Clinical and exercise professional opinion of return-to-running readiness after childbirth: an international Delphi study and consensus statement

CHRISTOPHER, Shefali Mathur, DONNELLY, Gráinne, BROCKWELL, Emma, BO, Kari, DAVENPORT, Margie H., DE VIVO, Marlize <http://orcid.org/0000-0002-7873-5985>, DUFOUR, Sinead, FORNER, Lori, MILLS, Hayley, MOORE, Isabel S., OLSON, Amanda and DEERING, Rita E.

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Clinical and Exercise Professional Opinion of Return-to-Running Readiness After Childbirth: An International Delphi Consensus Statement

Authors:

Shefali Mathur Christopher[1], PT, DPT, Ph.D., ATC, Gráinne Donnelly[2,3], PT, BSC (Hons), PgCert, MSc; Emma Brockwell, PT, BSc (Hons)[4]; Kari Bø PT, Ph.D., Professor, Exercise Scientist[5,6]; Margie H Davenport Ph.D[7]; Marlize De Vivo Ph.D[3,8,9]; Sinéad Dufour PT, Ph.D[10]; Lori Forner BScH, MPhtySt, Ph.D candidate[11]; Hayley Mills Ph.D[3]; Izzy Moore BSc (Hons), Ph.D[12]; Amanda Olson PT, DPT, PRPC[13]; Rita E. Deering PT, DPT, Ph.D[14,15]

Abstract

Objective: Female athletes have identified a lack of guidance as a barrier to successfully returning to running postpartum, and existing guidelines are vague. Our aim was to define the current practice of determining postpartum run-readiness through a consensus survey of international clinicians and exercise professionals in postpartum exercise to assist clinicians and inform sport policy changes.

Methods: A three-round Delphi approach was used to gain international consensus from clinicians and exercise professionals on run-readiness postpartum. Professionals that work with postpartum runners participated in an online survey to answer open-ended questions about the following postpartum return-to-running topics: definitions (runner and postpartum), key biopsychosocial milestones that runners need to meet, recommended screening, timeline to initiate running, support items, education topics, and factors that contribute to advising against running. Consensus was defined as ≥75% participant agreement.

Results: One hundred and eighteen professionals participated in Round I, 107 participated in Round II (response rate 90.6%), and 95 participated in Round III (response rate 80.5%). Responses indicated that, following a minimum 3-week period of rest and recovery, an individualized timeline and gradual return to running progression can be considered. Screening for medical and psychological concerns, current physical capacity, and prior training history is recommended prior to a return to running.

Discussion: This study proposes recommendations for the initial guidance on return-to-running postpartum, framed in the context of current research and consensus from professionals. Future research is needed to strengthen and validate specific recommendations and develop guidelines for best practice when returning-to-running after childbirth.

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Statements

Contributors SMC, RED, GD, and EB convened the author group. All authors conceived the idea for this Delphi study. SMC, RED, SD, and MD 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.

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Introduction

Females experience key transitions across the lifespan—including puberty, pregnancy, and menopause—where significant changes in hormones and body morphology may influence exercise participation and performance.[1-3] The perinatal period is one such transition that profoundly affects a female's physiology and biomechanics, with lasting implications that may challenge future exercise participation.[4-6] Running is a popular form of exercise for the perinatal population[7-10], but a recent study reported only 31% of pregnant or postpartum runners received advice on returning to running after childbirth.[11] As a result, runners often self-determine how to continue running during and after pregnancy, and approximately 46% of runners stop running during pregnancy and 25% do not return-to-running after childbirth.[12] This lack of information on safe participation in running during the perinatal period is a significant barrier to gender and sex equity in sports.[13]

After major surgery or injury, most athletes undergo rehabilitation before returning to sport. During rehabilitation, the athlete must meet key milestones to progress through rehabilitation stages and, at a minimum, be screened for mental and physical readiness to fully participate in sport.[14,15] A similar approach has been proposed for return-to-running postpartum[16-19] but the high-quality evidence needed to confirm and optimize these approaches is still lacking. Due to this lack of evidence, runners and the clinicians who work with them have to rely on expert opinion, which extrapolates findings from the general research on return-to-sport (i.e., following an athletic injury), postpartum populations (non-athletes), and running-related injury research.[16-22] While the existing frameworks have many similarities, there are some conflicting theories (i.e. timeline for return). Therefore, the current study employed a Delphi technique to determine consensus from many experienced clinical and exercise professionals on current practice of

determining run-readiness after childbirth. Expert opinion consensus on the rehabilitation program and running program design is presented in another publication.[23]

Methods:

The Delphi technique (three rounds)—which is commonly used for decision making and forecasting studies—was used to determine consensus of clinical and exercise professionals on postpartum return-to-run topics.[24-31] Experienced professionals (respondent group) were asked their opinion on key musculoskeletal assessments, milestones and screening that should be used when determining run-readiness postpartum. The study was approved by the Elon University Institutional review board.

Participants

The respondent group were experienced professionals recruited through personal networks, social media (i.e., Twitter, Instagram, and Facebook) and word-of-mouth via a purposeful and snowball sampling approach. All prospective participants completed an online recruitment survey in which they reported demographic information, profession, number of years working with postpartum runners, and percentage of caseload consisting of postpartum runners. From this online recruitment survey, respondents were eligible to participate (i.e., considered experienced professionals) if they were health, rehabilitation and/or fitness professionals with either a) ≥5 years' experience treating postpartum runners, OR b) if <5 years' experience, their caseload is primarily postpartum runners (≥50%).

