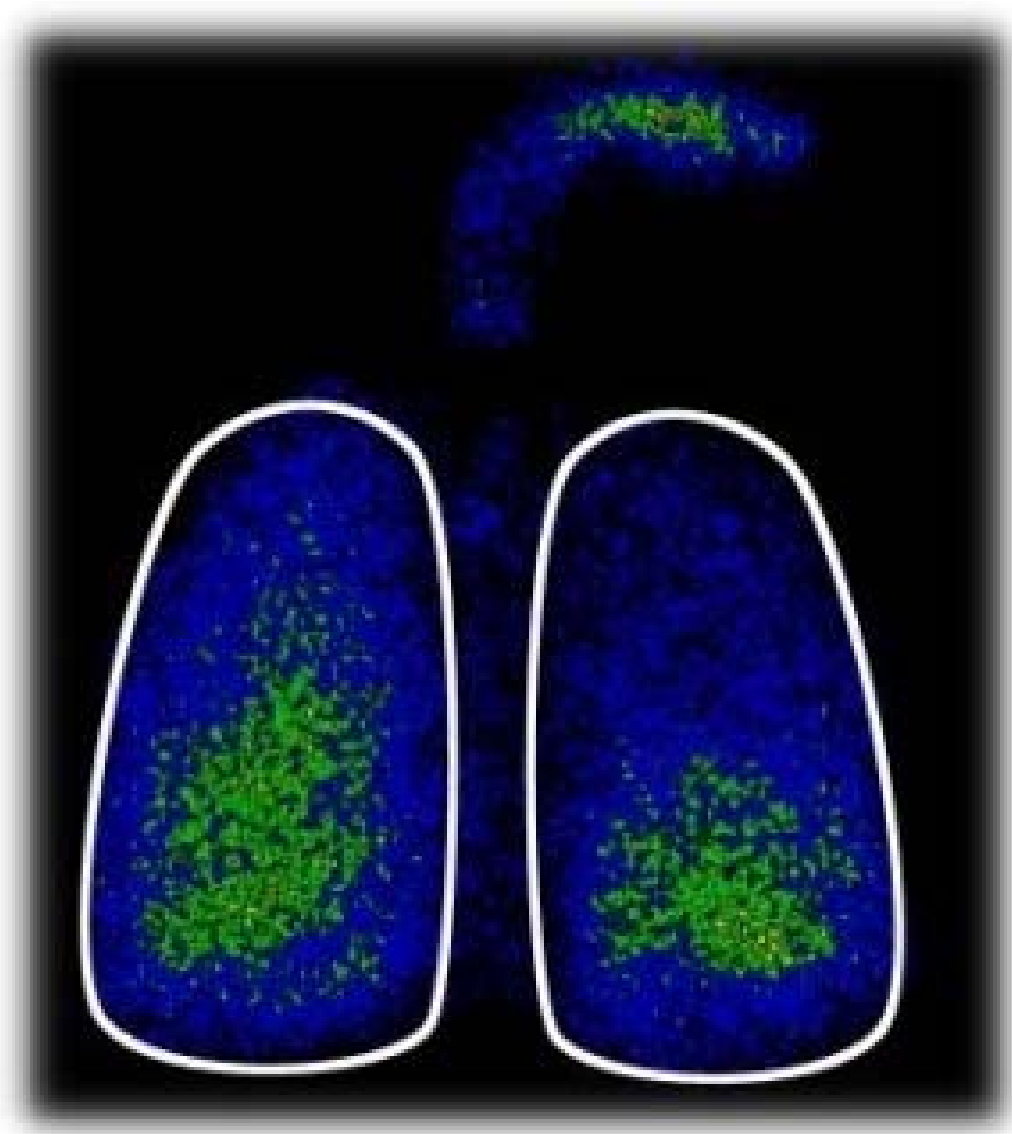


# **Comparison of four tests of cognition as predictors of ability to acquire MDI technique in old age**

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## Ideal technique

About 20% deposited in large airways

20-30% deposition in medium and small airways

About 50% exhaled  
swallowed or exhaled

Image by courtesy of Hovione

# Background

- Inability to learn inhaler technique has been shown to be predicted by:
  - AMTS < 7/10
  - MMSE < 24/30
  - EXIT25 > 14/25
  - IMDT abnormal
  - pentagon drawing test (IP) negative

