

How to give home BP monitoring patients the correct cuff? Using BMI as a surrogate estimate of arm circumference.

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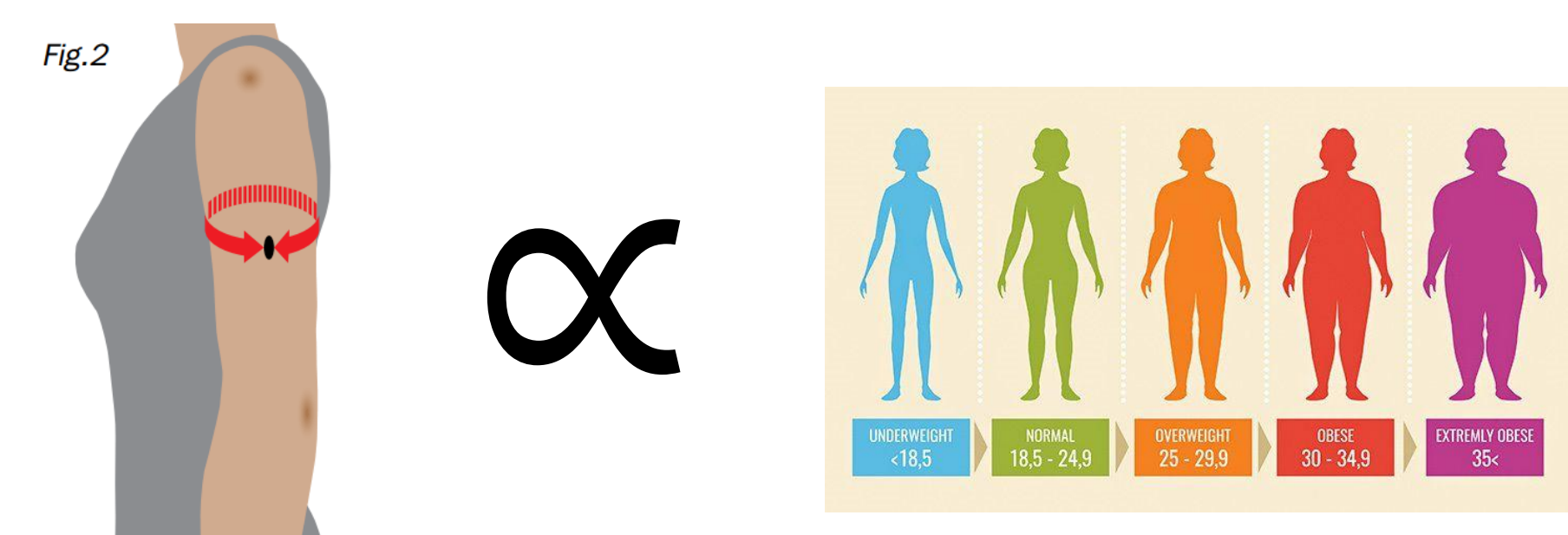
Find out more about our work at: <https://www.qmul.ac.uk/blizard/ceg/>

What we did:

1. We used published Body Mass Index (BMI) / Mid-Upper Arm Circumference (MUAC) data to generate a linear regression model of BMI \propto MUAC.
2. We applied the model to a large cohort of London (UK) primary-care patients with hypertension to estimate cuff-requirements for such a population.
3. From this work, we propose a simplified BMI-based BP cuff-prediction scheme for individual patients.

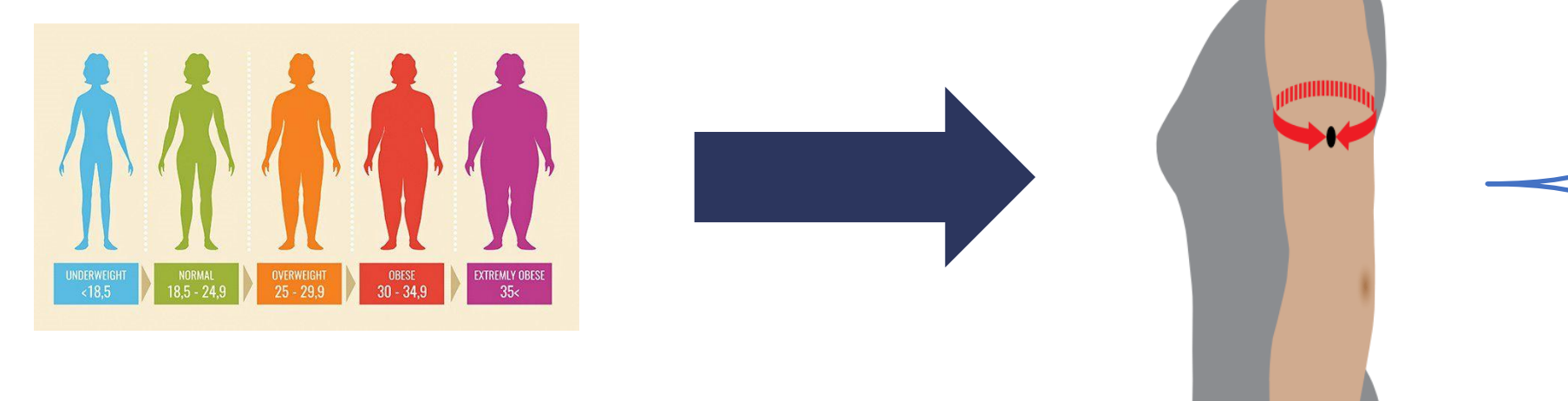
WHY?

