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Sex-based differences in running performance among children aged 7–9 years in new South Wales track competition

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ABSTRACT

Background: Recent research has shown that prepubertal males outperform females in running competitions; however, prior studies have focused on distances of 100–1600 m and most have relied on U.S.-based data. This study evaluated sex-based differences in running performance among under-8, under-9, and under-10 athletes in 70 m, 100 m, 200 m, and 400 m races at the 2024 Little Athletics New South Wales (NSW) Regional Track & Field Championships in Australia.

Methods: Official race times for all competitors (n = 1442 males; 1405 females) from all seven NSW regional meets were analyzed. Performance was compared by sex for both preliminary and final times using two-way ANOVA. Additional analyses examined time gaps between successive finishers within each sex and time differences between male and female athletes placing in the same ordinal position, using ANOVA on ranks.

Results: Males ran significantly faster than females across all events and age groups ($P < 0.05$), with an average advantage of 4.88 ± 0.57 % and medium to large effect sizes (Hedges' g = 0.451–0.878). In contrast, within-sex time gaps between successive finishers did not differ significantly (males: 1.63 ± 0.12 %; females: 1.71 ± 0.17 %).

Conclusions: These findings confirm previously reported male performance advantages in prepubertal children and extend the evidence to a shorter sprint distance (70 m) and to Australian data. Notably, between-sex performance differences were more than twice as large as the variability within sex among comparably placed finishers. These results may help inform research and practice on youth sport talent identification and development.

1. Introduction

Position statements from organizations such as the American College of Sports Medicine and the Endocrine Society define sex as the biological attributes distinguishing males and females, whereas gender refers to socially constructed roles and identities [1,2]. As debates over fairness and inclusion intensify, the longstanding practice of organizing sport by biological sex has come under renewed scrutiny [3,4].

Biological sex, however, is a primary determinant of athletic performance. Across activities requiring endurance, strength, speed, and power, adult males consistently outperform females by 10–40 %, largely due to testosterone-driven increases in muscle mass, hemoglobin, and cardiorespiratory capacity after puberty [2,5,6]. Notably, recent evidence shows that sex-based performance gaps are also present before puberty [7–11].

The sex-based differences in adults are typically ~10–15 % in running, ~6–13 % in swimming, while sports such as weightlifting and throwing have differences up to 40 % [2,6]. Although long considered negligible [2,12], prepubertal gaps are measurable: U.S. data indicate boys run 3–8% faster than girls across 100–1600 m [7,8,10] with much larger differences in throwing events [9]. Handelsman's analysis of age-group world records suggested similar trends globally, but aggregation across events limited specificity [5]. Thus, it remains unclear whether U.S. findings generalize to data from other nations.

Running offers a valuable lens for studying these differences, as it underpins performance across most sports by integrating speed,

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endurance, and agility [6,13,14]. Examining youth sprint running performance therefore provides insight into early sex-based differences with broad implications for sport.

The purpose of this study was to evaluate sex-based differences in running performance among prepubertal athletes at the 2024 Little Athletics New South Wales (NSW) Regional Track & Field Championships. We analyzed race times for all competitors in the under-8, under-9, and under-10 age groups across 70 m, 100 m, 200 m, and 400 m events to (1) test whether U.S.-based findings extend internationally, and (2) assess consistency across sprint distances. By examining performance across the 70–400 m distances in 7–9-year-old athletes, this study provides new insight into early sex-based patterns in sprinting performance and establishes an evidence base for future work on youth athletic development.

2. Methods

2.1. Participants

To evaluate the running performance of prepubertal children outside the United States, data were drawn from Little Athletics New South Wales (NSW), a youth sport development program with standardized competition structure, consistent timing protocols, and broad participation [15]. NSW is divided into eight regions, seven of which held Regional Track & Field Championships in 2024.

Performance data were obtained for all competitors in the under-8 (U8), under-9 (U9), and under-10 (U10) age groups who ran the 70 m, 100 m, 200 m, and 400 m events during the 2024 Regional Championships, as reported on Athletic.net [16]. Age-group eligibility is determined by age on December 31 of the competition year, meaning U8, U9, and U10 athletes were 7, 8, and 9 years old, respectively. These cohorts were chosen because they are below the typical age of pubertal onset (~10.0 y in females, ~11.5 y in males) [2]. Although the 800 m event was contested in the U9 and U10 age groups, it was not included in this analysis because it was not offered to U8 competitors and therefore would not allow consistent comparisons across all three age groups.

