From survey data to model-ready blood pressure curves

Age–sex–treatment BP distributions from Health Survey for England 2022

A resource for cardiovascular prevention modelling, salt reduction and potassium-enriched salt substitute implementation

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Health Studies User Conference, 25 June 2026

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1. Why this work exists

The original modelling need

Salt reduction and potassium-enriched lower-sodium salts act partly through blood pressure.

Models need age- and sex-specific baseline BP, not only broad prevalence summaries.

Paired SBP/DBP allows pulse pressure, MAP and hypertension categories to be derived consistently.

The implementation-safety need

Potassium-enriched salts require safety-netting for people less able to excrete potassium.

CKD is not a single risk category: eGFR thresholds matter.

Self-reported kidney disease may under-identify the subgroup needing caution.

Aim: derive a weighted, reusable HSE BP resource and link it to renal-safety scenarios for LSSS modelling.

2. Analysis flow

Key derivations

Person-level BP from up to 3 paired readings

Weighted means and SDs by AGE35G midpoint × sex

Reading-rule sensitivity: 1, 2 or 3 valid pairs

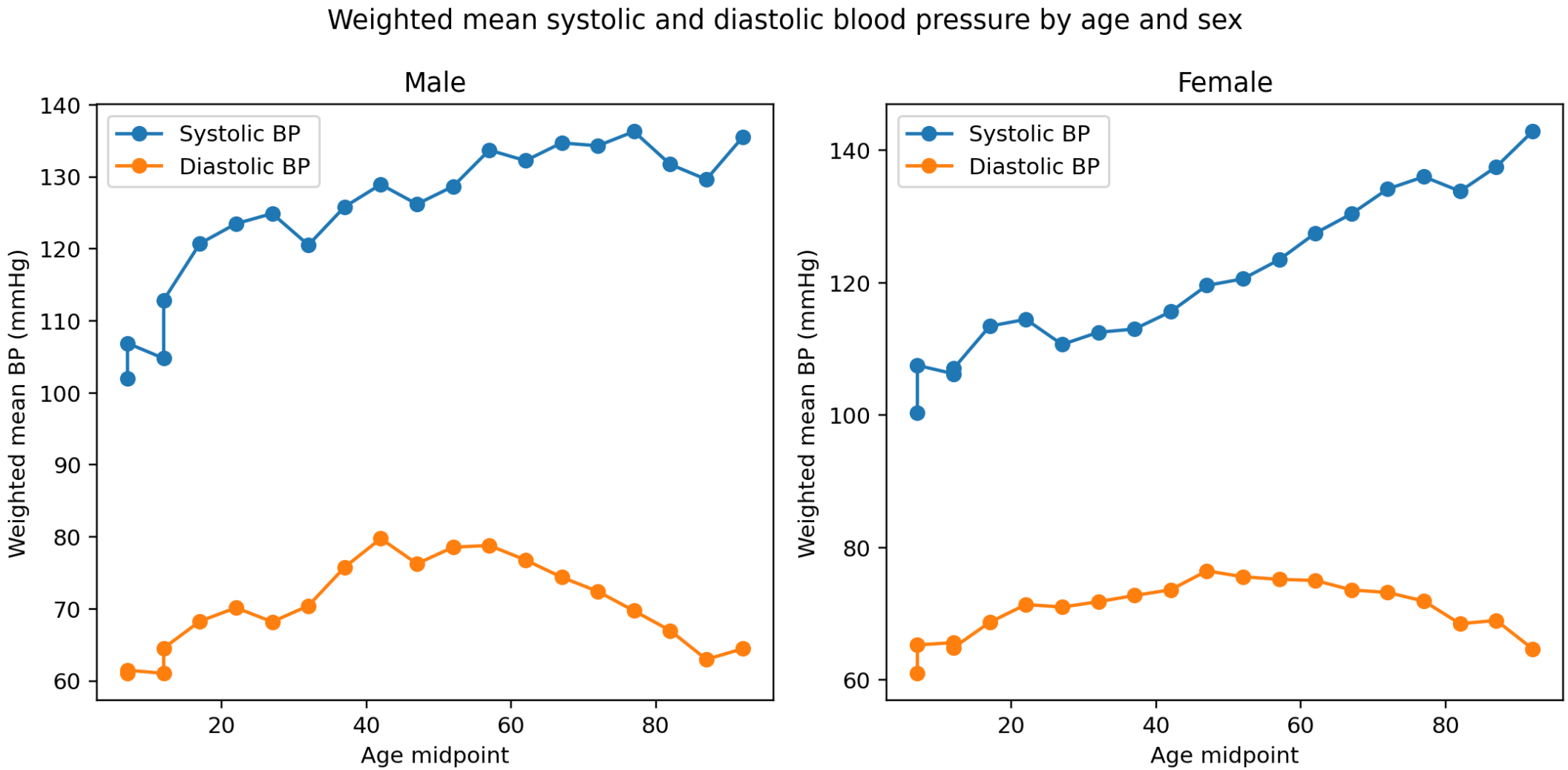
Renal-safety framing

S1: eGFR <30, narrow high-risk renal threshold

S2: eGFR <45, moderate caution threshold

S3: CKD stages 3–5, broad public-health caution

3. Core output: population BP curves for modelling



SBP rises with age; DBP peaks in mid-life then declines, widening the SBP–DBP gap.

Analysis by author. Chart created by Amanda Shiach using an *AI-generated image, created with Chat GPT+. Data source:* UK Data Archive Study Number SN 9469 - Health Survey for England, 2022; NatCen Social Research/UCL via UK Data Service. 22.06.26

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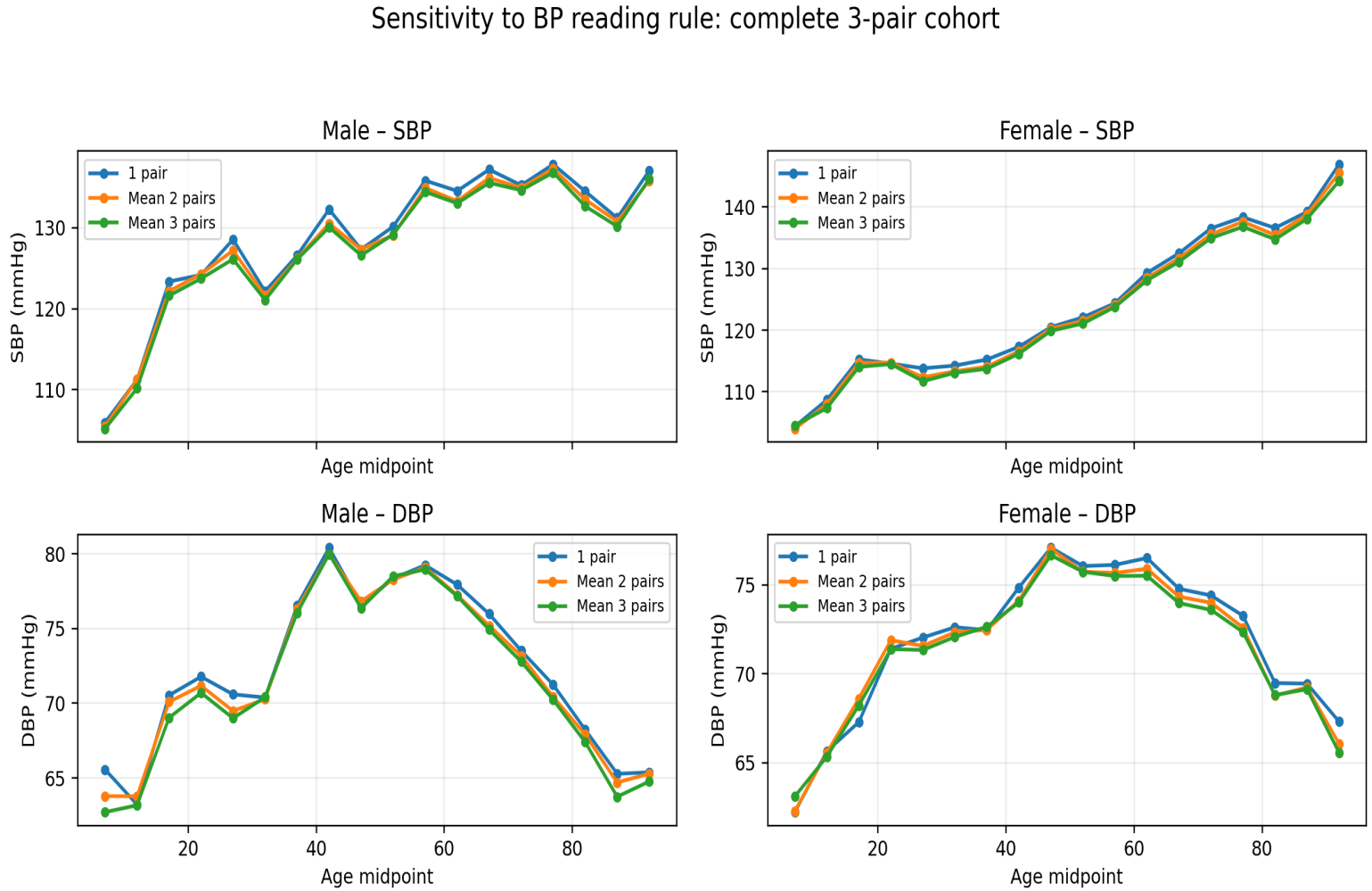
4. Sensitivity: BP reading rule



