

Essential Components of School-Based Strength and Conditioning: A Delphi Study

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Abstract

Background: Schools offer large-scale access to youth athletic development, yet no consensus defines what school-based strength and conditioning (S&C) should include.

Aim: To establish expert consensus on the essential components required for safe and effective school-based S&C.

Methods: A three-round e-Delphi within an explanatory sequential mixed-methods design. Practitioners delivering school-based S&C within the past two years (Round 1 n = 52; Round 2 n = 42; Round 3 n = 33) generated components through an open question analysed by inductive content analysis, then rated them on a 9-point scale. Consensus required ≥80% "essential", IQR ≤2 and, in Round 3, stability between rounds (Wilcoxon p > 0.05).

Results: Thirty-five components across six categories were identified. Twenty-four reached consensus (22 in Round 2; 2 in Round 3), led by Safe Training Environment (100%) and Coaching Skills and Expertise (97.6%). Two met agreement but were unstable, and nine did not reach consensus, including all formal monitoring and planning components and Sports-Specific Delivery (42.4%).

Conclusion: Practitioners prioritise safety, coaching quality and developmental foundations over formal monitoring and sport-specific delivery.

Introduction

- Youth are not "miniature adults"; training must reflect their development (Lloyd and Oliver, 2012).
- Most adolescents globally fail to meet physical activity guidelines (Guthold et al., 2020).
- Inconsistent training leaves youth overtrained or underprepared (Lloyd et al., 2016).
- Schools offer large-scale access to long-term athletic development (Till et al., 2022), but delivery is highly contextual (Varghese et al., 2022).
- Developmental models exist (Pichardo et al., 2018), yet consensus-driven operational guidance for school-based S&C is lacking.

Aim and Objectives

To establish expert consensus on the essential components required for safe and effective delivery of strength and conditioning within school-based settings.

- Identify key components of school-based S&C
- Establish the level of consensus among expert practitioners
- Analyse consensus findings and allow re-rating
- Identify areas of consensus and non-consensus
- Translate findings into practical guidelines

Research question (Round 1)

