

Inspiratory load detection threshold in old age

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Clinical background

- Elderly asthmatics have a high mortality
- There is narrative evidence that they present late during exacerbations
- They report breathlessness less often as a symptom of worsening airflow obstruction

Ageing physiology background

- Sensory acuity falls in old age
- Proprioceptive measurements become coarser after age 60 (sway, point relocation etc)
- Thoracic structures are rich in mechanoreceptors – including the diaphragm
- Ability to detect and quantify respiratory loading is reduced under high drive conditions in old age

Proprioceptive changes in old age

- Reduced somatosensory input is partly responsible for reduced postural stability in old age (Corriveau et al 2004)
- Sway mean track length increases in old age (Fujita et al 2005)
- Proprioceptive acuity falls in old age (You 2005)
- Adaptation to perturbation of eye-hand relocation is slower in elderly subjects (Guan et al 2000)

Respiratory load detection in old age

- Progressive elastic loading results in lower breathlessness scores (Tack et al 1981)
- Magnitude scaling of resistive loads is diminished (Altose et al 1985)
- Tidal volume judgement becomes more dependent on muscle force cues (Tack et al 1983)
- Reduced awareness of methacholine induced bronchoconstriction (Connolly et al 1992)

Background hypothesis

- Ability to detect a rise in airflow resistance depends on mechanoreceptor acuity
- This is an example of the length-tension principle
- The sensory substrate for this is known to deteriorate in old age
- Therefore, the threshold for detecting such a rise should rise in old age

Allen SC, Khattab A. *Med Hypoth*(2006):67:1406-10

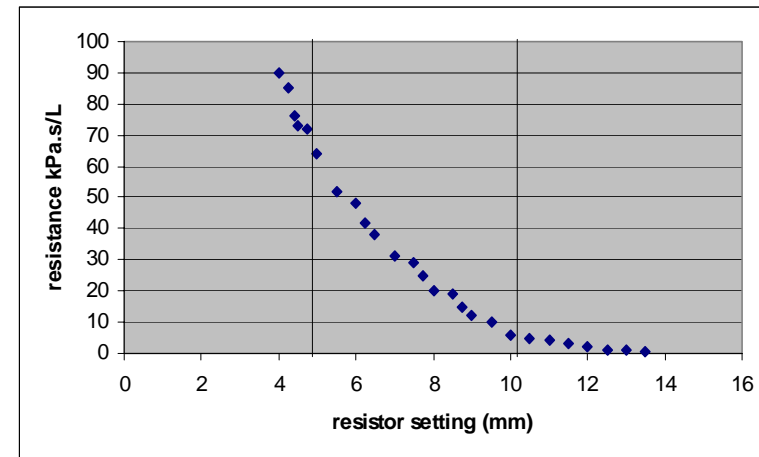
Methods - equipment

Standard respiratory tubing, valves and filters

Lentiform airflow resistor

Calibrated against standard air flows and pressures in 0.5mm increments at room temperature