The workgroup (authors) consisted of investigators that had an average of 10 years of experience working with perinatal runners and represented a variety of disciplines (exercise physiology, biomechanics, psychology, and physiotherapy). All authors reviewed the Delphi results and current literature, then participated in a discussion to finalize recommendations.

Instrument development and piloting

All authors contributed to the development of a pilot survey consisting of open-ended questions with free-text responses (figure 1). Eleven practitioners, who were either retired professionals in the field or were no longer working with this population, were identified by the authors as pilot participants for Round 1 of the survey. Pilot participants provided feedback (e.g., question clarity), and necessary changes were made before distribution of Round I of the survey to study participants. This data was separate from the Delphi survey and used only for development and piloting round I of the survey.

Procedure

A narrative literature review on postpartum physiology/biomechanics, running, running-related injury (RRI), and existing run-readiness frameworks (including grey literature) informed the questions chosen for Round I of the survey (appendix A). For each round, Qualtrics (Seattle, USA) distributed surveys via a personalized email link. Informed consent was obtained prior to entering the survey questions. The definition of "consensus" was established *a priori* as 75% and it was decided to limit voting to three rounds for participant retention.[32] All identified experienced practitioners from the recruitment survey were sent a link to the Round I survey. All participants who completed Round I were sent the survey for Rounds II and III. Each round was live for 3-4 weeks with weekly email reminders sent to respondents who had not completed the survey. Four authors (SMC, MHD, SD, RED) with experience in Delphi studies or similar mixed-methods research undertook thematic coding of the survey free text responses in Rounds I and II.

After completion of all rounds of the Delphi survey, all authors contributed to an additional literature search to summarize the current scientific evidence and determine if respondent

consensus was in line with current research. Search topics were determined by the themes identified by respondents and a narrative review was conducted. Due to limited evidence in the postpartum running population, searches were not limited to postpartum running-related literature or to systematic reviews or randomized control trials (RCTs). When appropriate, grey literature was included. The level of evidence for each topic, based on the Sackett scale of scientific evidence (figure 2), is provided at the end of each evidence summary section.[33] A table indicating the level of evidence for each article cited is provided in supplemental digital content.

Round I survey

The first round included demographic questions about the respondents. There were also five open-ended questions about screening for run-readiness and three open-ended questions about return-to-running considerations (key milestones, factors to stop running, items that can aid running). In addition, respondents were asked to define "postpartum" and "runner." (Appendix A)

Round II survey

Thematic coding of Round I responses led to the development of the round II survey, which was primarily statements with Likert-scale choices (strongly agree, agree, disagree, strongly disagree).

Round III survey

Round III of the survey was designed to establish consensus on the Likert-scale statements from Round II. According to Delphi methodology, the same survey questions from Round II were presented to the participants with the addition of graphs representing participant responses from Round II (percentage of votes for strongly agree, agree, disagree and strongly disagree) in lieu of

in-person discussion.[31] Participants were again asked to choose their level of agreement (as per Round II) with each statement.

Author recommendations

After reviewing the survey results and completing a narrative literature review, recommendations were proposed based on author discussion and synthesis of the Delphi data and current evidence. An anonymous survey was then sent out to all authors to determine author consensus on the recommendations. Authors completed three rounds of voting: Vote 1 consisted of the original recommendation for each section from the group meeting along with free-text options to indicate dissenting opinions. Vote 2 presented all author-suggested recommendations for each section. Vote 3 again presented all author-suggested recommendations along with the results of Round 2 voting.

Diversity, Equity, and Inclusion Statement

The all-female author group, representing five countries across three continents, were primarily Caucasian with one woman of color. Experienced practitioners (Respondent group) were included based on number of years working with postpartum runners and thus junior, mid-career and senior level practitioners from a variety of professional backgrounds were included. Only two men participated in the Delphi survey as respondents. In discussing generalizability of our results and limitations in our findings, we recognize that these results may exclude professionals of a low socioeconomic status, where advanced education is unavailable, or from marginalized communities as perinatal care is not part of basic training in many professions. While efforts to recruit diverse respondents with sociocultural differences were made (through personal networks, social media (i.e., Twitter, Instagram, and Facebook) and word-of-mouth) , the recommendations made in this consensus statement were not be reflective of every culture.

RESULTS

Two hundred and twenty-two professionals met the inclusion criteria and were sent the link for Round I. 118 participants completed Round I. Those 118 participants were sent invitations to complete Rounds II and III. 107 completed Round II, and 95 completed Round III. Participants had an average of 8.9 (range 2-37) years' experience working with postpartum runners and represented seven different professions, 12 countries and four continents (North America, Europe, Australia, and Africa). Most of the participating professionals identified as women (97%) (Table 1).

Definitions of 'runner' and 'postpartum'

Consensus. Consensus was reached that 'runner' was defined as "anyone who runs, regardless of frequency or mileage" (90.6%) and/or "anyone who self-identifies as a runner" (92.9%). No true consensus was reached on the definition of 'postpartum', though respondents agreed (78.8%) that it does not refer only to the first 12 weeks after childbirth.

Current evidence. Various definitions of 'runner' exist. Some studies identify runners by a certain number of miles per week.[34] Experience level is usually reported (e.g., novice, competitive), but standard terminology has not been used, meaning different terms may be used to describe similar cohorts (e.g., beginner and novice).[35] The definition of 'postpartum' also varies, focusing on length of time since giving birth (e.g., 12 weeks to two years).[36-38] The consensus that 'postpartum' does not refer to only the first 12 weeks after childbirth is supported by several studies using timeframes > 12 weeks to define their postpartum population [7-9,11,12,38-43] and by evidence that postpartum mental health symptoms can still be present up to three years postpartum.[44] The inconsistencies in the literature of how long the postpartum phase persists

appear to be reflected in several timeframes being identified by respondents in free-text responses and inability to reach consensus on one specific timeframe.

