

## Establishing Expert-Based Recommendations for the Conservative Management of Pregnancy-Related Diastasis Rectus Abdominis: A Delphi Consensus Study

Sinéad Dufour, PT, PhD<sup>1</sup>  
Stéphanie Bernard, PT, MSc<sup>2</sup>  
Beth Murray-Davis, PhD, RM<sup>3</sup>  
Nadine Graham, PT, MSc<sup>1</sup>

### ABSTRACT

**Purpose:** Pregnancy-related diastasis rectus abdominis (DRA) is a prevalent condition. Consequences of a widened linea alba ultimately remain unknown. Current evidence on conservative management is conflicting, creating debate among practitioners. This study aims at developing a set of expert consensus-based recommendations for the assessment and conservative management of DRA.

**Methods:** Selected Canadian women's health physiotherapists were invited to participate in a 3-phase Delphi consensus study. Phase I comprised 82 items divided into 6 domains, and to determine agreement, each item was rated on a 5-point Likert scale. Consensus was defined as agreement greater than 80%. In phase II, items receiving consensus were ranked and collapsed and summary descriptions were proposed. In phase III, final consensus was determined.

**Results:** A total of 21 of the 28 (75%) invited experts participated. Phase I generated 38 consensus statements. Phase II translated into 30 consensus statements as well as modifications to proposed summary statements for each data category. Remaining items did not reach consensus. Consensus for 28 expert-based recommendations was achieved in phase III.

**Conclusions:** This study generated 28 expert-based recommendations achieved through a 3-phase consensus process for the assessment and conservative management of DRA. Nationally recognized Canadian expert physiotherapists in women's health agree that the impairments and dysfunctions related to DRA are multidimensional and emphasize the need for a global and tailored care approach.

**Clinical Relevance:** This is the first study to establish consensus across key stakeholders to assist in bridging the current evidence-practice gap regarding pregnancy-related DRA. Our findings point to matters that require further study.

**Level of Evidence:** 5 (expert opinion).

**Key Words:** conservative management, diastasis recti, physical therapy, postpartum, pregnancy, rehabilitation

This article has a Video Abstract available at <http://links.lww.com/JWHPT/A24>.

### INTRODUCTION

Pregnancy-related diastasis rectus abdominis (DRA) is an impairment to the linea alba (LA), a fibrous raphe running along the sheaths of the rectus abdominis muscles.<sup>1,2</sup> Mainly associated with the expanding uterus during pregnancy, this impairment is currently described as widening and thinning of the LA, creating a midline separation between the 2 rectus abdominis muscles. Hence, DRA is presently defined by an increased inter-recti muscle distance (IRD) from normal values.<sup>3</sup> DRA is highly prevalent throughout the perinatal period. During pregnancy, it is reported that 33% of women exhibit a wider LA during the second trimester, which rises to 100% by the end of the third trimester.<sup>4,5</sup> Prevalence remains high after delivery, with an estimated 23% to 32% of women presenting with a persistent DRA at 1 year postdelivery.<sup>4,6</sup>

<sup>1</sup>School of Rehabilitation Science, McMaster University, Hamilton, Ontario, Canada.

<sup>2</sup>Department of Rehabilitation, Faculty of Medicine, Université Laval, Quebec City, Quebec, Canada.

<sup>3</sup>Department of Obstetrics and Gynecology, School of Medicine, McMaster University, Hamilton, Ontario, Canada.

The authors declare no conflicts of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (<http://journals.lww.com/jwhpt/pages/default.aspx>).

DOI: 10.1097/JWH.000000000000130

Although being a highly prevalent condition in women, there is limited knowledge on the impacts and long-term sequelae of an increased IRD in pregnant and postpartum women.<sup>5</sup> With the many intrinsic anatomical links between the LA, the abdominal musculature, and the thoracolumbar spine, it has been suggested that DRA could affect trunk control.<sup>7–10</sup> However, this relationship is not supported by recent evidence.<sup>11</sup> For instance, Fernandes da Mota et al<sup>5</sup> found no association between mild DRA, as defined by a greater than 16-mm IRD measured at 2 cm below the umbilicus, and lumbopelvic pain at 6 months postpartum. It remains unknown whether a correlation would be found in a group of women exhibiting larger IRDs or accompanied by other dysfunctions of the abdominal wall. Nonetheless, as methods for measurement and criteria for diagnosis remain unstandardized between studies, evidence on the functional consequences of DRA is lacking.

The methods of a conservative care approach to DRA therefore create much debate among health care providers and women seeking care. It is well known that exercise is one of the most common modalities used by physiotherapists to address DRA during the perinatal period.<sup>12</sup> As for the effects of exercises during pregnancy, a small study by Chiarello et al<sup>11</sup> suggested that abdominal strengthening exercises (including transversus abdominis training), in addition to pelvic floor muscle (PFM) training and education on proper body mechanics, may be helpful to maintain small IRD during the prenatal period. On the contrary, Fernandes da Mota et al found<sup>5</sup> that women exercising regularly before and after pregnancy did not present with a lower risk of widening IRD. Regarding clinical practice with women who have previously given birth, regardless of the time since delivery, a national survey of women's health physical therapists (USA), conducted by Keeler et al,<sup>13</sup> determined that 89.2% of respondents used transversus abdominis exercises to address issues related to DRA and 62.5% used the Elizabeth Noble technique, where rectus abdominis muscles are manually approximated during a curl-up exercise. Despite the obvious popularity of these exercises, a review conducted by Benjamin et al<sup>12</sup> in 2014 on the effects of any pre- and postnatal exercises on DRA led to the conclusion that there was insufficient quality evidence to support any particular exercise approach for this condition. As the number of studies and the level of evidence remain limited, best conservative approach concerning DRA during and after pregnancy is debatable. Given that what presently constitutes the best approaches for this condition needs further research exploration and substantiation, we sought to bring together key knowledge users regarding this condition to inform practice through a systematic process of collecting expert knowledge and building consensus among them.