A priori sample size calculations were based on previously reported 100 m sex-based differences among 8-and-under athletes (males: 14.97 ± 0.97 s; females: 15.58 ± 0.96 s) [8]. Using *G*Power v3.1 [17] a minimum of 40 participants per sex was required to detect a significant difference with 80 % power at $\alpha = 0.05$.

Data were collected from publicly available, official meet results. As the study used de-identified, publicly accessible data, institutional ethics approval was not required, consistent with 45 CFR 46.102 and the Declaration of Helsinki.

2.2. Procedures

Finishing times for all male and female athletes in the U8, U9, and U10 70 m, 100 m, 200 m, and 400 m events were downloaded from Athletic.net between May 1 and July 1, 2025. Data entry was performed by a single investigator (G.A.B.) using Microsoft Excel 365 (Microsoft Corp., Redmond, WA), and accuracy was verified independently by two associates. Corrections were made as necessary. For the 70 m, 100 m, and 200 m events, both preliminary and final times were recorded. For the 400 m events, only final times were available, as those races were conducted without preliminary heats.

2.3. Statistical analyses

All data are presented as mean ± SD unless otherwise noted. Times recorded in minutes:seconds were converted to total seconds. Two-way ANOVAs (sex × time type [preliminary vs. final]) were used to assess sex-based differences in the 70 m, 100 m, and 200 m events within each age group. For the 400 m events, data violated normality assumptions (Shapiro–Wilk test, $P < 0.05$), so sex comparisons were conducted using Mann–Whitney *U* tests. Effect sizes were calculated using Hedges' *g* to account for unequal sample sizes. Statistical significance was accepted at $P < 0.05$.

Time gaps between successive finishers were analyzed using Kruskal–Wallis one-way ANOVA on ranks. Two outcomes were evaluated: (1) within-sex differences in successive finishing intervals (difference between the *n*th and *n*–1st finishers), and (2) between-sex differences for athletes finishing in the same ordinal position (e.g., 1st male vs. 1st female). Results are presented as medians with interquartile ranges (IQRs).

Percent within-sex finisher gaps were calculated as:

$$(\text{Time}_n - \text{Time}_{n-1}) \div \text{Time}_n \times 100$$

Percent male advantage was calculated using an established formula [5]:

$$(\text{Female time} - \text{Male time}) \div \text{Male time} \times 100$$

3. Results

Across all distances and age groups, males ran significantly faster than females ($P < 0.05$), with an average performance advantage of 4.88 ± 0.57 %. Successive finisher gaps were similar between males (1.63 ± 0.12 %) and females (1.71 ± 0.17 %). Only final times for all distances and ages were reported for Region 1.

3.1. 70 m

Across U8, U9, and U10 athletes, males were significantly faster ($P < 0.05$) than females in both preliminary and final rounds (Table 1).

3.1.1. U8 age group

Both sexes improved from preliminary to final races ($P < 0.001$), with no sex × time interaction ($P = 0.869$). The two fastest overall times were recorded by males, while three females placed among the top 10 (positions 3, 8, and 10). Males (12.13 ± 0.67 s) ran significantly faster than females (12.55 ± 0.72 s; $P < 0.001$, Hedges' $g = 0.604$; Fig. 1). Successive finisher gaps did not differ within sex (males: 0.09 s, IQR: 0.04–0.22; females: 0.13 s, IQR: 0.04–0.24; $P = 1.000$). Comparisons of athletes finishing in the same ordinal position showed that males were significantly faster (median difference = 0.40 s, IQR: 0.22–0.57; $P < 0.001$). Males were 3.43 % faster overall, with similar differences between sexes in preliminaries (3.28 %) and finals (3.62 %), and a smaller gap between the fastest individuals (1.68 %).

3.1.2. U9 age group

Females, but not males, improved from preliminary to final races ($P = 0.036$ vs. 0.155); however, the sex × time interaction was not significant ($P = 0.638$). The four fastest overall times were recorded by males, while the top 10 included one female (5th). Males (11.51 ± 0.63 s) were significantly faster than females (11.97 ± 0.77 s; $P < 0.001$, Hedges' $g = 0.654$; Fig. 1). Successive finisher gaps were similar within sex (males: 0.09 s, IQR: 0.03–0.22; females: 0.11 s, IQR: 0.04–0.21; $P = 1.000$). Same ordinal positions comparisons favored males (median difference = 0.42 s, IQR: 0.27–0.59; $P < 0.001$). Overall, males were faster by 4.02 %, including 4.32 % in preliminaries, 3.68 % in finals, and 3.07 % among the fastest individuals.