Weighted means; restricted to participants with all 3 valid paired readings to isolate reading-rule effect.

Using the first valid pair, mean of 2 pairs, or mean of 3 pairs gives the same BP pattern when restricted to the same 3-pair cohort

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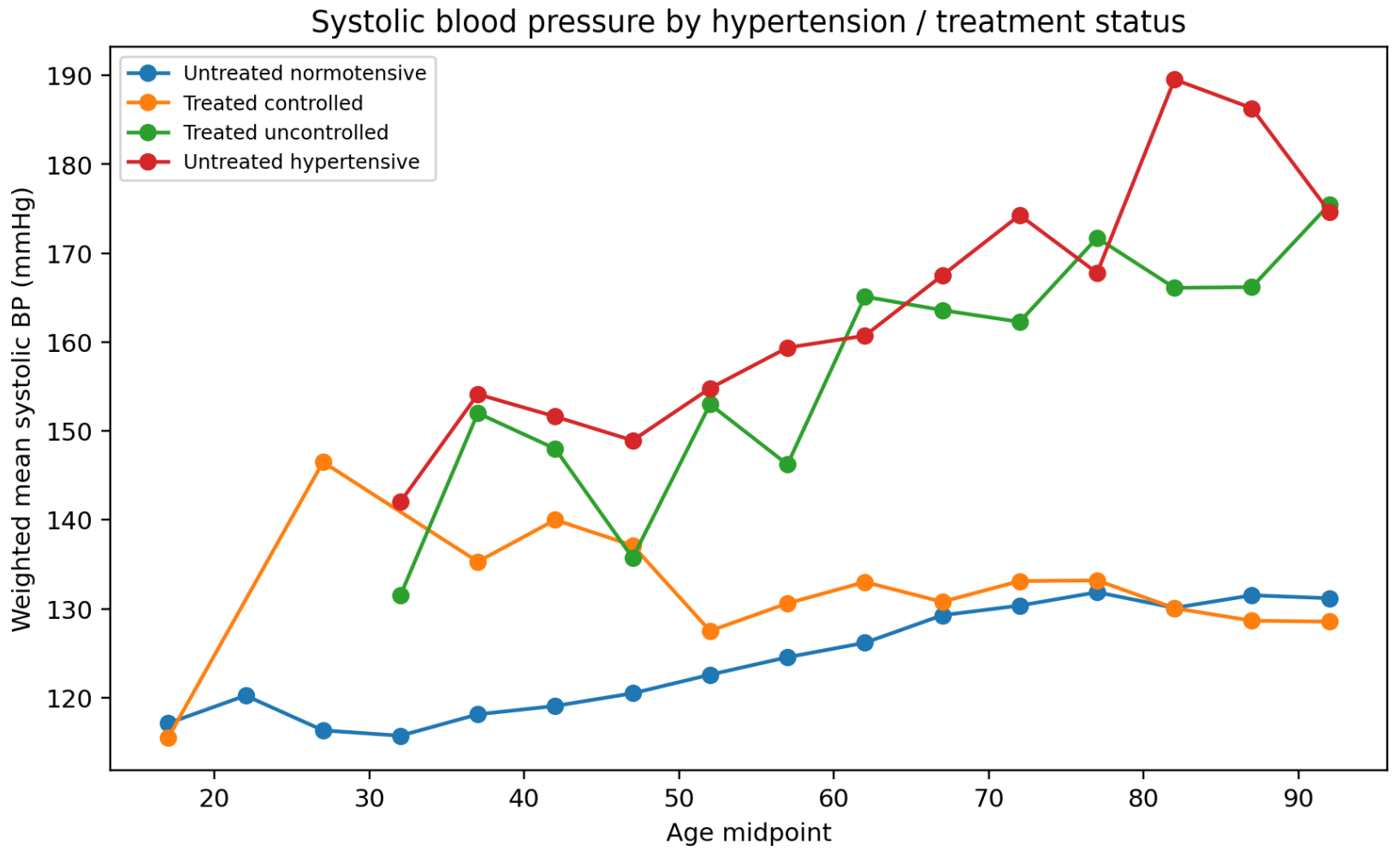
5. Treatment status: clinically meaningful BP subgroups



Population BP curves conceal distinct subgroups:
untreated normotensive, untreated hypertensive, treated controlled and treated uncontrolled.