(No summary of level of evidence is provided, as consistent definitions are non-existent.)

Recommendation (12/12 authors assent). This Delphi recommends that someone who self-identifies as a runner should be evaluated and treated as one, regardless of mileage, frequency, or skill level. Due to the lack of longitudinal evidence investigating perinatal runners, an individualized approach should be taken to determine if the runner is still recovering from pregnancy- and childbirth-related changes or not. For example, if someone is returning to running at two years postpartum, they should still be evaluated or screened for postpartum run-readiness, as pregnancy and childbirth related impairments may still be present.

<u>Key milestones that need to be addressed before postpartum return-to-running</u>

Consensus. From Round I, eleven themes were identified as key milestones that need to be addressed before return-to-running (Table 2), including: pelvic floor muscle (PFM) strength, endurance, and coordination; symptoms of urinary incontinence (UI); symptoms of anal incontinence (AI); symptoms of pelvic organ prolapse (POP); lumbopelvic strength; inter-recti distance (IRD); balance & proprioception; lower extremity strength; and running gait analysis. Ten milestones met consensus, with IRD being the only milestone that did not. To note, specific cut-offs or benchmarks were not identified; rather, respondents identified key areas for evaluation.

Current evidence. Symptoms of pelvic floor dysfunction (PFD) are widely reported in nulliparous and parous female runners,[6,9,45-59] and pregnancy and childbirth increase the general population risk of PFD.[60] Reported frequency of UI in postpartum runners ranges from 8-57%,[8,9,59] AI was reported in 39% of postpartum runners and 19% reported symptoms of POP.[59]

However, no studies have identified specific PFM function (strength, endurance, coordination) parameters that indicate definitive resolution and/or prevention of PFD symptoms in runners.[61-63] There is, however, strong evidence in the general postpartum population that PFM training is effective for treating PFD.[64]

Lower extremity strength has only been investigated in a small cohort of postpartum runners (N=9), which showed significantly lower hip abduction and adduction strength compared to nulliparous controls.[43] When considering the general running population, systematic reviews have reported that musculoskeletal measures (e.g., strength) and biomechanical measures (e.g., kinematics) are not stand-alone risk factors for RRI.[65]

Current literature on IRD has reported correlations with abdominal muscle strength and fatigability,[39,41,42,66] abdominal pain and quality of life[67], and no correlation between IRD and low back pain, pelvic girdle pain or UI.[67,68] Increased IRD can also lead to fear-avoidance behaviors, which may be a barrier to return-to-exercise and running.[69,70] One small study showed decreased IRD with exercise in postpartum runners.[38] While there is insufficient evidence to support reduction in IRD with exercise training[71], abdominal muscle training can influence muscular strength and endurance,[72,73] both of which are shown to be impaired in the general postpartum population and in postpartum females with diastasis recti abdominus (DRA) .[39,41,42,66]

An initial biomechanical investigation in a small cohort of postpartum runners showed no difference in kinematic and kinetic (except breaking loading rate) measures in postpartum running gait when compared to nulliparous controls.[43] Lastly, literature on balance and proprioception is non-existent in the postpartum running population. In the general perinatal population, evidence on changes in static balance is conflicting, with some reporting increased postural sway and others reporting no changes.[74,75,76] Expert opinions on rehabilitation of

postpartum runners have included exercises to improve balance and proprioception.[16,18] Balance and proprioception are recommended assessments for run-readiness following knee and ankle injuries in the general population.[77-80]

(Level of evidence: III)

Recommendation (12/12 authors assent). As incontinence and prolapse symptoms are well documented in both nulliparous and postpartum female runners, as well as in the general postpartum female population, a postpartum runner should ideally be evaluated for these pelvic health-related symptoms prior to initiating running. Runners with PFD should be referred to an appropriate and specialized professional. As running-related injury and pain are multifactorial, it is recommended to include pelvic floor muscle, lower extremity, and lumbopelvic strength as well as balance assessments in the physical examination to aid successful return-to-running; however, due to lack of evidence, no recommendation can be made on PFD (e.g., prolapse, incontinence) severity scores, objective strength or balance measurement minimums that would indicate return-to-running readiness. While IRD did not reach consensus as a milestone, runners with abdominal pain or who exhibit fear avoidance behaviors may benefit from assessment.

<u>Load and impact screening</u>

Consensus. Consensus was reached in both Rounds that a runner should be able to complete the screening tasks in Table 3 without musculoskeletal or pelvic health symptoms before initiating running.

Current evidence. No evidence exists assessing which load and impact screening tasks are ideal for identifying postpartum run-readiness. Several expert opinions recommend being able to walk for 30 minutes without eliciting/exacerbating cardiorespiratory, pelvic health, or other

musculoskeletal symptoms prior to engaging in running postpartum.[16-18,20] Two screens have been proposed to evaluate run-readiness, one specifically for postpartum runners. The Running Readiness Scale, which consists of five tasks (hopping, planks, step-ups, single leg squats, and wall sits), was proposed to identify injury risk due to movement patterns. An initial study of this scale, validating it against 3D running biomechanics in asymptomatic novice runners, showed reliability and validity with the screen and knee abduction angles.[81] Goom et al[19] proposed that a postpartum runner should be able to walk (30 mins), and perform exercises (single leg balance, single leg squats, jog, perform forward bounds, hops and single leg running man) to evaluate postpartum load and impact management in regard to provocation of pelvic floor symptoms or pain. To our knowledge, this screen has not been further investigated. A recent study of common running drills in healthy runners included three of the screening tasks (hopping in place [jump rope], jogging on the spot, and forward bounds) had 76%, 87% and 104% of the vertical reaction forces of fast running, respectively, indicating that these tasks may closely mimic loads associated with running. Therefore, these drills could be used to screen or progress asymptomatic or symptomatic runners (pain, incontinence, etc.) as high impact activities have been associated with incontinence in parous and nulligravid females.[50,82-84]