3.1.3. U10 age group

Both sexes improved from preliminary to final races ($P = 0.003$), with no sex × time interaction ($P = 0.876$). The four fastest overall times belonged to males, while females ranked 5th and 8th among the top 10. Males (11.08 ± 0.63 s) ran faster than females (11.57 ± 0.73 s; $P <$

Table 1
70 m Running Times for Athletes Aged 7–9 at the 2024 NSW Regional Championships Distance: 70 m.

Age Group	Round	Male mean ± SD	Male n	Male range	Female mean ± SD	Female n	Female range	Sex difference (*P*)	Within-sex improvement (*P*)
U8									
	Preliminary	12.25 ± 0.63	81	11.15–14.16	12.66 ± 0.74	81	11.34–15.48	<0.001	M: 0.013; F: 0.024
	Final	11.97 ± 0.69	61	10.71–14.31	12.40 ± 0.66	62	10.89–13.70	<0.001	–
U9									
	Preliminary	11.58 ± 0.59	78	10.61–14.16	12.08 ± 0.89	77	10.85–17.67	<0.001	M: 0.155; F: 0.036
	Final	11.41 ± 0.67	57	10.41–14.01	11.83 ± 0.53	59	10.73–13.24	<0.001	–
U10									
	Preliminary	11.18 ± 0.63	74	10.14–12.84	11.69 ± 0.78	74	10.19–13.89	<0.001	M: 0.013; F: 0.024
	Final	10.94 ± 0.62	56	9.92–12.77	11.42 ± 0.64	57	10.12–13.14	<0.001	–

Notes.
1. Times are in seconds.
2. Within-sex *P*-values compare preliminary vs. final races for the same sex.
3. All seven regional meets are included (six prelims, seven finals).

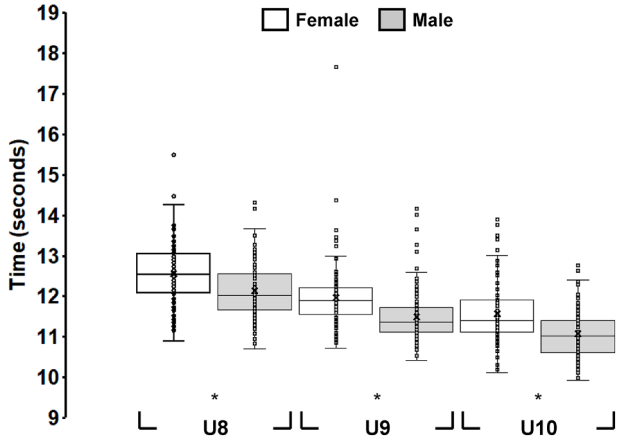


Fig. 1. Box-and-whisker plots of 70 m race times from all 2024 Little Athletics NSW Regional Championships. Boxes indicate the interquartile range (IQR; 25th – 75th percentiles), with medians shown as solid horizontal lines. Whiskers extend to values within 1.5 × IQR of the box limits; individual points beyond this range are plotted as outliers. Means are denoted by "X." Separate plots are shown by age group (U8, U9, U10) and sex (male, female), with data combining preliminary and final round times. *Males were significantly faster than females across all age groups ($P < 0.001$; Hedges' $g = 0.60$–0.72).

0.001, Hedges' $g = 0.718$; Fig. 1). Successive gaps did not differ within sex (males: 0.09 s, IQR: 0.05–0.23; females: 0.13 s, IQR: 0.05–0.26; $P = 1.000$). Same ordinal position comparisons showed males were significantly faster (median difference = 0.42 s, IQR: 0.28–0.59; $P < 0.001$). Overall males ran 4.47 % faster, including 4.54 % in preliminaries, 4.40 % in finals, and 2.00 % among the fastest individuals.

3.2. 100 m

Across all age groups, males were significantly faster ($P < 0.05$) than females in both preliminary and final rounds (Table 2).