9. Allen SC, Prior A. Brit J of Dis Chest (1986);80:45-49  
Allen SC. Age Ageing (1997);26:83-86  
Allen SC, Ragab S. Postgrad Med J(2002);78:37-39.  
Allen SC, Jain M, Malik N, Ragab S. Age Ageing (2003);32:299-302.  
Allen SC, Yeung P. Age Ageing(2006);35:304-305  
Board M, Allen SC. Int J Clin Pract(2006);60(5);510-13.

# Interpretation

- Learning to use an inhaler requires:
  - intact general cognition
  - preserved executive function
  - preserved ideo-motor sequencing
  - preserved motor praxis

# Utility

- Good for MMSE and AMTS (embedded in national guidelines)
- Commonly used
- Limited by moderate specificity (70-80%) and relatively low sensitivity (60-70%)

# The potential of CLOX as a predictor

CLOX 1 Draw a clockface on blank paper.

- Tests for executive dyscontrol in a novel and ambiguous situation

CLOX 2 Copy a clockface.

- Tests ideo-motor praxis

We hypothesized that CLOX tests, particularly CLOX 2 might predict inability to learn inhaler technique with a higher specificity and sensitivity than MMSE.

# Subjects and methods

- Prospective observational quasi-random study
- 80 inpatients (mean age 83, range 75-97, 63F)
- Inhaler naïve, medically stable, no delirium, adequate vision and hearing, no overt dyspraxia, no severe hand impairment, MMSE > 11/30
- Measured MMSE, pentagon copying (IP), CLOX 1&2,
- Inhaler training (BTS/Asthma UK standard) and assessment (separate observer)

# Results – categorical testing at normative thresholds

## Results

Test	Inhaler satisfactory	Inhaler unsatisfactory	P*
MMSE > 23	20	25	
MMSE < 24	8	27	0.04
IP+	22	13	
IP-	6	39	0.0000
CLOX1 > 9	16	9	
CLOX1 < 10	12	43	0.0004
CLOX2 > 11	18	22	
CLOX2 < 12	10	30	0.05

\* Fisher's test

# Predictive values

Predictive power – for inability to learn  
inhaler technique

Test	Sensitivity	Specificity	PPV	NPV
MMSE < 24	57(42-71)	76(57-88)	77(59-89)	56(40-70)
IP-	<b><u>75</u></b> (60-85)	<b><u>79</u></b> (59-91)	87(73-94)	63(45-78)
CLOX1 < 10	83(69-91)	57(37-75)	78(65-88)	64(43-81)
CLOX2 < 12	58(43-71)	64(44-81)	75(58-87)	45(30-61)

# Comment

- IP had the best overall predictive value
- The expected performance of CLOX tests was not demonstrated
- This might be because learning inhaler technique is more closely dependent on global cognitive function and ideo-motor praxis than on executive control
- An expected close concordance between IP and CLOX2 was not found

## Parallel study on spirometry

- Compared the same cognitive tests as predictors of ability to perform spirometry.
- MMSE and IP performed better than CLOX 1&2

Allen SC, Baxter M. Age Ageing(2009);38:537-41

# Conclusion

- In clinical practice:
  - MMSE and its IP component are the best predictors of inability to learn to use an inhaler or perform spirometry.
  - patients with significant cognitive impairment are unlikely to be able to learn to do either

Allen SC, Warwick-Sanders M, Baxter M. Int J Clin Pract(2009);63(8):1150-3.

Allen SC, Baxter M. Age Ageing(2009);38:537-41

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