



A Systemic Review: Normative Reference Values of the Median Nerve Cross-Sectional Area Using Ultrasonography in Healthy Individuals

Team 19 SRIP: Sulaiman, Athena, Daniel Peh, Jane
Lee Kong Chian School of Medicine

INTRODUCTION

Median nerve cross-sectional area (CSA) was used for screening and diagnosis of neuropathy

Ultrasonography² studies shows:

- CSA increase: carpal tunnel syndrome, diabetic neuropathy¹
- CSA decrease: neurodegenerative conditions, for example amyotrophic lateral sclerosis

Gap of current studies: few studies have suggested a reference range which would be helpful for clinicians in improving screening and diagnostic methods for median nerve neuropathy

AIM

Report the normal median nerve CSA along its course at predetermined anatomical landmarks ie mid-arm, elbow, mid-forearm, carpal tunnel (CT) inlet and outlet

Analysis of median nerve CSA in subgroup variables such as age, sex, ethnicity, geographical location and method of CSA measurement

MATERIALS AND METHODS

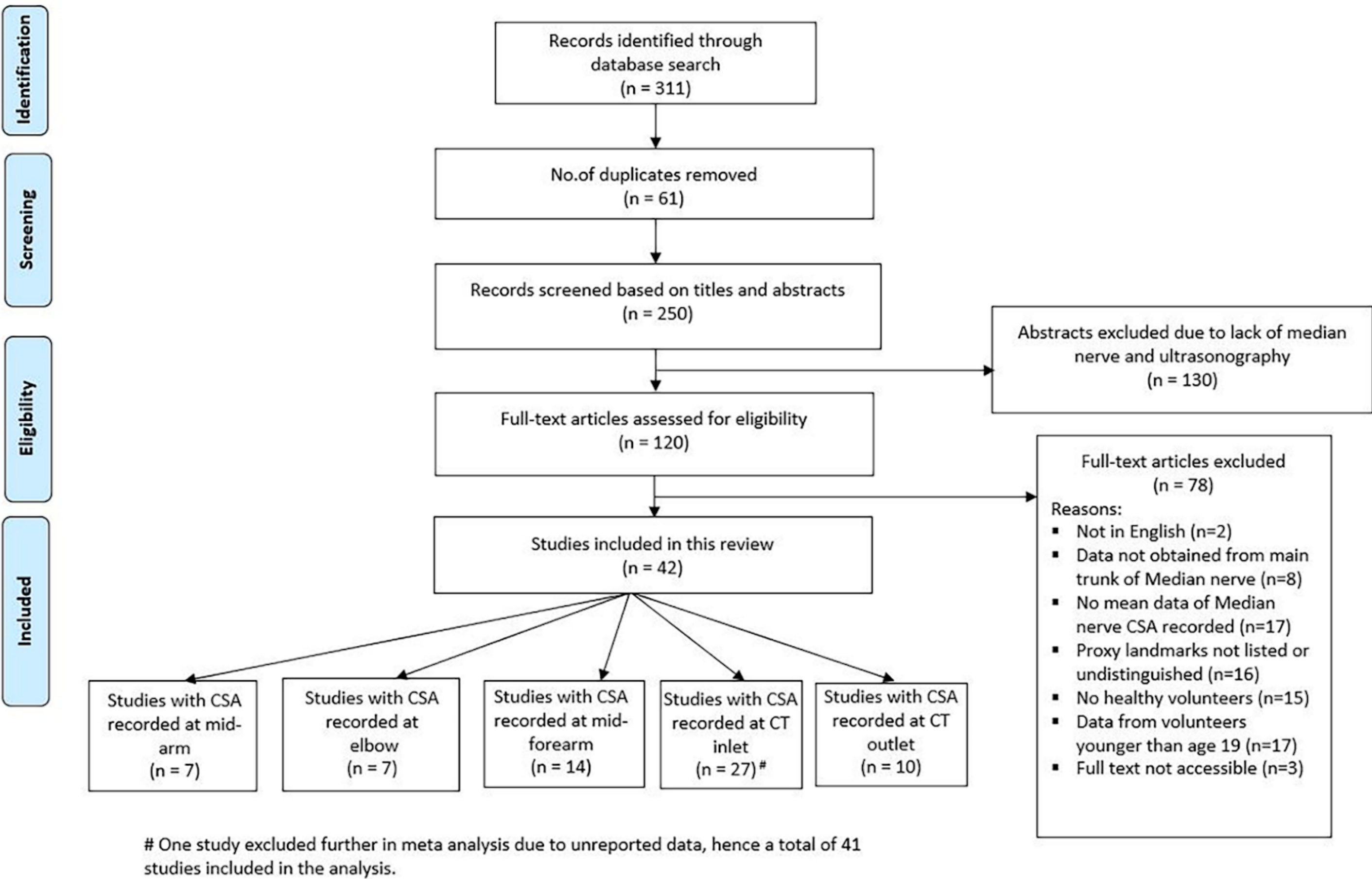
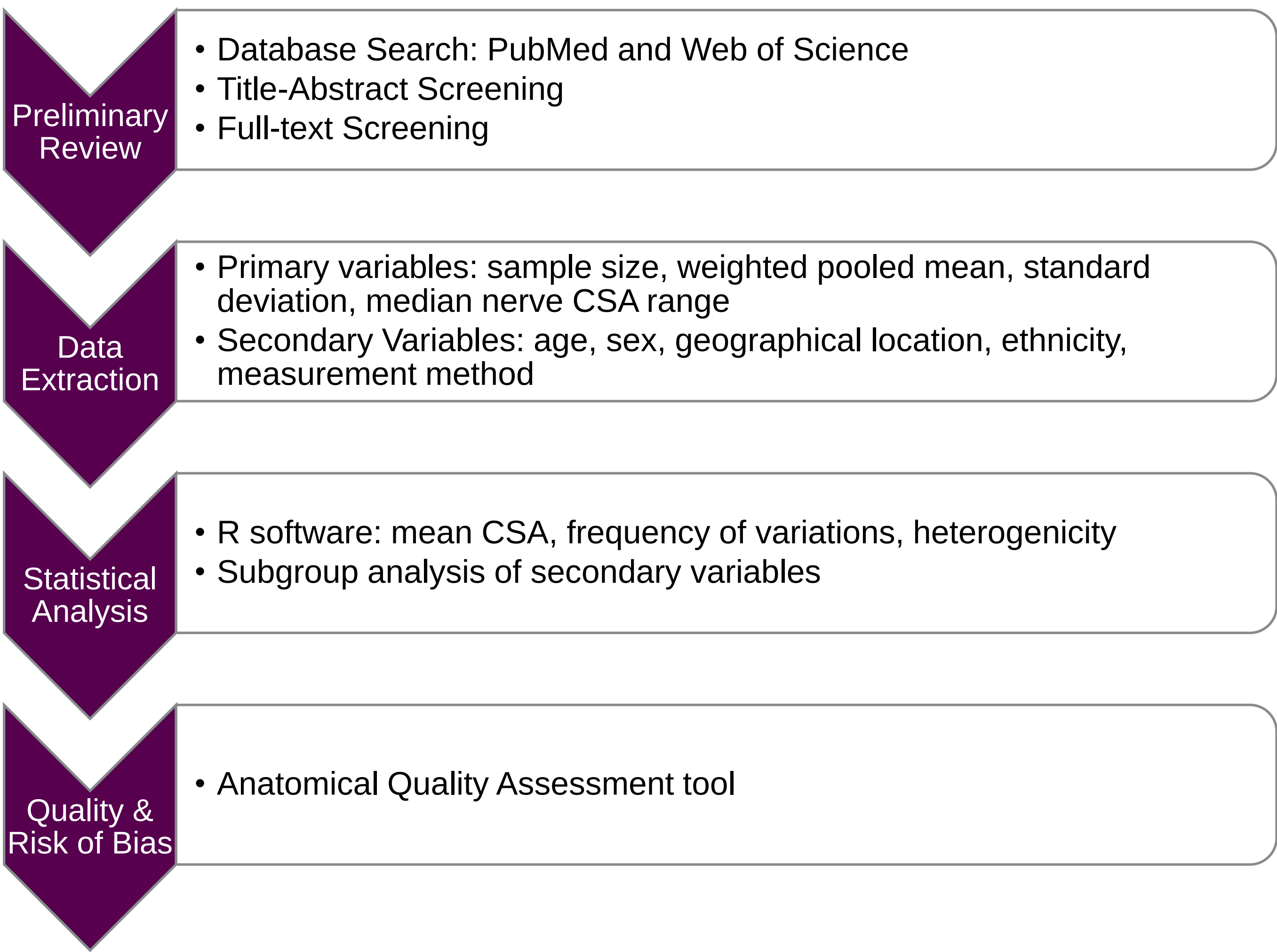