3.2.1. U8 age group

Final times were significantly faster than preliminaries ($P = 0.006$); with no sex × time interaction ($P = 0.659$). The 13 fastest overall times were recorded by males. Males (17.07 ± 0.93 s) were significantly faster than females (17.81 ± 0.91 s; $P < 0.001$, Hedges' $g = 0.804$; Fig. 2). Males improved significantly from preliminary to final, whereas females did not. There was no significant sex × time interaction ($P = 0.659$). Successive finisher gaps were similar within sex (males: 0.16 s, IQR: 0.06–0.31; females: 0.16 s, IQR: 0.07–0.32; $P = 1.000$). Same ordinal position comparisons showed that males ran faster (median difference = 0.68 s, IQR: 0.46–0.94; $P < 0.001$). Males ran 4.33 % faster overall, including 4.08 % in preliminaries, 4.74 % in finals, and 5.22 % among the fastest individual.

3.2.2. U9 age group

Finals were significantly faster than preliminaries ($P = 0.043$) with no sex × time interaction ($P = 0.986$). The four fastest times belonged to males, while the top 10 included one female (5th). Males (16.06 ± 0.67 s) ran significantly faster than females (16.71 ± 0.81 s; $P < 0.001$, Hedges' $g = 0.878$; Fig. 2). Neither group improved significantly from preliminary to final. The sex × time interaction was not significant ($P = 0.986$). Successive finisher gaps did not differ by sex (males: 0.10 s, IQR: 0.04–0.22; females: 0.11 s, IQR: 0.05–0.27; $P = 1.000$). Same ordinal position comparisons indicate that males ran faster than females (median difference = 0.70 s, IQR: 0.47–0.93; $P < 0.001$). Males ran faster by 4.01 % overall, including 3.98 %, in preliminaries, 4.04 % in finals, and 3.70 % for fastest individuals.

3.2.3. U10 age group

The final times were significantly faster than preliminaries ($P = 0.012$), with no sex × time interaction ($P = 0.926$). The fastest overall time was by a male, while females ranked 2nd and 8th among the top 10. Males (15.41 ± 0.84 s) were significantly faster than females (15.98 ± 0.75 s; $P < 0.001$, Hedges' $g = 0.717$; Fig. 2). Neither sex improved significantly between rounds, and the sex × time interaction was not significant ($P = 0.926$). Successive finisher gaps were comparable within sex (males: 0.13 s, IQR: 0.05–0.27; females: 0.12 s, IQR: 0.05–0.21; $P = 1.000$). Same ordinal position comparisons indicate that males ran faster than females (median difference = 0.54 s, IQR: 0.35–0.75; $P < 0.001$). Overall, males were 3.73 % faster, including 3.75 % in preliminaries, 3.69 % in finals, and 0.29 % among the fastest individuals.

3.3. 200 m

Across all age groups, males were significantly ($P < 0.05$) faster than females both in preliminary and final rounds (Table 3).

3.3.1. U8 age group

Final and preliminary times did not differ ($P = 0.714$). Among the ten fastest times, one belonged to a female (ranked seventh). Overall, males (36.65 ± 3.03 s) ran significantly faster than females (38.51 ± 3.08 s; $P < 0.001$, Hedges' $g = 0.609$; Fig. 3). There was no significant sex × time interaction ($P = 0.790$). Time gaps between successive finishers did not

Table 2
100 m Running Times for Athletes Aged 7–9 at the 2024 NSW Regional Championships Distance: 100 m.

Age Group	Round	Male mean ± SD	Male n	Male range	Female mean ± SD	Female n	Female range	Sex difference (*P*)	Within-sex improvement (*P*)
U8									
	Preliminary	17.22 ± 0.94	83	15.18–19.70	17.92 ± 0.83	81	16.12–19.78	<0.001	M: 0.022; F: 0.097
	Final	16.86 ± 0.87	59	15.12–18.80	17.66 ± 1.02	60	15.91–20.69	<0.001	–
U9									
	Preliminary	16.14 ± 0.65	87	14.92–17.81	16.78 ± 0.79	82	15.26–18.88	<0.001	M: 0.140; F: 0.161
	Final	15.96 ± 0.67	63	14.31–17.72	16.60 ± 0.79	58	14.84–18.61	<0.001	–
U10									
	Preliminary	15.51 ± 0.82	72	14.13–17.87	16.10 ± 0.74	76	14.11–17.71	<0.001	M: 0.088; F: 0.061
	Final	15.29 ± 0.80	62	13.80–16.99	15.85 ± 0.70	64	13.84–17.25	<0.001	–

Notes.
1. Times are in seconds.
2. Within-sex *P*-values compare preliminary vs. final races for the same sex.
3. All seven regional meets are included (six prelims, seven finals).