(Level of evidence: V)

Recommendation (12/12 authors assent). While no studies have examined the influence of ground reaction forces on symptoms in the postpartum runner, high impact activities have been associated with incontinence in both nulligravid and parous females. As such, it is recommended that, prior to initiating running after childbirth, a series of gradual and progressive load and impact challenges be administered to assess provocation or exacerbation of symptoms.

Screening for biopsychosocial milestones

Consensus. Unanimous consensus was reached that it is important to assess sleep quality and habits, screen for pre-existing conditions (i.e., musculoskeletal, or pelvic floor symptoms) and evaluate mental health and fatigue when determining postpartum run-readiness. The importance of screening for energy availability (EA)/relative energy deficiency in sport (REDs) (97.7%); whether milk supply has been sufficiently established (if desired) (98.8%); and hydration status (98.8%) also reached consensus in both Rounds.

Current evidence. Several qualitative studies and expert opinions on readiness for return-to-running have highlighted the need to screen biopsychosocial factors. [7,8,16-19,21,23,45,85] Lack of sleep and a high level of fatigue have been identified as risk factors for pain in postpartum runners.[7] As low EA affects up to 47% of female athletes, several experts on postpartum running have stressed the importance of evaluating this.[16,17,21,86,87] While the difficulties of lactation have not been directly measured in runners, athletes have reported difficulties with breastfeeding, supply, and training schedules.[13] Experts have also stressed the importance of lactation consultants when working with athletes returning to sports.[20,88] Lastly, per a systematic review in 2019, postpartum depression is common after childbirth (up to 20%)[89]; however, no studies have assessed this in postpartum athletes.[6,90] Due to these biopsychosocial concerns, experts are recommending that the postpartum runner have access to a multidisciplinary team of providers to aid with a successful return to running.[8,16]

(Level of evidence: III)

Recommendation (12/12 authors assent). Based on consensus from experienced professionals working with postpartum runners, as well as current evidence in the general athletic population, it is recommended that runners be screened for concerns or issues with sleep, pre-existing

conditions, lactation concerns, hydration, fatigue, and mental health. When possible, an appropriate multidisciplinary team, consisting of a variety of healthcare professionals with expertise in the presenting concerns (for example, primary care providers, lactation consultants, pelvic health physiotherapists (PTs), mental health providers, physiatrists, orthopaedic specialists, obstetricians/gynecologists, urogynecologists, etc.), should work with the runner to address these issues.

Support items/adjuncts for return to running.

Consensus. A unanimous consensus was reached that intravaginal support devices (e.g., vaginal pessaries) can be helpful for prolapse and incontinence symptoms. Respondents agreed that runners should be educated on proper breast support (97.7%), that footwear should be assessed for fit and compatibility with running goals and current musculoskeletal profile (96.5%), and that runners who plan to run with a stroller have it assessed for appropriateness (94.1%). Respondents disagreed (92.9%) that sacroiliac joint (SIJ) belts can be helpful for some runners, and no consensus was reached on utility of abdominal braces (71% agreed abdominal braces can be helpful for some runners).

Current evidence. There is limited evidence on use of vaginal support pessaries in the postpartum period. Pessaries in addition to PFM training may improve POP symptoms[91] and may help with UI.[92] However, not all females will be candidates for pessary use, those who are may not have success with use, and intravaginal devices may not be as effective as PFM training.[93] The Society of Obstetricians and Gynaecologists of Canada recommends that intravaginal devices be used on an individualized basis and are considered as a first-line option for UI with high-impact exercises or when there are barriers in accessing supervised PFM training.[93] Such devices also promote empowerment and self-management.[93] No studies have been conducted on

the use of absorbent items in postpartum runners. Women who exercise and experience stress urinary incontinence (SUI) do report use of liners or pads to manage symptoms.[94-96]

The breasts can experience high magnitudes of three-dimensional motion during running.[97-99] The amount, and the perceived impact, of breast motion is also influenced by individual breast size.[100] Motion-related breast pain has been reported in up to 40% of athletes and can negatively impact performance.[101] Adequate breast support is considered particularly important perinatally to accommodate breast shape and size changes, especially if lactating, as breast size can increase by 1 or more cup sizes during pregnancy.[102] In the general population, poor breast support is also a barrier to physical activity.[103] An individually fitted sports bra has been shown to reduce motion-related breast pain[97] while improving running economy and performance.[104]

Stroller running is associated with increased energy cost compared to running independently.[105,106] A 2-handed approach to stroller running may change trunk, pelvis and hip kinematics[107] but spatiotemporal factors have been shown to be similar compared to independent running.[105]

There is no current evidence on compression garment use or the use of SIJ belts in postpartum runners. Compression garments targeting the lumbopelvic region are reported to reduce perceived symptoms of pain[108,109], incontinence[110,111], and POP.[112] One study in the general postpartum population found that SIJ belts were helpful in reducing pelvic girdle pain during performance of the Active Straight Leg Raise Test .[113] In the general population with lumbopelvic pain, the effectiveness of SIJ belts is inconclusive and often described as having person-specific results.[114-117] There is also no data on footwear and postpartum runners. Experts

have recommended evaluation of a postpartum runner's footwear due to potential pregnancy related changes and incidence of running-related pain, especially in the lower extremity.[16]

There is currently no data examining taping (abdominal, low back, etc.) for postpartum runners. The only studies examining the effect of taping in postpartum populations relates to DRA, with no implications for running.[118,119] In the general running population, only lower extremity taping has been studied and there is conflicting evidence on whether it provides benefits for pain or performance. [120-123]

(Level of evidence III).

