

From Prescription to Monitoring: Applied Use of the 1000-m Shuttle Test in Italian Serie D Soccer

Pasquale D'Antonio,^{1 2} Giuseppe Barile³

¹Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Verona, Italy

²Department of Education and Sport Sciences, Pegaso Telematic University, Naples, Italy

³Head of Performance, Gelbison S.S.D., Italian Serie D, Italy

Aerobic assessment | Conditioning prescription | Field testing | Individual change | Measurement error | Preseason training

Headline

We integrated the 1000-m shuttle time trial into an established preseason framework refined by the same staff over approximately five years. The test required minimal equipment and direct cost and supported both running prescription and player-level monitoring. In 17 adult male Serie D outfield players, 12 were faster after preseason and 10 improved beyond Clancy et al.'s external MDC75 of 4.56 s; the squad mean improved by 4.06 s.

Aim of the paper

We examined whether the 1000-m shuttle test could be integrated into an established preseason methodology in an Italian Serie D semi-professional working environment to support individual running prescription and player-level monitoring. The same staff had refined the broad preseason framework over approximately five years. In previous seasons, the staff had used intermittent field tests, including the 45-15 test and the 30-15 Intermittent Fitness Test (30-15 IFT), for aerobic assessment and training prescription (4,5), but had not routinely used the 1000-m shuttle. The present test was selected as a simpler, self-paced, low-equipment option that did not require externally paced audio. Clancy et al. reported concurrent validity and between-session reliability for the protocol (1), and a recent systematic review identified the 1000-m test within field-based aerobic testing in elite male soccer (2). We therefore evaluated its applied feasibility rather than attempting to revalidate it.

Design

We conducted a prospective, single-team cohort study with pre-post assessment embedded within routine preseason practice.

Methods

Seventeen adult male outfield players from an Italian Serie D team operating in a semi-professional working environment completed both assessments and formed the paired analytical sample (mean age, 25.6 years). Players were remunerated under sports-work collaboration agreements and were primarily engaged in football activities during the study period. Three additional players completed T0 but left the club before T1; we excluded goalkeepers because of their distinct training and match demands. Before enrolment, we informed each player about the study purpose, testing procedures, expected involvement, and research use of the collected data. Participation was voluntary, and we obtained informed consent before T0. The study was conducted in accordance with the Declaration of Helsinki.

The same technical staff had worked together for approximately five years and retained the same broad preseason struc-

ture and methodological principles, with minor athlete- and context-specific adjustments. The staff pre-planned the programme as part of routine team practice; we therefore evaluated one ecological implementation of an established methodology rather than a study-specific intervention. The present preseason represented the staff's first systematic integration of the 1000-m shuttle into this framework. We completed T0 on study Day 3 and T1 on Day 26. Between assessments, the programme included eight strength sessions, five running-conditioning sessions, three pre-match technical-tactical sessions, four friendly matches, and one speed-endurance session (Table 1). Table 1 reports the principal physical component when dedicated physical work was performed, generally after low-to-moderate-intensity technical-tactical work; otherwise, we report the principal technical-tactical session.

At both assessments, players completed a maximal 10 × 100-m shuttle run on synthetic turf, with a 180° turn after each 100-m length and alternating turning leg. We recorded total completion time in seconds and used the same procedure at T0 and T1. Ten of the 17 paired players had previous test exposure; this reflected experience in previous club environments rather than routine use of the test by the current staff. At baseline, we calculated operational estimated maximal aerobic speed (eMAS) as 1000 m divided by T0 completion time. We assigned the 20 players available for initial prescription to the nearest 0.5 m·s⁻¹ reference group (4.0, 4.5, or 5.0 m·s⁻¹), following Clancy et al. (1) (Table 2). This approach individualized running prescription while retaining practical group organization (Figure 1).

We used an estimation-based analysis and did not report p-values. We summarized T0 and T1 as mean ± SD and defined paired change as T1 - T0, with negative values indicating faster performance. We used the mean paired change with its 95% CI to summarize the overall squad-level shift. For applied monitoring, however, we prioritized player-level changes by reporting individual direction and magnitude and interpreting them against Clancy et al.'s external MDC75 of ±4.56 s (1), not as a study-specific reliability estimate. We also calculated the SD of paired changes, mean percentage improvement, and Hedges' g_z with participant-level bootstrap 95% CIs (5,000 resamples). We assessed robustness using the median and IQR, Hodges-Lehmann estimator, observed range, and leave-one-player-out mean-change range. We described individual changes without labeling players as biological responders or non-responders (3).

