

Data Request form YOUth (version 6.0, February 2020)

Introduction

The information you provide here will be used by the YOUth Executive Board, the Data Manager, and the Data Management Committee to evaluate your data request. Details regarding this evaluation procedure can be found in the Data Access Protocol.

All data requests will be published on the YOUth researcher's website in order to provide a searchable overview of past, current, and pending data requests. By default, the publication of submitted and pending data requests includes the names and institutions of the contact person and participating researchers as well as a broad description of the research context.

After approval of a data request, the complete request (including hypotheses and proposed analyses) will be published. If an applicant has reasons to object to the publication of their complete data request, they should notify the Project Manager, who will evaluate the objection with the other members of the Executive Board and the Data Management Committee. If the objection is rejected, the researcher may decide to withdraw their data request.

Section 1: Researchers

In this section, please provide information about the researchers involved with this data request.

- Name, affiliation and contact information of the contact person
- Name and details of participating researchers (e.g. intended co-authors)
- Name and details of the contact person within YOUth (if any)

Contact person for the proposed study:	
Name:	Sonja de Zwarte
Institution:	UMC Brain Center
Department:	Psychiatry
Address:	Heidelberglaan 100
Email:	s.m.c.dezwarte@umcutrecht.nl
Phone:	0623033048

Participating researcher:	
Name:	Yaron Caspi
Institution:	UMC Brain Center
Department:	Psychiatry
Address:	Heidelberglaan 100
Email:	y.caspi-2@umcutrecht.nl
Phone:	

Participating researcher:	
Name:	Hilleke Hulshoff Pol
Institution:	UMC Brain Center
Department:	Psychiatry
Address:	Heidelberglaan 100
Email:	H.E.Hulshoff@umcutrecht.nl
Phone:	

Participating researcher:	
Name:	
Institution:	
Department:	
Address:	
Email:	
Phone:	

Participating researcher:	
Name:	
Institution:	
Department:	
Address:	
Email:	
Phone:	

Contact person within YOUth (if any)	
Name:	Hilleke Hulshoff Pol
Institution:	UMC Brain Center
Department:	Psychiatry
Address:	Heidelberglaan 100
Email:	H.E.Hulshoff@umcutrecht.nl
Phone:	

Section 2: Research context

In this section, please briefly describe the context for your research plans. This section should logically introduce the next section (hypotheses). As mentioned, please note that this section will be made publicly available on our researcher's website after submission of your request.

Please provide:

- The title of your research plan
- A very brief background for the topic of your research plan
- The rationale for and relevance of your specific research plan
- The specific research question(s) or aim(s) of your research (Please also provide a brief specification)
- A short description of the data you request

References can be added at the end of this section (optional).

Title of the study
Automatic measurements of fetal brain volume from 3D ultrasound scans

Background of the topic of your research plan, rationale, relevance (max. 500 words)

The brain undergoes major developmental changes already very early in life. Fetal brain development is therefore critical for normal functioning later in life. Early brain development is characterized by complex molecular and cellular processes, and a disruption to these processes can have severe consequences. Both genetic and environmental factors that interfere with normal fetal brain growth are associated with severe developmental disorders. Whether the relationship between fetal brain development and later-life functioning holds over the whole range of fetal growth values or is restricted to extreme growth abnormalities is still not fully settled. Therefore, it is essential to study normal fetal brain development (without severe growth complications) to further understand human development.

Ultrasound is the preferred modality for assessing prenatal neurodevelopment, and three-dimensional (3D) ultrasound can be used to study the volumetric development of brain structures. However, to date, there are no publicly available automatic procedures for delineating the intracranial volume (ICV) – an important biomarker for neurodevelopment. Hence, ICV annotations from 3D ultrasound images are predominantly performed manually, which is a highly time-consuming task.

Here, we will present and validate an automated tool to extract ICV from fetal 3D ultrasound scans that were acquired as part of the YOUTH Baby and Child cohort. The procedure is based on the registration of a brain model to a subject's brain. ICV is measured by applying the inverse of the final transformation to an ICV mask of the brain model. Automatic measurements of fetal ICV were compared to manual delineated ICV for two gestational age groups, i.e., 20 and 30 weeks.

The specific research question(s) or aim(s) of your research

To develop and validate an automated tool to extract ICV from fetal 3D ultrasound images.

Summary of the data requested for your project: Please indicate which data you request to answer your research question.

- N=100 subjects with 3D ultrasounds that were previously manually annotated (part of a previous QC data request)
- Gestational age
- Sex

References (optional)**Section 3: Hypotheses**

In this section, please provide your research hypotheses. For each hypothesis:

- Be as specific as possible
- Provide the anticipated outcomes for accepting and/or rejecting the hypothesis

Hypotheses

Based on our previous experience with applying these methods in MRI data, we hypothesize that we will be able to successfully annotate ICV in 3D ultrasounds acquired at 20- and 30-weeks of gestational age.

Section 4: Methods

In this section, you should make clear how the hypotheses are tested. Be as specific as possible.

Please describe:

- The study design and study population (Which data do you require from which subjects?)
- The general processing steps (to prepare the data for analysis)
- The analysis steps (How are the data analysed to address the hypotheses? If possible, link each description to a specific hypothesis)
- Any additional aspects that need to be described to clarify the methodological approach (optional)

Study design, study population and sample size (e.g. cross-sectional or longitudinal; entire population or a subset; substantiate your choices)

Longitudinal; subset of ultrasounds that previous have been manually annotated.

General processing steps to prepare the data for analysis

The procedure is based on the registration of a model brain to a subject's brain. The registration algorithm is based on a series of affine and B-spline refined registrations between a fetal brain scan and a model brain. After each registration step, an average image is calculated between the registration results of the two scans. This average is used as the template for registration at the sequential registration step.

A subset of the subjects from the validation cohort included in this work will be used to construct the brain models for both the 20- and 30-week gestational age groups. Several steps will be used to create an accompanying ICV mask for the model brains. To obtain the highest quality ICV mask for the brain models, the ICV masks were manually edited and finetuned using the anatomical knowledge of a fetal brain.

ICV is measured by applying the inverse of the final transformation to an ICV mask of the brain model.

To add a layer of quality control, two different intensity-based registration pipelines will be employed, i.e., Minc and Elastix. If both output measures are in agreement, the average ICV will be considered the automatic ICV, otherwise this subject will be excluded for further analyses.

Specific processing and analysis steps to address the hypotheses

The findings of automatic calculated ICV and previously manually annotated ICV will statistically compared via regression analysis and Intraclass Correlation Coefficients (ICCs).

Additional methodological aspects (optional)

Section 5: Data request

In this section, please specify as detailed as possible which data (and from which subjects) you request.

Data requested
<ul style="list-style-type: none">• N=100 subjects with 3D ultrasounds that were previously manually annotated (part of a previous QC data request)• Gestational age• Sex

Data request for the purpose of:

- Analyses in order to publish
 Analyses for data assessment only (results will not be published)

Publication type (in case of analyses in order to publish):

- Article or report
 PhD thesis
 Article that will also be part of a PhD thesis

Would you like to be notified when a new data lock is available?

- Yes
 No

Upon approval of a data request, the complete request will be made publicly available on our researcher's website by default.

Do you agree with publishing the complete request on our researcher's website after it is approved?

- Yes
 No. Please provide a rationale