# INPLASY PROTOCOL

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**Support:** **None.**

**Review Stage at time of this submission:** **Formal screening of search results against eligibility criteria.**

**Conflicts of interest:**
**None declared.**

# Technical aspects of the inter-recti distance measurement with ultrasonographic imaging for physiotherapy purposes: A protocol for a scoping review

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**Review question / Objective:** **The scoping review aims to identify publications describing the measurement of inter-recti distance (IRD)/diastasis recti abdominis (DRA) using ultrasonographic imaging (USI). The identification is based on the population/concept/context (PCC) framework that concerns human adults that underwent IRD/linea alba width/ DRA measurement with USI for physiotherapy/physical exercise purposes. Based on systematically mapped peer-reviewed studies it is aimed to perform data extraction and synthesis of specific aspects of the IRD measurement procedure and discuss their similarities and differences. Related to that the attempt will be made to formulate recommendations on the IRD measurement procedure, which might be considered in future physiotherapy studies and practice. The recommendations will be made based on the synthesis of the results in light of existing literature and as the result of discussions and consensus between the authors (coming from three research centers).**

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 September 2022 and was last updated on 27 September 2022 (registration number INPLASY202290116).

## INTRODUCTION

**Review question / Objective:** **The scoping review aims to identify publications describing the measurement of inter-recti distance (IRD)/diastasis recti abdominis (DRA) using ultrasonographic imaging (USI). The identification is based on the population/concept/context (PCC) framework that concerns human adults that underwent IRD/linea alba width/DRA measurement with USI for physiotherapy/ physical exercise purposes. Based on**

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**Background:** The IRD measurement using musculoskeletal USI has been used in physiotherapy research to investigate pregnancy-related DRA and to search for effective DRA treatment methods [1-3]. Persistent postpartum DRA is related to abdominal muscle laxity and weakness, and it is also a serious cosmetic problem for women [4]. Severe and untreated DRA may result in insufficient uterus protection by the soft tissues in successive pregnancies and the formation of umbilical or epigastric hernias that may require surgical procedures [5]. Possible pregnancy-related DRA risk factors and the association of post-pregnancy DRA with chronic low back pain or support-related pelvic floor dysfunction are still investigated [6,7]. It has been shown that physiotherapy has a positive effect on improving the condition [2,8,9].

**Rationale:** The IRD measurement procedure with USI for physiotherapy purposes has not been standardized so far [8,9]. The discrepancies between the study protocols concern the choice of measurement site along the linea alba, the criteria as to what IRD is indicative of DRA [2,8-10], the examinee's body position, way of abdominal muscle activation, or breathing phase during image capturing. Such differences may influence study outcomes and cause difficulties in the comparison of findings between research centers [9]. Therefore, systematic mapping of physiotherapy-related studies that involved IRD measurement with the use of USI is needed to compare and discuss the specific aspects of the measurement procedures conducted in various research centers.

## METHODS

**Strategy of data synthesis:** PubMed, Embase (Elsevier), and Ovid (Medline) databases were searched for relevant publications from their inception to August 31, 2022, by two review leads (D.C. and A.O.B.). The reviewers gained their knowledge on search strategy through video tutorials and close cooperation with an experienced librarian from the Medical University Library. For PubMed, the final search strategy used was as follows: ((interrect*[tiab]) OR (inter-rect*[tiab]) OR (linea alba[tw]) OR (recti abdominis[tiab]) OR (recti muscle*[tiab]) OR (rectus muscle[tw]) OR (rectus abdom*[tiab]) OR (recti[tiab]) OR (rectus abdominis[mh])) AND ((diastasis[tiab]) OR (separation[tw]) OR (width[tw]) OR (distance[tiab]) OR (widening[tw])) AND ((USI[tw]) OR (ultrasound imaging[tiab]) OR (ultrasonography[tiab]) OR (ultrasonography[mh]) OR (US[tw]) OR (ultrasound[tiab])); filter: English. All literature search results were saved, and duplicate publications were removed manually. To reduce the risk of error, two researchers (D.C. and M.R.Z.) independently removed duplicates and compared the outcomes of their selection. The reference lists of studies meeting the inclusion criteria were searched to identify additional relevant studies. Two researchers (D.C. and A.O.B.) performed screening independently.

