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Return to Sport After Childbirth: Pelvic Floor Dysfunction and Diastasis Recti Abdominis — A Narrative Review

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Abstract

Background: Pregnancy and childbirth impose sustained mechanical and hormonal load on the abdominal wall and pelvic floor, frequently producing diastasis recti abdominis (DRA) and pelvic floor dysfunction (PFD) — urinary incontinence (UI), pelvic organ prolapse (POP) and anal incontinence — that may persist and complicate the return to sport.
Aim: To synthesise current medical evidence on DRA and PFD in the postpartum athlete, critically comparing their epidemiology, mechanisms, mutual relationship, conservative management and implications for return to sport.
Material and methods: Narrative review of 34 studies — systematic reviews, meta-analyses, randomised and non-randomised trials, cohort and cross-sectional studies, case reports and consensus statements — addressing postpartum DRA, PFD, physical activity and return to sport.

Results: DRA affects up to 60% of women at six weeks and about 30–33% at one year; higher parity, age and body-mass index are the most consistent risk factors. Postpartum PFD is common, UI affecting roughly one-third of women. Evidence links DRA weakly, if at all, to PFD. Pelvic floor muscle training reduces the odds of UI by about 37% and of POP; structured abdominal exercise reduces the inter-recti distance (pooled mean difference ≈ −8 mm), most when begun within three months, yet anatomical narrowing does not consistently improve function. High-impact sport is associated with stress UI even in nulliparous athletes. Return to running is best individualised, gradual and screened for pelvic-floor symptoms.
Conclusions: Return to sport after childbirth should be guided, criterion-based and multidisciplinary, integrating supervised pelvic-floor and abdominal training, symptom monitoring and realistic timelines rather than fixed dates.

Keywords: diastasis recti abdominis; pelvic floor dysfunction; urinary incontinence; pelvic organ prolapse; postpartum; return to sport; pelvic floor muscle training.

1. Introduction

Participation of women in recreational and competitive sport has grown markedly, and for many athletes the peak of the sporting career now coincides with the childbearing years, so that pregnancy, childbirth and the return to training are navigated at the height of athletic life [1,2]. Pregnancy and delivery are simultaneously medical and musculoskeletal events: the abdominal wall and the pelvic floor undergo among the most pronounced anatomical changes in the female body, commonly producing muscle, nerve and connective-tissue injury that outlasts tissue healing [3,4]. Two conditions dominate the medical picture of the early and late postpartum period and, crucially, may interfere with a safe return to sport: diastasis recti abdominis (DRA), the separation of the two rectus abdominis muscle bellies along a thinned and widened linea alba, and pelvic floor dysfunction (PFD), an umbrella term encompassing urinary incontinence (UI), anal incontinence (AI), pelvic organ prolapse (POP) and sexual dysfunction [5,6,7].

The scale of the problem is substantial. Urinary incontinence affects roughly one-third of women a year after delivery, anal incontinence about 13–14% at six to twelve months, and symptomatic or examination-defined POP between 20% and 65% depending on the definition used; if untreated, the lifetime risk of surgery for prolapse or stress incontinence reaches 20% by the age of 80 [5]. DRA has been observed in up to 60% of women at six weeks and roughly a third at one year postpartum [5,8]. These conditions are not merely cosmetic: PFD reduces quality of life, deters exercise and, in the athlete, may limit performance and even precipitate withdrawal from sport [9,10].

Despite this burden, guidance on how to progress from childbirth to full sporting activity has historically been sparse, inconsistent and, at worst, contradictory [3,11]. The traditional six-week postpartum check is widely treated as a green light for unrestricted activity, yet pelvic-floor and abdominal-wall recovery follows a slower and more variable trajectory, and musculoskeletal examination is rarely performed at that visit [3]. Referral to physical therapy in the perinatal period is not standard care in many health systems, leaving women to negotiate the “fourth trimester” largely unsupported [2]. The consequences are visible in the running population: approximately three-quarters of postpartum runners return to running within eight weeks of delivery, more than a third report running-related pain, and around a third report some form of UI on return [3,12].

The context for these questions is a sustained rise in female sport participation: women have made up more than half of all runners since 2018, and elite athletes increasingly combine motherhood with competition at the highest level, returning to sport in the peak fertility years [11]. This demographic reality has outpaced the evidence base, leaving athletes, coaches and clinicians reliant on extrapolation from general postpartum and general athletic populations and on expert opinion [3,11]. The stakes are not trivial: beyond individual health, inadequate management of postpartum PFD and DRA carries competitive, economic and equity implications for the growing population of mother-athletes [11,12].

This narrative review synthesises the medical evidence on DRA and PFD in the context of return to sport after childbirth. Adopting the critical and comparative posture characteristic of a narrative review, it examines the epidemiology and risk factors of the two conditions; the mechanisms by which pregnancy and delivery injure the abdominal wall and pelvic floor; the much-debated relationship between DRA and PFD; the effectiveness of conservative management for each; the influence of physical activity and high-impact sport on the pelvic floor; and the emerging frameworks for a criterion-based return to running and sport. The aim is to provide clinicians, physiotherapists and exercise professionals with an integrated, evidence-based account of how the medical sequelae of childbirth should shape the return-to-sport pathway. Table 1 summarises the core studies underpinning this synthesis.

This review is narrative in design. It draws on 34 sources relevant to the medical management of DRA, PFD and return to sport after childbirth, spanning systematic reviews and meta-analyses, a network meta-analysis, an umbrella review, randomised and non-randomised controlled trials, prospective and retrospective cohort and cross-sectional studies, case reports and case series, and international consensus statements. In keeping with the critical and comparative aims of a narrative synthesis, the evidence is appraised for consistency, methodological quality and clinical applicability rather than pooled statistically, and particular attention is paid to points of genuine disagreement — most notably the relationship between DRA and PFD, the optimal type and timing of abdominal rehabilitation, and the safety of high-impact activity — where the direction of the evidence is contested.

2. Physiological and biomechanical adaptations of pregnancy and childbirth

The rationale for a cautious, structured return to sport rests on the magnitude of the physiological changes imposed by pregnancy and delivery. During gestation the abdominal musculature is stretched to approximately 115% of its resting length by 38 weeks, while the growing uterus displaces the abdominal organs, shifts the centre of gravity forward, increases lumbar lordosis and loads the pelvic floor [3]. Cardiovascular adaptation is equally marked: cardiac output rises by 30–50% by mid-pregnancy through increases in heart rate and stroke volume, and baseline oxygen consumption increases by 10–20%, reducing the oxygen available for aerobic work [3]. Ligamentous laxity, mediated by relaxin, progesterone and oestrogen, softens connective tissue and increases joint mobility — changes that facilitate delivery but also reduce pelvic stability and abdominal-wall stiffness [7,13].

During labour and vaginal delivery the pelvic floor musculature — principally the levator ani and its associated connective tissue — is stretched to as much as 250% of its resting length [3]. Recovery of the levator ani and the fascial support is thought to be maximised only by four to six months postnatally, and bladder-neck mobility remains higher after delivery than in late pregnancy [3]. After caesarean section the uterine scar is still remodelling at six weeks, and pelvic-floor weakness or coordination deficits attributable to the antenatal load of the gravid uterus may persist even though the woman is often told she may resume unrestricted activity at that point [3]. More than a 50% reduction in pelvic-floor muscle strength and endurance six weeks after delivery, relative to pregnancy values, illustrates how far function lags behind the calendar; in women with major levator defects the strength deficit is compounded further [9,12].

These adaptations underpin the concept of a vulnerable early-postpartum "window" in which tissues are simultaneously more pliable — and therefore more amenable to rehabilitation — and less able to tolerate high mechanical load [3,2]. The abdominal and pelvic-floor muscles form a functional "canister" that regulates intra-abdominal pressure together with the diaphragm; disruption of any wall of this canister degrades the distribution of intra-abdominal forces and can propagate dysfunction to the others [14,8]. This anatomical interdependence is the conceptual bridge between DRA and PFD and the reason both must be considered together when planning a return to sport, even though, as discussed below, coexistence does not imply causation [5,15].

The core operates as an integrated pressure-regulating unit: the diaphragm above, the pelvic-floor muscles below, the transversus abdominis anteriorly and the multifidus posteriorly act together to maintain intra-abdominal pressure and trunk stability [16]. During pregnancy the growing fetus compresses the diaphragm, so that its excursion and contribution to this system diminish and accessory muscles compensate, while sustained stretching of the transversus abdominis reduces its capacity to generate tension across the linea alba [16]. Restoration of diaphragmatic function and of coordinated, well-timed activation among these muscles is therefore a physiological goal of postpartum rehabilitation, and it provides the rationale for breathing-based and whole-canister approaches to both DRA and pelvic-floor recovery [16,8].

3. Diastasis recti abdominis: definition, diagnosis, prevalence and risk factors

DRA is defined as an abnormal separation of the rectus abdominis muscles along the linea alba. The 2021 European Hernia Society guideline defines it clinically as a widening and thinning of the linea alba exceeding 2 cm, standardised at 3 cm above the umbilicus and assessed by palpation, calipers or ultrasound [14]. However, no universally accepted threshold exists: studies variously define DRA as an inter-recti distance (IRD) greater than 2 cm, 2.5 cm, two finger-widths (approximately 3 cm), or by the normative values of Beer et al. (2.2 cm above, 2.7 cm at, and 1.0 cm below the umbilicus) [17,8,18]. Severity is sometimes graded by maximum IRD as mild (<3 cm), moderate (3–5 cm) and severe (>5 cm) [15]. This heterogeneity of definition, measurement site (above, at, or below the umbilicus), position (rest versus head-lift or curl-up) and instrument (ultrasound versus caliper versus palpation) is the single greatest obstacle to comparing prevalence and treatment data across studies, a limitation acknowledged in virtually every review [6,17,19]. Two-dimensional ultrasound has the best reliability, with intra- and inter-rater intraclass correlation coefficients above 0.9, and is regarded as the most accurate non-invasive method [18,19].

Prevalence estimates therefore vary widely but converge on a broad pattern: DRA is nearly universal in late pregnancy (reported up to 100% in the third trimester), affects roughly 60% of women at six weeks postpartum and declines to around 30–33% at twelve months [5,17]. Individual series report early-postpartum figures as high as 72.6% at six weeks and 88.5% in mixed early-postpartum cohorts, reflecting differing thresholds and timing [20,15]. A large cross-sectional study of 1,000 women examined at 3, 5, 10, 20 and 30 years postpartum found, using the IRD >2 cm criterion, prevalences of 36%, 31%, 22%, 26% and 30% respectively, and using the stricter IRD >3 cm criterion, 13%, 8%, 6%, 8% and 10% [8]. Notably, prevalence fell from three to ten years and then rose again toward thirty years, a late increase the authors attributed to ageing, obesity, chronic cough and reduced linea alba collagen [8]. They argued that the >2 cm threshold overestimates clinically relevant disease and proposed that >3 cm, being closer to the two-finger method and convenient as an integer, may be a more appropriate diagnostic cut-off — an argument with direct implications for how many postpartum athletes are labelled as having a treatable condition [8].

