

Clinical and Exercise Professional Opinion on Designing a Postpartum Return-to-Running
Training Program: An International Delphi Study and Consensus Statement

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Competing Interests: IM is an Associate Editor of BJSM

Contributorship: SMC, RED, GD and EB convened the author group. All authors conceived the idea for this Delphi study. SMC, RED, SD and MHD performed the thematic coding and data analysis. SMC and RED wrote the initial draft of the manuscript. All authors contributed to reviewing and giving feedback on each iteration of the survey and manuscript drafts. All authors contributed to the literature review. All authors reviewed the final manuscript.

Acknowledgements: The Delphi author group would like to extend their gratitude to all the pilot participants and the following researchers and experts who informed sections of the report relevant to their specialist fields: Dr Celeste Coltman – University of Canberra, Australia; Dr Chris Mills – University of Portsmouth. Thanks, also, to research assistant Katelyn Hickey DPT.

Funding, grant and award info: MD is a Christenson Professor in Active Healthy Living

Ethical approval: Elon University IRB 22-112

Data sharing statement: Data is available upon request.

Abstract

Objective: Returning to running postpartum presents challenges such as musculoskeletal pain and pelvic floor dysfunction for some females, but there is little guidance on developing and progressing postpartum training programs. This study aims to establish expert consensus recommendations on designing and modifying a postpartum return-to-running training program, highlight costs and access to qualified professionals as potential barriers, and discuss clinical, research, and sport policy implications.

Methods: A three-round Delphi survey of clinical and exercise professionals working with postpartum runners was conducted. Round 1 consisted of open-ended questions related to designing the training plan, modifications based on biopsychosocial factors, key muscle groups to train, and referral and payment sources. Rounds 2 & 3 involved Likert-scale voting to identify consensus ($\geq 75\%$ agreement).

Results: 118 participants completed Round I, 107 completed Round II (response rate 90.6%), and 95 completed Round III (response rate 80.5%). Consensus was reached in 42/47 (89%) statements, including recommendations for a period of relative-rest, gradual increases in duration and intensity, starting with a walk-run protocol, and incorporating strength training. Training should be modified based on musculoskeletal or pelvic symptoms, sleep, mental health, lactation, or energy availability concerns. Cost and access to experienced postpartum running professionals were identified as potential barriers for runners to receive care.

Conclusion: Consensus recommendations for a postpartum return-to-running program include an individualized exercise prescription, gradual increases in physical activity, walk-run protocols

and targeted muscle strengthening. Further research and improved access to clinical and exercise professionals is needed to inform and facilitate best practices.

Word count: 248/250

Accepted

1 **Introduction**

2 The last century has seen a change in our view of what athletic females can or should do.
3 In 1926, Violet Piercy was the first female in modern times to run in a marathon recognized by
4 the International Association of Athletics Federations. It would be decades before female
5 runners would become commonplace, and 2018 was the first year that females made up more
6 than half of all runners.¹ In the last decade, Allyson Felix, the most decorated athlete in World
7 Athletics history, smashed societal norms by returning to elite sport as one of the top runners in
8 the world after experiencing an emergency, pre-term Caesarean delivery due to pre-eclampsia.^{2,3}
9 While she has served as a role model for future mother-athletes, some runners—whether elite or
10 recreational—report facing several barriers to returning to running after childbirth.⁴⁻⁶ Felix, along
11 with other professional runners like Alysia Montano and Kara Goucher, have also reported
12 facing significant pay cuts from sponsors while navigating pregnancy and the recovery from
13 childbirth, which puts undue pressure on athletes to rapidly return to pre-pregnancy
14 performance.⁷

15 At the elite level, up to 50% of postpartum runners report injuries that delayed
16 training/running or competition⁸, while 33-84% of recreational postpartum runners report
17 running-related pain.^{9,10} While running related injuries (RRIs) and pain are common in the
18 general running population¹¹, the prevalence of pain/injury in postpartum runners may be due to
19 lack of evidence informed guidance provided by healthcare, clinical, fitness, and rehabilitation
20 professionals on how to return to running safely.⁴⁻⁶ Some athletes report anxiety regarding injury
21 susceptibility after childbirth, which can also act as a barrier to returning-to-sport and athletic
22 performance.^{4,5} Given the high rates of pain and injury among postpartum runners, along with

23 the increased risk of pelvic health symptoms (e.g., incontinence and pelvic organ prolapse
24 [POP]), guidance on how to return to running after childbirth is essential.^{8-10,12,13}

25 It is increasingly recognized that rehabilitation following pregnancy and childbirth is
26 needed to optimize return to running.¹⁴⁻¹⁸ Following major injuries or surgeries, post-operative
27 protocols or rehabilitation guidelines provide individuals with phase-specific exercises.^{19,20}
28 These guidelines are based on tissue healing, the individual's symptoms, psychological
29 readiness, and clearly defined goals that indicate an individual's ability to safely progress to the
30 next stage, eventually culminating in full return to the desired level of exercise/sport
31 participation.^{19,20} Pregnancy and childbirth can result in several biopsychosocial changes (e.g.,
32 incontinence, depression, muscular weakness, lack of social support, etc.) that may influence
33 physical activity (PA) and/or exercise participation and performance.²¹⁻²⁵ Consequently, some
34 postpartum females may benefit from directed, evidence-informed guidance on how to start and
35 progress PA/exercise, as well as access to health and fitness professionals who can identify
36 specific areas of impairment and tailor a return-to-exercise program. In the last five years,
37 postpartum return-to-running guidelines and frameworks have been suggested to support safe
38 return to running.^{14-18,26} However, it is unclear what specific parameters are used by exercise and
39 clinical professionals for progression of PA/exercise to running postpartum, how those
40 parameters align with best practice, or what barriers postpartum runners face when trying to
41 access this expertise. As consensus and expert opinion recommendations on how to determine
42 postpartum run-readiness have been described elsewhere²⁷, this study sought to establish an
43 international consensus on key topics related to designing a postpartum training plan to facilitate
44 return to running (i.e., training plan design and key muscle groups to strengthen) by surveying
45 experienced clinical and exercise professionals in postpartum running. Study participants were

46 also asked to identify current practice factors that may act as barriers to postpartum females
47 accessing professional return-to-running guidance (i.e., referral sources and payment sources),
48 and to identify where they obtain information that guides their professional practice.