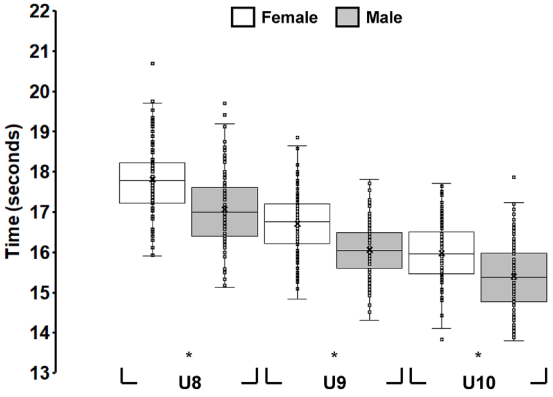


Fig. 2. Box-and-whisker plots of 100 m race times from all 2024 Little Athletics NSW Regional Championships. Boxes represent the interquartile range (25th – 75th percentiles), with medians shown as solid lines. Whiskers span up to 1.5 × IQR; outliers are plotted as individual points. Means are marked with "X." Data are grouped by age (U8, U9, U10) and sex (male, female) and include both preliminary and final round performances. *Males outperformed females in all age groups ($P < 0.001$; Hedges' $g = 0.72$–0.88).

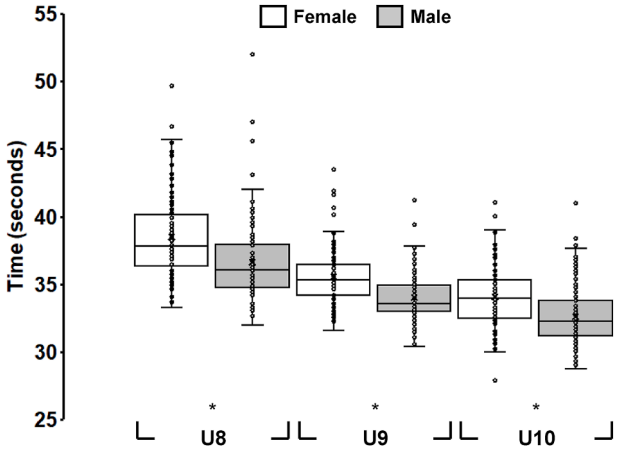


Fig. 3. Box-and-whisker plots of 200 m race times from all 2024 Little Athletics NSW Regional Championships. Boxes show the interquartile range (25th – 75th percentiles), with medians represented as solid horizontal lines. Whiskers extend to 1.5 × IQR; outliers are plotted individually. Means are indicated by "X." Results are shown by age group (U8, U9, U10) and sex (male, female), with times reflecting both preliminary and final races. *Significant male performance advantages were observed in all age groups ($P < 0.001$; Hedges' $g = 0.61$–0.79).

differ significantly by sex (males: 0.37 s, IQR: 0.15–0.95; females: 0.60 s, IQR: 0.26–1.31; $H = 0.00$, $P = 1.000$). Same ordinal position comparisons showed that males ran significantly faster ($H = 65.594$, $P < 0.001$; median = 1.99 s, IQR: 0.86–3.11). Males ran faster than females by 5.08 % across all times, 5.41 % in preliminary races, 4.83 % in finals, and 4.10 % based on the fastest individual performances.

3.3.2. *U9 age group*

There was no difference between final and preliminary times ($P = 0.711$). Of the ten fastest times, one female was ranked seventh. Overall, males (34.03 ± 1.73 s) ran significantly faster than females (35.53 ± 2.06 s; $P < 0.001$, Hedges' $g = 0.793$; Fig. 3). There was no significant

Table 3
200 m Running Times for Athletes Aged 7–9 at the 2024 NSW Regional Championships Distance: 200 m.