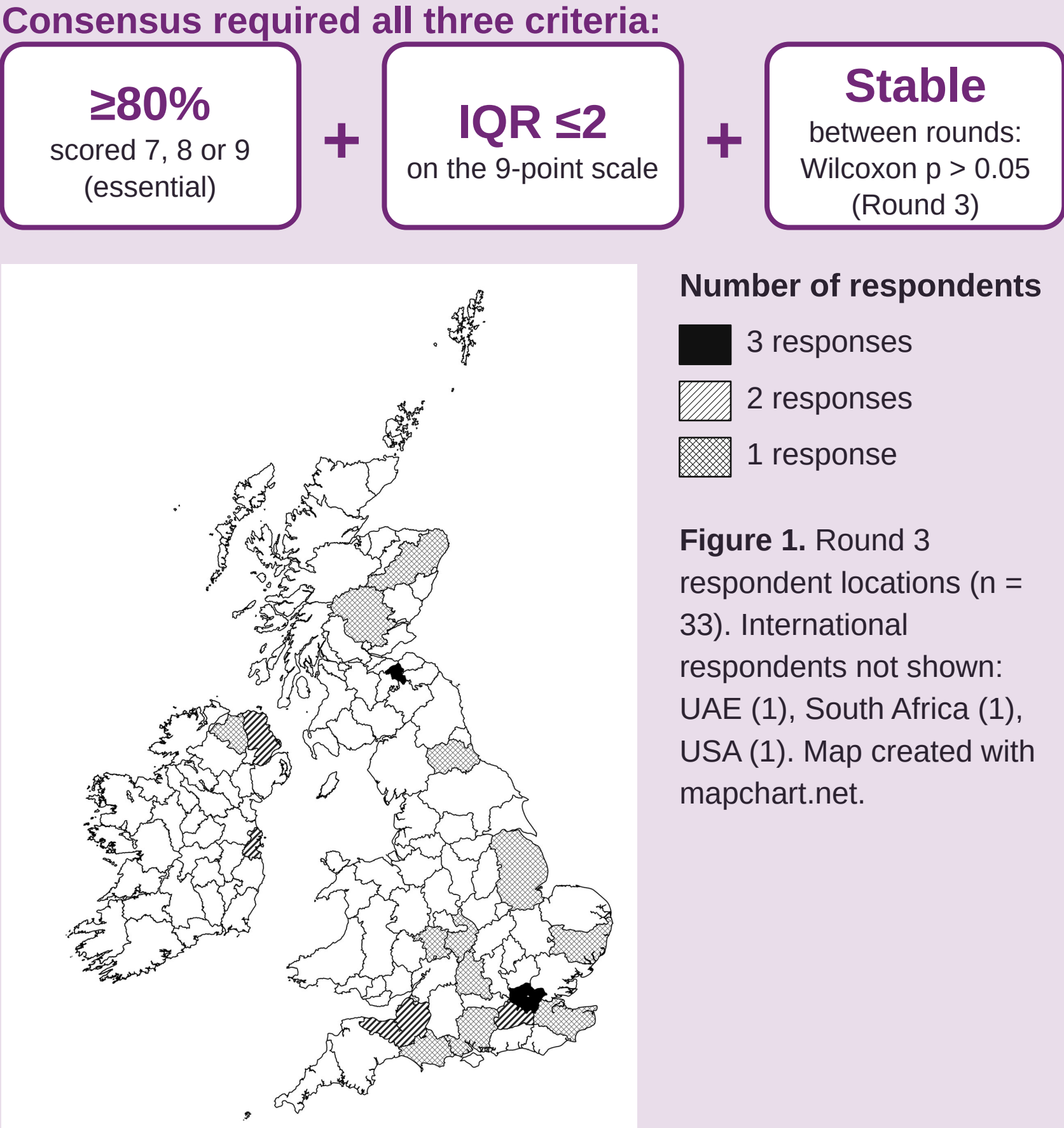
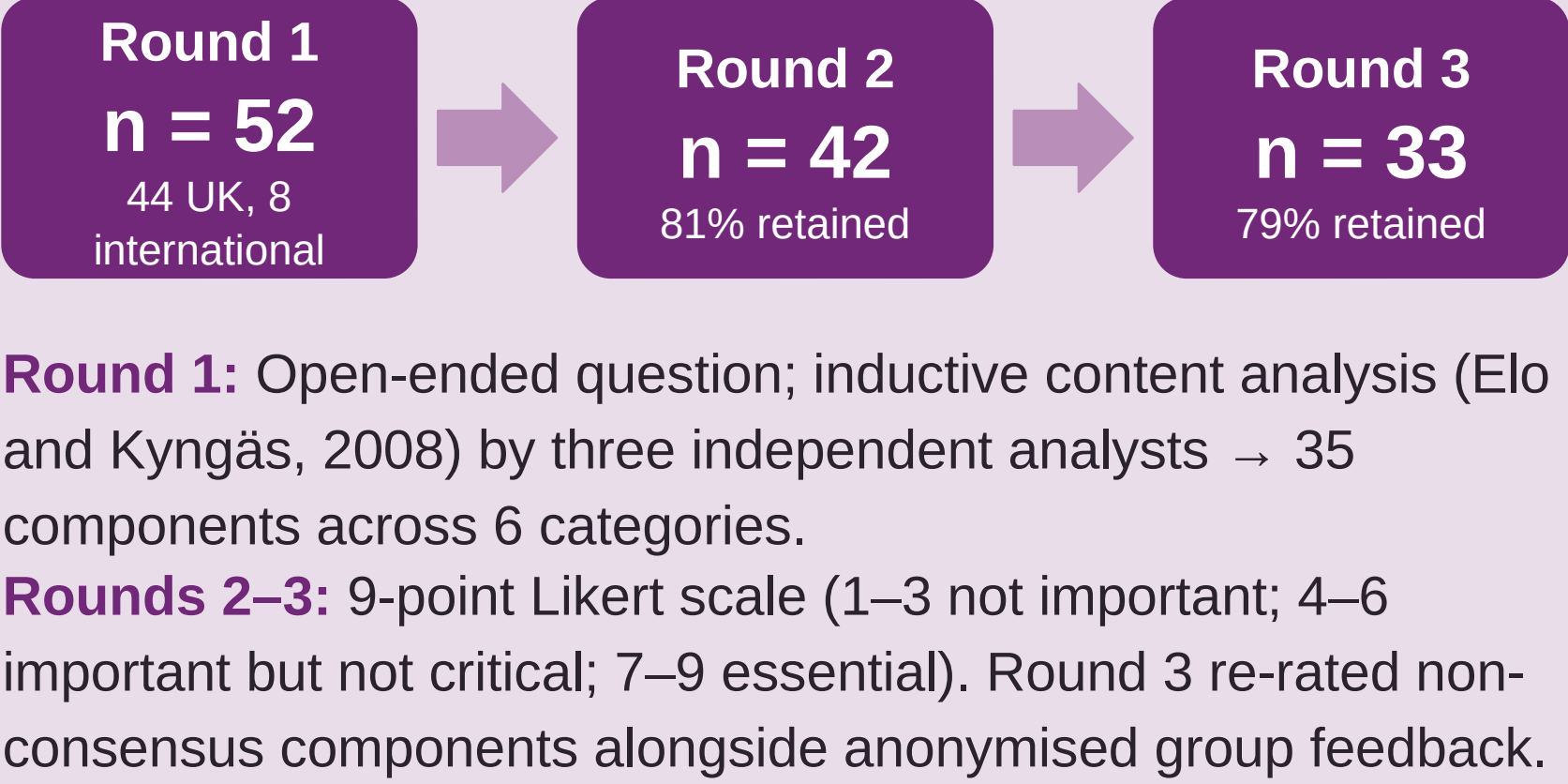
"Based on your professional experience, what do you consider to be the key programme content and delivery components required for the safe and effective design and delivery of a school-based strength and conditioning programme?"