Mid-upper arm circumference (MUAC) correlates strongly to BMI

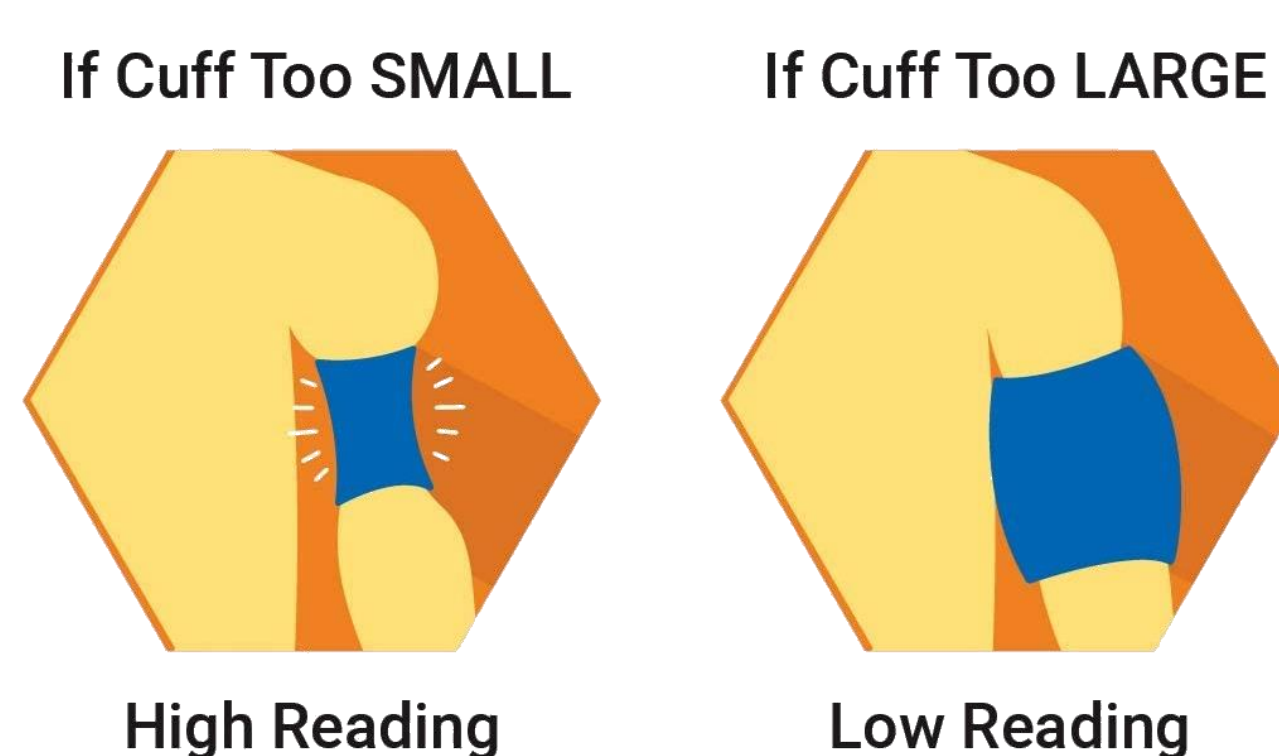


BMI is one of the **most commonly recorded** primary care patient datum

So...