49

50 **Methods**

51 A three round Delphi survey design was utilized.²⁸⁻³² The study was approved by the Elon
52 University Institutional review board. Methods are outlined in detail in a previous manuscript.²⁷
53 In summary, the authors (all of whom are research and/or clinical experts in perinatal health)
54 developed an initial survey of open-ended questions regarding return to running after childbirth.
55 This initial survey was piloted by experts in the field who are no longer working with postpartum
56 runners. The survey was edited based on feedback from the pilot participants and used for Round
57 I.

58 Subjects (Respondent Group)

59 Inclusion criteria are described in a previous manuscript.²⁷ Briefly, all participants had to be
60 health, exercise or fitness professionals who worked with postpartum runners. A minimum of
61 five years' professional experience with postpartum runners was used as the threshold to be
62 considered "experienced clinical and exercise professionals" unless their caseload was reported
63 to be $\geq 50\%$ postpartum runners, in which case the 5-year minimum was waived. Recruitment
64 was conducted through a purposeful snowball sampling method. All possible participants
65 completed a recruitment survey which was used to determine if the inclusion criteria were met.

66 Procedure

67 Figure 1 provides an overview of the study procedure. Participants received an email through
68 Qualtrics (Seattle, WA USA) with a personalized link to each Round of the survey which

69 prevented each participant from completing the survey more than once while also allowing
70 respondents to complete the survey in multiple attempts. Respondents were not notified of who
71 else was participating in the study, thus responses were anonymous. Written informed consent
72 was obtained on the first page of each survey Round. Consensus was defined *a priori* as 75%
73 agreement.³³ Round I was distributed to all interested participants who met inclusion criteria,
74 while Rounds II and III were only distributed to those participants who completed the Round I
75 survey.

76 Round I Survey

77 The first Round consisted of demographic questions, referral patterns and how clinical and
78 exercise professionals are compensated for the services they provide to postpartum runners, and
79 four open-ended questions about return-to-running program development (exercises, running
80 progression, amount of mileage initially, and milestones for advancement). Participants were
81 also asked about sources of information that inform their clinical decision making.

82 Round II Survey

83 Four authors (SMC, RED, SD and MHD) with experience in consensus statements and/or mixed
84 methods research coded the responses from Round I to identify common themes. These themes
85 were used to develop the Round II survey, which consisted of statements and a four-point Likert-
86 scale for respondents to indicate their level of agreement/disagreement with each statement.
87 Some gaps in knowledge were also identified during Round I coding, and additional free-text
88 questions were developed and included in Round II to obtain additional information, such as
89 specific starting points for a mileage- or time-based run training plan.

90 Round III Survey

91 For Round III, the Likert-scale questions from Round II were presented again with graphs
92 indicating participant responses (percentages of respondents who strongly agreed, agreed,
93 disagreed, strongly disagreed) from Round II, and respondents were again asked to rate their
94 level of agreement using a Likert-scale. The free-text questions from Round II were thematically
95 coded, and themes were presented as statements with the Likert-scale to indicate level of
96 agreement when there were any gaps in the knowledge. As these items provided specific
97 parameters used by the respondents for previously established themes (time-based vs mileage-
98 based progression), these items only went through one round of voting.

99 Author Recommendations

100 The authors discussed the Delphi data and current evidence, leading to development of
101 recommendations for each section. A survey consisting of the recommendation created from
102 group discussion and free-text options to indicate dissenting opinions was then sent to all
103 authors. A second survey with all author-suggested recommendations for each section was then
104 sent out. Unanimous agreement was obtained after two rounds on all recommendations except
105 one, which had one dissenting opinion.

106 Evidence Review

107 All authors participated in the review of evidence, searching for articles related to exercise,
108 rehabilitation, running, and/or sport in the postpartum period/after childbirth/after pregnancy.
109 Evidence review was utilized to inform the creation of Round I survey questions, and to
110 determine if the results of the clinical and exercise professional consensus was in line with
111 current research evidence, thus allowing the authors to make final recommendations on each

112 topic. The level of evidence is provided for the literature summary after each consensus
113 section.³⁴

114 Equity, Diversity, and Inclusion Statement

115 The author group consists of 12 women, primarily white and a woman of color, from five
116 different countries.. Clinical and exercise professionals (Respondent group) were included based
117 on number of years working with postpartum runners and thus junior, mid-career and senior
118 level practitioners from a variety of professional backgrounds were included. Only two men
119 participated in the Delphi survey as respondents. In discussing generalizability of our results and
120 limitations in our findings we recognize that these results may exclude professionals of a low
121 socioeconomic status, where advanced education is unavailable, or from marginalized
122 communities as perinatal care is not part of basic training in many professions.

123

124 **Results**

125 Respondent Group

126 Two-hundred-twenty-two participants met inclusion criteria and were sent a link for Round
127 I. 118 participants completed Round I, 107 completed Round II (response rate 90.6%), and 95
128 completed Round III (response rate 80.5%). Demographics for the respondents are presented in
129 Table 1.

130 Referral sources and payment

131 Referral sources and method of payment are presented in Tables 2 and 3. The top three sources
132 referring postpartum runners to clinical and exercise professionals were: (1) self-referral, (2)
133 primary care providers and (3) birth providers. In Round I, 42% of respondents indicated that
134 they exclusively work with self-pay postpartum running clients (i.e., care is not covered by

135 insurance or a universal health care system) and 78% reported at least part of their caseload was
136 self-pay.

137 Sources of Information for Clinical Decision Making

138 In Round I, participants were asked to identify specific sources used to inform their clinical
139 decision making while designing postpartum return-to-running training programs. Five themes
140 were identified (Table 4), with non-peer reviewed expert opinion being the most common
141 source.