Methods

Design: Explanatory sequential mixed-methods, three-round e-Delphi within a pragmatic paradigm; reported using DELPHISTAR (Niederberger et al., 2024).

Panel: Criterion-based purposeful sampling with snowball recruitment. Eligible: currently delivering, or delivered within the past two years, S&C in a primary or secondary school; international practitioners eligible.

Panel profile: predominantly male (90–94%), aged 25–34 (64–69%), with independent-school experience (82–87%).



Next Steps

- Post-Delphi interviews exploring consensus and non-consensus components
- International research into sociocultural differences
- Intervention studies on the impact of school-based S&C systems

Key Findings

- Strongest consensus: safe training environments, coaching quality and athlete–coach relationships (95–100%).
- Broad agreement on developmental foundations: LTAD, maturation, movement skills, strength, speed and plyometrics.
- Consensus was not reached for formal monitoring and planning (training load, wellness, performance tracking, periodisation) or for individualised, gender-specific and sports-specific delivery.

Conclusion

- Practitioners agree school-based S&C should be built on safe environments, high-quality coaching and developmentally appropriate training.
- Formal monitoring and sport-specific delivery were not considered essential by consensus and warrant further exploration.
- Findings provide consensus-informed components for school-based S&C, bridging the gap between theory and practice.

Practical Applications

- Professional: will inform provision at partner school Robert Gordon's College and offer guidance for independent and state-funded schools.
- Policy: provides organisations such as the UKSCA with practitioner-derived consensus.
- Academic: lays groundwork for future implementation studies.

Limitations

- Self-selected panel, predominantly male, UK-based and from independent schools.
- Five Round 2 consensus components were re-rated in Round 3 (see Figure 2 footnote).

References

Diamond, I.R. et al. (2014) Journal of Clinical Epidemiology, 67(4), pp. 401–409.

Elo, S. and Kyngäs, H. (2008) Journal of Advanced Nursing, 62(1), pp. 107–115.

Guthold, R. et al. (2020) The Lancet Child & Adolescent Health, 4(1), pp. 23–35.

Lloyd, R.S. and Oliver, J.L. (2012) Strength and Conditioning Journal, 34(3), pp. 61–72.

Lloyd, R.S. et al. (2016) Journal of Strength and Conditioning Research, 30(6), pp. 1491–1509.

Niederberger, M. et al. (2024) PLoS ONE, 19(8), e0304651.

Pichardo, A.W. et al. (2018) International Journal of Sports Science & Coaching, 13(6), pp. 1189–1199.