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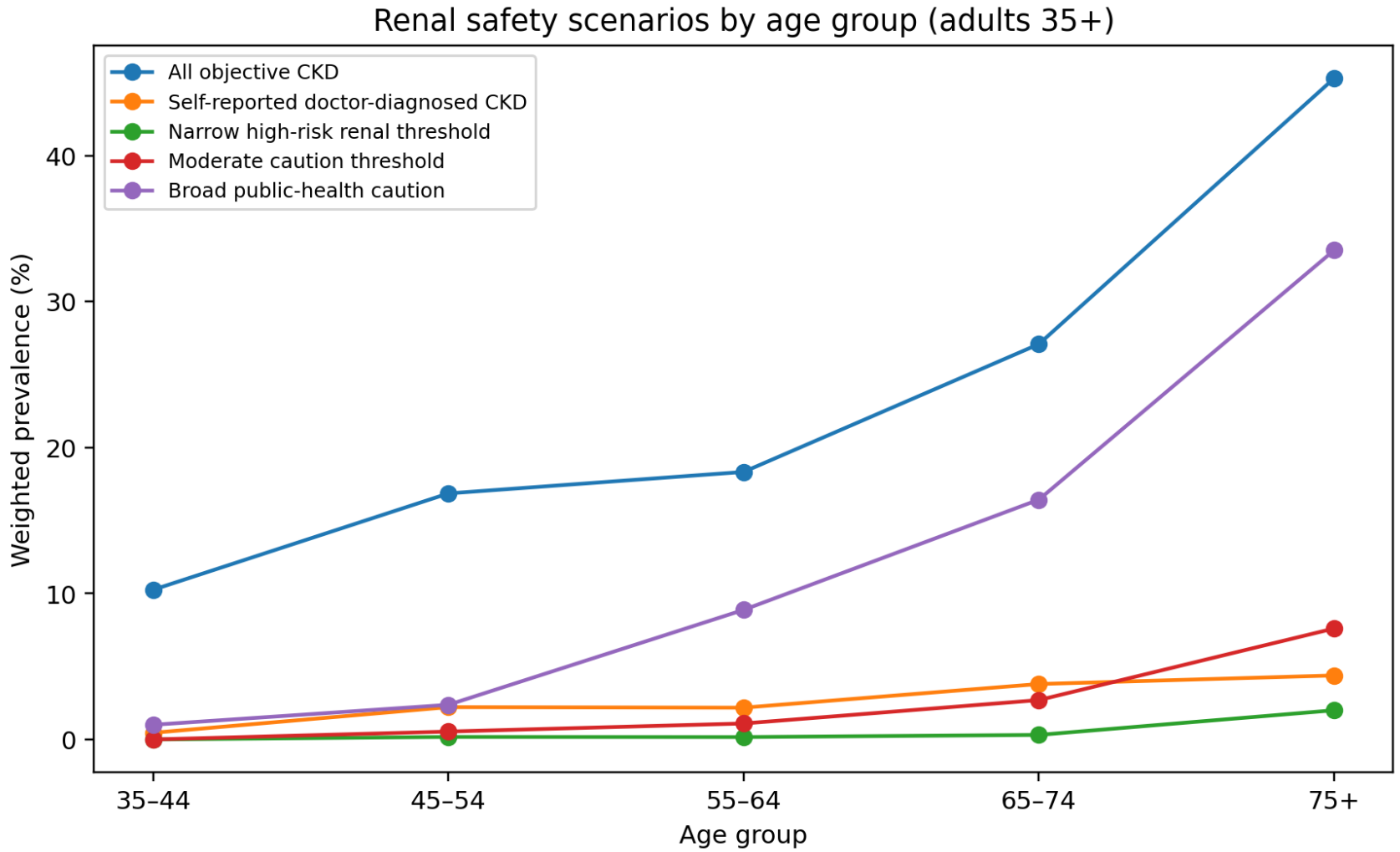
6. CKD safety framing: not all CKD carries equal potassium risk

For potassium-enriched salts, renal-function thresholds are more useful than a broad “any CKD” category.