## Objective

The objective of this study was to establish a set of expert-based recommendations for the assessment and conservative management of pregnancy-related DRA up to 12 months postpartum.

## METHODS

### Study Design

An expert consensus process was conducted. A Delphi methodology was performed to collate expert knowledge and build systematic consensus. The Delphi technique is designed as a group communication process to achieve convergence of opinion on a specific issue.<sup>14–17</sup> The Delphi method in its simplest form solicits the opinions of “experts” through a series of carefully designed questionnaires interspersed with information and opinion feedback.<sup>15</sup> For this study, a 3-phase Web-based survey (SurveyMonkey Inc, 2017; San Mateo, California) design was adopted. Consensus was determined by level of agreement defined a priori. Following principles of participant anonymity, iterative questionnaire presentation and feedback of analysis were administered to participants in each phase.<sup>18–20</sup> Informed by the “Knowledge to Action” framework of the Canadian Institutes for Health Research and principles of practice-based inquiry, identified experts were invited by e-mail to participate in this Delphi consensus.<sup>21–23</sup> In each of the 3 phases, the feedback process within the Delphi method allowed for and encouraged the participants to reassess their initial judgments pertaining to information provided in previous iterations and provide comments.

### Participants

Following ethical approval from the Hamilton Integrated Research Ethics Board (#2319), an expert panel was purposively assembled and individuals were invited to participate. Participants were deemed to be “experts” through identification as nationally (Canadian) credentialed women's health physiotherapists, with evidenced clinical and/or academic achievements. Specifically, participants were either designated “Women's Health Clinical Specialist” through the Canadian Physiotherapy Association or involved in research, academic teaching or clinically oriented teaching outside of academia. To avoid selection bias, the research team collaborated with key stakeholders, including the members of the Executive Committee of the Women's Health Division of the Canadian Physiotherapy Association, to recognize all physiotherapy experts in women's health across Canada. A total of 28 experts were identified, from various clinical and academic backgrounds, ensuring a comprehensive representation (maximum variation

sampling) of the field of women's health in physiotherapy in Canada.

### Item Development

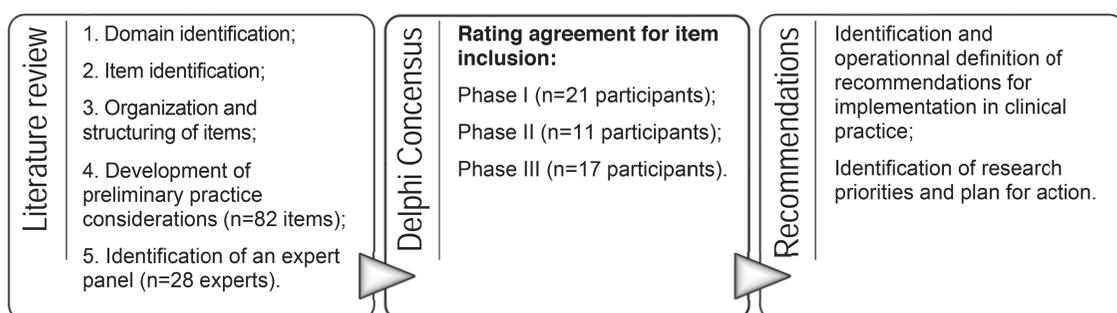
A 3-step process was followed to develop the initial list of 82 items related to conservative management strategies for DRA that formed the items examined in phase I (see the Figure). The first step identified key relevant domains. This was achieved by the members of the research team, with the help of research assistants, by completing a comprehensive scoping review of the scientific literature. The research team comprised health disciplines in physiotherapy, medicine, and midwifery. Specifically, 4 databases were searched (CINAHL, MEDLINE, PubMed, and Google Scholar) and 4 separate search strategies were performed in each one: (1) diastasis rectus abdominis AND conservative care, (2) diastasis rectus abdominis AND assessment, (3) diastasis rectus abdominis AND management, and (4) diastasis rectus abdominis AND pregnancy. In addition to scoping published peer-reviewed literature, the team also reviewed "gray literature," specifically content of nonacademic postgraduate courses, published theses, and white papers. From this process, 6 domains related to the conservative management of DRA emerged, 4 of which pertained to different perinatal stages: (1) general perceptions on DRA, (2) prenatal period, (3) intrapartum, (4) early postpartum period, defined as the first 3 months following birth, (5) late postpartum, defined as period between the third month up to 1 year following birth, and (6) assessment. The second step involved the research team generating items within each domain from the literature base gathered during step 1. The final step involved reorganizing and restructuring the generated items so that they were written in an appropriate format to be rated for agreement vs disagreement in phase 1 of the Delphi. A pretest survey with 6 women's health physiotherapists was conducted to ensure clarity and appropriateness of each item of the survey. Once these steps were accomplished, the final version of phase I survey was sent out to participants.