Risk factors for DRA remain contested. The most consistently reported associations across cohort and cross-sectional studies are higher body-mass index (BMI), greater parity, advanced maternal age, twin pregnancy and, in some series, caesarean delivery and higher birth weight [8,20,19]. In the 30-year cross-sectional study, higher BMI was an independent risk factor at 10 years, greater number of parturitions at 3, 5 and 10 years, twin pregnancy at 3 years, and diabetes at 20 and 30 years, suggesting that different risk factors dominate at different life stages [8]. A retrospective study of 478 early-postpartum women found older maternal age, lower educational attainment and higher parity to be independent predictors of DRA, whereas fetal weight and BMI were not significant in the final model — the association with lower education plausibly reflecting differences in health literacy, access to care and gestational weight gain [20]. Ultrasonographic work in 143 women with DRA versus 57 controls similarly implicated advanced age (odds ratio 3.21 for age ≥35 years), caesarean delivery (3.08), multiple births (2.44) and higher pre-pregnancy BMI (1.51), and documented larger rectus separation at the umbilicus (28.5 vs 24.1 mm) and a larger levator hiatus (24.7 vs 16.2 cm^2) in the DRA group [19]. These discrepancies largely reflect differences in the timing of assessment, the dynamic nature of DRA prevalence across the postpartum period, and the inconsistent diagnostic thresholds already noted [8,20].

The choice of diagnostic method is not merely academic, because it determines who is counted as a patient and who is offered treatment. Palpation and calipers are inexpensive and widely used but less reliable than ultrasound; the transducer footprint of some ultrasound systems nonetheless exceeds the separation being measured, introducing its own error [18]. Measurement during a curl-up or head-lift, at rest, or in different positions yields different values, and DRA may be present at one abdominal level but not another, so single-site assessment can misclassify [8,18,19]. These methodological choices, compounded by the natural decline in prevalence across the first postpartum year, explain why reported figures for the same condition range so widely and why direct comparison of treatment effects across trials must be undertaken with caution [6,17].

The relevance of conservative DRA management to surgical decision-making has been highlighted by abdominal-wall specialists. If a structured eight-week programme can narrow the inter-recti distance by nearly a centimetre, women initially classified as having moderate diastasis may be reclassified as mild, potentially avoiding or simplifying surgery [14]. Conversely, where functional instability or chronic lumbopelvic pain fails to respond to exercise despite IRD reduction, the underlying problem may be a loss of fascial integrity or muscle atrophy — the "floppy abdomen" — that could warrant surgical plication, though evidence in this subgroup is limited [14]. Undiagnosed ventral hernia, frequently associated with rectus diastasis and often not systematically screened for in trials, is a further consideration that may confound both the assessment and the management of the postpartum abdominal wall, and it reinforces the need for individualised clinical evaluation rather than reliance on the inter-recti distance alone [14].

Some risk associations have plausible mechanisms and practical implications. Higher parity and twin pregnancy increase and prolong the mechanical stretch on the rectus abdominis and linea alba, and incompletely recovered tissue is more vulnerable in a subsequent pregnancy [8]. Higher body-mass index increases intra-abdominal adipose tissue and pressure on the abdominal wall, an effect that appears to require time to manifest, which may explain why BMI emerged as a risk factor mainly in longer-postpartum cohorts [8]. The association with lower educational attainment, though less expected, plausibly reflects differences in health literacy, access to prenatal and postpartum care, nutritional quality and gestational weight gain, and it identifies a group that might benefit from targeted education and screening [20]. These considerations reinforce that some risk factors — chiefly weight and, to a lesser extent, gestational health — are modifiable, whereas others, such as parity and age, are not, and that prevention should concentrate on the former [8,20].

4. Functional consequences of DRA and its relationship with pelvic floor dysfunction

The rectus abdominis contributes to posture, trunk movement, pelvic stabilisation, respiration and visceral support, and DRA has been linked to impaired core stability, lumbopelvic and low-back pain, reduced abdominal-wall strength, poorer trunk biomechanics and, in extreme cases, ventral herniation [16,8]. Yet the strength of these associations is modest. A systematic review found only weak evidence that DRA severity is associated with impaired abdominal strength and low-back-pain severity, and most trials have enrolled only women with mild-to-moderate diastasis [6]. Importantly, an "anatomical–functional dissociation" recurs throughout the literature: a meta-analysis of nine randomised controlled trials (RCTs) demonstrated that structured exercise significantly narrowed the IRD (mean difference −8.05 mm) but did not improve perceived disability measured by the Oswestry Disability Index, and the authors argued that functional recovery depends more on the tension-generating capacity of the linea alba and recruitment of the transversus abdominis than on the absolute inter-recti gap [14].

The relationship between DRA and PFD is one of the most actively debated questions in this field, and the evidence is genuinely conflicting. The theoretical basis for a link is the shared dependence of the abdominal and pelvic-floor muscles on coordinated regulation of intra-abdominal pressure, with activation of the transversus abdominis and internal oblique during voluntary pelvic-floor contraction [20,15]. Some cross-sectional data support an association: an ultrasonographic study reported larger rectus separation and levator hiatus area, lower pelvic-floor electromyographic (EMG) values during rapid and tonic contractions, and higher pain scores in women with DRA than in controls [19]. A multisite surface-EMG study found that moderate-to-severe DRA independently influenced resting-tone parameters (anterior resting potential) of the puborectalis, pubococcygeus and urethral sphincter, suggesting compensatory tension rather than weakness, although DRA had limited impact on three-dimensional ultrasound measures of pelvic organ support [15].

However, the larger and more rigorous studies find no meaningful relationship. A retrospective cohort of 213 women, 82.6% of whom had DRA, found no difference in the occurrence of UI or POP between women with and without DRA, and no association even when the IRD cut-off was raised progressively to 30, 40 and 50 mm — directly refuting the hypothesis that more severe diastasis carries greater pelvic-floor risk [18]. A retrospective study using ultrasound for DRA and the Glazer surface-EMG protocol for the pelvic floor found no significant difference in pelvic-floor muscle strength or endurance between women with and without DRA, and only weak correlations between maximum inter-rectus distance and isolated EMG parameters [20,15]. The systematic review by Beamish and colleagues explicitly noted that, although DRA was previously proposed as a risk factor for PFD, contemporary evidence counters this hypothesis [5]. The balance of evidence therefore suggests that DRA and PFD frequently coexist because they share antecedents — pregnancy, delivery and raised intra-abdominal pressure — rather than because one causes the other, and that clinical management of postpartum DRA should prioritise targeted abdominal and core rehabilitation rather than assuming an obligatory pelvic-floor deficit [20,18].

The link between DRA and lumbopelvic pain is similarly equivocal. Some data associate DRA with impaired trunk-flexor and rotational strength — women with DRA showing reduced trunk-rotation strength at one year postpartum — and with disability, and a “floppy” abdomen or loss of core stability may coexist with only a modest inter-recti distance if the underlying problem is muscle atrophy or global fascial laxity [14]. Yet other work finds no higher prevalence of pelvic-floor disorders, low-back or pelvic-girdle pain in women with DRA than in those without, and no consistent correlation between the inter-recti distance and low-back or pelvic-girdle pain [5,18]. The clinical implication is that abdominal-wall integrity and lumbopelvic function must each be assessed directly rather than inferred from the size of the inter-recti gap [14,18].

The clinical nuance of the electromyographic evidence is worth drawing out. In the multisite surface-EMG study, women with moderate-to-severe DRA showed higher resting anterior potentials in specific pelvic-floor muscles — a sign of increased tone rather than weakness — leading the authors to caution that indiscriminate strength training such as intensive Kegel exercises could aggravate an already over-active, hypertonic pelvic floor, and that rehabilitation for these women should prioritise relaxation and coordination alongside abdominal restoration [15]. This overturns the assumption that every postpartum pelvic floor is weak and needs strengthening, and it aligns with the wider recognition that some athletes suffer from over-active, non-relaxing musculature [15,21]. It reinforces the central message that assessment must precede prescription: strength, tone, coordination and relaxation should all be evaluated, ideally by a pelvic-health professional, before a training emphasis is chosen [15,4].

A retrospective study integrating ultrasound and pelvic-floor surface EMG drew the practical corollary explicitly, concluding from the absence of a demonstrable link between DRA and pelvic-floor strength or endurance that postpartum management should prioritise targeted abdominal and core rehabilitation rather than focusing exclusively on pelvic-floor strengthening — a recommendation that follows from the abdominal-pelvic dynamics model in which the transversus abdominis and internal oblique co-activate with the pelvic floor [20]. The same study highlighted lower educational attainment as an independent risk marker for DRA, plausibly a proxy for access to care and health literacy, and argued that educational screening could form part of early risk assessment — a consideration relevant to the equitable delivery of postpartum care to athletes and non-athletes alike [20].

5. Pelvic floor dysfunction after childbirth: epidemiology and mechanisms

Pelvic floor dysfunction encompasses urinary incontinence, anal incontinence, pelvic organ prolapse and sexual dysfunction, and pregnancy and childbirth are established independent risk factors for each [7,22]. UI — the involuntary loss of urine — is the most prevalent form, affecting approximately 30–70% of women depending on population and definition, typically rising during pregnancy and declining across the first postpartum year but not resolving completely [4,7]. Stress UI, provoked by increased intra-abdominal pressure during coughing, sneezing, lifting or exertion, predominates in the postpartum and athletic populations [22,21]. POP — the descent of bladder, uterus or bowel into the vagina — has a reported prevalence of 3–50%, affects about half of women at routine gynaecological examination, and severely reduces quality of life; its prevalence in some populations is projected to rise by nearly half by 2050 [4,7]. In a cross-sectional study of 845 women assessed six to eight weeks postpartum by surface EMG and clinical examination, abnormal electromyographic values were common (78–91.5% across phases) even though clinically diagnosed UI and POP were much less frequent, underscoring that subclinical neuromuscular impairment substantially exceeds symptomatic disease [22].

The mechanisms are multifactorial. Vaginal delivery stretches and can rupture pelvic-floor muscle, fascia and ligaments and may cause permanent nerve injury, reducing urethral closure pressure and predisposing to stress UI [22,13]. Mode of delivery matters but is not deterministic: vaginal delivery carries a higher incidence of UI than caesarean section, yet caesarean is not fully protective and has itself been associated with abnormal resting muscle tone through altered bladder–uterus anatomy and post-operative inflammation [7,22]. Parity, advancing age, obesity, gestational weight gain, constipation during pregnancy and disturbance of the vaginal flora have all been implicated as modifiable or non-modifiable contributors; in one large cross-sectional analysis, gestational constipation increased the odds of abnormal resting muscle tone, greater gestational weight gain increased the risk of UI, and caesarean delivery raised the odds of abnormal resting tone while lowering the odds of UI (OR 0.30) relative to vaginal delivery [22]. Pre-pregnancy and antenatal UI are strong predictors of long-term UI: in a seven-year follow-up of a randomised trial, UI in mid-pregnancy conferred a roughly five-fold increase in the odds of UI seven years later [23].

Levator ani injury and hiatal enlargement are central to POP: the strong association between prolapse and levator avulsion is explained largely by increased hiatal size and weaker pelvic-floor muscles rather than the avulsion itself, and pelvic-floor muscle strength and endurance are independently related to POP [9]. Women with major levator defects have approximately 47% lower pelvic-floor strength and endurance than those without [9]. Because most such women can still contract the pelvic floor correctly, training remains worthwhile [9]. These observations frame the pelvic floor as a trainable muscular system whose strength, endurance and timing determine continence and support — the rationale for pelvic-floor muscle training (PFMT) as first-line therapy [5,7].