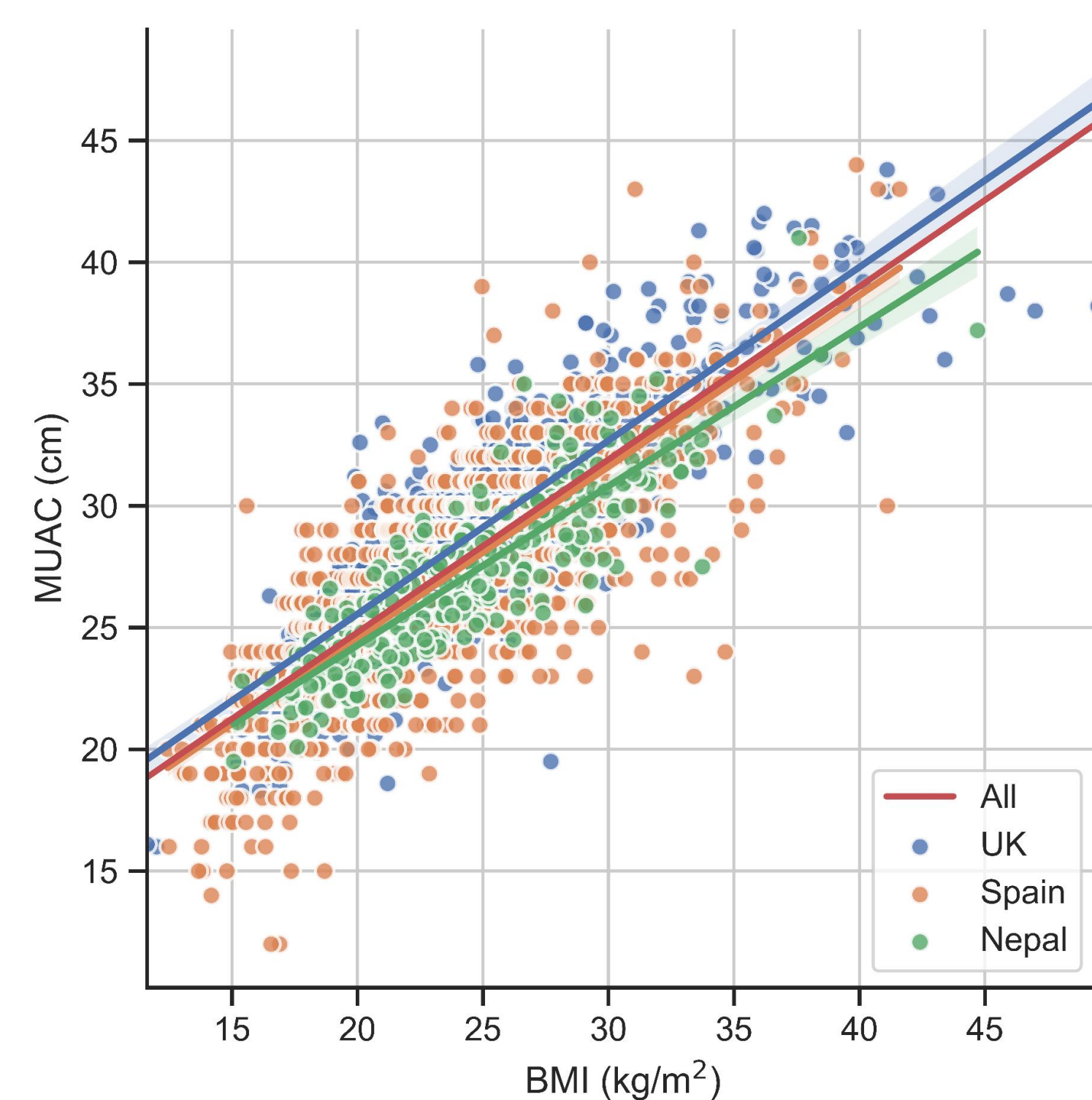
The wrong cuff size gives wrong readings



Blood pressure monitor manufacturers provide a **range of cuff sizes**

Cuff	Circumference range (cm)
S	17-22
M (Standard)	22-32
L	32-42
XL	42-50

The BMI predicts the MUAC... the MUAC predicts the cuff size.