Results

Figure 2 displays player-level changes, which we prioritized for applied interpretation. Twelve of 17 players were faster at

T1, one was unchanged, and four were slower; 10 improved beyond the external 4.56-s MDC75, five remained within the ± 4.56 -s band, and two were slower beyond the benchmark. Individual changes ranged from -15 to +10 s, with a median change of -6.0 s (IQR 9.0 s). At squad level, mean comple-

tion time decreased from 232.3 ± 10.4 s at T0 to 228.2 ± 6.7 s at T1. We observed a mean paired change of -4.06 s (SD 6.49 s; 95% CI -7.39 to -0.72), equivalent to a mean 1.66% improvement (bootstrap 95% CI 0.30 to 2.86%); Hedges' g_z was -0.60 (bootstrap 95% CI -1.42 to -0.13) (Table 3).

Table 1. Principal preseason training exposures and assessment sequence.

Day	Relation	Session / event	Dose / prescription	Domain
1	Reintroduction	Low-intensity aerobic reconditioning + low-intensity ball-based technical drills	~60 min	Recovery / technical
2	Reintroduction	Neuromuscular warm-up + low-intensity technical-tactical drills	~60 min	Recovery / technical-tactical
3	T0	1000-m shuttle time trial	10 x 100 m; 180-degree turns; alternating turning leg; maximal effort	Testing
4	Between T0-T1	Strength training	45-50 min	Strength
5	Between T0-T1	Repeated 600-m runs	5 x 600 m; recovery 1:1	Running conditioning
6	Between T0-T1	Pre-match technical-tactical session	Routine team session	Technical-tactical
7	Between T0-T1	Friendly match	Match exposure	Match
8	Between T0-T1	Strength training	45-50 min	Strength
9	Between T0-T1	Repeated 400-m runs	6 x 400 m; recovery 1:1	Running conditioning
10	Between T0-T1	Strength training	45-50 min	Strength
11	Between T0-T1	Repeated 300-m runs	8 x 300 m; recovery 1:1	Running conditioning
12	Between T0-T1	Strength training	40-50 min	Strength
13	Between T0-T1	Pre-match technical-tactical session	Routine team session	Technical-tactical
14	Between T0-T1	Friendly match	Match exposure	Match
15	Between T0-T1	Strength training	45-50 min	Strength
16	Between T0-T1	30-s/30-s interval running over 160 m	2 x 10 min	Running conditioning
17	Between T0-T1	Strength training	45-50 min	Strength
18	Between T0-T1	20-s/20-s interval running over 100 m	2 x 8 min	Running conditioning
19	Between T0-T1	Strength training	45-50 min	Strength
20	Between T0-T1	Pre-match technical-tactical session	Routine team session	Technical-tactical
21	Between T0-T1	Friendly match	Match exposure	Match
22	Between T0-T1	Strength training	45-50 min	Strength
23	Between T0-T1	Speed-endurance training	Dose not specified in source programme	Speed endurance
24	Between T0-T1	Friendly match	Match exposure	Match
25	End of programme	Camp departure / end of programme	No training dose specified	End of camp
26	T1	1000-m shuttle time trial	10 x 100 m; 180-degree turns; alternating turning leg; maximal effort	Testing

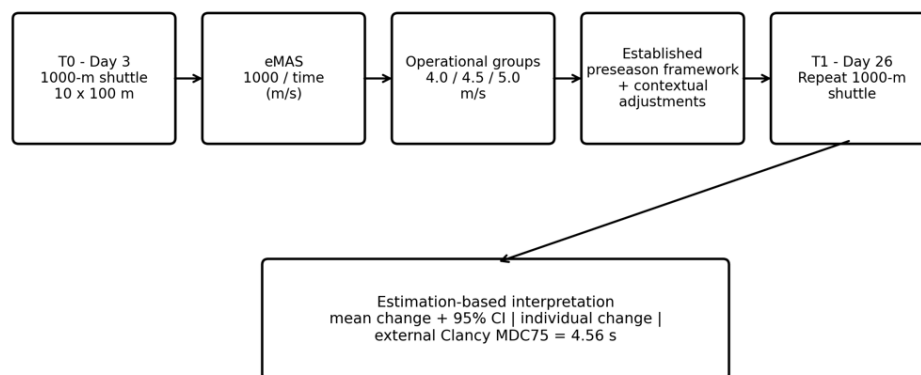
Note. The staff had used the same broad preseason framework for approximately five years, with minor athlete- and context-specific adjustments. We summarize the principal training exposure rather than every element of each session. When dedicated physical training was performed, we report that component and omit the preceding low-to-moderate-intensity technical-tactical work. On days without dedicated physical training, we report the principal technical-tactical session. We present the programme to support replication of the applied training context.

Table 2. eMAS operational groups used for running-intensity individualization.