Anal incontinence, though less discussed, is a further component of postpartum PFD, affecting roughly 13–14% of women at six to twelve months and closely tied to obstetric anal sphincter injury; only about 30% of primiparous women who sustain such injury, and 40% of those with no or first-degree perineal tears, return to normal urinary and colorectal function by six months postpartum, and forceps-assisted delivery further increases the odds of PFD years later [5,11]. Postpartum PFD also carries a psychological and social cost: it is associated with fatigue, sleep disturbance, reduced quality of life and difficulty in embracing the maternal role, and it deters physical activity — a barrier of particular importance to the athlete [22]. The high prevalence of these conditions, and the projected rise in prolapse surgery as populations age, make effective prevention and conservative management a public-health as well as an individual concern [5,7].

A large cross-sectional study using surface EMG and clinical diagnosis in 845 postpartum women extended the list of modifiable contributors beyond the obstetric: gestational constipation increased the odds of abnormal resting pelvic-floor tone, greater gestational weight gain increased the risk of UI, and disturbance of the vaginal flora was associated with abnormal fast-twitch muscle activity, plausibly through an inflammatory effect on pelvic-floor connective tissue [22]. These findings imply that antenatal counselling on diet, weight and vaginal health, and prompt treatment of vaginal inflammation, may complement pelvic-floor training in reducing postpartum PFD — measures readily incorporated into the athlete’s perinatal care [22].

6. Pelvic floor dysfunction, physical activity and the female athlete

A distinctive and clinically important body of evidence concerns UI in athletes, including young nulliparous women, which reframes pelvic-floor symptoms as relevant not only to parous women but to sportswomen at large [10,21]. Two competing hypotheses have been advanced regarding the effect of exercise on the pelvic floor [9]. The first holds that physical activity strengthens the pelvic floor through repeated co-contraction and impact-induced training; the second holds that repetitive rises in intra-abdominal pressure overload, stretch and fatigue the pelvic-floor muscles and connective tissue, weakening support — the "hammock hypothesis" [21,24]. The empirical picture supports the view that high-impact loading can outstrip pelvic-floor capacity: stress UI is common in high-impact sport even among nulliparous athletes with no classical risk factors [21,24]. Continence is normally maintained by a balance between intravesical and intraurethral pressure, the levator ani — comprising the iliococcygeus, puborectalis and pubococcygeus — firmly compressing the urethra during pressure rises; injury or fatigue of the levator ani reduces urethral support and provokes leakage [21].

Prevalence data illustrate the point. A systematic review and meta-analysis reported UI in about 25.9% of female athletes across sports, with volleyball players showing rates as high as 75.6% [21]. Among adolescent female athletes, a systematic review found UI prevalence ranging from 18% to 80%, averaging roughly 48.6%, with the highest rates in trampolining (up to 80%) and rope-skipping (75%) — sports characterised by repeated jumping and high ground-reaction forces — and the lowest in rhythmic gymnastics (31.8%) [10]. A pilot survey of women performing CrossFit, kickboxing and boot-camp found that 64.2% reported urinary leakage during exercise, with CrossFit — which involves the most jumping — carrying significantly greater risk ($p = 0.023$), and importantly leakage occurred in nulliparous as well as parous participants [24]. Peak vertical ground-reaction forces during high-impact activity may reach many times body weight, and jumping and abrupt increases in intra-abdominal pressure displace the urethra caudodorsally; where pelvic-floor support is insufficient, the urethral closure mechanism is overwhelmed, and leakage tends to occur later in the day and during high-impact tasks, consistent with muscular fatigue [21,24]. Nulliparous athletes engaged in strenuous activity have been shown to have larger levator hiatus area, greater bladder descent on Valsalva and increased levator-ani cross-sectional area, changes interpreted as stress-induced hypertrophy [21].

Whether high-impact sport causes lasting harm remains unresolved. Some evidence suggests athletes have stronger pelvic-floor muscles than non-athletes, and one case-control study found similar UI prevalence in former elite athletes and non-athletes later in life, implying that high-impact sport at an early age is not a risk factor for later UI [21]. It is also unclear whether leakage arises through pelvic-floor fatigue or through damage; incontinent athletes sometimes have stronger, less relaxable muscles [21]. These uncertainties notwithstanding, the findings carry two implications for the postpartum athlete. First, the pelvic-floor demands of returning to high-impact sport such as running are considerable: running generates ground-reaction forces of roughly 1.6–2.5 times body weight and requires the pelvic-floor musculature to contract and relax rapidly and repeatedly; inability to do so in a supervised setting predicts dysfunction during the largely subconscious task of running [3]. Second, UI is under-reported and under-treated: athletes frequently regard leakage as normal, are reluctant to disclose it to coaches (up to 87% would not tell their coach), and adopt self-management strategies such as pads, fluid restriction and pre-emptive voiding rather than seeking care, while 69–90% of adolescent athletes have never heard of pelvic-floor muscle training [10,25,21]. High-impact exercise has been reported to increase the risk of pelvic-floor dysfunction nearly five-fold compared with low-impact exercise, further justifying a graded reintroduction of impact after childbirth [3].

The relationship between sport type and pelvic-floor risk can be systematised by ground-reaction impact. Sports have been graded from impact grade 0 (less than one time body weight, e.g. swimming) through grade 1 (light lifting) and grade 2 (two to four times body weight, e.g. running and ball sports with sprinting and rotation) to grade 3 (greater than four times body weight, e.g. jumping, trampolining and gymnastics) [10]. The highest UI prevalences cluster in grade-3 activities, and team and track sports (grade 2) also show substantial rates, consistent with the mechanistic role of repeated high ground-reaction forces and abrupt intra-abdominal pressure rises [10]. Relative energy deficiency in sport and low energy availability compound the risk: adolescent female athletes with low energy availability have a higher prevalence of UI, and the female-athlete triad — disordered eating, menstrual dysfunction and low bone density — overlaps with the athletic populations most affected by pelvic-floor symptoms [10]. Structural adaptation may also matter: incontinent athletes have been found to have a thicker pubovisceral muscle, interpreted as compensation for reduced reactivity or delayed reflex activation rather than true weakness [25].

Sport-specific data sharpen this picture. A meta-analysis grouping athletes by impact reported UI prevalences of 36.4%, 50% and 64% in low-, moderate- and high-impact groups respectively [21]. Cross-fit exercises involving double-unders (47.7%), rope-skipping (41.3%) and box-jumps (28.4%) showed high leakage rates, and trampolinists reported urinary leakage of around 72.7% [21]. Triathletes reported stress-UI rates of about 37.4%, and a modified pad test during one hour of training in nulliparous athletes quantified leakage in 43.7%, including 24% who did not complain of UI — evidence that leakage is often present but unrecognised [21]. In the CrossFit, kickboxing and boot-camp survey, jumping and intra-abdominal manoeuvres such as coughing, sneezing or laughing triggered leakage in 78% of symptomatic respondents and running or sport in 67%, yet none had sought treatment, most reporting only small, infrequent losses [24]. Long-distance running, through the prolonged duration of force on the pelvic floor, has been proposed to carry a high UI prevalence, whereas jumping — once thought the highest-risk activity — has more recently been reported among the lowest, illustrating how contested the ranking of risk remains [21].

Two conflicting theories continue to frame the interpretation of these data [21]. One holds that athletes' pelvic-floor muscles are stronger than non-athletes' through repeated training use; the other holds that repeated intra-abdominal pressure stretches the fascia and muscles and weakens the floor [21]. Supporting the fatigue model, nulliparous women who undertook strenuous exercise and had stress UI showed lower maximum voluntary vaginal contraction pressure, indicating pelvic-floor exhaustion, and perineal pressure measured by perineometer is lower in athletes than non-athletes, correlating with greater UI symptoms [21]. Yet some incontinent athletes have stronger pelvic-floor muscles that fail to relax fully, raising the alternative possibility that non-relaxing, over-active muscles contribute to symptoms [21]. It remains unresolved whether high-impact sport causes UI through muscle fatigue or muscle damage, and the balance may differ between individuals — a genuine gap that limits prescriptive guidance for the returning athlete [21].

Individual studies in the adolescent review underline the range: 80% of nulliparous elite trampolinists leaked urine on a pad test (mean loss 28 g); 62.8% of adolescent soccer players, 48% of mixed-sport athletes, 48% of high-school and collegiate athletes, and 75% of competitive rope-skippers reported UI; and 31.8% of high-level rhythmic gymnasts were affected, many of whom were unaware that UI occurs in athletes and would not disclose it [10]. The predominant assessment tool across these studies was the International Consultation on Incontinence Questionnaire short form, with only occasional use of the more objective pad test, so that comparability is limited and true prevalence uncertain [10]. Nonetheless, the concentration of the highest rates in jumping-dominated sports is consistent and clinically actionable: adolescent and young-adult athletes in such disciplines should be proactively screened and educated about pelvic-floor health, ideally before symptoms become entrenched [10,25].

A recent systematic review focused on physical-therapy approaches drew similar conclusions, reporting UI prevalence in sportswomen ranging from 5.7% to 80% and identifying pelvic-floor muscle training — performed several times daily in sets of ten to fifteen repetitions — as the mainstay of both prevention and treatment, combined with education about pelvic anatomy and correct technique [25]. It emphasised that intense physical activity raises intra-abdominal pressure repeatedly, deforming ligaments and connective tissue and, at threshold, provoking leakage in young nulliparous women without other risk factors, while also noting that co-contraction of the pelvic floor and abdominal muscles during exercise can, conversely, strengthen the floor — the same unresolved duality seen elsewhere [25]. Crucially, it underscored that self-management strategies substitute for care, and that education of athletes, coaches and clinicians is needed to bring affected women to appropriate treatment before they abandon their sport [25].

7. Conservative management of diastasis recti abdominis

Physiotherapy is the recognised first-line treatment for DRA, but the evidence base is heterogeneous and of variable quality [6,14]. Historically, transversus abdominis (TrA) "drawing-in" exercises and pelvic-floor muscle training were the most commonly prescribed interventions, and curl-up type exercises were discouraged for fear of widening the gap; this clinical convention has been challenged by experimental and trial evidence showing that curl-up produces an immediate decrease in IRD whereas in-drawing and isolated pelvic-floor contraction can transiently increase it by a few millimetres [6].

Early meta-analytic work was cautious. Gluppe and colleagues, pooling seven RCTs, found very-low-certainty evidence that TrA training reduced the IRD (mean difference −0.63 cm) and only very-low-to-low-certainty evidence that curl-up or pelvic-floor training was more effective than minimal intervention; they concluded that there was insufficient evidence to recommend any specific programme and questioned the clinical relevance of a pooled 6-mm change [6]. Since then, larger syntheses have reached more definite — though still qualified — conclusions.