### Data Collection

In phase I, participants were asked to rate each item of the online survey, indicating their degree of agreement on a 5-point Likert scale, with 1 being "strongly disagree" and 5 being "strongly agree." Consensus for item inclusion was defined a priori as greater than 80% agreement of respondents based on mean score calculations. Statements that had a mean ranking below 40% were removed and those with a mean ranking between 41% and 79% were kept for phase II for further exploration and consideration. In addition, points raised by participants in phase I (with a mean ranking of 41% or higher) in free-form text sections were added for further consideration in phase II. Following phase II, redundancy was identified and relevant items were collapsed or removed. In phase III, participants were asked to rank consensus items from phase II into 2 categories: (1) primary importance, meaning the recommendation is believed to be of high priority by the participants; and (2) secondary importance, for when the recommendation is thought to be important but not of primary importance to include. The summary statements were developed on the basis of an iterative process whereby the research team assembled these statements through thematic content analysis of free-text comments and feedback through phase I. Draft versions of these summaries were provided to participants in phase II, eliciting feedback before determining consensus in phase III. In phase III, the procedure for consensus outlined for phase II was repeated. Final consensus was determined on all recommendations from phase III presented as primary versus secondary importance based on the priority given by participants. Each phase lasted 4 to 6 weeks, with 2 reminder e-mails distributed to nonrespondents in each phase.

### Data Analysis

All data were extracted from the online survey and coded into a Microsoft Excel (2014) spreadsheet. Visual inspection of the data allowed identification of any missing or aberrant data. Coding of results allowed to pool data from the expert panel for each question. At each phase, the mean score for each



**Figure.** Flow of the study.

individual item was calculated and transformed into a percentage using standard descriptive Microsoft Excel's statistical functions. Again, agreement was determined for mean score of 4 or more ( $\geq 80.0\%$ ).

## RESULTS

### Response Rate

A total of 21 participants, out of 28 invited experts (75.0% participation rate), made up the panel in phase I, with representation spanning 6 provinces in Canada. All participants were female. Demographic characteristics of participants are presented in Table 1. A total of 11 (39.2%) participants contributed in phase II, and 17 (60.7%) participants contributed in phase III. All 21 participants who contributed in phase I also contributed in phase II, phase III, or both (see the Figure).

### Delphi Phases I and II

After phase I, 38 of the 82 items achieved consensus for agreement among participants, 20 of which had a high percentage ( $>90\%$ ) of agreement. Disagreement was determined for 9 of the 82 statements, and the remaining 40 required further exploration. Results from phase II translated into 28 statements that received consensus for agreement; 4 statements received consensus for disagreement and

were removed. The remaining items received mixed perspectives, requiring further exploration. For brevity purposes, only items achieving high agreement during phase I or II are reported and summarized in Table 2.

**Table 1. Demographic Characteristics of Participants**

Demographic Characteristics <sup>a</sup>	Number of Participants
Location <sup>b</sup>	
Atlantic provinces	2
Quebec	7
Ontario	9
Saskatchewan	1
Alberta	1
British Columbia	3
Years in practice	
0-9	5
10-19	11
20+	7
University faculty (PhD)	
Community education faculty	14
Researchers	12
Clinical specialists: Canadian Physiotherapy Association designation	4
Fellows of the Canadian Academy of Manipulative Practitioners	8
<sup>a</sup> All participants were female.	
<sup>b</sup> Two participants work (teach) out of 2 provinces.	

**Table 2. Results of Items Achieving Consensus—Phases I and II**

Items Achieving Consensus With High Agreement During Phases I and II	Phases I and II (%)
Prenatal period	
Avoid exercises that concentrically engage the superficial abdominal muscles. <sup>a</sup>	83.2
Facilitate optimal coactivation of the inner unit during exercises. <sup>b</sup>	87.4
Promote effective tension-free diaphragmatic breathing, such as breathing with a freely moving abdomen.	82.2
Emphasize postures that reduce excessive sustained intra-abdominal pressure.	90.6
Encourage optimal elimination habits to reduce straining.	86.4
Early postpartum period	
Avoid exercises that concentrically engage the superficial abdominal muscles. <sup>a</sup>	83.2
Avoid exercises in which continence mechanism is not maintained.	94.8
Avoid high-impact exercise.	86.4
Facilitate optimal coactivation of the inner unit muscles during exercises. <sup>b</sup>	87.4
Late postpartum period	
Avoid exercises that cause doming or invagination of the LA.	93.6
Introduce front loaded exercises if tension through the LA is maintained.	90.0
Avoid exercises in which continence mechanism is not maintained.	87.8
Progress core training if appropriate tension through the LA is achieved.	90.0
Address contributing pelvic girdle and thoracic movement impairments.	86.6
Assessment of DRA	
Assess development of tension through the LA with voluntary PFM and transverse abdominis coactivation.	88.8
Ensure optimal PFM contraction through a digital examination.	84.4
Assess for doming or invagination of LA during exercises.	82.2
A nonfunctional DRA is determined when tension of LA cannot be developed voluntarily.	81.2
Abbreviations: DRA, diastasis rectus abdominis; LA, linea alba; PFM, pelvic floor muscle.	
<sup>a</sup> Refers to exercise that shortens the rectus abdominis muscles, external obliques, and internal obliques.	
<sup>b</sup> Refers to exercise including pelvic floor and transversus abdominis muscles.	