Figure 1 PRISMA chart on preliminary review

RESULTS

MEDIAN NERVE CSA by:

Anatomical Landmark

Landmark	Pooled weighted mean and 95% CI [upper bound, lower bound] of the median nerve CSA
Mid-arm	8.81 mm ² , CI [8.10, 9.52]
Elbow	8.57 mm ² , CI [8.00, 9.14]
Mid-forearm	7.07 mm ² , CI [6.41, 7.73]
CT inlet	8.74 mm ² , CI [8.45, 9.03]
CT outlet	9.02 mm ² , CI [8.08, 9.95]

Table 1: Pooled weighted mean and 95% confidence interval of the median nerve CSA

Age

CSA is variable at different ages

- CSA at mid-forearm was higher in younger adults compared to other groups, while CSA at mid-arm and CT outlet was higher in middle-aged adults compared to other groups
- CSA at the elbow and CT inlet were similar in young and middle age groups

Sex

Males generally have larger CSA than females

- The CSA of males was generally larger than females at all 5 landmarks (>1 mm²), except for CT inlet and mid-forearm where CSA values were similar (<0.5 mm²)

Geographical Location

Variation of CSA among the different geographical locations for different landmarks of the upper limb except for the CT inlet

- CSA varies greatly aside from CT inlet - where CSA was similar across locations (8.68mm² to 8.90mm²)

Geographical Ethnicity

CSA varies greatly aside from CT inlet - where CSA was similar across locations (8.12mm² to 8.50mm²)

LIMITATIONS

- Differences in method of measuring CSA and definition of CSA boundary: Lack of standardised protocol for CSA measurement and ultrasound methodology
- Considerable heterogeneity among the included studies
- Lack of categorization of mean median nerve CSA calculated based on right and left hands and BMI
- Lack of standardised ultrasound protocol and CSA measurement methods
- Limited sample size for various subgroup analysis
- Publication bias English language

FUTURE STUDIES AND DEVELOPMENTS

- Establishing standardised protocols and methods
- Explore whether differences in median nerve CSA with or without epineurium of the median nerve can be considered
- Inclusion of other methods for reviewing normal median nerve CSA cut-offs
- Ultrasound measurements and comparison of the ratio between fascicular bundles and non-fascicular areas
- Exploring how to categorize age groups when measuring CSA in human peripheral nerves
- Future artificial intelligence utilizing calculated median nerve CSA to deduce abnormalities

CONCLUSION

This paper provides insights to address the gaps current literature where there is a lack of reference range for median nerve CSA. With the consolidated data, This can serve as a resource for practitioner and surgeons as a cut-off point for pre-clinical screening and diagnosing median nerve neuropathy. Future research would be recommended to obtain normative median nerve CSA values based on other characteristics using standardized protocols.

References:
¹ Singh, Y., Dixit, R., Singh, S., Garg, S. & Chowdhury, N. High resolution ultrasonography of peripheral nerves in diabetic peripheral neuropathy. *Neurol. India* 67, 71 (2019).
² Simon, N. G., Talbott, J., Chin, C. T. & Klot, M. Peripheral nerve imaging. *Handb. Clin. Neurol.* 136, 811–826 (2016).