Recommendations *(12/12 authors assent)*. Despite low-level evidence in postpartum populations, support items may be beneficial for symptom management in postpartum runners. If an intravaginal support or other continence device is desired by a postpartum runner, a collaborative pelvic health care team should assess the runner to determine appropriateness. Absorbent products can also be used, but runners should be encouraged to seek treatment for incontinence. Runners may benefit from a professionally guided, individualized bra fitting to select bras to suit the breast size and type of activity of the postpartum runner. Due to pregnancy related changes, footwear should also be evaluated. Postpartum runners should be educated on considerations with stroller running for both mother and baby, and that a 2-handed approach to stroller running may be favorable. Compression garments may be appropriate adjuncts to active rehabilitation in runners with lumbopelvic and/or PFD symptoms. No recommendation can be made on taping.

<u>Other considerations for readiness to return-to-running after childbirth.</u>

Consensus. Respondents unanimously agreed that it is important to consider prior running habits—both during pregnancy and pre-pregnancy—as well as current training and performance

goals when considering run-readiness postpartum. Respondents also agreed that is it important: (1) to prioritize the runner's role in shared decision making (100%); (2) to honour the runner's wishes about when to return-to-running, even if ideal milestones have not been met (100%); (3) to consider the runner's stress level when determining run-readiness (100%); (4) to include a multidisciplinary care team (97.7%); (5) to assess breathing technique prior to initiating running (84.7%); and (6) to consider the runner's social support when determining run-readiness (98.8%). Table 5 outlines additional considerations for recommending that a postpartum runner NOT participate in running, such as significant pelvic organ prolapse (80% agreement).

Current evidence. Several studies have highlighted the importance of shared decision making for patient-centered care.[124,125] Expert opinion encourages consideration of goals for postpartum return-to-running and highlights a multi-disciplinary approach.[16,20,21] Two reviews reported lack of social support as a barrier to postpartum exercise.[126,127]

There is no evidence in postpartum runners on the influence of returning-to-running on PFD symptoms. The American College of Obstetricians and Gynecologists (ACOG) states that symptomatic POP should be further assessed and treated.[128] Lochia can be present under normal circumstances for up to eight weeks postpartum.[129] Persistence of vaginal bleeding (stage 1 lochia) beyond two weeks postpartum is likely indicative of significant pathology[129], thus medical treatment should be sought and return-to-running should be delayed in this circumstance.

Pain is common in the general running population[130] and among postpartum runners.[7,8,12,45] Some causes of pain in runners (e.g., bone stress injuries, medial tibial stress syndrome, etc.) will require a period of rest from running, but other causes of pain (e.g.,

patellofemoral syndrome, etc.) do not have evidence supporting termination of running.[131] No evidence currently exists on treatment of pain (i.e. period of rest) in postpartum runners.

There is currently no scientific evidence that that there is a relationship among DRA/abdominal wall integrity, diaphragm mechanics, and breathing technique. Breathwork has been shown to not influence pelvic floor muscle function.[132]

(Level of evidence: V).

Recommendation (12/12 authors assent). The runner should play an active role in the plan-of-care and decision making. The runner's previous medical and social history, training and goals should be considered when determining run-readiness. Runners with pain should be evaluated to determine the cause of pain, which will determine whether running is appropriate or not. Significant pelvic health symptoms should be assessed by a specialist (for example, a urogynecologist) and may take priority over return-to-running in runners who are open to delaying running. A multi-disciplinary team is encouraged to identify biopsychosocial red flags to return-to-running. It is important to identify and address barriers when designing the plan of care and return-to-exercise. No literature exists related to breathing mechanics and outcomes for perinatal runners; as such, no expert recommendation can be made.

<u>Education topics for postpartum runners.</u>

Consensus. Respondents unanimously agreed that it is important to educate postpartum runners on (1) postpartum physiological and musculoskeletal recovery and (2) a gradual return-to-running after childbirth. Respondents also agreed that it is important to educate runners on the key milestones that indicate run-readiness (98.8%), that hydration and nutrition recommendations should be different for postpartum runners than for runners who are not

postpartum (96.5%), and that runners who are lactating should be advised to express milk prior to going for a run (88.2%).

Current evidence. To support continued running during pregnancy, which increases the likelihood of returning to running postpartum,[12] education needs to be specific to running (i.e., not general physical activity).[11] The majority of postpartum runners prefer information disseminated via websites and pelvic health PTs.[12] A gradual return to exercise, including running, has been recommended by several expert opinions[6,16-18,20,21] and is supported by RRI evidence suggesting that rapid increases in mileage or intensity increase risk.[133-135] Further information on gradual progression of exercise and running is presented in a companion paper.[23] As novice postpartum runners have higher odds of postpartum pain and up to 84% of postpartum runners have running-related pain across several body regions with the lower limbs being the most common site of pain [7,8], educating runners on run readiness and how to return to running may be a priority.