142 Consensus on Designing a Postpartum Return-to-Running Training Program

143 Training Plan Design:

144 **Consensus.** Consensus was reached (92.9%) that *how* the return-to-running plan is implemented
145 (i.e., dosing of exercise) is more important than *when* a runner returns to running after childbirth
146 (i.e., weeks postpartum). Respondents also agreed (97.7%) that it is better to be conservative
147 than to progress too fast too soon. Consensus was reached that the run-training program should
148 incorporate progression of walk-run intervals (98.8%), cross-training (95.3%), strength training
149 (100%), and a rest day between runs (75.3%). Consensus was also reached (98.8%) that the
150 amount of running prescribed in the initial stages of run training is dependent upon the runner's
151 past running history, including time since their last run and how far they were running at that
152 time. Additionally, consensus was reached regarding the optimal starting point for a return-to-
153 running program from a time perspective, but not from a minimum distance perspective (Table
154 5).

155 **Current evidence.** All runners will experience some deconditioning during recovery following
156 birth and will require reconditioning prior to resuming running.^{15,16,35} The degree of deconditioning

157 will influence the duration of the rehabilitation phase.^{15,16,35} A gradual return to baseline (pre-
158 pregnancy) fitness is encouraged³⁵ and experienced clinical and exercise professional consensus
159 recommends that an individual first be able to walk 30 minutes without pelvic health or other
160 musculoskeletal symptoms before being assessed for run-readiness.²⁷ While some postpartum
161 females can resume symptom-free physical activities/exercise prior to six weeks postpartum^{36,37},
162 others may be more susceptible to injury.^{8,24} Although the underlying mechanisms are unclear,
163 recent literature has reported bone stress injuries (BSIs) in lactating elite athletes (~3% of elite
164 athletes; 43% of BSIs were sacral stress fractures), some of which have occurred during non-
165 impact exercise, such as cross-country skiing.^{8,24} In addition, several case studies have reported
166 sacral stress fractures in sedentary postpartum females with and without normal bone mineral
167 density (BMD).^{38,39} Although BSIs after childbirth are relatively rare, the elevated risk of sacral
168 stress fractures compared to nulligravid females highlights the importance of gradual progression
169 of low-impact aerobic activities to ensure an appropriate progression of load and to monitor for
170 signs/symptoms of BSI before initiating high impact activities. Regarding rest between run days,
171 no literature exists in the postpartum population. In the general running population, two expert
172 opinion papers have suggested one day of rest between run days for the first two weeks of a run-
173 training progression following return to running after a stress fracture^{40,41}, and one study on elite
174 endurance athletes showed that less than two rest days per week during training was associated
175 with a 5.2 fold increased risk of overuse injury.⁴² (Overall level III evidence with minimal level I
176 evidence)

177 To our knowledge, there is no evidence to support a mileage- vs. time-based approach
178 when designing a run training program in the general population. A recent expert opinion
179 suggested a mileage-based approach for postpartum return to running in an effort to control total

180 load accumulation and load tolerance¹⁴, as rapid mileage progression (>30%) has been shown to
181 cause an increase in injury risk.^{43,44} This expert opinion also recommended that running speed be
182 held constant while mileage is progressed, and suggested the use of RPE to avoid drastic increases
183 in intensity while using a mileage-based approach.¹⁴ (Overall level V evidence)

184 **Recommendations (12/12 authors assent):** The length of the recovery period after childbirth is
185 person-specific and should be based on the individual's symptom and risk-factor profiles (e.g.,
186 physiological recovery, tissue healing, training history, psychosocial factors, etc.). Once readiness-
187 to-run has been established, initiation of run training should begin slowly with a walk-run protocol
188 to assess symptom provocation. Cross-training can be used to optimize cardiorespiratory and
189 muscular fitness prior to and after initiating running. Although BSI is a relatively rare occurrence,
190 particularly in non-elite athletes, runners (and the professionals working with them) should be
191 vigilant for signs and symptoms of BSI. Due to lack of evidence, no recommendation can be made
192 regarding the amount of rest/recovery between runs (i.e., spacing of run days). No recommendation
193 can be made at this time regarding the use of a mileage-based or time-based run training plan.

194

195 Progressions/Regressions based on Biopsychosocial factors

196 **Consensus:** There was unanimous agreement that biopsychosocial factors (e.g., sleep, fatigue,
197 pain, social support, infant needs, energy availability, lactation, etc.) should be considered when
198 adapting training (progression vs. regression), and that progression of the run training program
199 should be specific to each runner's goals. There was no agreement on *how* run training programs
200 should progress (e.g., distance vs. time), but agreement was reached (89%) for educating runners

201 on the need to cease run portions of walk-run programs if pelvic health symptoms arise (Table
202 6).

203 **Current evidence:** When considering biopsychosocial factors, sleep has been identified as an
204 important predictor of athletic performance and injury.⁴⁵ Sleep is often disrupted while caring for
205 an infant⁴⁶, with poor sleep and fatigue having been identified as barriers to exercise
206 participation in postpartum females.^{6,47} Sleeping less than 6.8 hours/night and a Postnatal
207 Accumulated Fatigue Scale (a validated questionnaire that assesses physical, emotional and
208 cognitive fatigue, with a maximum score of 39 indicating severe fatigue in all three
209 subsections)⁴⁸ score ≥ 19 , were identified as risk factors for postpartum running-related pain⁹,
210 which is experienced by 33-84% of postpartum runners.^{9,10} However, engaging in regular PA is
211 associated with improved sleep quality and duration, as well as tiredness and daytime function
212 during the perinatal period.⁴⁹⁻⁵¹ Thus, encouraging some level of PA postpartum may have a
213 beneficial impact on sleep, but sleep deprivation may also prevent participation in impact
214 exercise like running and/or increase the risk of running-related pain in postpartum
215 runners. (Overall level II evidence)