A 2026 meta-analysis of nine RCTs (450 women) found that structured exercise significantly reduced the IRD by a mean of 8.05 mm relative to no intervention or standard care, with the greatest effect when the intervention began within three months of delivery (−10.2 mm) rather than after six months (−5.93 mm); there was no significant difference between specific exercise types and, critically, no corresponding improvement in Oswestry disability scores (mean difference 0.82; $p = 0.75$), producing a marked "anatomical–functional dissociation" [14]. A network meta-analysis of 27 RCTs (1,340 women) ranked comprehensive programmes engaging both deep and superficial abdominal muscles — especially when combined with neuromuscular electrical stimulation and breathing techniques — above isolated single-muscle or passive approaches; combined traditional core exercise with breathing plus kinesiotaping (mean difference −26.25 mm) and core suspension exercise (−25.14 mm) ranked highest, whereas kinesiotaping alone (−3.93 mm) and abdominal binders (−10.32 mm) were less effective, and isolated exercises such as straight-leg-raise or curl-up-only were ineffective or even worsened the IRD [17]. A separate systematic review and meta-analysis of postpartum exercise reported that abdominal muscle training reduced the IRD at rest (pooled mean difference −0.52 cm) and during a head-lift task (−0.47 cm), with moderate certainty for the head-lift outcome, and that adding co-interventions increased the effect (−1.54 cm) [5].

The transversus-versus-rectus debate has been directly tested. A pilot RCT comparing a rectus abdominis "crunch" programme with a standard TrA programme in early postpartum women found greater IRD reduction with rectus training at both six and twelve weeks — by 19.2 mm above, 22.9 mm at, and 20.2 mm below the umbilicus at twelve weeks — challenging the long-standing preference for TrA-focused rehabilitation, although the trial was underpowered and heavily affected by COVID-19-related loss to follow-up [26]. The anatomical rationale behind this debate is instructive. When the transversus abdominis contracts, its insertions pull the linea alba laterally, so that in the pliable early-postpartum abdomen a bilateral transversus contraction can transiently widen the inter-recti distance, whereas contraction of the rectus abdominis shortens the muscle bellies and draws them toward the midline [26]. This mechanism, demonstrated on ultrasound, provided the rationale for testing rectus-focused training and for questioning the long-standing convention of transversus-only rehabilitation; it does not, however, imply that transversus and pelvic-floor training are harmful, since their immediate widening effect is small — of the order of millimetres — and their broader role in trunk stability and continence is well established [6,26]. The pragmatic synthesis is that comprehensive programmes engaging both superficial and deep muscles, rather than either in isolation, are most likely to reduce the inter-recti distance while preserving core function [17,26]. Consistent with the value of whole-core, respiratory approaches, a randomised trial of core-muscle-strength stability-oriented breathing training significantly reduced the IRD above, at and below the umbilicus compared with self-directed rehabilitation, on the rationale that strengthening the diaphragm and transversus abdominis restores intra-abdominal pressure control [16]. A Pilates programme based on breathing and core training reduced the IRD, decreased waist circumference and improved abdominal endurance in primiparous women over four weeks, although rectus thickness did not change — possibly because the four-week intervention was too short to alter muscle thickness [27]. A single-group study of a ten-week combined aerobic and resistance programme reported improved fast-twitch (type II) and slow-twitch (type I) pelvic-floor fibre function and reduced resting tension, illustrating that whole-body training can influence the abdominopelvic complex, though the absence of a control group limits inference [28].

Three cross-cutting messages emerge. First, structured, supervised, comprehensive exercise reliably narrows the IRD, whereas isolated or passive modalities do not, and supervision and consistency may matter more than the specific anatomical focus of the exercises [14,17]. Second, the timing of intervention matters: the first three postpartum months appear to constitute a “golden window” of myofascial plasticity, plausibly related to residual relaxin-mediated tissue remodelling, during which exercise is most effective [14,17]. Third, and most importantly for the returning athlete, anatomical narrowing of the linea alba does not automatically translate into functional recovery, so management must be individualised and expectations managed — the woman whose primary complaint is instability or lumbopelvic pain may not be satisfied by IRD reduction alone, and the development of DRA-specific functional outcome scales is a stated research priority [14]. Natural involution, which continues up to roughly 18 months postpartum, further confounds the attribution of improvement to therapy and limits the certainty of short-follow-up trials [14,8].

Adjunctive modalities have been examined but occupy a subordinate place. Neuromuscular electrical stimulation added to abdominal or core exercise augments IRD reduction in both the network meta-analysis and pooled analyses, and biofeedback-assisted training combined with electrical stimulation has outperformed stimulation alone in trials of rectus diastasis [5,17]. Passive supports — abdominal binders, corsets and kinesiotaping — produce smaller effects than active exercise; in the network meta-analysis kinesiotaping alone reduced the IRD by only 3.93 mm and binders by 10.32 mm, and where a corset appears effective, part of the effect may be a mechanical confounder, the device holding the abdominal wall in a shortened position and facilitating connective-tissue remodelling independently of muscle strengthening [14,17]. The practical inference for the postpartum athlete is that binders and tape may offer short-term symptomatic support but should not substitute for a supervised, progressive, whole-core exercise programme [14,17].

Quantitatively, the network meta-analysis benchmarked treatment effects against a minimal clinically important difference for the inter-recti distance of approximately 5–10 mm [17]. Combined traditional core exercise with breathing and kinesiotaping, core suspension training, and combinations of neuromuscular electrical stimulation with core and pelvic-floor biofeedback all exceeded this threshold with mean differences beyond 20 mm, whereas single-modality or isolated-muscle interventions such as straight-leg-raise, curl-up-only or global core stability alone typically fell below it or even worsened the separation [17]. The consistent hierarchy — comprehensive, multimodal, deep-and-superficial training above isolated or passive approaches — held across sensitivity and subgroup analyses, even though the certainty of individual comparisons ranged from low to high and many rested on single studies [17].

A further theme is that whole-body training benefits the abdominopelvic complex, not only the targeted muscles. In a ten-week combined aerobic and resistance programme, postpartum women improved the maximum value of fast-twitch (type II) pelvic-floor fibres and the mean value of slow-twitch (type I) fibres while reducing resting tension and variability, with large effect sizes for several parameters, and the authors argued that aerobic exercise preferentially enhances slow-twitch endurance whereas resistance training strengthens fast-twitch fibres, the two complementing each other [28]. Pilates, likewise, improved abdominal endurance and reduced both the inter-recti distance and waist circumference through breathing and core training [27]. Although these single-group or small trials cannot isolate the active ingredient, they support integrating pelvic-floor and abdominal work into a broader conditioning programme — the model most relevant to an athlete returning to sport [27,28].

A methodological caveat pervades the DRA-treatment literature and tempers even the positive syntheses. Because the inter-recti distance narrows spontaneously over the first postpartum year and connective-tissue remodelling continues to roughly 18 months, trials with short follow-up and, especially, those lacking a genuine no-treatment control group risk attributing to therapy improvements that would have occurred anyway [6,14,8]. In one meta-analysis, some trials compared exercise with no intervention while others compared it with standard or corset care, and diagnostic thresholds differed across studies, diluting the population with both very mild and very severe cases that respond differently [14]. The certainty of evidence is correspondingly downgraded — commonly to low — so that, while the direction of effect (exercise narrows the inter-recti distance) is consistent, its true magnitude and durability remain uncertain [6,14].

8. Conservative management of pelvic floor dysfunction

In contrast to DRA, the evidence for conservative management of postpartum PFD is stronger and more consistent, and pelvic-floor muscle training is unequivocally first-line therapy [5,7]. The systematic review and meta-analysis by Beamish and colleagues, conducted to inform Canadian postpartum guidelines, provided moderate-certainty evidence that PFMT in the first year postpartum reduced the odds of UI by 37% (OR 0.63) and, in a single RCT, the odds of POP by 56% (OR 0.44) relative to controls [5]. An umbrella review of nine systematic reviews, undertaken for Finnish national guidelines, found the highest level of evidence for the prevention of postpartum UI through exercise and PFMT during pregnancy, with meta-analytic estimates of a roughly 50% reduction in the odds of developing UI during pregnancy (OR 0.50) and a 37% reduction in the odds of postpartum UI (OR 0.63); group PFMT during pregnancy significantly reduced UI prevalence both antenatally (risk ratio 0.67) and postpartum (0.66) [4]. Structured PFMT also produced a reduction in bothersome vaginal bulging postpartum (risk ratio 0.48) [4].

For anal incontinence the evidence is weaker. Pooled analyses show a 42% reduction in the odds of anal incontinence with PFMT (odds ratio 0.58), although this estimate did not reach statistical significance and the certainty was low, and a single trial found a greater reduction in anal-incontinence symptom severity when PFMT was combined with a co-intervention [5]. The evidence for anal incontinence, and for the severity as opposed to the mere presence of symptoms, is therefore less robust than for the risk of urinary incontinence, and represents an acknowledged gap that limits firm recommendations for the athlete with bowel symptoms [5].

Timing and indication modulate these effects. PFMT appears most effective as primary prevention in continent women: continent women performing antenatal PFMT were 62% less likely to report UI in late pregnancy (risk ratio 0.38), whereas PFMT used to treat established UI in already-symptomatic pregnant women showed no clear benefit [4]. The durability of the effect is uncertain. In a seven-year follow-up of a randomised trial of antenatal exercise including PFMT, UI was reported by 51% of the intervention group and 57% of controls with no significant group difference, and the strongest predictor of long-term UI was UI at study inclusion (OR ≈ 5.4) rather than the intervention; the authors could not draw firm conclusions because of a low (35%) response rate, but the finding is consistent with other evidence that antenatal PFMT effects may not persist beyond twelve months without continued training [4,23]. Interestingly, incontinent women who exercised regularly were more than twice as likely to exercise at lower intensity than continent women, suggesting a bidirectional relationship between continence and exercise participation [23]. This transience argues for ongoing pelvic-floor training rather than a time-limited course, a point of direct relevance to athletes who must sustain pelvic-floor capacity against repeated high-impact loading [23].

The temporal pattern of benefit is worth specifying. Antenatal PFMT reduced the risk of UI in early postpartum (six weeks to three months) — women were 46% less likely to report leakage in one analysis — and probably in mid-postpartum (three to six months), but the evidence of a difference disappeared in late postpartum (six to twelve months) and beyond, with no benefit detected at one, five, six or twelve years in pooled analyses [4,23]. One meta-analysis did, however, find a significant reduction in UI persisting to twelve months with structured postpartum PFMT, indicating that continued postnatal training may extend the benefit [4]. The practical inference is that pelvic-floor training should be framed not as a finite antenatal course but as an ongoing habit — a message especially pertinent to athletes whose sport repeatedly loads the pelvic floor [4,23].

The wider narrative literature reinforces that PFMT improves pelvic-floor muscle strength and reduces UI and, in early stages, POP symptoms, though most trials are limited by small samples, short follow-up and heterogeneous protocols [7]. Adjuncts such as biofeedback, electrical stimulation and vaginal devices have shown promise in individual trials but do not consistently outperform well-taught PFMT [7]. A recurring and clinically critical caveat is that a substantial proportion of women — reported between 14% and 53% on initial testing, and around a quarter with no knowledge of the pelvic floor at all — cannot correctly contract the pelvic-floor muscles without instruction, frequently substituting gluteal or abdominal contraction [9,29]. Correct technique, verified by palpation or biofeedback, is therefore a prerequisite for effective training, and symptomatic women should be referred to a physiotherapist or professional specialised in pelvic-floor function [4,7]. For the postpartum athlete specifically, the pelvic floor must be trained not only for strength and endurance but for the rapid, well-timed pre-contraction ("the knack") that precedes rises in intra-abdominal pressure during jumping and running, a strategy proposed to pre-empt exertional leakage [29,30].