Age Group	Round	Male mean ± SD	Male n	Male range	Female mean ± SD	Female n	Female range	Sex difference (*P*)	Within-sex improvement (*P*)
U8									
	Preliminary	36.67 ± 2.89	54	33.04–51.98	38.66 ± 3.11	49	33.70–49.70	<0.001	M: 0.942; F: 0.667
	Final	36.63 ± 3.15	69	31.97–47.17	38.40 ± 3.07	64	33.29–56.85	<0.001	–
U9									
	Preliminary	34.03 ± 1.41	59	30.40–37.82	35.42 ± 1.71	44	32.73–40.12	<0.001	M: 0.990; F: 0.624
	Final	34.03 ± 1.95	73	30.54–41.22	35.60 ± 2.26	71	31.57–43.51	<0.001	–
U10									
	Preliminary	32.69 ± 1.83	57	29.01–36.79	34.30 ± 1.98	38	30.72–39.00	<0.001	M: 0.702; F: 0.428
	Final	32.57 ± 2.47	65	28.77–41.00	33.95 ± 2.35	72	27.89–41.07	<0.001	–

Notes.
1. Times are in seconds (mean ± SD, range).
2. Within-sex *P*-values compare preliminary vs. final performances for the same sex.
3. Data include all seven regional meets: for U8 males and females, results were available from four preliminaries and seven finals; for U9 and U10, results were available from four male preliminaries and three female preliminaries, with seven finals for both sexes.

sex × time interaction ($P = 0.724$). Time gaps between successive finishers did not differ by sex (males: 0.27 s, IQR: 0.10–0.68; females: 0.39 s, IQR: 0.15–0.67; $H = 0.00$, $P = 1.000$). Males were significantly faster in same ordinal position comparisons ($H = 142.028$, $P < 0.001$; median = 1.53 s, IQR: 0.98–2.32). Males ran faster than females by 4.42 % across all times, 4.11 % in preliminary races, 4.62 % in finals, and 3.85 % based on the fastest individual performances.

3.3.3. U10 age group

There was no difference between final and preliminary times ($P = 0.399$). One female ran faster than the fastest male, but males held nine of the ten fastest times (positions 2–10). Overall, males (32.61 ± 2.19 s) ran significantly faster than females (34.07 ± 2.23 s; $P < 0.001$, Hedges' $g = 0.661$; Fig. 3). There was no significant sex × time interaction (P = 0.742). Time gaps between successive finishers did not differ significantly within sex (males: 0.39 s, IQR: 0.11–0.77; females: 0.40 s, IQR: 0.16–0.84; $H = 0.00$, $P = 1.000$). Same ordinal position comparisons showed males were significantly faster ($H = 54.052$, $P < 0.001$; median = 1.40 s, IQR: 0.84–1.78). Males ran faster than females by 4.47 % overall, 4.92 % in preliminary times, and 4.33 % in final times. Notably, the fastest individual female outperformed the fastest male by 3.16 %.

3.4. 400 m

Across all age groups, males were significantly ($P < 0.05$) faster than females both in final rounds (Table 4).

3.4.1. U8 age group

Only final races were conducted at all seven regional meets. Among the ten fastest performances, females ranked seventh and eighth. Mann–Whitney tests indicated that males (median = 86.23 s, IQR: 82.77–91.40) were significantly faster than females (median = 93.33 s, IQR: 88.20–100.70; $U = 1942.500$, $P < 0.001$, Hedges' $g = 0.878$; Fig. 4). Time gaps between successive finishers did not differ significantly within sex (males: 1.10 s, IQR: 0.44–2.97; females: 1.64 s, IQR: 0.80–3.41; $H = 0.00$, $P = 1.000$). Same ordinal position comparisons revealed significantly faster male times ($H = 69.145$, $P < 0.001$; median = 7.01 s, IQR: 3.64–9.25). Males were 8.70 % faster than females on average, and 3.35 % faster when comparing the fastest individuals.

3.4.2. U9 age group

Only final times were recorded at all seven meets. Nine males ran faster than the fastest female. Mann–Whitney tests showed that males (median = 79.26 s, IQR: 75.42–83.96) were significantly faster than females (median = 84.09 s, IQR: 80.03–87.57; $U = 2377.000$, $P < 0.001$, Hedges' $g = 0.451$; Fig. 4). Successive finisher time gaps did not differ significantly by sex (males: 0.91 s, IQR: 0.45–2.20; females: 1.22 s, IQR: 0.51–2.26; $H = 0.00$, $P = 1.000$). Same ordinal position male–female comparisons showed significantly faster male performances ($H = 31.147$, $P < 0.001$; median = 5.11 s, IQR: 1.14–8.37). Males were 3.91 % faster on average, and 5.66 % faster when comparing the fastest individuals.