Silent in operation



Typical calibration curve – lentiform aperture

Method - subjects

Age 20 – 86, n = 124, at least 8 in any 10 year age band

No history of respiratory disease

Never-smoker or trivial experimentation only

Negative ERS bronchial screening questionnaire

Spirometry in the normal reference range for age and height

Methods - procedure

Consent

Resp questionnaire

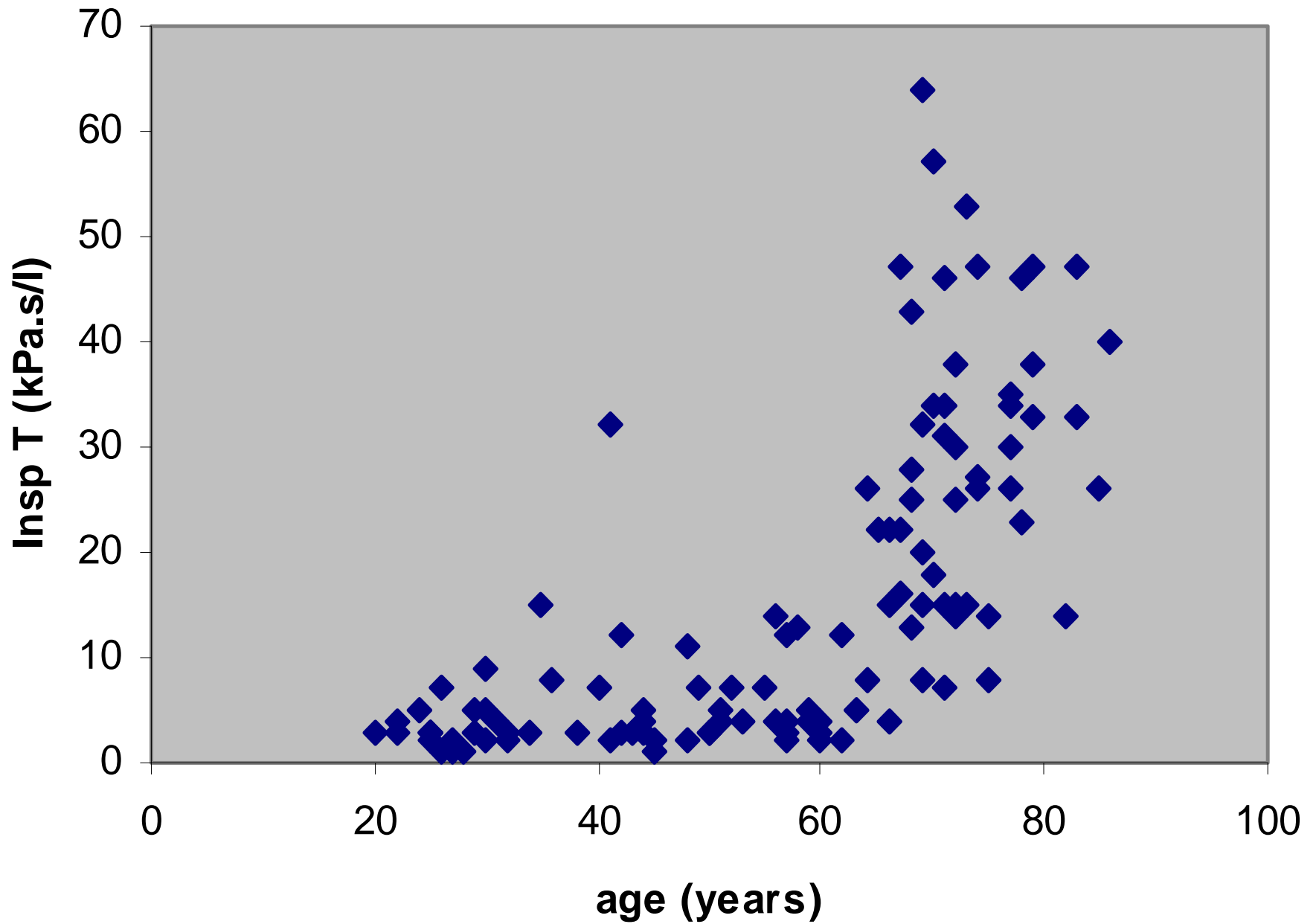