Pharmacological and surgical options exist for UI but are largely irrelevant to the young postpartum athlete, in whom leakage typically occurs only during high-impact activity rather than daily life; mid-urethral slings and drug therapy are not first-line in this group, and non-invasive supports such as pessaries or vaginal tampons may provide situational urethral support during sport [21]. Biofeedback, whether by surface EMG, suprapubic ultrasound or intravaginal pressure devices, is a useful teaching adjunct that increases awareness of correct contraction and can improve pelvic-floor strength, and it is particularly valuable in the substantial minority of women who cannot otherwise identify the correct muscles [21,29]. Across the pregnancy and postpartum literature, the recurring lesson is that the efficacy of PFMT depends on correct performance, adequate dosage — typically several sets of contractions on most days, progressed over weeks — and, ideally, professional supervision or verification of technique [4,7].

Programme structure also influences outcomes. Group-based, supervised PFMT during pregnancy significantly reduced UI prevalence antenatally and postpartum, and supervised delivery has been associated with greater symptom-severity reduction than individual home programmes in some analyses [4]. Adherence is decisive but inconsistently reported: exercise adherence affects treatment outcomes, yet many trials do not document it, and control-group definitions are frequently vague, limiting interpretation [4]. For athletes, whose training discipline may favour adherence, the more pertinent obstacles are correct technique and the integration of pelvic-floor work into functional, sport-specific movement rather than its practice in isolation [12,4].

Specific trials illustrate the range of effective conservative options in athletes. Pelvic-floor rehabilitation programmes emphasising awareness and timed contractions have reduced urine leakage substantially more than pamphlet-based education; an eight-week EMG-biofeedback programme improved voluntary contraction across sitting, standing and supine postures; and a randomised trial of a biofeedback Vibrance Kegel Device combined with pelvic-floor exercise produced greater strength gains than exercise alone ($P = 0.001$) [21]. Biofeedback, based on self-monitoring of previously unconscious physiological activity, increases motivation and awareness of correct contraction, while surface electromyography records the electrical activity of muscle and nerve to guide technique [21]. These modalities reinforce, rather than replace, the core intervention — correctly performed, adequately dosed pelvic-floor muscle training — which remains first-line among nulliparous and postpartum athletes alike, and athletes should be taught to contract the pelvic floor correctly before such programmes are advanced [21].

The picture for prolapse is more nuanced than for incontinence. While structured PFMT can reduce bothersome vaginal bulging in the first postpartum year, at least one randomised trial found no effect of postpartum PFMT on prolapse in primiparous women, and the evidence base for POP prevention is weaker than for UI [4,7]. Complementary obstetric measures have been studied for the prevention of pelvic-floor trauma — perineal massage and pelvic-floor exercises from around 32–34 weeks reduced episiotomy and severe tears in some trials, whereas antenatal perineal-distension devices did not consistently protect pelvic-floor structures — but these target the intrapartum injury that predisposes to later dysfunction rather than the postpartum recovery itself [7]. For the athlete, the practical message is that PFMT is a reliable tool for continence, a probable tool for early prolapse symptoms, and one component of a broader perinatal strategy that also encompasses obstetric care [4,7].

9. Timing, supervision and mode of delivery of interventions

Two practical questions — when to begin and how to deliver rehabilitation — recur across the DRA and PFD literatures and bear directly on the returning athlete. On timing, the weight of evidence favours early initiation. Subgroup analyses of DRA meta-analyses show greater IRD reduction when exercise begins within three months of delivery, attributed to a window of higher myofascial plasticity [14,17]. For the pelvic floor, moderate physical activity begun shortly after childbirth does not worsen PFD symptoms and may enhance early tissue healing, and delaying intervention until six weeks or later risks missing the dynamic early-regeneration phase [13]. A large randomised study introducing exercises between the second and fourth postpartum weeks and completing them by the sixth week reported a fall in UI prevalence from 49% during pregnancy to 36.9% postpartum and a fall in DRA prevalence from 76.2% in the early postpartum days to 23.4% at six weeks [13].

On delivery, supervised training consistently outperforms unsupervised or purely educational approaches. In the same randomised study, supervised physiotherapy produced the greatest improvements in both UI and DRA (DRA present in only 9.8% of the supervised group at six weeks versus 33.3% online and 27.3% control), the highest frequency of pelvic-floor exercise performance (94.7%) and the highest rate of correct technique (72.2%), compared with an online group and an education-only control in which only about a fifth exercised correctly [13]. This mirrors evidence across the field that supervised PFMT is more effective than unsupervised training and that supervision improves adherence and correct performance [4,28]. Telerehabilitation is a reasonable intermediate option — online supervision outperformed education alone — but did not match in-person supervision for DRA outcomes [13]. Meta-analytic subgroup findings on supervision are not entirely uniform (some abdominal-training analyses favoured unsupervised home programmes), reflecting the heterogeneity of protocols and the difficulty of isolating supervision as a variable [5].

The strength of the timing signal should not be overstated. Although subgroup analyses favour early intervention, the tests for subgroup differences frequently did not reach statistical significance, and the network meta-analysis could not conclusively separate the effect of intervention timing from spontaneous recovery because most evidence fell in the early-postpartum window and comparisons across immediate, early and late strata were sparse [14,17]. The pragmatic reading is that early, supervised initiation is reasonable and probably advantageous, but that its superiority over later, well-conducted rehabilitation is not firmly established, and that women who present later — as many athletes do, once symptoms interfere with training — should still be offered structured training [14,17].

The importance of structured programme design has prompted the development and validation of reporting-standardised interventions. The “Active Mums” programme, developed using the CReDECI-2 and Consensus on Exercise Reporting Template (CERT) frameworks, exemplifies a tailored, supervised, periodised postpartum programme delivered by qualified exercise professionals and incorporating cardiorespiratory, strength, flexibility, balance, abdominal-recovery and pelvic-floor components across adaptation, improvement and maintenance mesocycles; such reporting standardisation is essential if effective programmes are to be reproduced and implemented, and it explicitly integrates pelvic-floor training into a whole-body plan rather than treating it in isolation [31]. Cost and access to appropriately qualified professionals, however, remain significant real-world barriers, particularly where perinatal rehabilitation is self-funded, and lack of social support, fatigue and childcare demands further limit adherence [11,31].

Delivery of care is further constrained by structural factors. Delphi respondents working with postpartum runners reported that most of their clients self-refer and self-pay, identifying cost and access to appropriately qualified professionals as key barriers, and called for protected maternity-leave policies that allow a gradual, safe progression of exercise rather than a pressured return to performance [11]. These barriers fall hardest on women of lower socioeconomic status and in settings where perinatal rehabilitation is not part of standard professional training — precisely the groups already at higher risk of poorly managed PFD [11,31]. The dissemination of freely available, evidence-informed education and reproducibly reported programmes has therefore been proposed as a means of extending good practice beyond those able to access individual supervision [1,31].

The design of such programmes is instructive. The validated postpartum programme was periodised into three 60-minute weekly sessions across adaptation (two weeks), improvement (six to eight weeks) and maintenance (four to six weeks) mesocycles, each session addressing cardiorespiratory, resistance, flexibility and relaxation components alongside daily pelvic-floor muscle training, with intensity guided by perceived exertion (a Borg rating of 11–13, rising to 14–15) and progressed by increasing complexity, sets or load [31]. Delivery could be in-person or online in small groups, and adherence exceeded 90% with high participant satisfaction, illustrating that a structured, supervised, whole-body model incorporating the pelvic floor is both feasible and acceptable to postpartum women [31]. Reporting such programmes against standardised templates is what allows them to be reproduced and, ultimately, tested for effectiveness in athletic populations [31].

10. Exercise in pregnancy and the high-impact question

Because pre-pregnancy and antenatal pelvic-floor status strongly predict postpartum outcomes, the management of the returning athlete effectively begins in pregnancy [23,29]. High-impact activity during pregnancy has been proposed as a risk factor for pelvic-floor dysfunction, prompting debate over whether such exercise should be curtailed [9,29]. The evidence suggests that, with appropriate safeguards, it need not be. A randomised controlled trial of a structured high-low impact aerobic programme supported by pelvic-floor muscle exercises in 97 healthy pregnant nulliparas improved the neuromuscular activity of the pelvic floor — significantly higher EMG amplitude during rapid "quick-flick" contractions ($p = 0.014$) and improved relaxation — without any adverse effect on continence or quality of life, provided participants could contract the pelvic-floor muscles correctly and used the "knack" before jumps and runs; women unable to contract the pelvic floor on initial EMG testing (15%) were excluded, underscoring the primacy of correct technique [29]. A subsequent quasi-experimental trial in 260 women showed that a prenatal high-low impact programme supported by pelvic-floor education and training reduced the life impact of postnatal UI at both two months and one year postpartum — symptomatic women numbering 22% versus 35% of controls at two months and 14% versus 28% at one year — with the decline in symptom burden almost twice as large as in controls [30]. Crucially, both authors restricted their recommendations to continent women able to contract the pelvic floor correctly, and emphasised that the potential harm of high-impact loading can be mitigated — not by prohibition — but by multidirectional preventive strategies: pelvic-floor education, correct-technique training, the "knack", and limitation of impact when leakage occurs [29,30].

This nuanced position is echoed in the analysis of physical-activity intensity guidelines. A scoping review of 22 public-health and sports-medicine guidelines found that moderate-intensity activity is almost universally recommended in pregnancy, but that recommendations for vigorous or high-intensity activity are contradictory across countries, and that guidance for elite or highly active women and trimester-specific advice is scarce [32]. Only one document specified an upper limit (elite athletes advised against training above 90% of maximal oxygen uptake), and both American and Polish guidelines concede that a safe upper limit has not been established [32]. Methods for determining and monitoring intensity — the rating of perceived exertion, the Talk Test and heart-rate ranges — are inconsistently included, and the historical maternal heart-rate ceiling of 140 beats per minute, introduced in 1985 and removed in subsequent revisions, persists in practice despite being obsolete [3,32]. For the athlete, the practical consequence is that intensity should be individualised and monitored rather than dictated by a fixed heart-rate ceiling [3,32].

The broader narrative on strenuous exercise and the pelvic floor remains unsettled. A scoping review of POP in exercising women found symptomatic prolapse prevalence ranging from 0% to 23%, highest among Olympic weightlifters and power-lifters, and reported that short-term strenuous exercise and a prospective study of six-week military parachute training both reduced pelvic-floor support — suggesting that heavy loading which markedly raises intra-abdominal pressure may be the most relevant risk factor [9]. A single randomised trial in that review even found that adding transversus abdominis training to PFMT after prolapse surgery increased bulging symptoms, a counter-intuitive result warranting caution [9]. Yet the same review emphasised that most physical activity does not harm the pelvic floor, that the data are insufficient to determine how strenuous activity relates to pelvic-floor disorders, and that women should not be advised to stop exercising because of PFD but rather to train the pelvic floor and, if necessary, temporarily substitute low-impact for high-impact activity while doing so [9]. Parity, not exercise per se, was the factor most consistently associated with POP among exercising women [9].