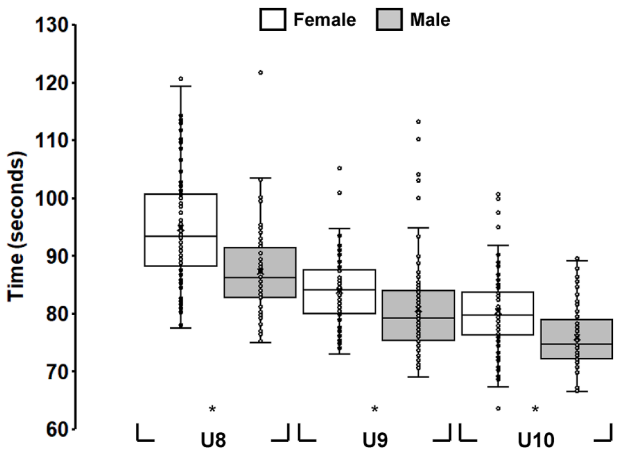


Fig. 4. Box-and-whisker plots of 400 m race times from all 2024 Little Athletics NSW Regional Championships. Boxes represent the interquartile range (25th – 75th percentiles), with medians shown as solid lines. Whiskers denote values within 1.5 × IQR; outliers are shown as individual points. Means are marked by "X." Plots are stratified by age group (U8, U9, U10) and sex (male, female); all data are from final rounds only, as no preliminary heats were held. *Males recorded significantly faster times than females in each age group ($P < 0.001$; Hedges' $g = 0.61$–0.79).

3.4.3. U10 age group

Only final times were recorded for all seven meets. The fastest female outperformed the fastest male, and females held three of the ten fastest times (1st, 8th, and 10th). Males (median = 77.75 s, IQR: 72.15–78.96) were significantly faster overall than females (median = 79.72 s, IQR: 76.32–83.72; $U = 2281.500$, $P < 0.001$, Hedges' $g = 0.745$; Fig. 4). No sex-based differences were observed in time gaps between successive finishers (males: 0.96 s, IQR: 0.31–2.39; females: 1.05 s, IQR: 0.48–2.23; $H = 0.00$, $P = 1.000$). Same ordinal position comparisons showed males ran significantly faster ($H = 30.134$, $P < 0.001$; median = 2.88 s, IQR: 1.47–6.04). Males were 5.94 % faster than females in final times, although the top female was 4.48 % faster than the top male.

4. Discussion

This study analyzed all finishing times from the U8, U9, and U10 age groups in the 70 m, 100 m, 200 m, and 400 m events at the 2024 Little Athletics NSW Regional Championships. Across all running events, males consistently outperformed females, with an average performance advantage of 4.9 %, despite comparable within-sex variability in finishing times. These differences were evident in every age group and distance, with the largest gap observed in the U8 400 m (8.7 %). Improvements from preliminary to final races were similar across sexes, and successive finisher gaps did not differ, suggesting that male–female differences reflect physiological rather than competitive density factors. Same ordinal position comparisons (e.g., 1st-place male vs. 1st-place

Table 4
400 m Running Times for Athletes Aged 7–9 at the 2024 NSW Regional Championships Distance: 400 m.

Age Group	Round	Male mean ± SD	Male n	Male range	Female mean ± SD	Female n	Female range	Sex difference (*P*)	Within-sex improvement (*P*)
U8									
	Final	87.22 ± 7.37	84	75.00–121.68	94.81 ± 9.70	89	77.51–120.63	<0.001	–
U9									
	Final	80.83 ± 7.95	92	69.06–113.17	83.99 ± 5.79	84	72.97–105.20	<0.001	–
U10									
	Final	75.82 ± 5.56	86	66.48–89.56	80.33 ± 6.47	93	63.63–100.68	<0.001	–

Notes.
1. Times are presented as mean ± SD with range values.
2. Only final races were held at all seven regional meets; therefore, within-sex preliminary–final comparisons are not applicable.

female) consistently revealed significant male advantages. These findings indicate that sex-based differences in running performance are present even before age eight and across sprint distances shorter than those previously studied.