Scenario	Definition	Use in modelling
S1 Narrow high-risk	eGFR <30	Most specific proxy for impaired potassium excretion
S2 Moderate caution	eGFR <45	Sensitivity/caution: CKD G3b–G5
S3 Broad caution	CKD stages 3–5	Conservative public-health warning scenario

Key point: CKD stages 3–5 are useful for broad caution, but likely over-inclusive as a biological hyperkalaemia risk threshold.

7. Renal-safety scenarios rise with age



The narrow eGFR <30 group is small; the broad CKD stages 3–5 caution group is much larger, especially at 75+.

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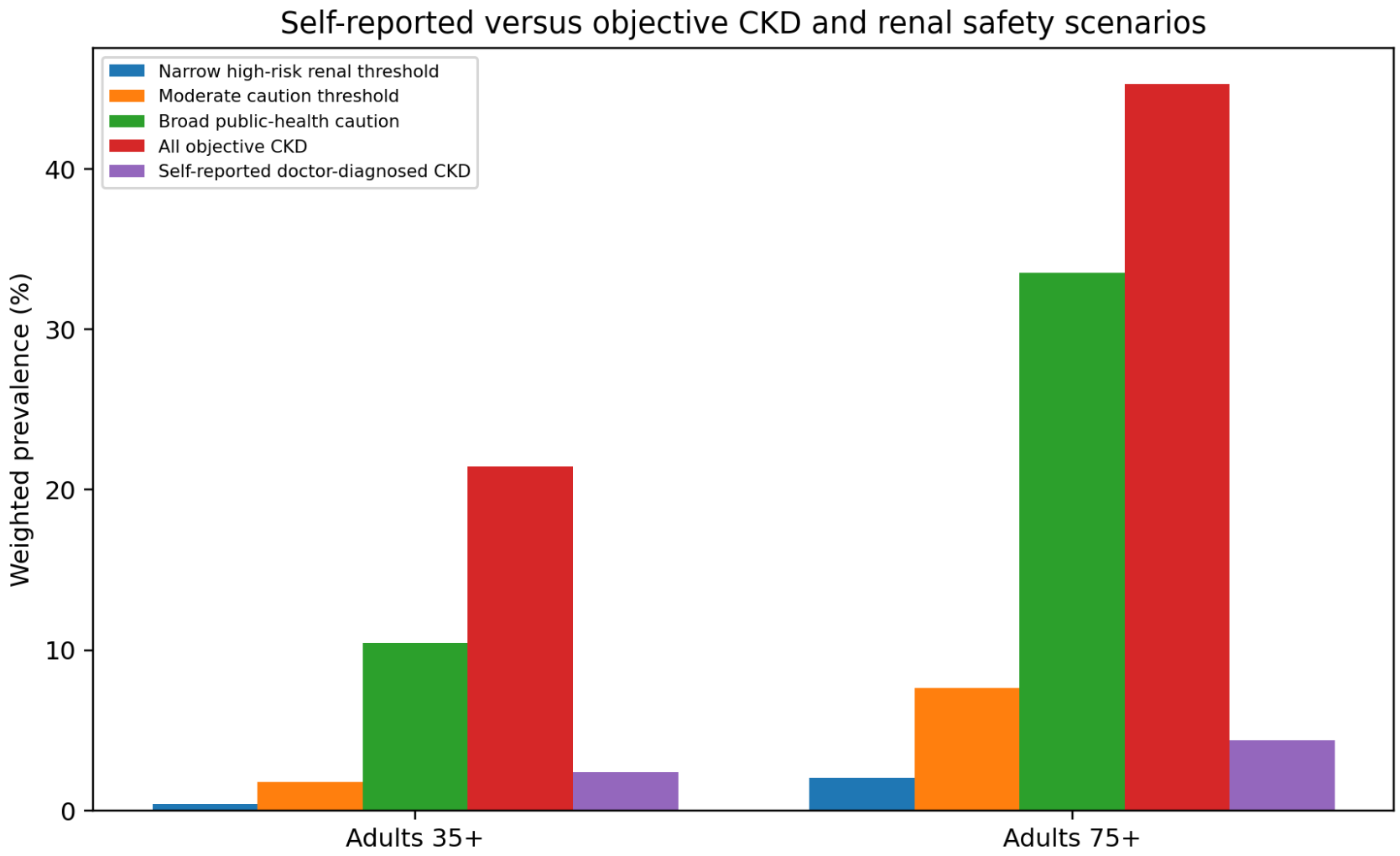
8. Self-report alone is not enough for CKD safety-netting



Self-reported doctor-diagnosed CKD is far lower than objective CKD; implementation cannot rely only on people knowing/reporting kidney disease.