Spirometry and height

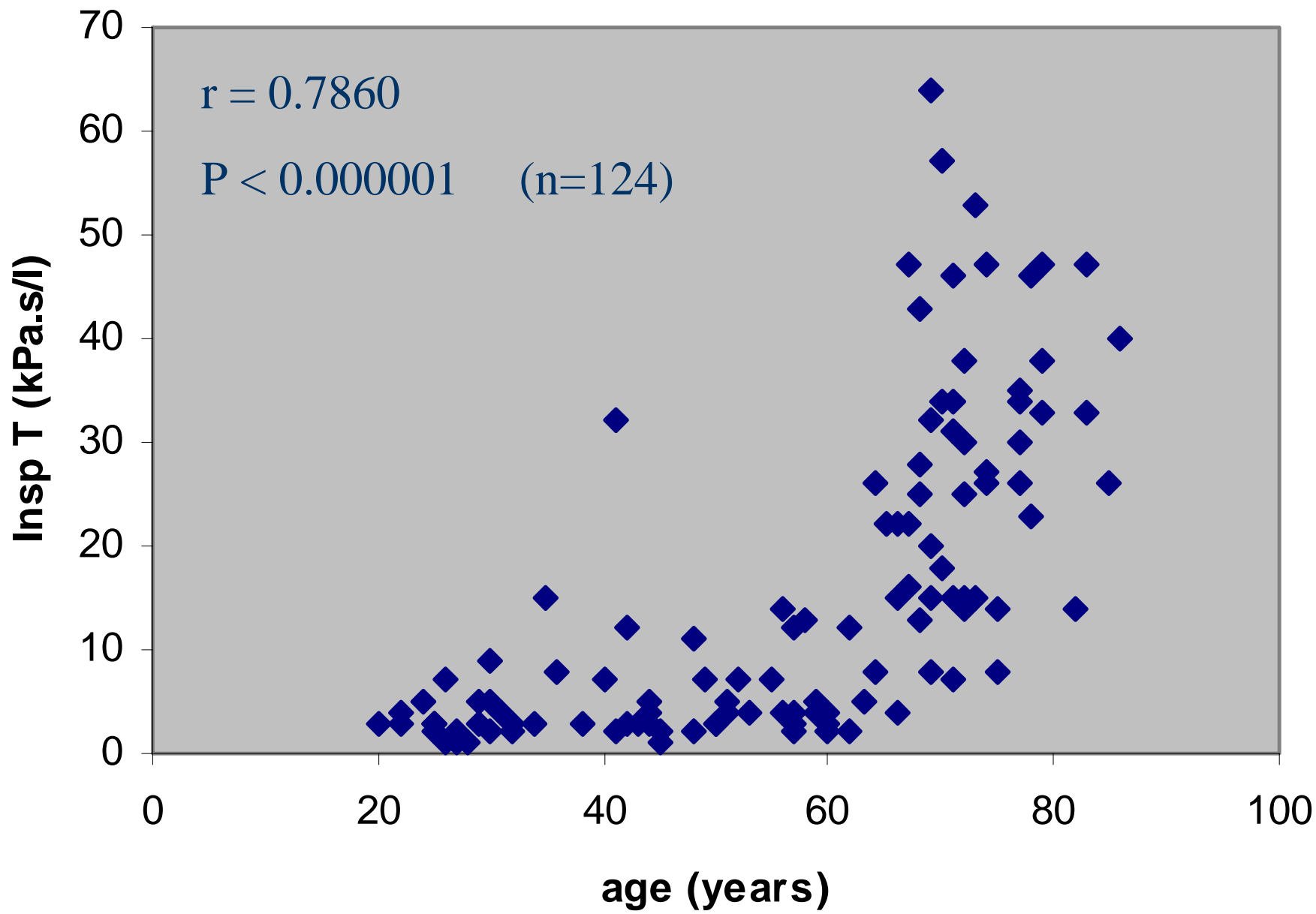
Settling for 3 minutes on the apparatus

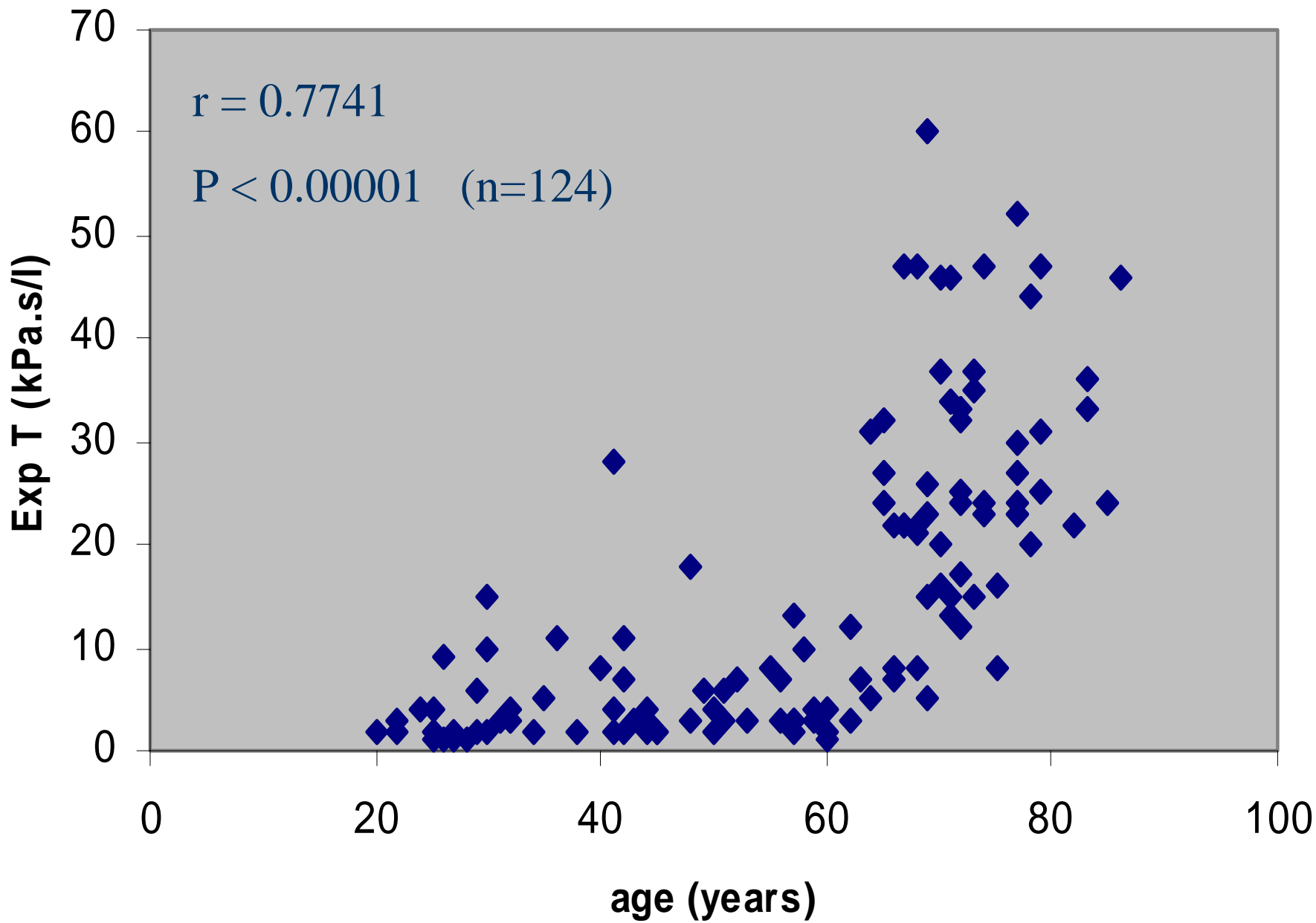
Inspiratory progressive loading until detected (X3)