### Delphi Phase III

The output of the Delphi consensus process translated into 28 expert-based recommendations, organized according to the 6 previously indicated domains, prioritized into 2 categories: (1) primary importance and (2) secondary importance. In addition, the expert-based recommendations from each domain were accompanied by a summary statement. The first domain reflects general perspectives, and these recommendations translated into 1 summary description. The breakdown of recommendations within each domain was as follows: domain 2 (prenatal) = 5 recommendations; domain 3 (intrapartum) = 4 recommendations; domain 4 (early postpartum) = 7 recommendations; domain 5 (late postpartum) = 9 recommendations; and domain 6 (assessment) = 3 recommendations. A complete list of established consensus-based summary statements and expert-based recommendations is presented in Table 3.

Several items from each domain did not reach consensus. For example, experts did not agree on the activity counseling item in domain 2 (prenatal). Participants generally indicated the importance of counseling pregnant women on appropriate activity; however, some did not feel this should be outlined as specific to DRA and others felt it should be more tailored to individual goals that encompass more than DRA. All recommendations in domain 3 (intrapartum) were reframed from phase I and approached from the perspective of the physiotherapists' advocacy role based on participant's feedback. One item in domain 4 (early postpartum), on avoiding front loaded positions, did not achieve consensus as it was indicated by many that there is too much individual variability related to this item for it to translate into a recommendation. For domain 5 (late postpartum), 3 items from phase II did not achieve consensus. Like the early postpartum domain, avoiding front loaded activities was deemed to implicate too many individual barriers. Counseling related to nutrition (73.4%) and sleep (63.6%) did not reach consensus either; the experts' perspectives were very mixed on these issues, although trending toward consensus. Consensus to remove 2 discussion items from phases I and II was also achieved during phase III. The first item was regarding highlighting exercises that eccentrically lengthen superficial abdominal muscles, referring to the rectus abdominis, and external and internal oblique muscles. Generally, the participants agreed by phase III that there was not enough evidence to support this item. The second item was the use of abdominal support; the main issue communicated was the lack of evidence to use abdominal binding as a corrective technique, although several participants did indicate they may use this tool in certain

situations. Related to domain 6 (assessment), the expert panel was not able to establish consensus on the items regarding measuring LA doming or invaginating, described as identifying through palpation a slackened LA that is collapsing inwardly or bulging out, as an assessment technique to identify failure to transfer load in the LA that may be seen in DRA. In addition, the experts were unable to establish consensus on what constitutes a "significant" or "severe" DRA. Several participants indicated palpable abdominal pulse or contents; however, agreement was not reached. Finally, the notion of ensuring that all recommendations did not elicit excessive or irrational fear among women surfaced across all domains. As such, some of the language in the final recommendations and summary statements reflects this prevailing sentiment.

### DISCUSSION

The main objective of this consensus study was to identify a set of expert-based recommendations for the assessment and conservative management of pregnancy-related DRA for up to 12 months postpartum. Through a diverse panel of recognized experts from different backgrounds and regions of Canada, and a rigorous and systematic study design, this study allowed for the gathering and exploration of participants' knowledge and experiences.<sup>23</sup> The importance of engaging knowledge users throughout the various steps of research represents an approach that is currently advocated for as it harnesses a potential to garner results that will directly impact clinical practice.<sup>21</sup> From a predetermined threshold for determining agreement or disagreement among participants, a total of 28 recommendations were established after a 3-phase Delphi consensus. Interestingly, most recommendations that achieved agreement regarding management of DRA point toward the need to understand, assess, and approach impairments of the LA as an integrative component of the thoracopelvic abdominal system. To provide the most appropriate care for any woman presenting pregnancy-related DRA, practitioners first need to assess and determine the extent of the problem. One notable finding from this study relates to using IRD as the main or only criterion for assessing and diagnosing impairments of the LA. Such notion was challenged by the participating experts, and this perspective is shared by other authors as well.<sup>25</sup> For instance, experts from this study emphasized the need to assess various anatomical and functional aspects of the LA in addition to the measure of IRD, such as palpation at rest to appreciate the integrity of the anatomical structure aspects of the LA, as well as fascial tension, or passive resistance at palpation,

**Table 3. Final Expert-Based Summary Statements (A) and Recommendations (B) Derived From Items Achieving Consensus During Phase III**

**Expert-Based Recommendations**

Domain 1: General perspectives on DRA

A. Summary statement

Pregnancy-related DRA represents an important and under-recognized concern. All relevant health and fitness providers working with pregnant women should know how to promote best care practices for this condition; however, general agreement of what constitutes the best approach is lacking. Given that the complex 3-dimensional tissue of the LA is intrinsic to the thoracopelvic abdominal manometric system, compromised integrity of the LA needs to be considered within the context of this system. As experts in women's health, we have come to understand that the impairments and dysfunctions related to DRA as multidimensional and multifactorial. Furthermore, in line with other thoracic, lumbar, and pelvic conditions we manage in the profession of physiotherapy, the interaction between the musculoskeletal, nervous, and immune systems represents a central aspect of our global care approach, which is then individually tailored. Thus, our approach allows for the integrated targeting of modifiable factors that are potential drivers of DRA and associated impairments or participation restrictions across multiple dimensions. As a group, we have agreed that a set of practice principles are needed when working with women to guide clinical decision-making with respect to pregnancy-related DRA. These practice principles have been developed with intent of guiding practice of all relevant care providers.