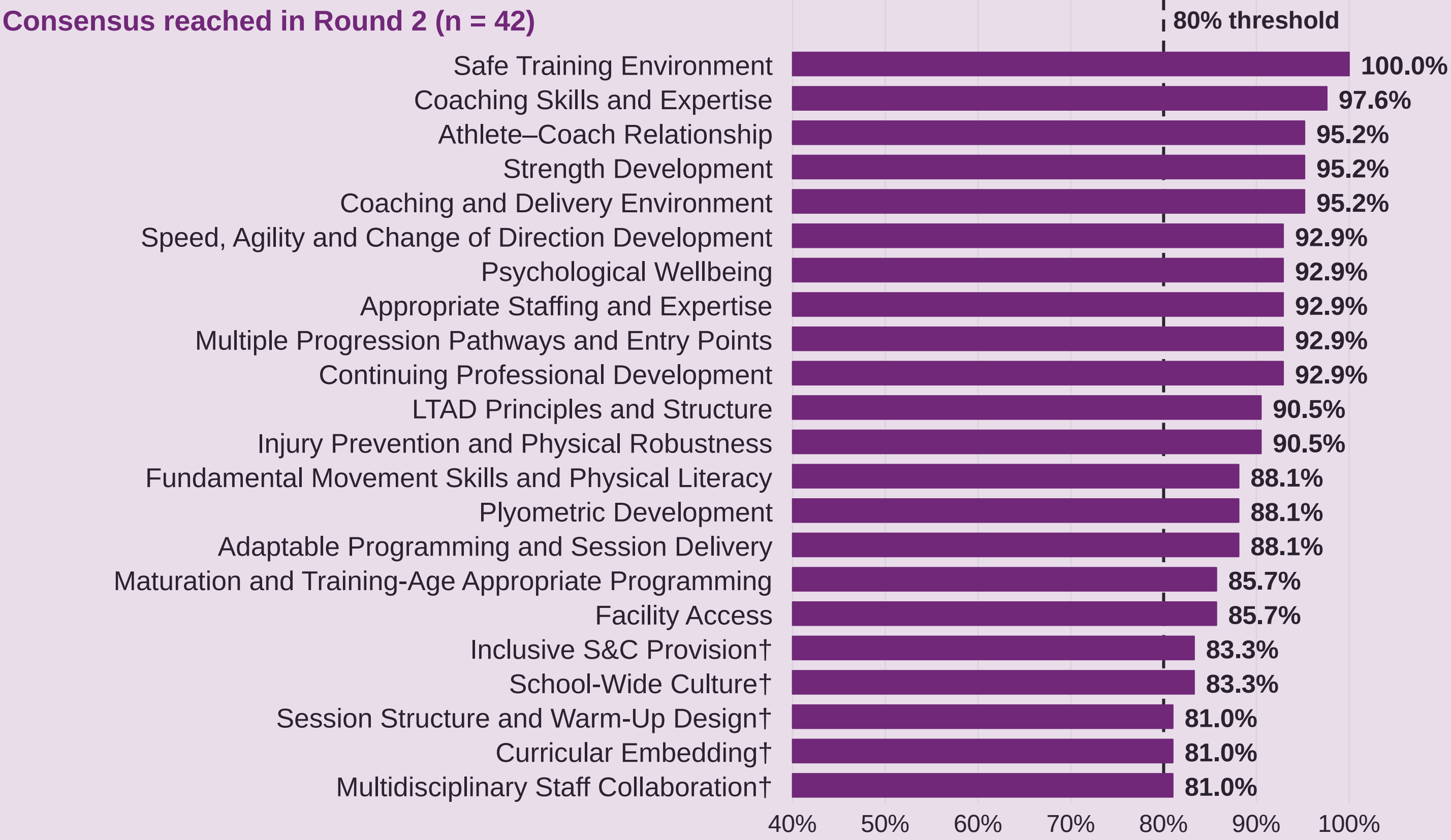
Till, K. et al. (2022) British Journal of Sports Medicine, 56(9), pp. 479–480.

Varghese, M., Ruparell, S. and LaBella, C. (2022) Sports Health, 14(1), pp. 20–29.