216 Lack of physical and emotional support from family or healthcare professionals is
217 consistently cited as a key barrier to exercise in the general postpartum population.^{23,47,52} Elite
218 athletes (including, but not limited to, runners) have also expressed a lack of social support—
219 including childcare and sport organizations and policy makers—as well as negative public
220 opinion as challenges to returning to training after childbirth.^{5,53} (Overall level I evidence, some
221 level II evidence)

222 Lack of social support and increased stress are two of many established factors that
223 contribute to depression and anxiety postpartum.⁵⁴ One in seven postpartum females world-wide

224 are affected by depression or anxiety, with even greater prevalence (~33%) in low- and middle-
225 income countries.^{22,55} Maternal depression and anxiety can negatively impact mother-child
226 bonding and child development.⁵⁶ PA can be beneficial for preventing and ameliorating
227 postpartum depression and depressive symptoms.⁵⁷ The use of validated measures to screen for
228 postnatal depression and well-being issues when returning to activity has been recommended to
229 allow for targeted appropriate support.¹⁶ (Level I to Level V evidence)

230 Consensus from the Delphi respondents also identified two important biological factors
231 to consider when adapting the postpartum training plan: (1) lactation and (2) the risk of relative
232 energy deficiency in sport (REDs). Energy requirements increase after childbirth for lactating
233 females and vary based on the timeframe postpartum.⁵⁸ A multi-center study of lactating females
234 found that overall energy intake and intake of several key vitamins and minerals was below
235 recommended amounts.⁵⁹ Problematic low energy availability (LEA) and REDs in female
236 athletes is associated with a number of detrimental conditions, such as urinary incontinence,^{60,61}
237 BSI, cardiovascular dysfunction, and endocrine dysfunction, all of which effect exercise
238 participation and performance.⁶²⁻⁶⁴ Energy balance is a difficult construct to assess in the
239 lactating athlete⁶⁵ as many lactating females experience a prolonged absence of the menstrual
240 cycle,⁶⁶ a commonly used marker of energy status in non-lactating athletes.^{63-65,67-69} In healthy
241 lactating females (i.e., in the absence of chronic LEA), there is sufficient evidence to show that
242 PA and exercise are compatible with breastfeeding. Low- to moderate-intensity aerobic activities
243 do not alter levels of cortisol or lactic acid in breastmilk and will not impair volume of
244 breastmilk as long as hydration and nutrition intake is adequate.^{70,71} Maximal or very high
245 intensity activities have been shown to influence breastmilk composition⁷², but further high-
246 quality research is needed in this area. (Overall level II evidence)

247 There is no evidence to date that has assessed an ideal magnitude of change in running
248 volume in postpartum runners when progressing run training. In the general running population,
249 sudden increases in mileage or intensity have been hypothesized as risk factors for RRIs: in
250 novice runners, a running mileage progression of $\geq 30\%$ compared to $\leq 10\%$ in a span of two
251 weeks was associated with 59% greater volume of injury.^{43,44} In healthy runners training for a
252 half-marathon, progression of running distance by $< 20\%$ per week was associated with a 22.6%
253 decreased risk of developing a RRI.⁷³ Recent changes in velocity, distance and/or running
254 frequency have also been shown to increase risk of RRI.⁷⁴ In addition, the runner's training
255 history may also influence RRI risk: novice postpartum runners have increased odds of
256 developing running-related pain.⁹ In the general population of novice runners, use of structured
257 run progressions (such as "Couch to 5K") have been associated with decreased injury risk
258 compared to self-progressing.⁷⁵ When considering what component of the training plan to
259 progress first, general exercise physiology evidence recommends increasing the duration of
260 exercise prior to increasing intensity for safe progression of cardiorespiratory fitness and
261 decreased risk of injury⁷⁶, which is also supported by a narrative evidence review on postpartum
262 females engaging in elite sport and physically demanding jobs.⁷⁷ Injury risk associated with
263 increasing running volume has been shown to be similar to increasing running intensity, but in
264 recreational runners with a degree of conditioning already present.⁴³ (Overall level II evidence)

265 There is minimal long-term evidence on pelvic floor symptoms in postpartum runners²¹,
266 and no studies have been done to compare long-term pelvic floor function in runners who
267 *stopped* the run-portion of a run-walk protocol due to presence or exacerbation of symptoms to
268 those who *completed* the run-portion of a run-walk protocol despite the presence or exacerbation
269 of symptoms. That is, there is no evidence to say that terminating running due to pelvic health

270 symptoms is protective to PFM function or that continuing to run despite symptoms is
271 detrimental to PFM function. It is known, however, that pelvic health issues are common in
272 nulligravid female athletes (including, but not limited to, runners) and in the general postpartum
273 population.^{13,21,35,61,78-90} Two of the three primary reasons that postpartum females report not
274 returning-to-running are incontinence and pelvic organ prolapse symptoms.⁶ Returning to
275 running was also associated with increased odds of urinary incontinence compared to females
276 who ran prior to or during pregnancy but did not return to running after childbirth.¹⁰ (Overall
277 level II evidence)

278 To our knowledge, no evidence exists on muscle flexibility and functional mobility in
279 postpartum runners. There is very low quality (and often conflicting) evidence addressing the
280 influence of muscle flexibility and range of motion on RRI in the general running population,
281 with no clear associations identified regarding RRI and lower extremity range of motion or
282 alignment.⁹¹ A recent Delphi study reported that clinicians working with postpartum runners
283 identified impaired flexibility in the hip flexors, limited lumbar extension, “dynamic knee
284 valgus, increased lumbar lordosis, overpronation, and thoracic kyphosis” in postpartum runners
285 with running-related pain.¹³ However, literature review did not support the Delphi consensus in
286 that study.¹³ (Level I and Level V evidence)

287 **Recommendations (12/12 authors assent):** When determining whether to progress or regress
288 training, several biopsychosocial factors (including sleep, mental health, lactation, energy
289 availability, pelvic health and musculoskeletal symptoms, etc.) should be monitored and training
290 should be adjusted accordingly (i.e., decrease running volume if symptoms arise or baseline
291 symptoms are exacerbated; running volume can be progressed if symptoms are not present or
292 existing symptoms do not worsen). When progressing run-training, only one variable should be

293 changed at a time, and overall running volume should be progressed gradually, avoiding drastic
294 increases in volume, to minimize injury risk. General principles of exercise prescription
295 recommend that the duration (mileage or time) of exercise be progressed before intensity
296 (speed).