B. Recommendations

None identified.

Domain 2: Prenatal

A. Summary statement

As experts in women's health, we understand the importance of promoting health for women and their developing babies. We recognize the prenatal period as a time of transition that warrants mindfulness related to exercise and movement strategies to promote optimal physical function through the pregnancy, limit potential functional impairment, and prepare for birth and postpartum recovery. As a group, we have agreed on 5 practice principles as they relate to prenatal care when considering DRA.

B. Recommendations

1. Emphasize static and dynamic postures that reduce excessive intra-abdominal pressures (ie, maintaining a relaxed neutral spine).<sup>a</sup>
2. Encourage habitual activity patterns that reduce repeated increases in intra-abdominal pressure (ie, rolling to the side to get up; avoid straining on the toilet).<sup>a</sup>
3. Commence inner unit exercises that facilitate optimal isolated and synergistic activation of the inner unit, and once control is achieved, progress with tailored outer unit and functionally oriented exercises.<sup>a</sup>
4. Avoid exercises that concentrically engage the superficial abdominal muscles (ie, sit-ups).<sup>b</sup>
5. Encourage a breathing pattern that promotes a tension-free diaphragmatic pattern (eg, downward motion of diaphragm and lateral costal expansion on inhale).<sup>b</sup>

Domain 3: Intrapartum

A. Summary statement

As experts in women's health, we approach intrapartum care from the perspective of promoting strategies that are least likely to result in impairment to the pelvic tissues or dysfunction in the thoracopelvic abdominal manometric system. Our perspectives are congruent with best practice guidelines for physiologic birth published by the Society of Obstetricians and Gynecologists of Canada.<sup>24</sup> As a group, we have agreed on 4 practice principles related to intrapartum care, considering DRA within the context of global pelvic health.

B. Recommendations

1. Advocate for the ability to be mobile during labor.<sup>a</sup>
2. Avoid directed pushing practices that increase intra-abdominal pressure for sustained periods and close the glottis (ie, Valsalva maneuver).<sup>a</sup>
3. Advocate for sacrum freeing rather than recumbent birth positions.<sup>b</sup>
4. Advocate for practices that reduce the likelihood of operative birth procedures.<sup>b</sup>

Domain 4: Early postpartum period

A. Summary statement

As experts in women's health and pelvic health, we approach the early postpartum period, the fourth trimester, as an important time to promote optimal recovery. Movement is important through this period and should not be feared; however, the emphasis is on gentle restorative exercises that are tailored to each woman's needs. Given the incredible healing and restoration that takes place in the fourth trimester, a diagnosis of DRA should be reserved for after this period.

B. Recommendations

1. Emphasize static and dynamic postures that reduce excessive intra-abdominal pressures (ie, maintaining a relaxed neutral spine).<sup>a</sup>
2. Encourage habitual activity patterns that reduce repeated increases in intra-abdominal pressure (ie, rolling to the side to get up; straining on the toilet).<sup>a</sup>
3. Avoid exercises that concentrically engage the superficial abdominal muscles (ie, sit-ups).<sup>a</sup>
4. Encourage a breathing pattern that promotes a tension-free diaphragmatic pattern (ie, downward motion of diaphragm and lateral costal expansion on inhale).<sup>a</sup>
5. Commence inner unit exercises that facilitate optimal isolated and synergistic activation of the inner unit, and once control is achieved, progress with tailored outer unit and functionally oriented exercises.<sup>a</sup>
6. Avoid high-impact exercise.<sup>b</sup>
7. Avoid exercises in which continence mechanism is not maintained.<sup>b</sup>

(continues)

**Table 3. Final Expert-Based Summary Statements (A) and Recommendations (B) Derived From Items Achieving Consensus During Phase III (Continued)**