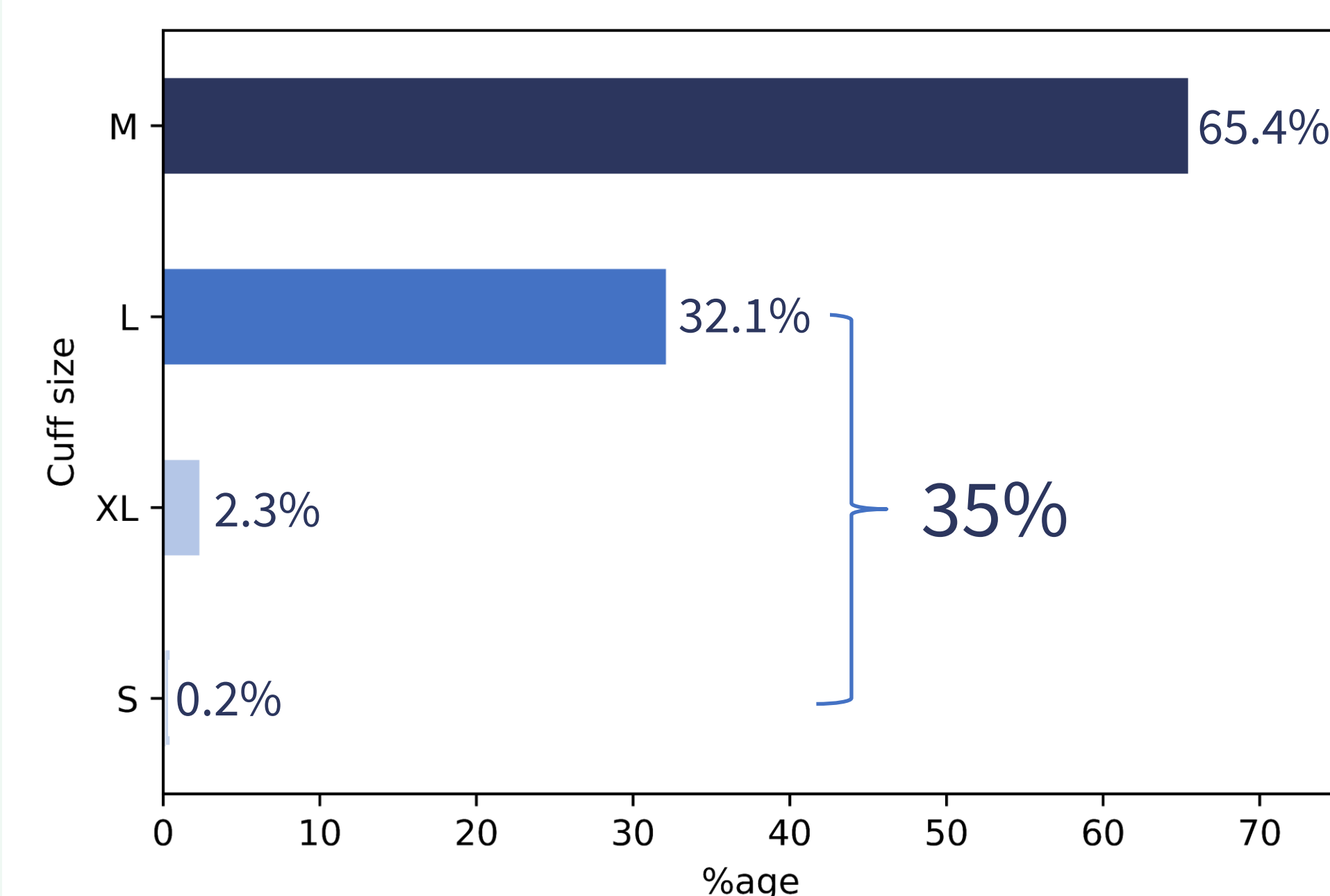
1. BMI correlates strongly with MUAC in 3 diverse populations

Country	Population
Nepal	Cross-sectional study conducted at two urban public hospitals
UK	Adult patients admitted as an emergency to a teaching hospital over a 20 months period
Spain	Retrospective analysis of hospitalised patients assessed by the Clinical and Dietetic Nutrition Section over a 10 year period

References
 1. **Nepal:** Thorup, L. *et al.* Mid-upper arm circumference as an indicator of underweight in adults: a cross-sectional study from Nepal. *BMC Public Health* **20**, 1187 (2020).
 2. **UK:** Powell-Tuck, J. & Hennessy, E. M. A comparison of mid upper arm circumference, body mass index and weight loss as indices of undernutrition in acutely hospitalized patients. *Clin. Nutr.* **22**, 307-12 (2003).
 3. **Spain:** Benítez Brito, N. *et al.* Relationship between Mid-Upper Arm Circumference and Body Mass Index in Inpatients. *PLoS One* **11**, e0160480 (2016).