297

298 **Key Muscle Groups to Target With Exercise Before and During Run-Training.**

299 **Consensus.** Several trunk (e.g., pelvic floor muscles, abdominal muscles) and lower extremity
300 (e.g., hip abductors, hamstrings) muscle groups reached consensus as key for exercise training
301 while preparing for return to running and throughout run training (Table 7). Consensus was
302 reached in both rounds that all postpartum runners should have a full musculoskeletal assessment
303 and areas of impairment should be targeted with exercise (95.3%) and that specific muscle
304 groups are less important than overall movement patterns (87.1%).

305 **Current evidence.** Very little evidence exists comparing postpartum pelvic floor outcomes in
306 active/athletic females and sedentary females. In the general postpartum population, there is
307 evidence that several metrics of pelvic floor muscle (PFM) function—such as ability to
308 volitionally contract the PFMs, vaginal resting pressure (VRP), maximal PFM strength, PFM
309 endurance, measurements of levator hiatus, etc.—are commonly impaired, particularly following
310 vaginal or instrumented vaginal birth.^{79,85,86} In addition, continent females have stronger and less
311 fatigable PFMs than incontinent females.⁷⁹ Up to 61% of females experience an episiotomy and
312 up to 57% sustain perineal tearing during vaginal birth.⁹² Although all degrees of perineal trauma
313 increase the risk for pelvic floor dysfunction (PFD), females who sustain third- or fourth-degree
314 obstetric anal sphincter injuries (OASIS) during childbirth are at a higher risk of experiencing

315 symptoms such as incontinence, pelvic pain, sexual dysfunction, or prolapse.⁹³ Only 30% of
316 primiparous females with OASIS and 40% of primiparous females with no, or first-degree,
317 perineal tears returned to normal urinary and colorectal function by 6-months postpartum.⁹³
318 Forceps-assisted vaginal delivery increases the odds of PFD at 5-10 years after first delivery.⁹²
319 Females with PFM defects (such as avulsion) have been shown to have 47% lower strength and
320 endurance, with no difference in VRP, compared to postpartum females without PFM defects.⁸⁰
321 Most females with major defects can contract the PFM correctly, which implies that pelvic floor
322 muscle training (PFMT) might be a worthwhile intervention in this population.⁸⁰ Again, it is
323 important to note that the majority of studies in this area have not been conducted in female
324 athletes, and research on these topics in athletic females is necessary to determine if female
325 athletes present similarly. A systematic review and meta-analysis of elite athletes showed no
326 association between athlete status before/during pregnancy with self-reported incidence of
327 urinary and fecal incontinence after childbirth.²⁴ (Overall level II evidence, with some level I)

328 It is important to note that postpartum PFD may be prevented by PFMT during
329 pregnancy. A Cochrane review by Woodley et al (2020)⁹⁴ found that there was a 22% reduced
330 risk of UI in late pregnancy and the “mid-postnatal period” in those who did PFMT during
331 pregnancy. In RCTs of pregnant continent females (primary prevention) who exercise, those
332 training the PFM were 62% less likely to experience UI in late pregnancy and had 29% less risk
333 of UI at 3-6 months postpartum.⁹⁴ There was insufficient evidence for effect >12 months
334 postpartum.⁹⁴ As many females (45%) do not contract their PFMs correctly (i.e., demonstrate
335 compensatory muscle contractions, such as the gluteal muscles or abdominal muscles, instead of
336 contracting the PFMs), when possible, professional assessment of PFM function and guidance of

337 PFMT is ideal.⁸⁶ Further studies are needed to assess the effect of PFMT on fecal incontinence
338 and POP in the peripartum period. (Level I Evidence)

339 Impairments in abdominal muscle function have also been reported in postpartum
340 females. Strength and fatigability of the trunk flexor muscles, as well as fatigability of the
341 lumbopelvic stabilizing muscles, has been shown to be impaired in a mixed-sample of
342 postpartum females (i.e., runners and non-runners) up to six months after childbirth compared to
343 nulligravid females.^{25,95} Females with diastasis recti abdominis (DRA) demonstrate impaired
344 trunk rotation strength compared to females without DRA at one year postpartum.⁹⁶ A systematic
345 review also highlighted a negative impact of DRA on physical functioning.⁹⁷ Additionally, some
346 females deliver via Cesarean section, which warrants appropriate consideration of tissue healing
347 and functional recovery.⁹⁸ However, to date there are no validated tools for determining such
348 recovery.⁹⁸ (Level I to II evidence)

349 While general muscle strength has not been identified as a risk factor for RRI in the
350 general population^{91,99}, it has been hypothesized that pregnancy may affect biomechanics.¹⁰⁰ In
351 initial small sample investigations, postpartum runners have weaker hip muscles than nulliparous
352 controls.¹⁰¹ A Delphi study that investigated impairments in postpartum runners with running-
353 related pain indicated that abdominal, hip, and pelvic floor weakness were all impairments
354 contributing to pain in postpartum runners.¹³ (Level II to III evidence)

355 **Recommendation (11/12 authors assent).** A return-to-running program should include
356 strengthening exercises in conjunction with a return-to-running plan. Postpartum runners with
357 pelvic health symptoms should receive specific PFMT. From a prevention standpoint, it is ideal
358 to begin PFMT during pregnancy, further emphasizing the need for a multi-disciplinary perinatal
359 care model. Considering the current evidence regarding PFM function in the general postpartum

360 population, as well as the lack of evidence regarding PFM tissue healing in multiparous females
361 and in athletic females, it is recommended that pelvic health symptoms be monitored throughout
362 training and not just in the initial return-to-running phase. There is also sufficient rationale to
363 support evaluation and strengthening (when necessary) of abdominal muscles after pregnancy
364 and childbirth. As research in postpartum running cohorts is limited but has identified hip
365 weakness in postpartum runners, it is also suggested to evaluate the postpartum runner for
366 weakness in the lower extremity muscles, particularly hip muscles.