Expert-Based Recommendations
Domain 5: Late postpartum
A. Summary statement
As experts in women's health, we approach the presence of pregnancy-related DRA from a biopsychosocial perspective, with particular attention to the thoracopelvic abdominal manometric system. Although movement and exercise will be modified to effectively address DRA, it is important that exercise and movement are embraced by women rather than feared. Furthermore, it is important that language emphasizing neuromuscular physiology rather than structure or "gap" is used when working with these women. An evolved understanding of restoring the integrity of the LA does not translate into "closing the gap," as it has been understood in the past. As such, the expert panel does not recommend using the popular "Noble technique" or other similar forms of splinted head lifts or crunches to address the complexity of pregnancy-related DRA.
B. Recommendations
<ol style="list-style-type: none"> <li>1. Advocate neutral spine posture and alignment.<sup>a</sup></li> <li>2. Encourage a breathing pattern that promotes a tension-free diaphragmatic pattern (ie, downward motion of diaphragm and lateral costal expansion on inhale).<sup>a</sup></li> <li>3. Encourage optimal body mechanics and motor activation strategies for everyday tasks (ie, pushing stroller, carrying baby).<sup>a</sup></li> <li>4. Encourage habitual activity patterns that reduce repeated increases in intra-abdominal pressure (ie, rolling to the side to get up; straining on the toilet).<sup>a</sup></li> <li>5. Commence inner unit exercises that facilitate optimal isolated and synergistic activation of the inner unit, and once control is achieved, progress with tailored outer unit and functionally oriented exercises.<sup>a</sup></li> <li>6. Correct or modify exercises that cause doming or invagination of the LA.<sup>b</sup></li> <li>7. Approach exercises that concentrically engage the superficial abdominals with caution.<sup>b</sup></li> <li>8. Address contributing pelvic girdle and thoracic movement impairments.<sup>b</sup></li> <li>9. Approach exercises in which continence mechanism is not maintained with caution.<sup>b</sup></li> </ol>
Domain 6: Assessment
A. Summary statement
As experts in women's health, we acknowledge the evolving understanding of pregnancy-related DRA such that measurement of the inter-recti distance does not provide sufficient and meaningful clinically relevant data. Rather, we agree that assessing aspects of the thoracopelvic abdominal manometric system garners a more relevant approach that acknowledges recent advances in clinical research and aligns with our respective clinical experience.
B. Recommendations
<ol style="list-style-type: none"> <li>1. Assess generation of tension in LA with voluntary PFM contraction.<sup>a</sup></li> <li>2. Assess pelvic floor function—digital examination or via ultrasound study.<sup>a</sup></li> <li>3. Assess LA at rest via palpation to determine integrity via depth and qualitative assessment of LA.<sup>a</sup></li> </ol>
Abbreviations: DRA, diastasis rectus abdominis; LA, linea alba; PFM, pelvic floor muscle. <sup>a</sup> Principle rated as first priority by participants. <sup>b</sup> Principle rated as secondary priority by participants.

of the LA during a voluntary contraction. Although there is scarce evidence on abdominal muscle function in the presence of increased IRD,<sup>8</sup> a recent study by Hills et al<sup>26</sup> in 2018 corroborated poorer trunk function associated with larger IRDs. This suggests that anatomy, structure, and function of the LA, as well as strength and endurance of the abdominal muscles, appear to be relevant to assess and identify dysfunction in DRA. The expert-based recommendations presented in this article support the need to reconsider actual criteria for identifying pathological DRA to acknowledge the anatomical and physiological relationships between the LA and abdominal muscle function, thoracopelvic static and dynamic stability, and breathing patterns.<sup>10,27</sup> This may explain why the final recommendations presented in this study do not address the different measures of

IRD, such as calipers or ultrasound imaging, which have been extensively covered in the literature.<sup>28–31</sup> Exploring assessment of other parameters that could be associated with diastasis-related abdominal wall dysfunction appears to be important according to the opinions of the participating experts. What constitutes the most important characteristics of a pathological LA has yet to reach unanimity and as such concepts supporting these recommendations need further exploration.

Many of the established recommendations in this study corroborate with the existing scientific literature. For instance, experts in this study believe and agree that it is important to encourage habitual activity patterns that reduce repeated increases in intra-abdominal pressure. This particular recommendation is concordant with findings by Sperstad et al,<sup>4</sup>

where a greater possibility for pregnant women to develop DRA was reported for those heavy lifting more than 20 times per week. In addition, the expert panel in this study agreed with the rehabilitation approach studied by Mesquita et al,<sup>32</sup> favoring early inner unit exercises, defined as PFM and transversus abdominis exercises, done postdelivery. Furthermore, participants agreed that when assessing DRA, it was important to appreciate the functional aspect of tension generation through the LA during pelvic floor and transversus abdominis coactivation, which are in accordance with the theories proposed by Lee and Hodges.<sup>7</sup>

However, some recommendations agreed upon by the experts of this study are not concordant with evidence previously published. For example, participants in this study consider it important that during the late postpartum period, exercise that concentrically engaged the superficial abdominals must be approached with caution and that a lack of tension in the LA during an exercise must be corrected. This opposes the conclusions by Sancho et al,<sup>33</sup> where the authors suggest achieving reduction in IRD through a small crunch exercise (head and scapula lift), which is a concentric exercise similar to the Noble technique. Participants in this study agreed with a high degree of consensus (>90%) that the “Noble technique” was not an appropriate management strategy to use and that pregnancy-related DRA represents more than a “gap” that needs to be narrowed. This perspective does conflict with practice patterns described by women’s health physical therapists in the United States in the Keeler et al<sup>13</sup> study and requires testing in an appropriate scientific trial. Canadian experts in this study also believe and agree that abdominal binding should not be recommended as a first-line treatment and should be reserved for use in specific cases. With the rise of waist corsets on the market, systematic binding of the abdomen in postpartum women is questioned by the participants of this study. To date, no randomized controlled trials have investigated the effectiveness of abdominal binding postpartum to address DRA.