No studies have investigated the relationship between breastfeeding and running. Milk secretion in the general postpartum population is associated with 700ML per day of water loss at 8 weeks postpartum[136,137], which may lead to dehydration and negatively affect maternal health and exercise performance. Energy needs are also increased while lactating, with a suggested increase of ~500 kcal/day above pre-pregnancy caloric intake.[138 139] Further discussion of lactation and exercise is presented in a companion paper.[23]

(Level of evidence: V).

Recommendation (12/12 authors assent). Perinatal runners should be provided with running-specific education, during and after pregnancy, that is individualized to their training level and goals. Educating postpartum runners on nutrition and hydration should also be a priority.

Timeline for returning to running.

Consensus. Five themes were identified in Round I for timing of return-to-running and are represented in Table 6, with unanimous consensus that "The timeline to return to running should be person specific". Respondents also reached consensus that one cannot start running before 3 weeks postpartum (85.5%) and that any birth injury should be completely healed before returning to running (97.6%).

Current evidence. Pelvic health metrics—such as vaginal resting pressure, levator hiatus area, PFM strength and endurance, and bladder neck mobility—have been shown to be altered after childbirth, particularly vaginal delivery in the general postpartum population.[47,48,53] Perineal trauma and surgical birth will also require adequate time for soft-tissue healing.[6,140] Although rare, risk for blood clots, hypertensive disorders, hemorrhage, and sepsis is elevated in the first 6 weeks postpartum.[129,141,142] ACOG recommends all females have healthcare provider contact within 3 weeks postpartum, with a "comprehensive postpartum visit and transition to well-woman care" between 4-12 weeks postpartum.[143]

Consensus (from Delphi respondents) was reached that returning to running before 12 weeks postpartum is possible. Longitudinal data investigating PFM function supports that returning to exercise within the first 12-weeks postpartum can be done successfully: PFM strength and endurance, vaginal resting pressure, POP, and UI symptoms were similar at one year postpartum in females who returned to exercise (including running) prior to 6-weeks postpartum and those who returned after 6-weeks postpartum.[144] Another longitudinal study demonstrated that early engagement in moderate-to-vigorous physical activity (MVPA) in the early postpartum period (≤6 weeks) did not directly influence pelvic floor dysfunctions at one year postpartum, but was associated with a lower symptom burden.[145] Elite female athletes (including runners) often return

to exercise before 6-weeks postpartum without increased incidence of incontinence.[90] A study of 42 elite runners (average return-to-running timeline of 6 weeks postpartum; training increased to 80% of pre-pregnancy levels by 14 weeks postpartum) found no association between musculoskeletal injury and timeline of return-to-running after childbirth.[146]

Data in postpartum recreational runners is more varied. Blyholder et al[9] reported that 49.2% of postpartum recreational runners returned within six weeks and 34.7% returned between 6-12 weeks. Moore et al[8] reported a median return-to-run time of 12 weeks (interquartile range 7-20 weeks), that returning-to-running increased the odds of developing SUI regardless of timeframe compared to females who stopped running during pregnancy and did not return-to-running after childbirth, and that 84% of postpartum runners reported pain.[8] Christopher et al[7] reported a mean time of 12.7±14.3 weeks to first postpartum run, that 33% of postpartum runners reported running-related pain, and that timeline was not a significant risk factor for postpartum running-related pain.[7] However, some postpartum females have reported delaying return-to-run because they felt it was "too soon postpartum."[12] It should be noted that the prevalence of PFD in athletes may be underreported.[147,148] It should also be noted that there is no evidence on postpartum pelvic floor tissue healing timelines specifically in athletes.

(Level of evidence: III).

Recommendation (12/12 authors assent). Given the range and complexity of factors involved (including injury, tissue healing timeframes, pain, and PFD symptoms), the lack of high-quality evidence, and the variability of local healthcare accessibility, a person specific timeline of initiating postpartum running is recommended. Following a period of relative rest and recovery after childbirth, gradual progression of cardiorespiratory fitness and strength training is recommended prior to initiating running (Delphi consensus recommends a minimum of 3 weeks

after childbirth prior to return-to-running). Prior training load—both before and during pregnancy—should also be considered. While many recreational runners may be able to return to running independently without significant issues, elite athletes and postpartum runners who are symptomatic (or otherwise concerned) should seek medical advice and/or evaluation by a pelvic health PT to determine run-readiness.

DISCUSSION

To our knowledge, this is the first time an international consensus—consisting of multidisciplinary professionals—has established how postpartum run-readiness is currently determined. This Delphi survey, the corresponding literature review, and expert recommendations (figure 3) start to address postpartum run-readiness and highlight knowledge gaps that need to be investigated. Due to the significant variability in postpartum runners, this study emphasizes the importance of individualized, athlete centered decision making. As not all runners will have access to health or fitness professionals, and evidence has demonstrated lack of education to perinatal runners[11,12], this consensus statement also highlights the importance of education of female runners and (where applicable) running coaches on return-to-running after childbirth.

Research implications. Multiple gaps in research have been identified by this consensus survey and literature review. Future longitudinal studies exploring the development/progression of incontinence and prolapse during and after pregnancy in athletic populations are needed to further understand if screening and rehabilitation of postpartum runners can prevent symptoms of incontinence and prolapse when returning to running; or, if symptoms are already present, if a return-to-running progression can be performed in tandem with rehabilitation without worsening symptoms. Furthermore, the effectiveness of adjuncts to pelvic floor function (e.g., compression

garments or pessaries) should be explored. In addition, lactating females and females with larger breasts have historically been excluded from studies on breast support, which highlights the need for specific investigations into breast support for lactating athletes. Future studies should also evaluate the role of musculoskeletal strength, as well as gait and balance changes in postpartum RRI risk. Evaluation of pelvic floor healing timelines in athletes is also needed. Validation of all recommendations made in this consensus statement is also required. In general, more high-quality research is necessary in all areas of postpartum exercise, particularly high-impact exercise like running.