367 *Dissenting opinion (1/12 authors):* One author disagreed with the recommendation of
368 evaluating for weakness of the lower extremity muscles due to lack of evidence.

369 [Figure 2]

370 **Discussion**

371 The results of an international Delphi consensus survey of experienced clinical and exercise
372 professionals on the development of a return-to-running exercise plan after childbirth have been
373 contextualized by current scientific literature and refined by an International Panel of researchers
374 and clinical experts in perinatal exercise and rehabilitation. The recommendations provide an
375 initial framework for clinical and exercise professionals to facilitate a postpartum-specific return-
376 to-running plan.

377 Limitations

378 Limitations of this study include the relative lack of research evidence in postpartum runners,
379 resulting in the need to extrapolate findings from the general running population and the general
380 postpartum population. In addition, a narrative evidence review was performed instead of a
381 systematic review as our goal was to see what is currently being done in the field, which would

382 make an *a priori* systematic review impossible. Because we took our search terms/topics for the
383 subsequent comparison with current literature from the Delphi responses, we chose to do a
384 narrative evidence review that would allow us to thoroughly search all of the topics indicated by
385 the Delphi respondents. Respondents were also predominantly white, female physiotherapists,
386 which may bias the consensus survey results. However, this sample does include a broader
387 multi-disciplinary voice than previous expert opinion on this topic. In addition, the author
388 group, which came to consensus on the recommendations, is also composed of individuals from
389 various areas of expertise. Finally, as these recommendations have not been tested in
390 postpartum runners, future research validating this approach is warranted.

391 Clinical Implications

392 While some runners are able to return to running after childbirth without major issues, the lack of
393 evidence on postpartum running presents a barrier to both symptomatic and at-risk postpartum
394 females who wish to run, and to healthcare providers who are guiding them. Several expert
395 opinion frameworks on return to running have been proposed by small author groups.^{14-18,26,102}
396 However, this consensus statement provides recommendations on the development of a
397 postpartum training program informed by a large, multi-disciplinary, international group of
398 experienced professionals and current research evidence. Widespread distribution of such
399 recommendations may help to minimize barriers to return to running postpartum and provide
400 health and exercise professionals with more detailed, evidence-informed recommendations to
401 apply to runners in their care.

402 As previously mentioned, many postpartum runners experience pain and/or pelvic health
403 symptoms that may require further evaluation and treatment to facilitate continued engagement

404 in physical activity and exercise.^{6,9,10,12,13} This Delphi survey identified that most clinical and
405 exercise professionals working with postpartum runners primarily see self-paying clients who are
406 self-referred, which highlights two key barriers to postpartum exercise: cost and access. These
407 barriers are not novel findings—a recent systematic review identified financial concerns and
408 healthcare provider knowledge gaps as barriers to postpartum females pursuing a healthy
409 lifestyle (encompassing both nutrition and physical activity/exercise).²³ Health care providers
410 have also acknowledged that financial issues (primarily insurance coverage) and lack of health
411 care access are barriers to postpartum females receiving appropriate postpartum care (not
412 specific to exercise), particularly in regard to low-income postpartum females.¹⁰³

413 Education needs to be provided to perinatal females regarding resources available on physical
414 activity and exercise engagement. Pelvic floor education is especially needed, as ~26% of
415 postpartum females have no knowledge of the pelvic floor.⁸⁶ An international survey of
416 postpartum runners indicated that 62% of runners prefer to receive return-to-running education
417 via websites and physiotherapists; only 41% preferred to receive return-to-running information
418 from their general practitioner.¹⁰⁴ As such, it is also necessary to educate birth providers and
419 primary care practitioners on the importance of referring perinatal runners to rehabilitation and
420 fitness professionals with expertise in perinatal exercise, running, and pelvic health. There is also
421 a need to increase overall accessibility of perinatal rehabilitation/ fitness services, both by
422 increasing the number of educated professionals in these fields and by decreasing financial
423 barriers to obtaining these services. Access to these professionals is especially crucial for elite
424 athletes, and sport policy organizations should be educated on the importance of incorporating a
425 multi-disciplinary team in postpartum training in order to promote gender equity in sport. The
426 need for a multi-disciplinary team is further supported by the importance of monitoring

427 biopsychosocial factors in perinatal care, and by literature regarding management of female
428 athletes.^{14-18,105,106} Barriers to physical activity and exercise can negatively impact both maternal
429 and child wellbeing,⁵⁶ thus it is crucial to keep the runner running if this is their preferred
430 exercise.

431 Research Implications

432 The postpartum period is notoriously understudied. The dearth of knowledge regarding general
433 postpartum exercise and physical activity, and return to running specifically, leaves both patient
434 and professional with little to no evidence-informed guidance. There is a significant need to
435 establish return-to-run protocols in postpartum runners of all experience levels via high-quality
436 research studies to determine incidence of injury. This consensus statement provides
437 recommendations for program design that should be tested for efficacy. There is also a need for
438 research examining whether inclusion of rehabilitation and fitness professionals throughout the
439 continuum of perinatal care influences postpartum return-to-running timelines, incidence of
440 injury/pelvic health symptoms, and the percentage of runners that can continue running during
441 pregnancy and return after childbirth. In addition, research is needed regarding clinical
442 assessments for postpartum females, including screening tools for REDs for lactating
443 amenorrheic females.⁶⁵

444 Unfortunately, clinical and exercise professionals in this study indicated that most of their
445 clinical decision making on postpartum running is based on non-peer reviewed opinion, with
446 research being listed as the fourth of five sources of information. In addition, health professionals
447 consistently report that they are not trained or up-to-date with best practice recommendations to
448 guide perinatal physical activity.^{23,107,108} This highlights not only the critical need for further