Operational group	eMAS band (m/s)	n	Observed eMAS (m/s)	Observed T0 time (s)	Reference speed (m/s)	Prescription rule
4.0 m/s	3.75 to <4.25	9	3.95-4.22	237-253	4.0	%eMAS x group reference
4.5 m/s	4.25 to <4.75	10	4.29-4.55	220-233	4.5	%eMAS x group reference
5.0 m/s	4.75 to <5.25	1	4.78	209	5.0	%eMAS x group reference

Table 3. External Clancy benchmark and present longitudinal estimates.

Source / purpose	Metric	Value
Clancy et al. (2020) - external reliability benchmark	Reliability sample	n = 10 elite development players
Clancy et al. (2020)	Typical error	2.86 s (90% CI 2.08 to 4.71)
Clancy et al. (2020)	ICC	0.82(90% CI 0.51 to 0.94)
Clancy et al. (2020)	CV	1.06% (90% CI 0.68 to 1.44)
Clancy et al. (2020)	MDC75	4.56 s (2.2%)
Present report - longitudinal field application	T0	232.3 +/- 10.4 s
Present report	T1	228.2 +/- 6.7 s
Present report	Mean paired change	-4.06 s (95% CI -7.39 to -0.72)
Present report	Mean percentage improvement	1.66% (bootstrap 95% CI 0.30 to 2.86)
Present report	Hedges gz	-0.60 (bootstrap 95% CI -1.42 to -0.13)
Present report	Individual change categories	12 faster; 1 unchanged; 4 slower
Present report	Against external MDC75	10 improved >4.56 s; 5 within +/-4.56 s; 2 slower >4.56 s
Present report	Robustness checks	Median -6.0 s; Hodges-Lehmann -4.5 s; leave-one-out mean range -4.94 to -3.38 s
Present report	SD of paired change	6.49 s
Present report	Median paired change	-6.0 s (IQR 9.0 s)
Present report	Observed paired-change range	-15 to +10 s
Present report	Faster at T1	12/17 (70.6%; 95% Wilson CI 46.9 to 86.7%)

Applied prescription-monitoring pathway used in the report**Fig. 1.** Applied pathway linking the baseline 1000-m shuttle test, eMAS-based group prescription, the established preseason framework and post-preseason estimation-based interpretation.

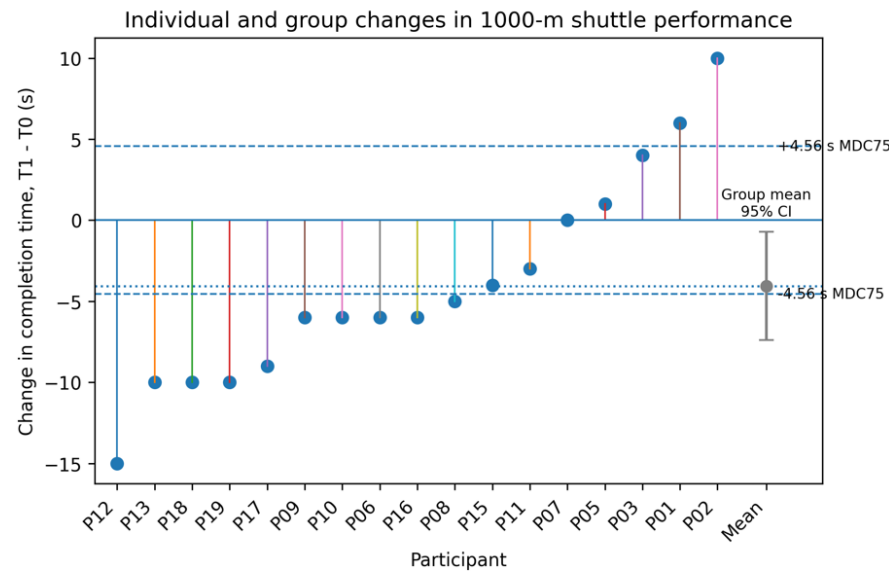


Fig. 2. Individual T1 - T0 changes in completion time. Negative values indicate faster performance. Dashed lines represent the external MDC75 (± 4.56 s) reported by Clancy et al. (1); the far-right point shows the squad mean change with its 95% CI.

Discussion

We used the 1000-m shuttle test to connect individual running prescription with player-level monitoring within routine preseason practice. The staff had previously used the 45-15 and 30-15 IFT, but selected the 1000-m shuttle as a feasible alternative because of its self-paced execution, low equipment burden, absence of an externally paced audio protocol, and straightforward conversion of completion time into an operational running speed (4-6). This should not be interpreted as evidence that the 1000-m shuttle is superior to those tests; field-test selection should reflect the purpose of testing and intended use of the result (6). At baseline, the test informed running-group organization, and after the established preseason framework we repeated it to quantify individual change. Because the same staff had refined this methodology over approximately five years, we evaluated an ecological implementation of established practice rather than a novel experimental programme. Without a control condition, we cannot attribute the observed changes to a specific training component or claim superiority over an alternative programme.