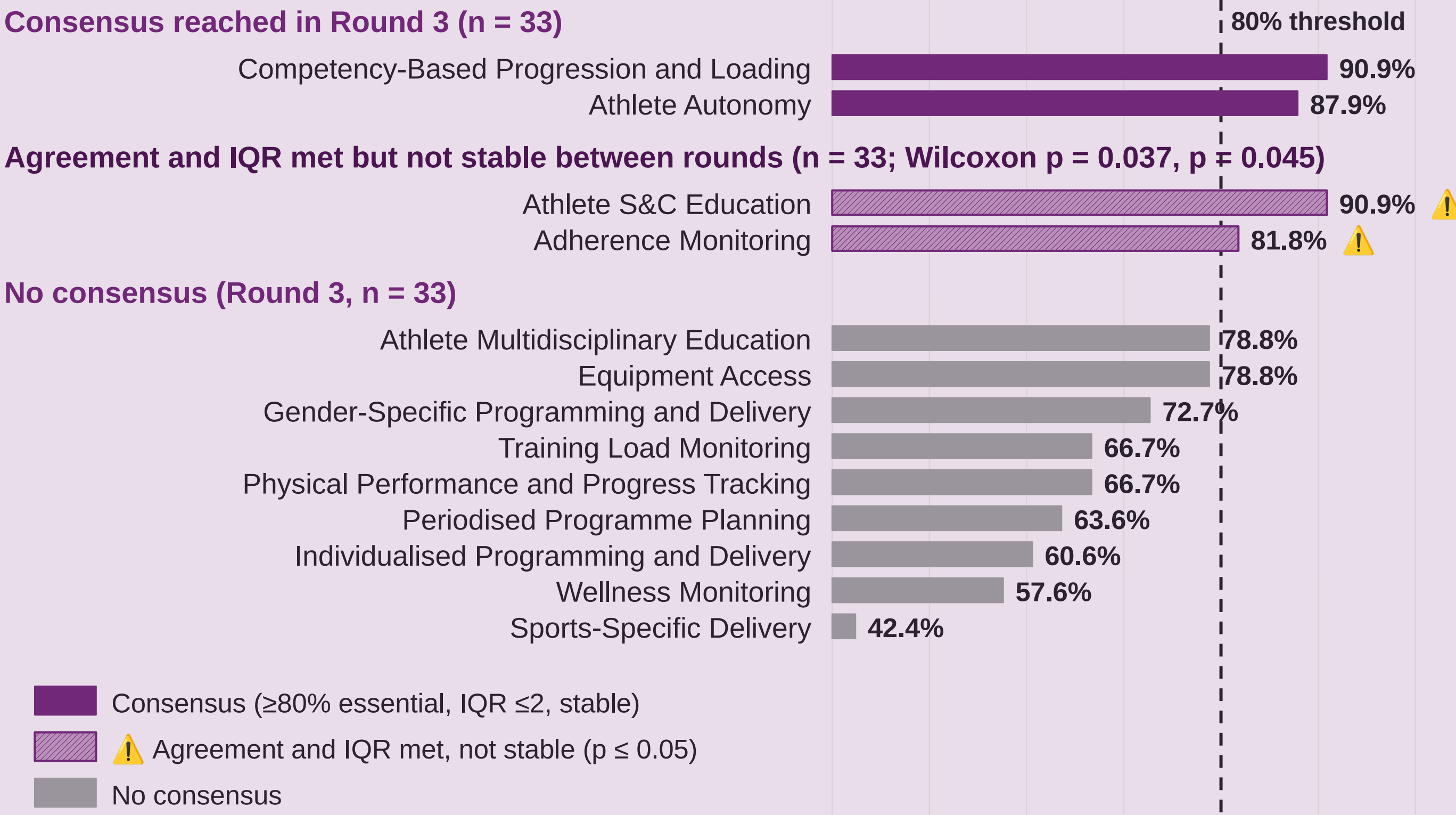
Results 24 of 35 components reached consensus

22 in Round 2 • 2 in Round 3 • 2 agreement met but unstable • 9 no consensus

Figure 2. Percentage of panellists rating each component “essential” (7–9). Dashed line = 80% consensus threshold.



†Met consensus criteria in Round 2 but were also re-rated in Round 3 owing to a calculation error; all remained ≥80% essential in Round 3 (81.8–97.0%).



Consensus (≥80% essential, IQR ≤2, stable)

Agreement and IQR met, not stable (p ≤ 0.05)

No consensus