$$\text{MUAC} = 0.71 \times \text{BMI} + 10.45$$

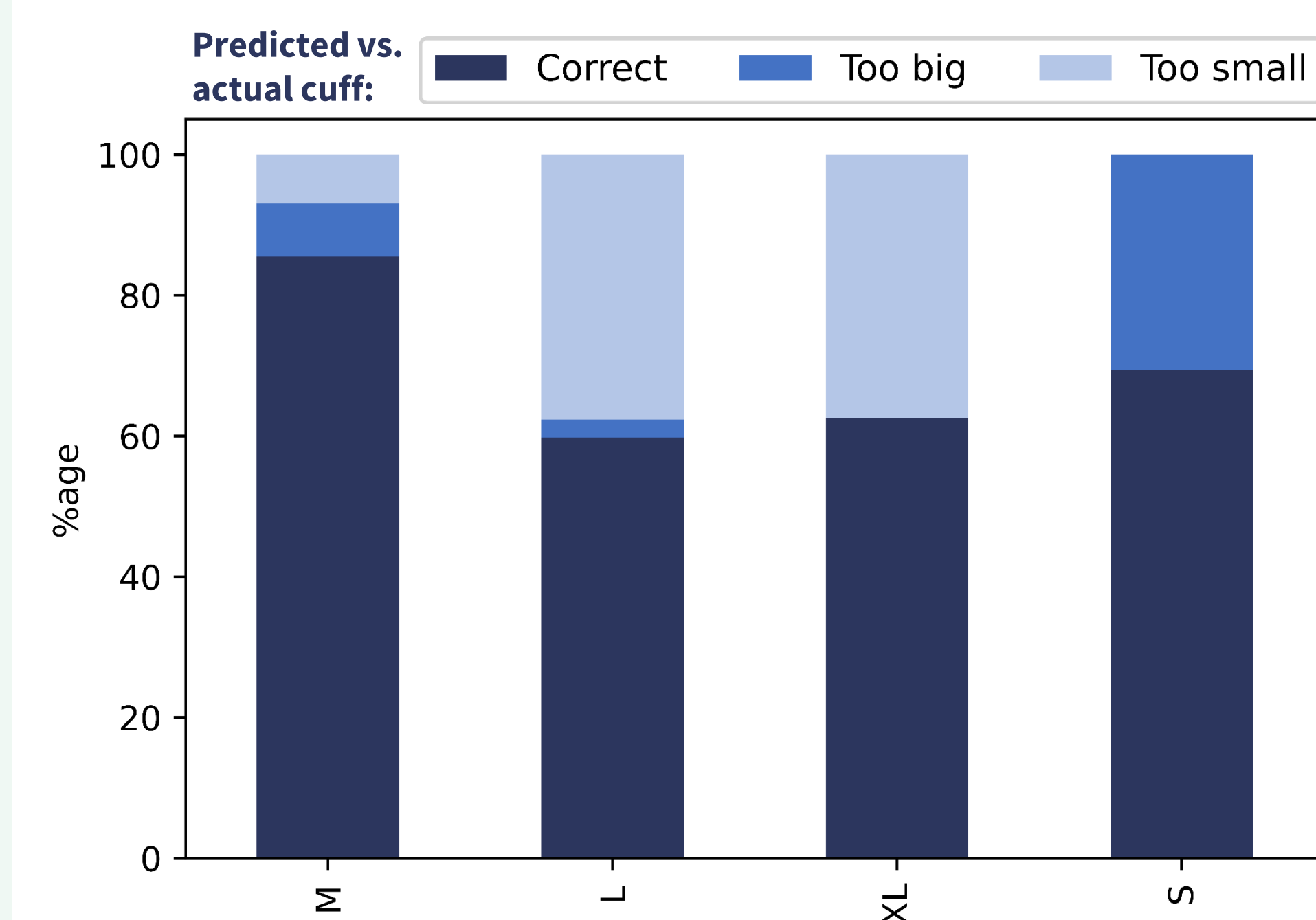
(n=2248; R²=0.69)



2. BMIs “predict” many patients require a non-standard cuff size

Adult patients with known hypertension and reliable recent BMIs in 207 North East London GP practices (n=167,262)

In large-scale home BP monitoring initiatives, anticipate procuring at least 1/3 non-standard cuffs



3. For individuals, our simplified cuff-prediction scheme gets it right most of the time

Patient BMI	Predicted BP cuff size	%correct cuff prediction (actual [MUAC] vs predicted [BMI])*
<18	S	69.4%
>=18 and <29	M	85.5%
>=29 and <40	L	59.8%
≥40	XL	62.5%

* Tested on data from linear regression calculation (Panel 1)

Conclusions

1. We derived a reliable linear regression model of BMI \propto MUAC using 2248 data points from literature.
2. Clinicians and researchers involved in population-wide home blood pressure monitoring (HBPM) initiatives should ensure a good supply of non-standard BP cuffs.
3. Consider the use of “wide-range” BP cuffs if available (typically \approx M+L [22-42cm]); these accommodate the vast majority of patients (\approx 97% in our Panel 2 data).
4. For individuals patients, the simplified scheme can help identify patients needing a non-standard cuff... but consider measuring actual MUAC in patient at BMI cuff boundaries.