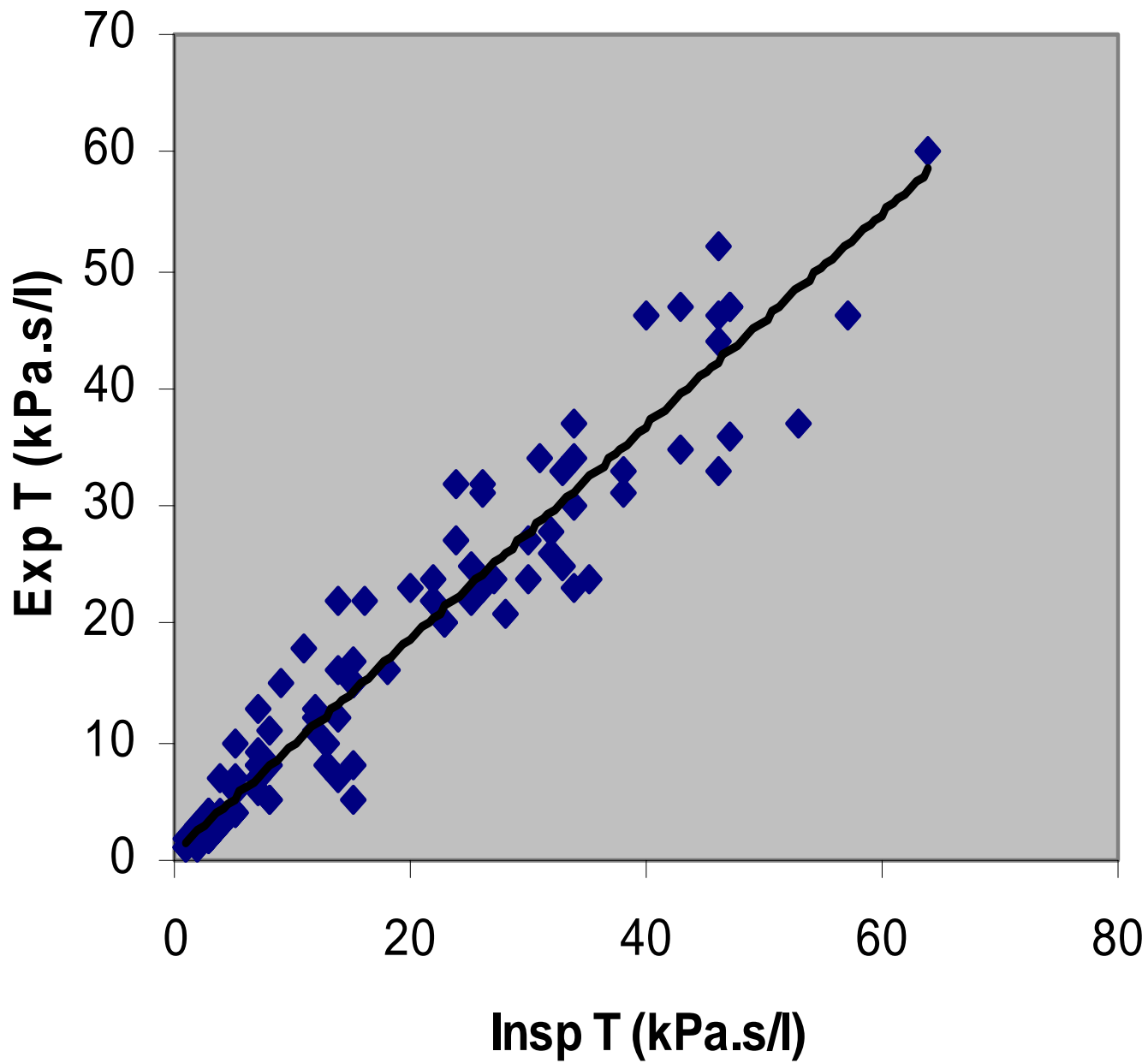
Expiratory phase

RR and oxygen saturation recorded



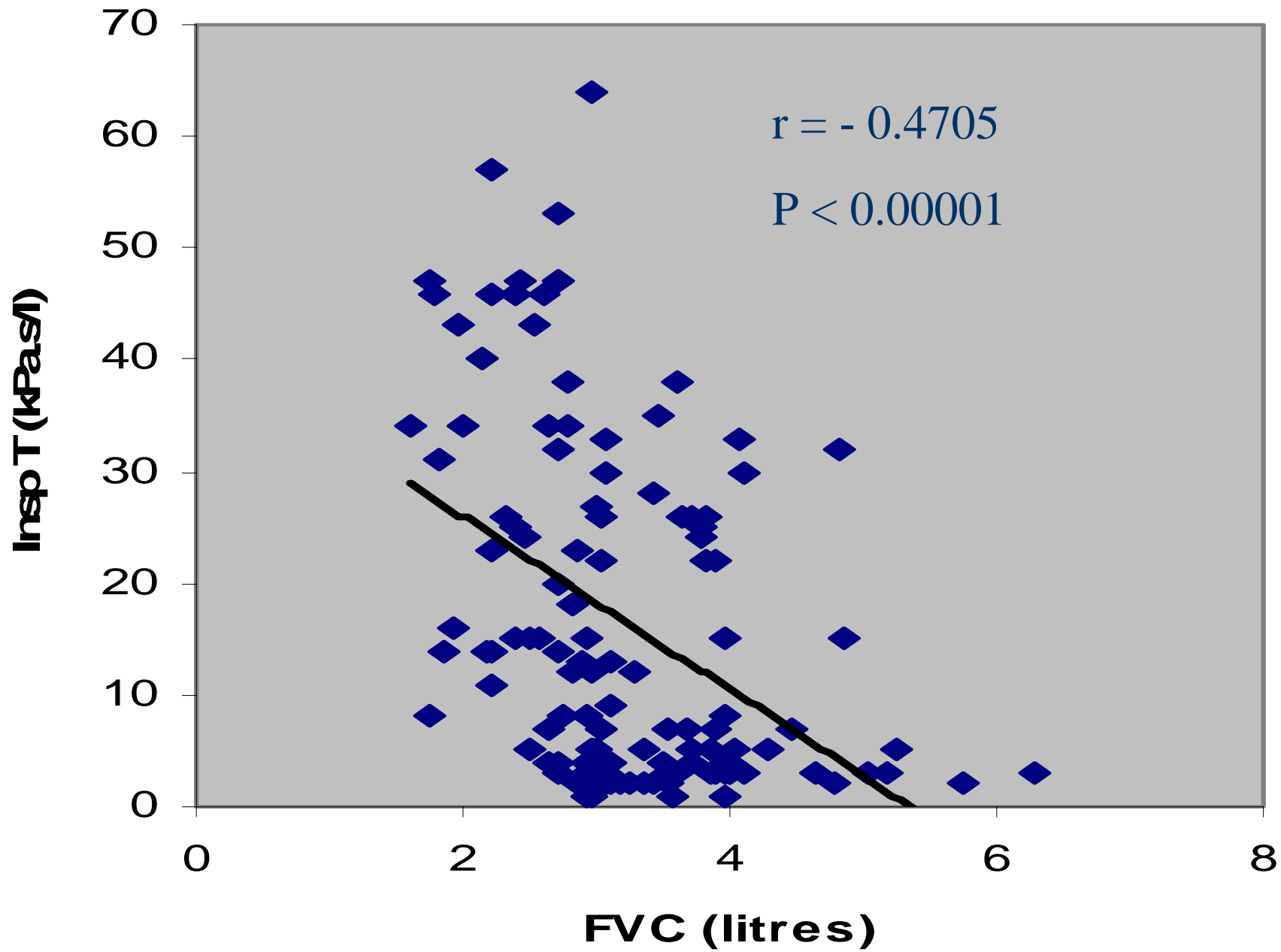


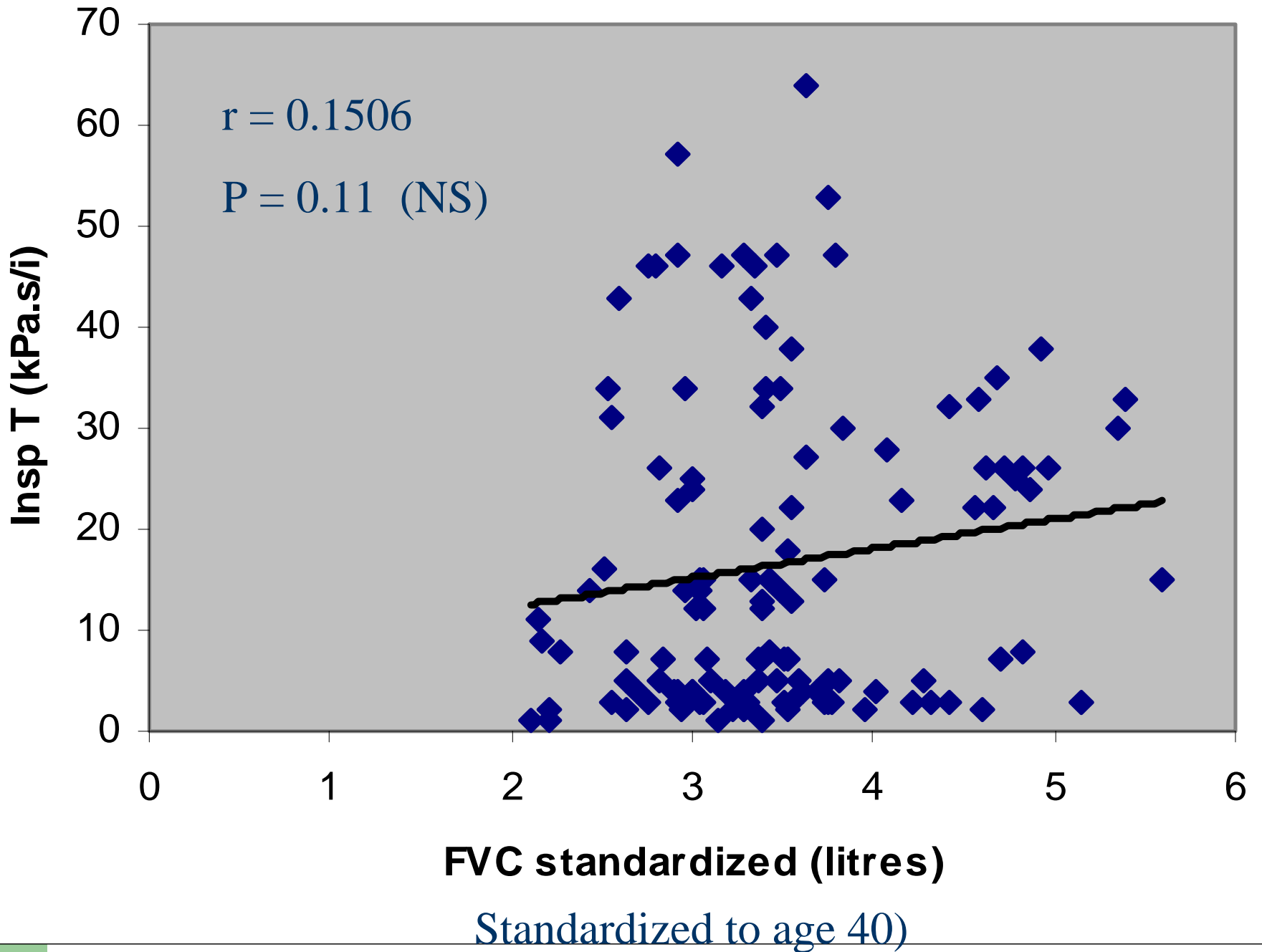




$R = 0.9685$

$P < 0.0000001$





Interpretation

- The pattern of the rise in threshold in old age reflects other systems ageing
- The observations support the hypothesis
- The change appears to be a normal consequence of ageing
- There are implications for the current asthma guidelines at step 2.

Next steps

- Asthma patients in the same age range (almost complete)
- COPD patients age 40+

First study has been published:

Allen SC, Vassallo M, Khattab A
Age Ageing(2009);38:548-552