The recommendations for the intrapartum phase are currently unsupported by evidence in the scientific literature. Although some of these recommendations were determined by our participants to be of secondary priority, they were possibly established on the basis of the theory of motor coactivation patterns between the PFMs and the abdominal muscles.<sup>34,35</sup> Further research is needed to determine whether there is a relationship between the birthing position, the degree of injury to the PFMs and endopelvic fascia from delivery (tear, avulsion, episiotomy, etc), and abdominal and LA function during postpartum recovery, which currently remains theoretical. Yet, experts were in agreement that these concepts are indirectly

connected and need to be considered holistically when addressing DRA as articulated in Table 3.

Finally, an interesting and unexpected finding was that the experts in this study did not agree on the role of health promotion in the conservative management of pregnancy-related DRA. Activity counseling, nutrition counseling, and sleep counseling were all left as inconclusive statements at the end of phase III. It has been proposed for more than a decade that physiotherapists need to demonstrate and enact clinical competencies that include assessments of health, lifestyle health behaviors, and lifestyle risk factors.<sup>36</sup> Furthermore, this perspective has been substantiated through a recent systematic review confirming that physiotherapists can effectively counsel patients with respect to lifestyle behavior change.<sup>37</sup> Knowledge translation related to the importance of integrating health promotion strategies into physiotherapy conservative management strategies is needed.

The 28 recommendations established by a consensus process among Canadian experts in women’s health corroborate many findings presented by Keeler et al.<sup>13</sup> Importantly, our results extend these findings by addressing DRA from additional perspectives and by the different perinatal stages. Interestingly, our expert panel was enthusiastic and in agreement that women’s health physiotherapists have a clear advocacy role during the intrapartum stage, which was not identified in the study by Keeler et al.<sup>13</sup> Finally, an overreaching sentiment reflected within the recommendations highlights our participants’ unanimous perspective related to avoiding any language within a recommendation that could potentially prompt fear of movement.

Overall, this study is the first to commence bridging the current evidence-practice gap through a systematic mode of practice-based inquiry. The major limitation of this study relates to the fact that it yields level 5 evidence (expert opinion) and is dependable on the reliability of the participating experts.<sup>38</sup> All established consensus-based recommendations require further testing in appropriate research designs to determine efficacy.<sup>38</sup> Another potential limitation relates to the relatively low participation rate for phase II. Although phases I and III garnered a high response rate, in phase II, only 11 participants contributed. However, it most likely did not impact the final results as the participants were able to reflect on these items again in phase III. Finally, although we applied methodological procedures to mitigate participant bias, we acknowledge that it was not possible to eliminate all potential bias.

## CONCLUSION

This study generated 28 Canadian expert-based recommendations for conservative care of pregnancy-related DRA. Nationally recognized expert physiotherapists

in women's health agree that the impairments and dysfunctions related to DRA are multidimensional and multifactorial and accentuate the need for a global, yet individually tailored care approach of this condition. Some of these consensus-based recommendations corroborate with the scientific literature, and some do not. Our findings point to research-practice gaps that require further study.