449 high-quality research in postpartum exercise/running, but also the need to make research more
450 accessible to the professionals in the field and the need for clinical leaders in the field to be up-
451 to-date with best practice recommendations. Increasing open access to research may be the key
452 to improved dissemination among professionals and the general public. For example, the first
453 return-to-run postpartum guidance by Goom and colleagues²⁶—which was released on the
454 author’s website and promoted on social media—led to subsequent research^{6,10,104} and their
455 associated British Journal of Sports Medicine blog¹⁰⁹, which has over 69,000 views, highlighting
456 the impact open access dissemination has had in this field. However, costs for publishing
457 research findings in open access formats are often burdensome for researchers, especially in a
458 field where research funding can be difficult to obtain.¹⁵

459 Sport Policy Implications

460 The need for policy and contract protections for pregnant and postpartum athletes has
461 received significant attention in recent years.^{4,5,53} While there is evidence to support that return to
462 physical activity and exercise can safely happen early in the postpartum period for some
463 females^{36,37,110}, there is also evidence of injury risk and pelvic health symptoms in athletes
464 following childbirth.^{9,10,21,24,35} As such, the highly individualized nature of pregnancy, childbirth
465 and postpartum recovery provide strong rationale for supporting protected recovery time for
466 postpartum female athletes. Evidence on pelvic health symptoms, running-related pain, running-
467 related injuries, and bone stress injuries in postpartum athletic females suggests rate of training
468 progression may be more closely associated with injury risk than when physical activity/exercise
469 is first initiated in the postpartum period.^{8-10,24} This further supports the need for protected leave
470 to allow gradual return-to-exercise and gradual progression of exercise to minimize injury risk.
471 Furthermore, elite athletes have reported that a more generous time frame for return-to-sport

472 would have lessened the challenges they faced when attempting to return to competition.⁵ Elite
473 athletes have also admitted to a more accelerated progression of exercise due to pressure from
474 sponsoring agencies and/or coaches of returning to top performance within such a short period of
475 time.⁵ In addition to physical recovery, there are many other reasons to support protected
476 maternity leave policies not only for athletes, but for all postpartum females. These include, but
477 are not limited to, promoting parent-child bonding, lactation struggles, mental health concerns,
478 sleep quality issues associated with the postpartum period, and time constraints for seeking out
479 professional care for perinatal issues. Sport policy makers and agencies that sponsor elite athletes
480 have an obligation to promote the health and well-being of postpartum athletes by
481 acknowledging appropriate timelines for initiation and safe progression of exercise in the context
482 of postpartum recovery and providing funding and access to a multidisciplinary health care team.

483 **Conclusion**

484 Research and consensus from clinical and exercise professionals support the recommendation
485 that physical activity and exercise should be initiated at a low level (i.e., low-impact, low-
486 moderate intensity) after childbirth and gradually progressed, while consistently monitoring for
487 the following: (1) pelvic health symptoms; (2) musculoskeletal pain; (3) sleep; (4) mental health
488 concerns (including, but not limited to, anxiety, depression, and maternal-infant bonding); and
489 (5) energy availability. There is a need for evidence informed return-to-run guidance to be freely
490 and easily accessible to the public so that postpartum females can be informed and empowered to
491 carry out a basic self-screen if necessary due to lack of available and affordable local healthcare
492 providers. Furthermore, there is an urgent need to improve interest in and accessibility of
493 evidence-based courses and/or literature to ensure that clinicians and fitness professionals are up-
494 to-date with current best practices. There is also critical need to support protected parental leave

495 to allow for recovery and safe, gradual progression of PA and exercise, as well as improved
496 social support of postpartum females. Further research is needed in all aspects of postpartum
497 exercise, with a concurrent need to increase the available research funding for investigation of
498 postpartum exercise to allow for creation of evidence-based guidelines.

499 Key Points:

What is already known on this topic:

- Running is associated with high rates of pain and injury both in the general population and following childbirth.
- High quality evidence on designing a return-to-running training programme is limited

What this study adds:

- Some period of recovery (i.e., relative rest) is recommended after childbirth; the length of the recovery period will be specific to each individual's pregnancy, birth and postpartum experience.
- A gradual exercise progression is recommended to facilitate cardiorespiratory and muscular reconditioning prior to initiating running.
- Progression or regression of exercise training should be determined by a number of biopsychosocial factors, including sleep quality/quantity, mental health status, lactation status, social support, socioeconomic status, and musculoskeletal dysfunction (including pain and pelvic health symptoms).
- Strengthening exercises for trunk and lower extremity muscles are important prior to and after returning to running.
- The majority of experienced professionals in postpartum running treat clients who self-pay for services, highlighting cost as a potential barrier for some postpartum runners to seek professional guidance.

How this study might affect research, practice, or policy:

- A high incidence of injury and/or pain in postpartum runners (elite and recreational) highlights the need for a gradual progression of training.
- Due to limited evidence and athlete calls for improved guidance on postpartum training, further research is needed in postpartum runners to determine best practice for designing and progressing a training program.
- Maternity leave protections are necessary to allow sufficient time to implement a gradual progression of exercise and training.

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782 TABLE 1. Respondent Group Demographics

	Round 1	Round 2	Round 3
Total number of surveys started (n)	144	108	96
Total number of surveys completed (n)	118	107	95
Physical Therapist/Physiotherapist	96	88	80
Occupational Therapist	1	1	1
Personal Trainer	8	7	6
Chiropractor	1	1	0
Exercise Physiologist	5	4	4
Physician	5	4	3
Run Coach	1	2	1
Completion Rate (%)	82	99	99
Years in current profession (n)			
0-4 years	10	10	8
5-9 years	27	24	22
10-14 years	36	31	28
15-19 years	20	18	15
20+ years	25	24	22
Years working with postpartum runners (years)			
Mean	8.85	8.99	8.93
Range	1-30	1-30	1-30
Percentage of caseload consisting of postpartum runners (n)			
0-24%	65	57	52
25-49%	37	35	31
50-74%	15	14	11
75-100%	1	1	1
Gender identity of respondents (n)			
Woman	116	105	93
Man	2	2	2
Age (years)			
Mean	38.9	39.0	39.2
Range	23-63	23-63	23-63
Race/ethnicity of respondents (n)			
White	114	103	92
Black/African American	2	2	1
Asian	3	3	3
Other	1	1	1
Respondents who identify as a runner (n)			
Yes	86	79	70
No	32	28	25
Have the respondents themselves given birth? (n)			