Emerging evidence on high-intensity interval training (HIIT) in pregnancy is reassuring: well-structured high-intensity training appears safe in terms of obstetric outcomes and is generally well tolerated, either improving or not affecting selected maternal and fetal parameters, with no adverse effects reported in the studies synthesised — though it should remain the province of women already accustomed to such intensity [32]. For the returning athlete, however, the postpartum period introduces specific physiological vulnerabilities beyond the pelvic floor: bone stress injuries have been reported in lactating elite athletes (around 3% of elite athletes, a large proportion of them sacral stress fractures), sometimes during non-impact exercise, and relative energy deficiency in a lactating athlete — in whom the usual menstrual marker of energy status is unreliable — can undermine bone and endocrine health [11]. These considerations reinforce a graded, individualised progression of load with vigilance for bone- and energy-related red flags [11].

Underlying the high-impact debate is the difficulty of measuring pelvic-floor load in vivo. Intra-abdominal pressure varies considerably between individuals performing the same activity and is highest during heavy resistance exercise such as squats and deadlifts (often exceeding 150–200 mmHg) and lower during many everyday tasks; some exercises promoted as pelvic-floor-safe do not in fact spare the pelvic floor, while common activities such as abdominal crunches or stair-climbing may not raise pressure more than standing from a chair [9]. This variability, and the absence of reliable, valid field measures of pelvic-floor function during activity, means that blanket prohibitions or permissions are unjustified; individual assessment of symptom provocation during graded loading is the more defensible approach [9,1].

Where intensity is to be monitored, the recommended tools are the rating of perceived exertion, the Talk Test and, more cautiously, heart-rate ranges [32]. On the Borg 6–20 scale, moderate intensity corresponds to a rating of 13–14 ("somewhat hard"), and modified heart-rate ranges for aerobic exercise in pregnancy have been proposed that depend on maternal age; for women aged 30 years or older, for example, moderate intensity has been defined as roughly 121–141 beats per minute and vigorous intensity as 142–162 beats per minute [32]. Because the heart-rate response to exercise is blunted and variable in pregnancy, however, perceived-exertion scales may be more practical than fixed heart-rate targets, and no method for determining maximal oxygen uptake is specified in most guidelines [32]. The clinical implication for the athlete is that intensity should be individualised, cross-checked with subjective effort, and not governed by a single numeric ceiling [32].

The prospective and experimental evidence on strenuous loading is instructive. A single 90-minute bout of strenuous running, jumping and weightlifting reduced pelvic-floor muscle strength by about 17% compared with rest, and one 25-minute bout of high-intensity exercise increased maximal vaginal descent and reduced resting pressure [9]. Over six weeks, women undertaking military parachute training showed a significant increase in the likelihood of developing stage-II prolapse (relative risk 2.72) [9]. Counter-intuitively, a randomised trial found more prolapse symptoms in women who added transversus abdominis training to pelvic-floor muscle training after prolapse surgery, and cross-sectional data show a lower prevalence of prolapse symptoms among heavy-lifting exercisers than among inactive or light-lifting women — a paradox most plausibly explained by selection bias, as symptomatic women may avoid heavy lifting [9]. These mixed findings underline that, while heavy loading can acutely reduce pelvic-floor support, the long-term causal picture is unresolved and individual variability is large [9].

11. Return-to-sport and return-to-running frameworks

The translation of this physiology into practice is the domain of the emerging return-to-sport literature, which is dominated by expert opinion, consensus statements and case reports because high-quality trials are lacking [3,11]. A recurring theme is the mismatch between medical "clearance" at six weeks and the slower musculoskeletal and pelvic-floor recovery, and the consequent need for a graded, criterion-based rather than calendar-based progression [3,2].

Selman and colleagues proposed a rehabilitation timeline spanning pregnancy through return to sport, structured around trimester- and week-specific goals: diaphragmatic breathing and transversus abdominis control antenatally; gentle mobility, walking and pelvic-floor coordination in the first weeks postpartum; progressive strengthening and impact readiness from weeks seven to twelve; and return to running and sport from about week thirteen, contingent on symptom-free performance of impact-readiness tasks [3]. They recommended that running begin no sooner than eight weeks postpartum, only after a woman can walk 30 minutes without symptoms and tolerate the tasks of a run-readiness screen (single-leg squats, hopping, planks, wall sits and step-ups), that a walk–run progression with recovery intervals twice the work interval be used, and that running cadence be kept between 160 and 180 steps per minute to limit lower-limb load; any pelvic-floor symptom should prompt reassessment [3]. A companion case series applying a pre- and postnatal physiotherapy protocol to six recreational athletes reported meaningful improvements in lower-extremity function (Lower Extremity Functional Scale +28 points), urinary distress (Urogenital Distress Inventory improved by 53 points) and pelvic-floor strength by discharge at 12–16 weeks, with all participants returning to their desired activity without pain, incontinence or prolapse — illustrating, at low level of evidence, the feasibility of guided rehabilitation [2].

The proposed rehabilitation timeline is granular. In the first two postpartum weeks it prioritises minimising musculoskeletal stress, diaphragmatic breathing, gentle mobility and short bouts of walking; from weeks three to six it advances transversus abdominis coordination, longer walking and light pelvic-floor and open-kinetic-chain work; at weeks five to six it revisits the distinction between medical and musculoskeletal clearance; from weeks seven to twelve it integrates strength, endurance and power training and introduces impact around the eight-to-ten-week mark; and from week thirteen it targets full return to running and sport, with a running-specific interview and gait analysis [3]. Throughout, coning or doming of the abdominal wall during exertion is used as a sign that a movement exceeds the linea alba's current tension-management capacity and should be modified or eliminated to limit diastasis progression [3]. This staged structure operationalises the criterion-based philosophy and provides clinicians with concrete, if expert-opinion-level, benchmarks against which to judge readiness [3].

International Delphi consensus work has begun to formalise this practice. A consensus of 118 clinical and exercise professionals on return-to-running readiness recommended a minimum three-week period of rest and recovery, an individualised and gradual progression, and pre-running screening for medical and psychological concerns, current physical capacity and prior training history [1]. Ten of eleven proposed pre-running milestones reached consensus — including pelvic-floor muscle strength, endurance and coordination, and screening for UI, AI and POP symptoms, lumbopelvic and lower-extremity strength, and balance — while inter-recti distance was the only milestone that did not reach consensus, reflecting the weak and inconsistent relationship between IRD and running-related outcomes [1]. Reported symptom frequencies in postpartum runners underline the need for such screening: UI in 8–57%, AI in 39% and POP symptoms in 19% [1]. A companion consensus on designing the training programme recommended an individualised prescription, gradual increases in duration before intensity, a walk–run protocol, cross-training and targeted strengthening of trunk and lower-extremity muscles, with progression governed by biopsychosocial factors — sleep (less than 6.8 hours per night and high fatigue being risk factors for running-related pain), mental health, lactation, energy availability and pelvic-floor and musculoskeletal symptoms [11,12]. Both consensus groups identified cost and access to qualified professionals as major barriers and stressed shared decision-making, honouring the athlete's goals and timeline even when ideal milestones are not met [1,12].

The individualised, multidisciplinary model is exemplified by a case report of an elite netballer returning after caesarean section, in which a staged, criterion-based programme — addressing wound healing, pelvic-floor rehabilitation, sport-specific power and endurance training, sleep, lactation and psychological readiness — achieved return to full match play at sixteen weeks with no adverse events at six-month follow-up [12]. This case also foregrounds the elevated pelvic-floor risk in athletes: athletes have a higher prevalence of PFD than non-athletes (reported as 54% versus 7%), and postpartum women a higher prevalence than nulliparous women (approximately 35% versus 2.8–7.9%), so that the postpartum athlete carries a compounded "mother load" of risk that warrants proactive, individualised assessment rather than a default timeline; the same report noted that pelvic-floor training should be sport-specific, targeting the endurance and repeated explosive demands of the athlete's discipline [12].

Beyond pelvic-floor and abdominal function, the return-to-running frameworks emphasise a battery of load-and-impact screening tasks — being able to walk 30 minutes symptom-free, then hop, run on the spot, and perform single-leg squats, forward bounds and planks without provoking pelvic-floor or musculoskeletal symptoms — as proxies for the demands of running [1]. Support items and adjuncts also feature: intravaginal support devices (pessaries) and absorbent products may help manage prolapse and incontinence symptoms during the return to running, an individually fitted supportive sports bra is important given pregnancy- and lactation-related breast changes, footwear should be reassessed because ligamentous laxity can alter foot size and shape, and stroller running (preferably two-handed) alters kinematics and energy cost [1]. None of these substitutes for addressing the underlying pelvic-floor symptoms, and runners using absorbent products should still be encouraged to seek assessment [1].

Mode of delivery modifies but does not remove the need for a structured return to sport. Caesarean section is relatively protective against urinary symptoms and prolapse but is not fully protective, and it introduces its own considerations — wound healing (scar tensile strength is low in the immediate postpartum weeks and continues to increase to around 80% by twelve weeks), higher fatigue, and abdominal-wall recovery that remains impaired at six months irrespective of activity level or birth mode [11,12]. In the elite netball case, a caesarean birth was treated not as a shortcut to return but as a distinct rehabilitation problem requiring scar management, graded abdominal loading and the same criterion-based pelvic-floor and sport-specific progression as vaginal birth [12]. After vaginal delivery, pelvic-floor metrics — vaginal resting pressure, levator hiatus area, muscle strength and endurance, and bladder-neck mobility — are demonstrably altered, and recovery is maximised only around four to six months, underscoring that neither birth mode licenses an unmonitored return to high impact [3,12].

In practice, the return-to-running progression is deliberately conservative. Consensus recommends that how the plan is implemented — the dosing of exercise — matters more than when running is resumed, that it is better to progress too slowly than too fast, and that a walk–run protocol with cross-training, strength training and a rest day between runs be used, the initial running volume depending on the runner's history [11,12]. General exercise-physiology principles favour progressing duration before intensity, and running-injury evidence warns that rapid increases in mileage (of the order of 30% or more over two weeks) raise injury risk, so that structured progressions and modest weekly increments are preferred [11,12]. Any pelvic-floor symptom during a run–walk protocol should prompt the runner to cease the running portion, and progression should be guided by symptom response over the ensuing 24–48 hours rather than by a fixed schedule [3,11]. The available longitudinal data are reassuring in aggregate — pelvic-floor strength, resting pressure and symptom rates at one year were similar in women returning to exercise before and after six weeks postpartum — but the rate of progression, rather than the mere timing of resumption, appears more closely associated with injury risk, which is the strongest argument for a graded, monitored approach [3,11].

Biopsychosocial screening is integral to these frameworks. Consensus recommends assessing sleep quality — sleeping less than about 6.8 hours per night, together with high accumulated fatigue, is a risk factor for running-related pain — as well as mental health (postpartum depression affects up to one in five to one in seven women), lactation status and energy availability before and during the return to running [1,11]. Relative energy deficiency in sport is associated with urinary incontinence, bone stress injury and endocrine dysfunction, and is difficult to detect in lactating athletes because the usual menstrual marker is absent; screening for it is therefore explicitly recommended [11]. These factors interact with pelvic-floor and musculoskeletal recovery, so that a runner who is sleep-deprived, under-fuelled or psychologically unready may need to regress training even when her pelvic-floor examination is reassuring [1,11].