Clinical implications. As healthcare providers and fitness professionals—particularly birth providers, primary care providers, personal trainers, and PTs—are likely to be asked questions by perinatal runners, it is imperative that these providers are educated on this topic and can refer runners to the appropriate, evidence-informed information or provider to guide running during and after pregnancy.

LIMITATIONS

Due to the lack of evidence guiding postpartum return-to-running, recommendations in this consensus statement were made based on integration of experienced professional consensus, literature review, and discussion among expert researchers and clinicians in the field. As such, a narrative literature review-not a systematic review-was conducted for the literature review sections. Much of the evidence in this field is level III or below.

Respondents were predominantly white PTs and therefore this review may not accurately reflect the opinions and experiences of other professionals (i.e., physicians, male providers, those in lower resource settings etc.) who may be the first contact and/or sole provider evaluating the runner. However, this is the first study to our knowledge, that has included occupational

therapists, chiropractors, and running coaches. This study also included more personal trainers, exercise physiologists and physicians than the current expert opinion publications on postpartum running. [16,18,19,22] All the multi-disciplinary participants had a voice in round 1 of the survey, thus informing the survey questions upon which all participants voted. Due to the nature of Delphi methodology and multiple survey rounds, the number of respondents also decreased between rounds.

Also, several cultures may have different postpartum practices and rituals (e.g., period of rest, confinement practices, avoidance of exercise, dietary requirements, breastfeeding practices, etc.) that may conflict with the run-readiness recommendations in this Delphi study.[149-152] While efforts were made to recruit diverse respondents (through personal networks, social media (i.e., Twitter, Instagram, and Facebook) and word-of-mouth) and authors to capture sociocultural differences, the recommendations made in this consensus statement may not be applicable to every culture.

CONCLUSION

Consensus was reached that postpartum runners were defined as anyone who self-identifies as a runner at any time after childbirth. Determining postpartum run-readiness is a multi-factorial decision-making process that should be individualized and include the following components: (1) assessment of key musculoskeletal (including pelvic floor) and biomechanical milestones; (2) load and impact screening; (3) screening of biopsychosocial factors; 4) considerations of support items if needed and (5) the runner's training history, current capacity, running goals, and training preferences. Due to the complexity of the postpartum experience, a multi-disciplinary team approach (e.g., primary care providers, lactation consultants, pelvic health PTs, mental health providers, sports medicine providers, orthopaedic specialists, physiatrists,

obstetricians/gynecologists, urogynecologists, etc.) is recommended when feasible. Education of perinatal runners on postpartum recovery and gradual initiation of exercise is crucial. Further research is required in postpartum runners to identify specific tests and measures to determine readiness to return-to-running while mitigating injury risk and/or symptom provocation in this population.

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Key points:

What is already known on this topic: • Evidence from randomized controlled trials and longitudinal studies is lacking for returning to running postpartum
What this study adds: • When evaluating readiness to run postpartum, professionals aim to include the following: assessment of musculoskeletal and biomechanical milestones, load and impact screening, consideration of biopsychosocial factors (energy availability/relative energy deficiency in sport, milk supply, mental health), and the runner's training history, current capacity, goals, and preferences. • Prior to initiating running after childbirth a series of gradual and progressive load and impact challenges should be administered to assess provocation or exacerbation of symptoms. • Runners should be screened for concerns or issues with sleep, pre-existing conditions, lactation concerns, hydration, fatigue, and mental health. When possible, an appropriate multidisciplinary team, should work with the runner to address and educate about these issues. Support items such as appropriate vaginal support, continence device options, absorbent products, sports bras, and compression garments may assist the runner. • Following a period of relative rest and recovery, a person specific timeline of initiating postpartum running is recommended and gradual progression of exercise. Experienced professionals reached consensus that *at least* 3 weeks should be allowed for recovery, relative rest, and progression of exercise before initiating running.
How this study might affect research, practice, or policy: • The recommendations provided in this study can assist runners with further guidance on how to determine readiness to run postpartum. Practitioners and policy makers should support the postpartum athlete's needs, including an appropriate multidisciplinary team, to work with the runner to address concerns and educate about integrating motherhood and running.

899 TABLE 1. Participant 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 (%)	**53**	**91**	**81**
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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903 TABLE 2. Key Milestones to Assess for Return to Running & Suggested Metrics for Meeting

904 Milestones

Key Milestones to Assess for Return to Running	Agree/Strongly Agree in Round II (%)	Agree/Strongly Agree in Round III (%)
Pelvic Floor Strength	**91.5**	**95.3**
Pelvic Floor Endurance	**89.4**	**94.1**
Pelvic Floor Coordination	**95.7**	**98.8**
Pelvic Organ Prolapse	**93.6**	**97.7**
Urinary Incontinence	**97.8**	**97.7**
Anal Incontinence	**97.9**	**97.7**
Lumbopelvic Strength	**96.8**	**95.3**
Lower Extremity Strength	**95**	**98.8**
Inter-recti Distance	62.8	55.3
Balance/Proprioception	**93.6**	**95.3**
Gait Analysis	**75.5**	**78.8**

905 Bold text indicates meets consensus (>75%)

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907 TABLE 3. Consensus on load and impact screen for Return to Running