**Eligibility criteria:** Eligibility criteria are based on the PCC framework.
Inclusion criteria: Study design: full-text of a peer-reviewed original research article or protocol that includes a detailed description of IRD measurement procedure using USI. Population: human adults. Concept: IRD/linea alba width/DRA measurement procedure with USI. Context: field of physiotherapy or physical exercise/training.

Exclusion criteria: Study design: only abstract form, conference proceeding, letter, review, meta-analysis.
Population: non-humans and human infants, children, and adolescents. Concept: USI or other procedures not related to IRD/linea alba width/DRA measurement; IRD/linea alba width/DRA measurement with other tools, e.g., manual caliper, tape measure, ruler, magnetic resonance, computer tomography, palpation, and intraoperatively. Context: Field of surgery (plastic, general) or other medical fields not related to physiotherapy or physical exercise/training.

**Source of evidence screening and selection:** The selection of articles is conducted in two stages. Two standardized forms have been developed (using the Microsoft Forms software, Office 365) to guide the screening of the publications through the search strategy. These forms have been developed by two review leads (D.C. and A.O.B.) during the prescreening of 50 random publications. Form I concerns selection at the title and abstract level and form II concerns the full-text level. The prescreening was a continuous interactive process of refining the questions to improve their appropriateness, accuracy, and comprehensiveness and to ensure that filling out both forms will enable capturing all relevant articles. Next, four members of the review team (D.C., A.O.B., M.R.Z, and J.N.) performed calibration exercises concerning the first phase of the relevant publication selection. They independently screened a sample of 30 titles and abstracts and filled out the form I. Next, the Kappa coefficient was applied and showed an interrater agreement of 0.80–0.93. The discrepancies between the reviewers' answers and any unclear issues were discussed until a consensus was reached, and final minor refinements were made to form I and the accompanying explanation and elaboration document. As the interrater agreements were satisfactory, the screening of the titles and abstracts of all remaining publications began. The same titles and abstracts are currently being screened independently by two reviewers (D.C./J.N. and M.R.Z.). After completing the form I for all publications, the reviewers compared the answers and discussed and resolved any disagreements by consensus. In cases of uncertainty, an additional reviewer (A.O.B.) was consulted to make the final decision. The same (above described) steps are currently undertaken for the second phase of the relevant publication selection concerning full-text screening and filling out form II.

**Data management:** To extract relevant information (concerning each data item) from the included sources of evidence a data-charting form jointly developed by two review leads (A.O.B. and D.C.) will be used. This data-charting form will be filled out independently by two reviewers (A.O.B./M.R.Z. and D.C./J.N.). Next, three reviewers (A.O.B., D.C., and M.C.) will compare charted extracts, discuss uncertain issues, and jointly make summaries of the extracts that will be placed in tables. PRISMA-ScR flow diagram will be presented.

**Reporting results / Analysis of the evidence:** Synthesis of the results (the details of the IRD measurement procedure) will concern the following main data items: the examinee's body position during the assessment at rest, specific muscle activation/task during the examination, the respiratory phase/pattern during image capturing, the examiner's profession and experience, type of ultrasonographic scanner and transducer, choice of measurement site/sites along the linea alba, the use of cutoff values for “normal” IRD or DRA, the number of images taken at each measurement site, the image processing, and IRD measurement methods.

**Presentation of the results:** The results will be presented in the tables (as summarized extracts) and their synthesis in the narrative format. The tables will include summarized data items (concerning specific aspects of the IRD measurement procedure) of all included publications. The synthesis of the results for each data item will be presented in the narrative format. The results synthesis will be made by two

review leads (A.O.B. and D.C). Interpretation of the results in light of existing literature made by the review lead (A.O.B) will be critically revised by the review team (D.C., M.C., K.G., J.B., A.G.P., and P.M.). Any disagreements on data interpretation will be discussed to reach a consensus on final conclusions.

**Language restriction:** Yes. Only papers published in English have been included.

**Country(ies) involved:** Poland and Portugal.

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**Keywords:** rectus abdominis; inter-recti distance; linea alba; diastasis recti abdominis, ultrasonography; musculoskeletal ultrasound imaging; rehabilitative ultrasound imaging.

**Dissemination plans:** We are planning to submit the scoping review to an international peer-reviewed journal.

**Contributions of each author:**

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