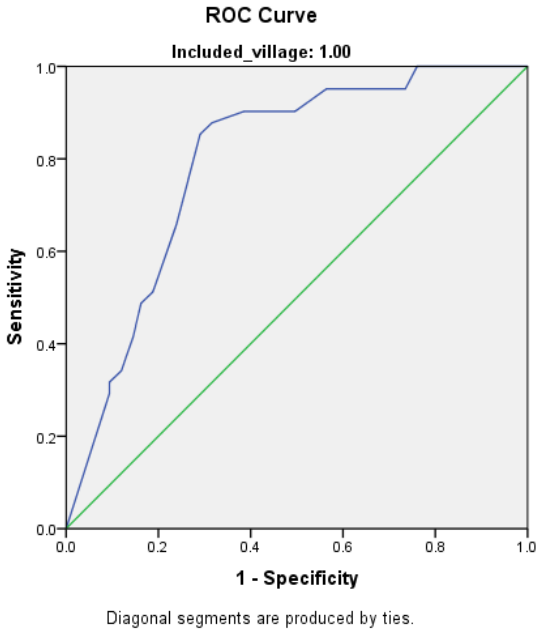
	Age band					Total
	60-69	70-79	80-89	90-99	100 and over	
No dementia	72	78	60	11	2	223
Dementia	0	8	29	14	3	54
Total	72	86	89	25	5	277

Diagnostic accuracy based on patients seen so far

IDEA SCREEN AUROC 0.809



IDEA-IADL AUROC 0.795



Acceptability of app based dementia screening

- 11/12 enumerators and 63/68 participants preferred the system to paper assessments
- 11/12 enumerators felt the assessment was too long, compared to 15/68 participants

Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Acceptability of app based dementia screening

	S. Agree	Agree	Neutral	Disagree	S. Disagree
The tablet was simple to use	3	5	4	0	0
The app was simple to navigate	2	4	6	0	0
The questions were confusing	0	2	4	5	1
App on screen instructions clear	3	6	3	0	0
Difficult to keep the tablet charged	0	3	3	4	2

Subjective memory complaint

- Has you memory become worse over last year:1888 (62.7%)
- Have your memory problems affected ADLs: 1040 (34.5%)

In screen probable dementia:

- 88.3% answered yes to question 1
- 75.6% answered yes to question 2

Next steps

- Complete analysis and explore by-village variation and most useful questions.
- Adapt to other settings by adjusting cut-offs for individual items and the whole scale (urban/rural/high-low ed)
- Small OPD-based validation (case-finding)
- Develop app further using other methods (e.g. Bayesian approaches, decision trees) – would need statistics/computing support

Ongoing work to refine app

- All dementia cases to be reviewed with further clinical history, examination and collateral history at home to assess dementia subtype
- Clinical interview (Mres student/medical officer) with supervision and case note review from psychiatry/geriatrics team
- Aim is to see all dementia cases/village in 4 villages (ideally). 54 confirmed cases to start

Aim- subtype study

- Pilot work
- Assess through modelling (logistic regression) whether the app can differentiate dementia subtypes (using different cut-offs –word learning, verbal fluency, compared with existing screen)

Diagnostic criteria – subtype study

- Dementia with Lewy bodies (DLB)
- McKeith criteria and DIAMOND-LEWY toolkit

- Vascular dementia
- Hachinski, ICD-10, NINDS –AIREN

- Alzheimer's disease dementia (ADD)
- NINDS-ADRA

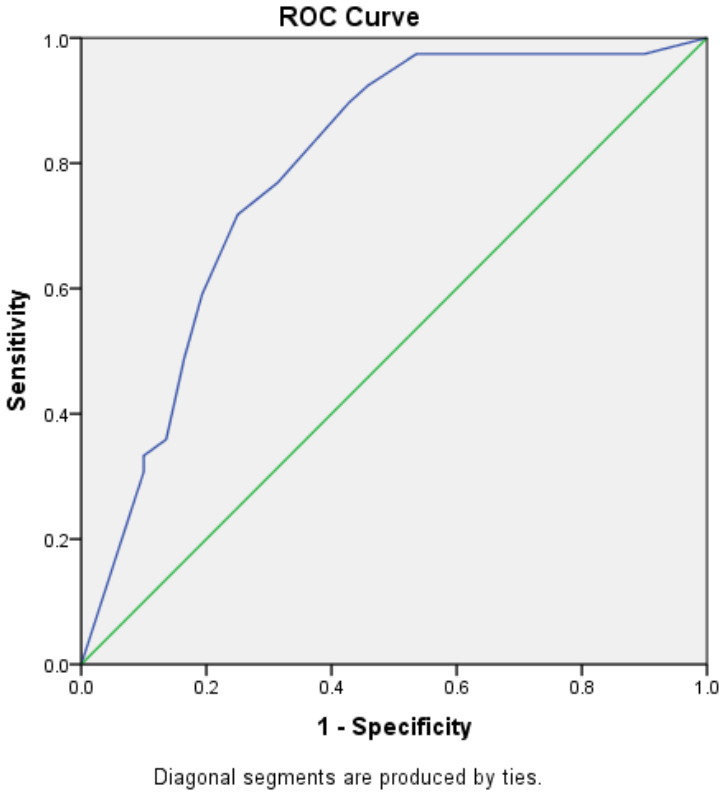
Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Thank you

Validation of IDEA screen only

- AUROC 79.0% (95% CI 71.7 to 86.3)
- At cut off ≤ 7
- Sensitivity 89.7%
- Specificity 57.1%



Global Health Research Group
on Dementia Prevention &
Enhanced Care: DePEC

NHS
National Institute for
Health Research

Validation of IDEA screen and IADL questionnaire

- AUROC 82.4% (95% CI 74.8 to 89.9

At cut off ≤ 10

- Sensitivity 93.3%
- Specificity 57.0%

At cut off ≤ 7

- Sensitivity 90.0%
- Specificity 69.8%