We treated player-level change as the principal applied monitoring signal and the squad mean as contextual summary. The external 4.56-s MDC75 and the squad mean address different questions: the group mean and CI describe the average longitudinal shift, whereas the MDC75 is an individual-level measurement-error benchmark derived from another sample. Ten players exceeded the benchmark in the faster direction, five remained within it, and two exceeded it in the slower direction. We interpret these classifications descriptively because individual change may reflect adaptation, measurement error, and normal within-player variability (3).

Clancy et al. provide the external measurement-property basis for our applied use of the protocol (1), including reliability estimates and a practical $0.5 \text{ m}\cdot\text{s}^{-1}$ grouping example. We do not interpret T0-T1 data as an internal test-retest validation because meaningful training occurred between assessments. Instead, the present report evaluates feasibility and applied use in a Serie D setting: a brief field test informed base-

line running organization and subsequent player-level evaluation. Its low logistical burden may be useful where laboratory testing, externally paced testing systems, or advanced monitoring technology are not routinely available. Robustness analyses supported the contextual squad-level estimate while preserving the inter-individual heterogeneity relevant to practical decision-making.

Practical applications

- Practitioners working in semi-professional or resource-constrained environments can implement the 1000-m shuttle test with minimal equipment and direct cost, without laboratory infrastructure or an externally paced audio protocol, to connect running prescription with subsequent player-level monitoring.
- Practitioners can convert baseline completion time into an operational eMAS and organize $0.5 \text{ m}\cdot\text{s}^{-1}$ running groups while retaining athlete- and context-specific adjustment within a simple field-based workflow.
- Practitioners should prioritize player-level change when monitoring adaptation and use the squad estimate as contextual information because group averages can conceal substantial inter-individual heterogeneity.
- Practitioners can use the external MDC75 reported by Clancy et al. to contextualize individual changes, while establishing setting-specific test-retest reliability data when feasible.

Limitations

- We did not include a control group; therefore, we cannot establish the causal efficacy of the preseason framework.
- We did not perform a study-specific reliability trial; we used the MDC75 reported by Clancy et al. as an external benchmark derived from a different sample and testing context.
- We implemented the programme in routine practice. Table 1 summarizes the principal physical or technical-tactical exposure according to the reporting convention described

above, and we did not have complete internal- and external-load monitoring for every training exposure.

- We analyzed a small, context-specific sample, and 10 of the 17 paired players had previous experience with the 1000-m shuttle test.

AI Use Statement

Language and editing: ChatGPT (OpenAI; GPT-5.6 Sol) was used to refine wording and language. Writing and drafting: it was used for limited restructuring of the manuscript. Data and analysis: it was used to support development and checking of R scripts. Study design, data collection, statistical decisions, interpretation, final literature selection, figures, tables, and final scientific content were produced and verified by the authors, who retain full responsibility for the manuscript and analyses.

Data availability

An anonymized dataset and reproducible analysis script accompany the submission. Identifiable working data are not included in the submission package.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Clancy C, Green P, Curnyn S, Donaldson E, Ring N. The concurrent validity and between-session reliability of a 1000m time trial for the assessment of aerobic fitness in elite development soccer players. *Sport Perform Sci Rep.* 2020 May 23;96:v1.

2. Asimakidis ND, Bishop C, Beato M, Turner AN. Assessment of aerobic fitness and repeated sprint ability in elite male soccer: a systematic review of test protocols used in practice and research. *Sports Med.* 2025 May;55(5):1233-64.

3. Bonafiglia JT, Preobrazenski N, Gurd BJ. A systematic review examining the approaches used to estimate interindividual differences in trainability and classify individual responses to exercise training. *Front Physiol.* 2021 Nov 8;12:665044.

4. Castagna C, Iellamo F, Impellizzeri FM, Manzi V. Validity and reliability of the 45-15 test for aerobic fitness in young soccer players. *Int J Sports Physiol Perform.* 2014 May;9(3):525-31.

5. Buchheit M. The 30-15 Intermittent Fitness Test: accuracy for individualizing interval training of young intermittent sport players. *J Strength Cond Res.* 2008 Mar;22(2):365-74.

6. Bok D, Foster C. Applicability of field aerobic fitness tests in soccer: which one to choose? *J Funct Morphol Kinesiol.* 2021 Aug 18;6(3):69.

Copyright: The article published on Sport Performance and Science Reports are distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated.