## REFERENCES

- Axer H, von Keyserlingk DG, Prescher A. Collagen fibers in linea alba and rectus sheaths. *J Surg Res*. 2001;96(2):239–245.
- Axer H, Keyserlingk DG, Prescher A. Collagen fibers in linea alba and rectus sheaths, part I: general scheme and morphological aspects. *J Surg Res*. 2001;96(1):127–134.
- Beer GM, Schuster A, Seifert B, Manestar M, Mihic-Probst D, Weber SA. The normal width of the linea alba in nulliparous women. *Clin Anat*. 2009;22(6):706–711.
- Sperstad JB, Tennfjord MK, Hilde G, Ellström-Eng M, Bø K. Diastasis recti abdominis during pregnancy and 12 months after childbirth: prevalence, risk factors and report of lumbopelvic pain. *Br J Sports Med*. 2016;50(17):1092–1096.
- Fernandes da Mota PG, Pascoal AG, Carita AI, Bø K. Prevalence and risk factors of diastasis recti abdominis from late pregnancy to 6 months postpartum, and relationship with lumbo-pelvic pain. *Man Ther*. 2015;20(1):200–205.
- Coldron Y, Stokes MJ, Newham DJ, Cook K. Postpartum characteristics of rectus abdominis on ultrasound imaging. *Man Ther*. 2008;13(2):112–121.
- Lee D, Hodges PW. Behavior of the linea alba during a curl-up task in diastasis rectus abdominis: an observational study. *J Orthop Sports Phys Ther*. 2016;46(7):580–589.
- Liaw LJ, Hsu MJ, Liao CF, Liu MF, Hsu AT. The relationships between inter-recti distance measured by ultrasound imaging and abdominal muscle function in postpartum women: a 6-month follow-up study. *J Orthop Sports Phys Ther*. 2011;41(6):435–443.
- Parker MA, Millar LA, Dugan SA. Diastasis rectus abdominis and lumbo-pelvic pain and dysfunction—are they related? *J Womens Health Phys Ther*. 2009;33(2):15–22.
- Hernandez-Gascon B, Mena A, Peña E, Pascual G, Bellón JM, Calvo B. Understanding the passive mechanical behavior of the human abdominal wall. *Ann Biomed Eng*. 2013;41(2):433–444.
- Chiarello CM, Falzone LA, McCaslin KE, Patel MN, Ulery KR. The effects of an exercise program on diastasis recti abdominis in pregnant women. *J Womens Health Phys Ther*. 2005;29(1):11–16.
- Benjamin DR, van de Water AT, Peiris CL. Effects of exercise on diastasis of the rectus abdominis muscle in the antenatal and postnatal periods: a systematic review. *Physiotherapy*. 2014;100(1):1–8.
- Keeler J, Albrecht M, Eberhardt L, Horn L, Donnelly C, Lowe D. Diastasis recti abdominis: a survey of women's health specialists for current physical therapy clinical practice for postpartum women. *J Womens Health Phys Ther*. 2012;36(3):131–142.
- Ulschak FL. *Human Resource Development: The Theory and Practice of Need Assessment*. Washington, DC: Reston Pub Co; 1983.
- Adler M, Ziglio E. *Gazing into the Oracle: The Delphi Method and Its Application to Social Policy and Public Health*. London, England: Jessica Kingsley Publishers; 1996.
- Ludwig B. Predicting the future: have you considered using the Delphi methodology. *J Extension*. 1997;35(5):1–4.
- Delbecq AL, Van de Ven AH, Gustafson DH. *Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes*. Illinois: Scott Foresman; 1975.
- Okoli C, Pawlowski SD. The Delphi method as a research tool: an example, design considerations and applications. *Inf Manag*. 2004;42(1):15–29.
- Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. *J Clin Epidemiol*. 2014;67(4):401–409.
- Kennedy HP. Enhancing Delphi research: methods and results. *J Adv Nurs*. 2004;45(5):504–511.
- Canadian Institutes of Health Research. More about knowledge translation at CIHR. <http://www.cihr-irsc.gc.ca/e/39033.html>. Accessed February 11, 2012.
- Canadian Institutes of Health Research. Funding opportunity: operating grant: knowledge to action, local research-user interaction. <http://www.researchnet-recherchenet.ca/mr16/vwOpprtntyDtIs.do?prog=170%26view=browseArchive%26browseArc=true%26progType=CIHR-12%26type=AND%26resultCount=25%26all=1>. Accessed February 11, 2012.
- Horn SD, DeJong G, Deutscher D. Practice-based evidence research in rehabilitation: an alternative to randomized controlled trials and traditional observational studies. *Arch Phys Med Rehabil*. 2012;93(8)(suppl):S127–S137.
- Lee L, Dy J, Azzam H. Management of spontaneous labour at term in healthy women. *J Obstet Gynaecol Can*. 2016;38(9):843–865.
- Braun D. Diastasis recti: clinical anatomy. *Plast Reconstr Surg*. 2008;122(5):1564–1569.
- Hills NF, Graham RB, McLean L. Comparison of trunk muscle function between women with and without diastasis recti abdominis at 1 year postpartum. *Phys Ther*. 2018;98(10):891–901.
- Levillain A, Orhant M, Turquier F, Hoc T. Contribution of collagen and elastin fibers to the mechanical behavior of an abdominal connective tissue. *J Mech Behav Biomed Mater*. 2016;61:308–317.
- Hills NF, Keshwani N, McLean L. Influence of ultrasound transducer tilt in the cranial and caudal directions on measurements of inter-rectus distance in parous women. *Physiother Can*. 2018;70(1):6–10.
- Keshwani N, Hills N, McLean L. Inter-rectus distance measurement using ultrasound imaging: does the rater matter? *Physiother Can*. 2016;68(3):223–229.
- Keshwani N, Mathur S, McLean L. Validity of inter-rectus distance measurement in postpartum women using extended field-of-view ultrasound imaging techniques. *J Orthop Sports Phys Ther*. 2015;45(10):808–813.
- van de Water AT, Benjamin DR. Measurement methods to assess diastasis of the rectus abdominis muscle (DRAM): a systematic review of their measurement properties and meta-analytic reliability generalisation. *Man Ther*. 2016;21:41–53.
- Mesquita LA, Machado AV, Andrade AV. Physiotherapy for reduction of diastasis of the recti abdominis muscles in the postpartum period. *Rev Bras Ginecol Obst*. 1999;21(5):267–272.
- Sancho MF, Pascoal AG, Mota P, Bø K. Abdominal exercises affect inter-rectus distance in postpartum women: a two-dimensional ultrasound study. *Physiotherapy*. 2015;101(3):286–291.
- Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. *Int Urogynecol J Pelvic Floor Dysfunct*. 2002;13(2):125–132.
- Madill SJ, McLean L. Quantification of abdominal and pelvic floor muscle synergies in response to voluntary pelvic floor muscle contractions. *J Electromyogr Kinesiol*. 2008;18(6):955–964.
- Dean E. Physical therapy in the 21st century (part II): evidence-based practice within the context of evidence-informed practice. *Physiother Theory Pract*. 2009;25(5/6):354–368.
- Frerichs W, Kaltenbacher E, van de Leur JP, Dean E. Can physical therapists counsel patients with lifestyle-related health conditions effectively? A systematic review and implications. *Physiother Theory Pract*. 2012;28(8):571–587.
- OCEBM Levels of Evidence Working Group. *The Oxford Levels of Evidence 2*. Oxford Centre for Evidence-Based Medicine. Oxford, England: Oxford Centre for Evidence-Based Medicine.