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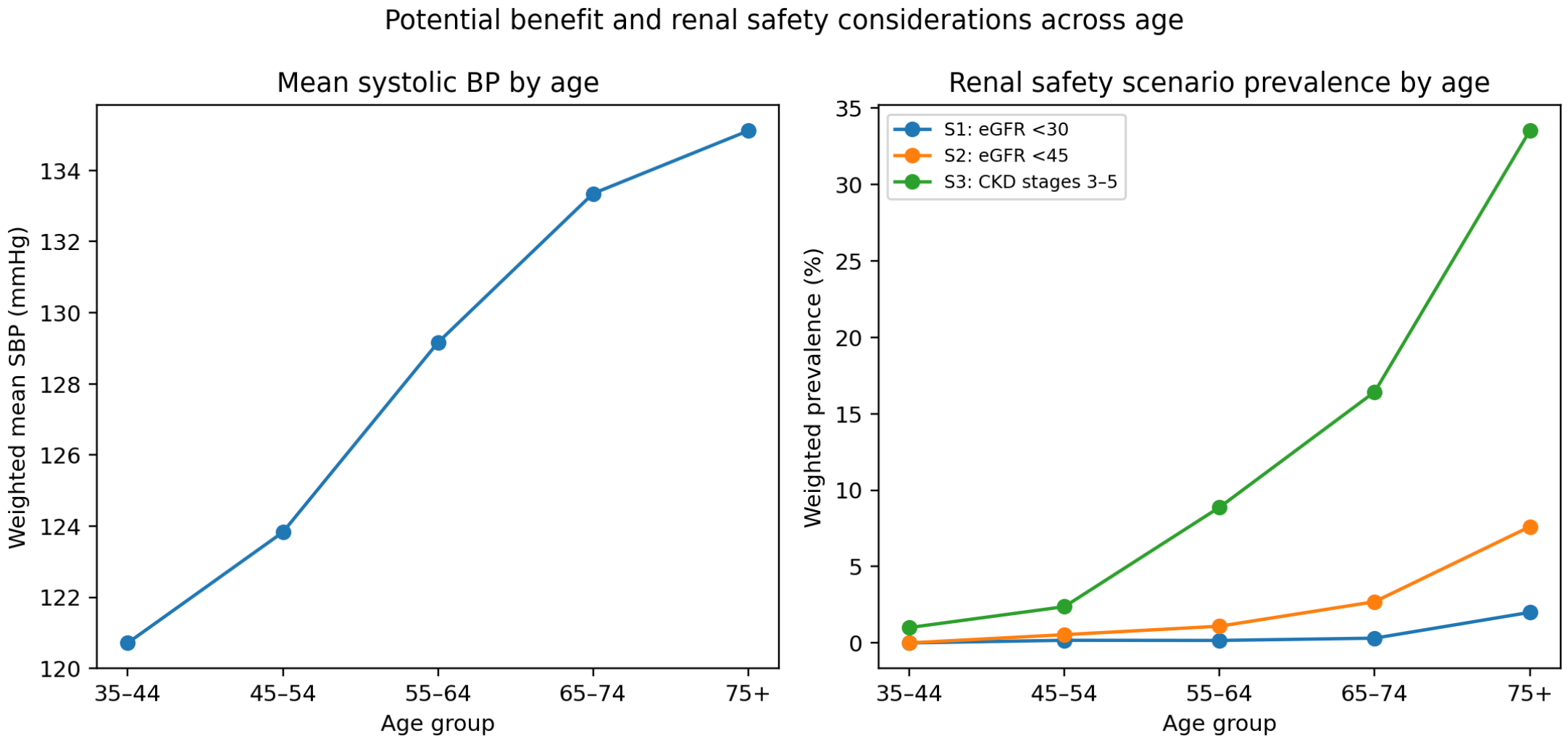
9. BP benefit and renal guardrails overlap with age



The age groups with higher SBP-mediated prevention opportunity are also where renal-safety considerations become more important.

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HSE can be repurposed into a practical modelling input for prevention policy.

BP distributions show where the population health gains from sodium reduction may occur.

Treatment-status curves show that population BP is made up of clinically meaningful subgroups.

Renal-safety scenarios show that potassium-enriched salt implementation needs targeted guardrails, not blanket assumptions.

A population modelling resource with clinical and implementation context

Thank you! Q?

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