Objective imaging can complement symptom-based screening in the returning athlete. In the elite netball case, two-dimensional transperineal ultrasound was used longitudinally to track bladder-neck descent and the genital hiatus at rest and under load, on the rationale that increased bladder-neck descent and excessive lengthening of the urogenital hiatus are independent risk factors for UI and prolapse, and that athletes may have incontinence despite strong pelvic-floor muscles when bladder-neck descent is increased [12]. Such assessment is not universally available, but it illustrates the principle that pelvic-floor readiness for high-impact sport is multidimensional — encompassing strength, endurance, timing, tone, relaxation and structural support — and cannot be captured by a single measure [12].

12. Lumbopelvic pain and the lumbo-pelvic-hip complex in return to sport

Musculoskeletal pain, particularly pelvic girdle pain (PGP) and low-back pain, is a further medical determinant of successful return to sport that interacts with abdominal-wall and pelvic-floor function [33,34]. Pregnancy-related PGP is common — global incidence is reported between 20% and 65%, and about 19% of women continue to experience chronic symptoms for up to eleven years — and reflects hormonal and biomechanical compromise of lumbopelvic stability, in which the pelvis relies on the dynamic interplay of “form closure” (bony fit) and “force closure” (active muscle support) [33]. Reduced force closure can increase pelvic-joint motion by 32–68% in women with PGP, placing greater demand on the surrounding musculature to transfer load between trunk and lower limbs [33].

Imaging and functional studies show that postpartum women with PGP have altered morphology and contractility of the lumbo-pelvic-hip complex — reduced resting thickness of the erector spinae and gluteus maximus bilaterally, increased thickness of the right latissimus dorsi and iliacus, asymmetry of the latissimus dorsi and gluteus medius, and diminished contraction ratios of the gluteus maximus, gluteus medius and rectus femoris — implying that exercise prescription for these women should target the erector spinae, gluteal muscles and rectus femoris rather than deep core muscles alone [33]. This is clinically significant because deep-core training has dominated PGP rehabilitation despite limited evidence of effectiveness, and because the gluteus maximus is morphologically linked via connective tissue to the pelvic floor, connecting lumbopelvic and pelvic-floor rehabilitation [33].

Intervention trials support a broader, function-oriented approach. A randomised controlled trial of functional training (thoracolumbar segmental mobility, glute bridges, abdominal co-contraction and clamshell exercises) added to conventional pelvic-floor physiotherapy for 40 women with postpartum PGP produced significantly greater reductions in pain (Visual Analogue Scale) and disability (Pelvic Girdle Questionnaire), and greater gains in pelvic-floor muscle contraction parameters (phasic, tonic and endurance) on Glazer surface EMG, than conventional physiotherapy alone — with the between-group difference in disability substantially exceeding the minimal clinically important change [34]. The authors interpreted these gains through dynamic-stability theory: the pelvic floor operates within a feed-forward postural system that activates before movement to stabilise the pelvis, and only functional training embedded in weight-bearing, perturbed tasks restores the anticipatory recruitment and cortical motor efficiency required for real-world activity and sport [34]. For the returning athlete, these data argue that assessment and rehabilitation should extend beyond the abdominal wall and pelvic floor to the whole lumbo-pelvic-hip complex, and that persistent PGP is a legitimate reason to delay or modify return to impact activity [33,34].

Chronic PGP is not a trivial obstacle to sport. Pregnancy-related PGP can persist for over a decade in a minority of women, causing disability and impaired ambulation, and its postpartum prevalence is reported between roughly 8.5% and 37% [33,34]. Because the pelvic floor contributes to lumbopelvic stability and shares connective-tissue links with the gluteal muscles, PGP, PFD and abdominal-wall dysfunction form an interacting cluster; addressing one in isolation — for example, training the pelvic floor while ignoring gluteal and erector-spinae deficits, or vice versa — is unlikely to restore the integrated control that high-impact sport demands [33,34]. The functional-training trial's finding that adding thoracolumbar mobility and lumbopelvic stability work to pelvic-floor physiotherapy improved both pain and pelvic-floor contraction supports treating the region as a whole and, by extension, screening the returning athlete for PGP as part of a comprehensive musculoskeletal assessment [34].

The specific muscle findings in postpartum PGP are mechanistically coherent. Increased iliacus thickness on the painful side, together with reduced rectus femoris contraction, is consistent with a pattern of anterior pelvic tilt and tightened hip flexors that increases lumbar lordosis and sacral tilt, plausibly exacerbating both low-back and pelvic-girdle pain; compensatory thickening of the latissimus dorsi on the non-painful side may reflect an attempt to stabilise the pelvis when the gluteus maximus on the painful side is inhibited [33]. These observations translate into targeted prescription — strengthening the erector spinae, gluteus maximus, gluteus medius and rectus femoris while lengthening tight structures — rather than the generic deep-core focus that has dominated practice, and they exemplify how objective assessment of the lumbo-pelvic-hip complex can individualise rehabilitation for the returning athlete [33].

13. Sexual dysfunction, quality of life and the psychosocial burden

Pelvic floor dysfunction extends beyond continence and support to sexual function and psychological well-being, dimensions that materially affect a woman's willingness and ability to return to sport. PFD is a crucial risk factor for sexual dysfunction, which may affect up to 64% of postpartum individuals, and is associated with reduced arousal, less frequent orgasm and dyspareunia; women who experience urinary leakage are more likely to reduce the frequency of intercourse [5,22]. Among athletes specifically, sexual dysfunction has been reported in around 44% of nulliparous athletes with UI, associated with reduced sexual desire, and UI more broadly may negatively affect psychological well-being [21].

Conservative therapy can help. A body of randomised trials indicates that PFMT, alone or combined with adjuncts such as intravaginal electrical stimulation, tends to improve postpartum sexual function — including desire, arousal, lubrication, orgasm, and symptoms of vaginal laxity, the last particularly where levator ani defects are present — and to reduce dyspareunia, although the evidence is of low quality owing to small samples, short follow-up and heterogeneous protocols [7]. The validated Pelvic Floor Distress Inventory (PFDI-20) has been advocated as a simple tool to identify women with troublesome symptoms who warrant individualised referral [4,7].

At the meta-analytic level, however, the evidence for exercise effects on sexual function remains inconclusive. In the systematic review of postpartum exercise, pooled estimates showed no clear difference in sexual function between pelvic-floor training and control groups, and the certainty of evidence was very low, reflecting small samples, heterogeneity and inconsistent instruments [5]. This does not contradict the trial-level signal that PFMT can improve specific sexual-function domains, but it tempers expectations and, once again, argues for individualised assessment and for measuring outcomes that matter to the woman rather than relying on a single composite score [5,7].

The psychosocial toll is substantial and directly relevant to sport. Untreated UI causes embarrassment and social withdrawal; roughly a quarter of incontinent women reduce or stop exercising because of leakage, and up to 60% of women with severe UI are inactive [21]. In a survey of women with pelvic-floor symptoms, 37% reported that they had stopped exercising because of prolapse symptoms [9]. For postpartum women more generally, PFD is intertwined with fatigue, sleep disturbance, low mood and difficulty in the maternal role, and it can interfere with breastfeeding [22]. Fear of movement and fear of worsening symptoms further deter return to activity, so that psychological readiness — assessed and supported alongside physical readiness — is a recognised component of return-to-sport frameworks and of the multidisciplinary case management described in elite postpartum athletes [1,12].

For athletes, psychological readiness is both measurable and modifiable. In the elite netball case, structured screening captured fear of movement, readiness to return to sport, fatigue and mood, and targeted education reduced the athlete's fear that a caesarean birth would cause pelvic-floor injury, improving her confidence to progress [12]. Fear-avoidance beliefs — for example, that leakage or a widened linea alba signals fragility — can themselves become a barrier to return to exercise, so that reassurance grounded in accurate information is a legitimate therapeutic intervention [1,12]. Integrating psychological support with physical rehabilitation, and honouring the athlete's own goals and timeline through shared decision-making, is a recurrent recommendation of the consensus literature and a defining feature of good postpartum sports-medicine care [1,11,12].

14. Under-reporting, barriers to care and the multidisciplinary team

A striking feature of the athletic pelvic-floor literature is the extent of silence around symptoms. UI in athletes is under-reported and under-diagnosed: women commonly regard leakage during sport as normal, up to 87% would not mention it to their coach, and between 69% and 90% of adolescent athletes have never heard of pelvic-floor muscle training [10,21]. Rather than seeking care, athletes adopt self-management strategies — absorbent pads, fluid restriction, pre-emptive voiding and dark clothing — that conceal the problem and delay treatment [25,21]. This normalisation, compounded by embarrassment and by sport cultures that valorise playing through discomfort, means that prevalence figures probably underestimate the true burden and that education is a prerequisite for effective care [10,25].

Structural barriers reinforce this silence. Access to qualified perinatal and pelvic-health professionals is limited, care is frequently self-funded, and referral to physiotherapy is not routine in many systems; postpartum women also face fatigue, time constraints, childcare demands, and concern that exercise might impair breastfeeding [11,31]. Reassuringly, low-to-moderate aerobic activity does not impair breast-milk volume provided hydration and nutrition are adequate, a point that should be communicated to lactating athletes [11,31]. Cost, geography and gaps in professional education fall disproportionately on marginalised groups, and sport policy — including protected maternity leave and access to a multidisciplinary team — has been repeatedly identified as necessary to promote equity for postpartum athletes [11,12].

The consistent solution advanced across the literature is multidisciplinary, individualised, biopsychosocial care. The elite-athlete case report illustrates a team comprising a sports physiotherapist, pelvic-health physiotherapist, physician, dietitian, psychologist, obstetrician and performance staff, coordinating wound healing, pelvic-floor rehabilitation, bone and energy monitoring, sleep, lactation and psychological readiness within a criterion-based return-to-sport plan [12]. Consensus statements similarly recommend that symptomatic or at-risk runners access a multidisciplinary team and that shared decision-making place the athlete's goals at the centre, honouring her chosen timeline even when ideal milestones are not fully met [1,11]. For most recreational athletes this level of resource is aspirational, which is precisely why validated self-screening tools, standardised and freely disseminated education, and reproducibly reported exercise programmes are essential to extend evidence-based care beyond those who can afford individual supervision [1,31].

15. Discussion

The evidence reviewed here supports several conclusions that should shape the medical management of return to sport after childbirth, and it also exposes the limits of current knowledge. First, DRA and PFD are common, frequently coexisting, and rooted in the shared antecedents of pregnancy, delivery and raised intra-abdominal pressure, yet they are not causally linked in any strong sense; the larger and methodologically better studies find no relationship between DRA severity and pelvic-floor symptoms [5,20,18]. This matters because it undermines the intuitive but unsupported practice of treating DRA in order to protect the pelvic floor: the two conditions should be assessed and managed on their own terms, with abdominal rehabilitation directed at core function and pelvic-floor training directed at continence and support [20,18].

Second, conservative management works, but its benefits are specific and bounded. PFMT reliably reduces the odds of UI (by around 37%) and probably POP, particularly as primary prevention in continent women and when supervised, but its effect may not persist beyond a year without continued training [5,4,23]. Structured, comprehensive abdominal exercise reliably narrows the IRD (by roughly 8 mm on average, most when begun within three months), but this anatomical gain does not consistently improve perceived function — the recurrent "anatomical–functional dissociation" [14,17]. The clinical corollary is that outcome measures matter: IRD is an imperfect proxy for what patients and athletes actually care about, and the development of DRA-specific functional scales is a genuine research priority [14]. It is also why inter-recti distance failed to reach consensus as a return-to-running milestone while pelvic-floor and lower-extremity function did [1].