	Yes	65	60	51
	No	21	19	19
	Preferred not to answer	32	28	25
Trained in internal pelvic floor muscle assessment? (n)				
	Yes		72	75
	No, refers to pelvic floor trained provider		20	20
	No, relies on symptom reports from patient		6	0
	No Response		9	0

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785 TABLE 2. Respondent Group Reported Sources of Referral of Postpartum Runners

	Round 1 (n)	Round 2 (n)	Round 3 (n)
Primary Care Provider	77	68	62
Birth provider (OB/GYN, midwife)	69	62	54
Urogynecologist	5	5	5
Self-referral by client	108	98	89
Running club	2	2	2
Chiropractor	5	5	5
Word of mouth (social media, mother's groups, other clients, family/friends, etc.)	9	8	9
Fitness professionals (personal trainers, pilates instructors, yoga instructors, etc.)	19	16	14
Perinatal Exercise Classes	1	1	0
Coaches (running coaches, triathlon coaches, etc.)	7	6	6
Health Visitor	14	14	11
Allied health professionals (massage therapists, acupuncturists, naturopathic providers, etc.)	6	5	5
Physical Therapist/Physiotherapist	17	16	15

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788 TABLE 3. Experienced Professional Report Payment Sources

Payment Source(s)	Round 1 (n)	Round 2 (n)	Round 3 (n)
Insurance only	22	19	19
Private pay only	50	45	41
National Health Service (NHS) only	4	4	2
Military	2	2	2
NHS + insurance + private pay	7	7	6
Insurance + private pay	35	32	27

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791 TABLE 4. Experienced Professional Reported Sources of Information to Inform Clinical
792 Decision Making When Working with Postpartum Runners

INFORMATION SOURCE	%
Expert opinion	68.6
Personal Experience	55.9
Organization sponsored continuing education	48.3
Research literature	41.5
Social media	6.8

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795 TABLE 5. Experienced Profession Consensus on Mileage vs. Time Considerations for
 796 Postpartum Run-Training

Theme for run training	Agree/ Strongly Agree (%)	Disagree/ Strongly Disagree (%)	Agree/ Strongly Agree (%)	Disagree/ Strongly Disagree (%)
Time-based progression (e.g., run for 1 minute, walk for 2 minutes) is better than distance-based progression (e.g., run 0.25 miles, walk 0.5 miles)	66	34	73.8	26.2
An ideal starting point for a time-based running progression is a walk-run interval with 30 second intervals of running to start, with 1-2 minutes of walking between each interval.			81	19
Distance-based progression (e.g., run 0.25 miles, walk 0.5 miles) is better than time-based progression (e.g., run for 1 minute, walk for 2 minutes)	4	96	1.2	98.8
An ideal starting point for a mileage-based running progression is 0.25 miles			64.7	35.3
An ideal starting point for a mileage-based running progression is 0.5 miles			44.1	55.6
An ideal starting point for a mileage-based running progression is 1 mile			25	75

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800 TABLE 6. Experienced Professional Consensus on Progression of the Postpartum Run-Training
 801 Program.

Theme for run training	Round II		Round III	
	Agree/ Strongly Agree (%)	Disagree/ Strongly Disagree (%)	Agree/ Strongly Agree (%)	Disagree/ Strongly Disagree (%)
It is important to only change one parameter at a time (e.g., distance, speed, incline, etc.)	93	7	98.8	1.2
It is important not to progress running volume by more than 10% per week in most cases.	80	20	87.1	12.9
It is important to progress distance first, then progress intensity	62	38	62.4	37.7
It is important to achieve mileage goals first, then add speed and tempo work	50	50	37.7	62.4
It is important to train overall functional mobility (e.g. thoracic rotation, hip range of motion, etc.) and flexibility (e.g., hamstring length, hip flexor length, etc.) while progressing running volume	95	5	97.7	2.4
It is important to use a pre-packaged, set program (such as a "couch to 5K" program) to dictate run progression parameters	14	86	3.6	96.4
Runners should be educated to stop running and return to walking if pelvic health symptoms (e.g., incontinence, vaginal heaviness, vaginal pressure, etc.) arise during the run portion of a walk-run interval training session	82	18	86.9	13.1
Runners should be educated that they can complete the full run portions of a walk-run interval training session if pelvic health symptoms (e.g., incontinence, vaginal heaviness, vaginal pressure, etc.) arise during the running portion	18	82	10.7	89.3

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804 TABLE 7. Experienced Professional Consensus On Muscle Groups To Target With Exercise
 805 Before and During Run Training

Muscle Group	Prior to Initiating Running		Throughout Run Training	
	Agree/Strongly Agree in Round II (%)	Agree/Strongly Agree in Round III (%)	Agree/Strongly Agree in Round II (%)	Agree/Strongly Agree in Round III (%)
Pelvic Floor Muscles	98.4	100	87.2	94.1
Abdominal Muscles (deep and superficial)	98.9	98.8	91.5	96.5
Hamstrings	92.6	95.3	90.4	96.5
Quads	93.6	98.8	86.2	98.8
Gastroc/soleus	94.7	98.8	89.4	98.8
Intrinsic foot muscles	86.2	90.6	80.9	89.4
Back extensors	77.7	80	74.5	76.5
Hip extensors	98.9	98.8	96.8	98.8
Hip abductors	98.9	97.7	97.9	98.8
Hip rotators	95.7	96.5	93.6	98.8
Diaphragm	88.3	92.9	81.9	90.6

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808 FIGURE 1. CREDES flowchart of study development, piloting, recruitment, and survey
809 distribution.

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811 FIGURE 2. Infographic summarizing the recommendations for designing a postpartum return-
812 to-running training plan.

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