Screening Activity	Agree/Strongly Agree in Round II (%)	Agree/Strongly Agree in Round III (%)
Walking for 30 minutes	**97.9**	**97.7**
Single leg balance for 10 seconds each leg	**89.4**	**92.9**
Single leg squats x10 repetitions each leg	**86.2**	**89.4**
Jogging on the spot for 1 minute	**92.6**	**98.8**
Forward bounds x10 repetitions	**79.8**	**87.1**
Hopping in place x10 repetitions each leg	**92.6**	**95.3**
Single leg "running man" (opposite arm & hip flexion/extension with knee bent) x10 repetitions each side	**85.1**	**84.7**
Calf raises x20 repetitions	**91.5**	**90.6**
Single leg bridge x20 repetitions each leg	**86**	**87.1**
Single leg sit to stand x20 repetitions each leg	**76.3**	**80**

908 Note: Load and impact screening activities should be performed without exacerbation of
909 musculoskeletal or pelvic health symptoms
910 Bold text indicates meets consensus (>75%)
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913 TABLE 4. Support Items for Return to Running

Support Items	Agree/ Strongly Agree in Round II (%)	Agree/Strongly Agree in Round III (%)
A runner requiring support items (such as sacroiliac joint belts, taping, compression shorts, etc.) is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	3.2	1.2
Runners should be educated on appropriate breast support before returning to running after childbirth.	**96.8**	**97.7**
Footwear should be assessed for proper fit and compatibility with running goals and current musculoskeletal profile before returning to running after childbirth.	**92.5**	**96.5**
Compression garments (e.g., compression shorts/leggings that go over the abdomen, compression socks) can be helpful for some postpartum runners.	**95.7**	**96.5**
Intravaginal support items (e.g., pessary, Poise Impressa, tampons, menstrual cups, etc.) can be helpful for postpartum runners with **prolapse** symptoms.	**97.9**	**100**
Intravaginal support items (e.g., pessary, Poise Impressa, tampons, menstrual cups, etc.) can be helpful for postpartum runners with **incontinence** symptoms.	**95.7**	**100**
Abdominal and/or low back taping techniques can be helpful for some runners.	**83.9**	**91.8**
Sacroiliac joint belts can be helpful for some runners.	21.5	7.1
Abdominal braces can be helpful for some runners	63	71
If a runner plans to run with their child, the stroller/pram/buggy that they intend to use should be assessed for appropriateness.	**89.4**	**94.1**
Incontinence products (e.g., pads, incontinence underwear, etc.) can be helpful for some runners.	**92.6**	**98.8**
Runners should not be encouraged to utilize support items (such as sacroiliac joint belts, taping, compression shorts, etc.); rather, they should be encouraged to build functional strength so that these items are not necessary.	50.5	42.3

914 Bold text indicates meets consensus (>75%)
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TABLE 5. Consensus On When to Advise Against Running

Themes for recommending abstaining from running	Agree/Strongly Agree (%) Round II	Agree/Strongly Agree (%) Round III
PELVIC HEALTH		
One CANNOT return to running with symptoms of pelvic organ prolapse	12.7	1.2
One CAN return to running with mild symptoms of pelvic organ prolapse	**88**	**100**
Presence of severe/significant POP is a reason to recommend that someone NOT resume/participate in/continue running postpartum	69.9	**80**
One CANNOT return to running with symptoms of urinary incontinence	10.3	2.4
One CAN return to running with mild symptoms of urinary incontinence	**92.1**	**98.8**
Presence of severe/significant urinary incontinence is a reason to recommend that someone NOT resume/participate in/continue running postpartum	67.7	**75.3**
One CANNOT return to running with symptoms of anal incontinence	26.6	5.9
One CAN return to running with mild symptoms of anal incontinence	**81.7**	**96.5**
Presence of severe/significant urinary incontinence is a reason to recommend that someone NOT resume/participate in/continue running postpartum	71	**82.4**
Presence of severe/significant structural pelvic floor muscle injury (e.g., levator ani avulsion, anal sphincter injury, etc.) is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	64.5	68.2
Presence of lochia (post-birth vaginal bleeding) is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	**86.2**	**92.9**
Presence of birth complications/delayed recovery from childbirth is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	71	**80**
MUSCULOSKELETAL		
Presence of musculoskeletal injuries is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	61.3	50.6

Presence of consistent musculoskeletal pain is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	59.1	50.6
Inter-recti distance of 3 finger widths or more without doming is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	0	3.5
Inter-recti distance of 3 finger widths or more with doming is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	41.5	28.2
Presence of Diastasis Recti Abdominis with a hernia is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	44.6	40
Poor biomechanics with day-to-day mobility (walking, stair negotiation, squats, etc.) is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	57.5	56.5
Poor bone health is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	39.8	27.1
A runner requiring support items (such as sacroiliac joint belts, taping, compression shorts, etc.) is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	3.2	1.2
BIOPSYCHOSOCIAL		
Poor sleep habits (less than 6 hours accumulated sleep/night; no stretches of sleep longer than 4 hours; etc.) are a reason to recommend that someone NOT resume/participate in/continue running postpartum.	44.7	31.8
Poor mental health status that may be worsened by running is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	**83**	**90.6**
High risk for REDs (i.e., poor nutritional intake, history of disordered eating, rapid and drastic weight loss, etc.) is a reason to recommend that someone NOT resume/participate in/continue running postpartum.	**86**	**89.4**
OTHER		
Runners with pre-existing medical conditions (i.e., present before pregnancy) should receive medical clearance before returning to running.	**85.9**	**91.8**
Runners who wish to run despite symptoms should not be told that they cannot run; rather, running habits may need to be modified (e.g., decrease mileage) while the runner is treated for identified impairments.	**94.7**	**100**

Bold text indicates meets consensus (>75%)

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