The present results align with prior studies demonstrating that males run approximately 3–6% faster than females before puberty [5,7,8,10,11]. Previous evidence was largely derived from U.S. competitions; by analyzing Australian athletes, the present study strengthens the conclusion that male advantages are consistent across different national contexts. These findings also mirror results from standardized youth fitness assessments dating back to the 1970s, which have repeatedly shown prepubertal males outperforming females in running tasks [18–20]. Together, these results confirm that sex-based differences in running speed are evident at young ages and are reproducible across both controlled test batteries and real-world competition.

One notable exception in the present dataset was a U10 female athlete who recorded the fastest performances in the 200 m and 400 m. While such exceptional cases demonstrate overlap at the individual level, they remain rare and do not negate the broader statistical pattern: across populations, young males consistently outperform females in running. This finding echoes prior work [7,11], which has shown that while some young females can match or exceed some males in isolated cases, males dominate the upper end of performance distributions.

The precise mechanisms underlying prepubertal sex-based differences are not fully understood, but several factors likely contribute. Biologically, prepubertal males possess ~10 % greater lean mass than females at the same age, which supports greater force production and sprinting ability [21,22]. Differences in cardiovascular morphology and pelvic structure may also predispose prepubertal males to better running performance than similarly aged, trained, and talented females [21,23]. Although testosterone and hemoglobin levels are similar between the sexes before puberty, early-life hormonal exposures such as minipuberty may contribute to lasting differences that favor males [2,6]. In addition to biological factors, behavioral factors may also play a role. It is well recognized that females are often discouraged from participating in more competitive or strength-based sports from a young age, which may influence observed participation rates and performance patterns. Furthermore, studies suggest prepubertal males engage in more unstructured physical activity and spend more time in moderate-to-vigorous exercise than females [24–26]. However, activity differences alone cannot explain physiological disparities in VO_2max or muscle mass [27,28], suggesting that both biological and behavioral contributors shape early sex-based differences in athletic performance.

The implications of these findings extend beyond track and field. Running ability underpins success in most sports, particularly those requiring sprinting, agility, and repeated high-intensity efforts [6,13,14]. Evidence that males are faster than females even before puberty suggests that sex-based performance differences may influence competitive outcomes and training across a broad range of youth sports. These findings may therefore inform research, coaching, and training practices on talent identification and athlete development expectations.

Specifically, the present findings that males run faster than females in the U8–U10 age groups may inform youth-sport programming in Australia, particularly within the broader ‘Sport for Development’ framework and initiatives such as Team Up [29]. Through Team Up's partnerships across multiple sports in the Asia–Pacific region, which aim to make sport more inclusive, accessible, and supportive of women, girls, and people with disabilities, policymakers and program designers may use empirical evidence from age-graded performance data to guide how youth training and participation pathways are structured (e.g., offering appropriately-scaled events, promoting early inclusive participation regardless of sex, and balancing performance-based selection with broad access). Future research could investigate how observed sex-based performance differences at young ages interact with talent-identification procedures, long-term athlete development models, and participation strategies in recreational, grassroots, and school-based settings.

This study has several limitations. Pubertal status was not clinically assessed and analyses are based on age-defined groups. Although testosterone concentrations typically remain low in males before 10 years of age [2,5,30], individual variability cannot be excluded. Archival competition data do not include individual-level information on maturation status, training history, coaching quality, or socioeconomic background, and age-group categories may not fully account for variation in biological development [6]. Such limitations are inherent to archival analyses [7,8,10] which consistently demonstrate statistically significant sex-based differences in athletic performance but cannot identify the underlying causes of these differences.

In conclusion, 7–9-year–old males in NSW consistently outperformed females across 70–400 m running events, with average advantages of 3–9%. These findings extend previous U.S.-based research to an international context and confirm that sex-based differences in running performance are already evident at ages when most children have not yet undergone significant pubertal changes. While individual females can match or exceed males in rare cases, population-level data consistently show that males run faster. These sex-based differences likely reflect a combination of biological and behavioral factors. Understanding and researching when and how sex-based performance differences emerge is essential for guiding evidence-based policies in youth sport.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Drs. Brandon Shaw and Ina Shaw have no conflicts of interest to declare.

Dr. Greg Brown currently serves as an expert witness in several U.S. legal cases concerning the inclusion of transgender-identified males (i.e., trans women) in female sports. He has also provided consultation to various sport governing bodies on related matters. The activities focus on biological sex differences and their implications for athletic performance. This manuscript was not prepared or funded in connection with any of these activities and its publication is not a condition of his role. While this is not a conflict of interest, it is disclosed here in the interest of full transparency.

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