Third, the athlete is a distinct population. High-impact sport is associated with stress UI even in nulliparous women, athletes carry a higher baseline risk of PFD than non-athletes, and postpartum athletes therefore face compounded risk [9,12,21]. Yet the evidence does not support prohibiting high-impact activity: with correct pelvic-floor technique, the "knack" and graded loading, high-low impact exercise in pregnancy improves pelvic-floor neuromuscular function and reduces the life impact of postnatal UI without harm [29,30]. The consistent thread is individualisation — of intensity, of timing and of progression — monitored against symptoms rather than fixed thresholds [1,12,32].

Fourth, how and when care is delivered is as important as what is delivered. Early initiation within the plastic early-postpartum window and supervised, correct-technique training are the strongest modifiable determinants of success, with telerehabilitation a reasonable but inferior alternative to in-person supervision [14,13]. Because a large minority of women cannot contract the pelvic floor correctly without instruction, unsupervised self-management is an unreliable default, and structured, reproducibly reported programmes are needed [4,29,31]. Fifth, return to sport is a whole-body problem: persistent pelvic girdle pain, driven by altered lumbo-pelvic-hip muscle morphology and impaired feed-forward control, must be addressed with global lumbopelvic and gluteal strengthening integrated with pelvic-floor rehabilitation [33,34].

Synthesising these strands, the postpartum athlete's pathway can be characterised as beginning in pregnancy — with continence screening, correct pelvic-floor technique and, for suitable women, continued high-low impact training — and proceeding through an early-postpartum phase of gentle mobility, breathing and coordination, a middle phase of progressive strengthening and impact readiness, and a criterion-based return to running and sport, all monitored against pelvic-floor, abdominal-wall and lumbopelvic symptoms and adjusted for sleep, energy availability, lactation and psychological readiness [3,1,11,12]. What distinguishes this from generic postpartum rehabilitation is the higher and repeated mechanical load of sport, which demands not merely restored strength but restored timing — the automatic, feed-forward pelvic-floor and deep-abdominal recruitment that precedes each footstrike or landing — and which therefore justifies sport-specific, supervised progression rather than a return dictated by the calendar [12,34].

Several limitations of the evidence base constrain these conclusions. The literature is dominated by heterogeneous definitions and measurement methods — especially for DRA, where thresholds range from 2 cm to two finger-widths and measurement varies by site, position and instrument — rendering cross-study comparison hazardous [6,17,8]. Follow-up is typically short (often two to three months), so that natural involution, which continues to around 18 months, confounds attribution of improvement to therapy [14,8]. Many DRA trials are small, at moderate-to-high risk of bias, and enrol only mild-to-moderate cases, leaving severe diastasis and long-term outcomes understudied [6,14]. The return-to-sport literature rests largely on expert opinion, consensus and case reports, with predominantly white, physiotherapist respondent groups that may limit generalisability, and few if any validated criteria [3,1,11]. Athletes — and especially elite and postpartum athletes — are underrepresented in pelvic-floor and abdominal-wall research, so much guidance is extrapolated from general postpartum or general athletic populations [9,12]. Finally, cost and access to qualified perinatal professionals are pervasive real-world barriers that even good evidence cannot overcome [11,31].

The research agenda that follows is clear: standardised DRA diagnostic criteria and outcome measures; longer-term, adequately powered trials that separate therapeutic effect from natural recovery; prospective studies of pelvic-floor and abdominal-wall loading during sport-specific tasks; validation of return-to-sport criteria in athletic postpartum cohorts; and investigation of how to deliver supervised rehabilitation affordably and equitably [1,14,8].

Finally, the applicability of this evidence to the athlete must be stated plainly. The great majority of pelvic-floor and abdominal-wall trials were conducted in general postpartum populations, and the return-to-sport literature is built largely on expert consensus and case material; systematic reviews of elite athletes have found no association between athlete status and self-reported incontinence after childbirth, but the number of high-quality studies in athletic postpartum cohorts is small [9,11]. Recommendations for the returning athlete are therefore, of necessity, extrapolations tempered by clinical judgement, and the field's most pressing need is prospective, athlete-specific research that measures pelvic-floor and abdominal-wall loading during sport-specific tasks and validates return-to-sport criteria in this population [9,1,11]. Until such evidence exists, the safest course is the one that recurs throughout this review: individualised, criterion-based, supervised and symptom-monitored progression within a whole-body rehabilitation framework [3,1,12].

Several practical recommendations can be distilled for clinicians and exercise professionals working with the postpartum athlete. Screen for pelvic-floor, abdominal-wall and lumbo-pelvic-hip symptoms and function before clearing a return to high-impact sport, and verify that the athlete can correctly contract and relax the pelvic floor, referring to a pelvic-health professional where technique is incorrect or symptoms are present [1,4]. Begin rehabilitation early and, where possible, under supervision, using comprehensive abdominal and pelvic-floor training rather than isolated exercises, and teach the "knack" for use before jumps, lifts and landings [14,17,29]. Progress load gradually and by criterion, monitoring symptoms over 24–48 hours after each increment, and address sleep, energy availability, lactation and psychological readiness as integral parts of the plan [1,11]. Manage expectations regarding diastasis: narrowing the inter-recti distance is achievable but may not, by itself, resolve functional complaints, and severe or refractory cases warrant specialist evaluation [14]. Finally, treat the six-week check as a milestone in a longer process rather than as clearance for unrestricted activity, and structure the return around what the athlete can do without symptoms rather than around a fixed date [3,12].

16. Conclusions

Return to sport after childbirth is a medical as well as an athletic process, shaped by two common and interacting sequelae of pregnancy and delivery — diastasis recti abdominis and pelvic floor dysfunction. On the evidence reviewed, the following principal conclusions are offered.

First, DRA and PFD are prevalent, frequently coexist and share antecedents, but are not strongly causally linked; DRA severity does not predict pelvic-floor symptoms, and the two should be assessed and treated on their own terms [5,20,18].

Second, supervised pelvic-floor muscle training is first-line therapy for postpartum urinary incontinence and pelvic organ prolapse, reducing the odds of UI by approximately 37%, most effective as prevention in continent women and dependent on correct technique and continued practice [5,4,23].

Third, structured, comprehensive abdominal exercise — engaging deep and superficial muscles, ideally begun within the first three postpartum months — reliably narrows the inter-recti distance, but anatomical narrowing does not guarantee functional recovery, so expectations must be managed and outcomes measured functionally [14,17].

Fourth, high-impact sport is associated with stress urinary incontinence even in nulliparous and postpartum athletes, but need not be prohibited: with correct pelvic-floor technique, the “knack” and graded loading, high-low impact exercise is safe and even beneficial for pelvic-floor function [29,30].

Fifth, return to running and sport should be individualised, gradual and criterion-based rather than calendar-based, guided by screening of pelvic-floor, abdominal-wall and lumbo-pelvic-hip function and by biopsychosocial factors, and supported by a multidisciplinary team; the six-week check should not be treated as clearance for unrestricted high-impact activity [3,1,11,12].

Sixth, persistent pelvic girdle and low-back pain, reflecting altered lumbo-pelvic-hip muscle morphology and control, are legitimate reasons to modify or delay return to impact and should be addressed with global lumbopelvic and gluteal strengthening integrated with pelvic-floor rehabilitation [33,34].

For the postpartum athlete, the central clinical message is that safe return to sport depends less on the passage of a fixed interval than on the guided, monitored restoration of abdominal-wall and pelvic-floor function within a whole-body, individualised rehabilitation pathway [3,12].

Table 1. Summary of core studies included in this narrative review.

Author (Year) [ref]	**Design**	**Population / N**	**Focus**	**Key findings**
Beamish et al. (2025) [5]	Systematic review + meta-analysis	65 studies; n = 21,334	Postpartum exercise, PFD and DRA	PFMT reduced odds of UI by 37% and POP by 56%; abdominal muscle training reduced inter-recti distance at rest (−0.52 cm) and head-lift (−0.47 cm).
Capoccia Giovannini et al. (2026) [14]	Meta-analysis of 9 RCTs	n = 450	Non-operative management of DRA	Structured exercise reduced IRD by 8.05 mm; greatest effect if begun <3 months; no improvement in Oswestry disability (anatomical–functional dissociation).
Bigdeli et al. (2025) [17]	Network meta-analysis of 27 RCTs	n = 1,340	DRA rehabilitation strategies	Comprehensive deep + superficial muscle programmes with NMES and breathing most effective; isolated single-muscle and passive approaches ineffective or harmful.
Gluppe et al. (2021) [6]	Systematic review + meta-analysis	7 RCTs	Abdominal / PFM training for DRA	Very-low-certainty evidence; TrA training reduced IRD by 0.63 cm; insufficient evidence for any specific programme.
Simpson & Hahne (2023) [26]	Pilot RCT	n = 44	Rectus vs transversus training for DRA	Rectus (crunch) training produced greater IRD reduction than TrA training at 6 and 12 weeks.

Lin et al. (2024) [8]	Cross-sectional	n = 1,000 (3–30 yr postpartum)	Long-term DRA prevalence and risk factors	DRA 22–36% (IRD >2 cm) and 6–13% (>3 cm); BMI, parity, twins and diabetes independent risk factors; proposes >3 cm cut-off.
Fei et al. (2021) [18]	Retrospective cohort	n = 213	DRA severity and PFD	No association between DRA and UI or POP even at IRD cut-offs of 30, 40 and 50 mm; caesarean and multiparity are DRA risk factors.
Ryhtä et al. (2023) [4]	Umbrella review of 9 systematic reviews	89 original studies	Exercise / PFMT for UI and POP	PFMT during pregnancy reduced odds of UI by up to 50% (pregnancy) and 37% (postpartum); PFMT is first-line; refer symptomatic women.
Stafne et al. (2022) [23]	RCT, 7-year follow-up	n = 262	Antenatal PFMT and UI	No group difference in UI at 7 years; UI at inclusion strongest predictor (OR ≈ 5.4); effect may not persist without continued training.
Joseph et al. (2021) [21]	Narrative review	52 articles	SUI in nulliparous female athletes	UI prevalence 25.9%; volleyball 75.6%; hammock hypothesis; PFMT first-line; leakage related to fatigue and high impact.
Szumilewicz et al. (2020) [30]	Quasi-experimental trial	n = 260	Prenatal high-low impact + PFM education	Reduced life impact of postnatal UI at 2 months (22% vs 35%) and 1 year (14% vs 28%); recommended only for continent women.
Christopher et al. (2024) [1]	Delphi consensus	118 professionals	Return-to-running readiness	Minimum 3-week rest; 10/11 milestones reached consensus; inter-recti distance did not; individualised, criterion-based progression.
Yang et al. (2026) [34]	RCT	n = 40	Functional training vs conventional PT for PGP	Functional training added to pelvic-floor physiotherapy gave greater reductions in pain and disability and greater PFM contraction gains.

DRA — diastasis recti abdominis; IRD — inter-recti distance; NMES — neuromuscular electrical stimulation; OR — odds ratio; PFD — pelvic floor dysfunction; PFMT — pelvic floor muscle training; PGP — pelvic girdle pain; POP — pelvic organ prolapse; PT — physiotherapy; RCT — randomised controlled trial; SUI — stress urinary incontinence; TrA — transversus abdominis; UI — urinary incontinence.

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