SAFETY OF FETAL MRI: Neonatal And Development Outcome

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Background

- MRI is a popular and widespread imaging technique. In contrast to many other imaging techniques, MRI lacks use of ionizing radiation and has very high resolution

- Ionizing radiation is a know teratogen, Therefore, when imaging is needed on a pregnant individual, MRI is preferred, when applicable

Is MRI always safe ?

Potential harmful effects on the fetus

- **Acoustic noise**: sound pressure levels can reach 120 dB (equivalent to a jet engine at take-off)
- **Heating**: caused by absorption of radio waves
- **Teratogenic effects**: due to exposure to high power electromagnetic fields

Literature Review

Animal studies

- “MF exposed pregnant rats showed a significant decrease in the number of live fetuses”
- “higher abnormality and mortality rates than their controls”
- “elevations in auditory brain stem response thresholds… the cochlea showed greater hair cell damage”

Human studies

- “In utero exposure to echo planar imaging thus did not have a marked effect on intrauterine fetal growth”
- “A small but significant decrease in length. No other significant developmental or social differences were seen between the two groups”
- “The rate of hearing impairment or deafness was found to be 0% (0 of 751) in the neonates in the exposed group”
- “There was no between-group difference in birth weight percentiles”

Weaknesses of the studies

- Most of the study cases were exposed to the MRI at the 3rd trimester, i.e. post organogenesis
- The study did not compare the outcome in different trimesters
- There was no follow-up in order to evaluate long term effects

And Now…

Our Study

Rationale

- Although research on animals demonstrates harmful effects of MRI on embryos, human studies do not support these claims, but do mention that due to scarce information, further research needs to be done.
- By gathering information and **follow-ups** about pregnant women that underwent MRI scans in different trimesters especially the **first and second** we can better evaluate the adverse effect of MRI if any

Methods

A retrospective study based on Sheba Medical Center's database and Telephone questionnaire

Methods

The first phase: selecting the study group

- Fetuses which were exposed to MRI during the pregnancy between 2011-2015 were depicted from the Sheba's computerized database

- The study group includes 133 fetuses that were exposed to MRI in different trimesters and from various indications: maternal, placental and fetal

Methods

The second phase: Building database

- Hospital database- short term outcome
- Telephone questionnaire (neurodevelopmental vineland score)- long term outcome

Methods

The third phase: control group

- A matched control group in the ratio of 4:1
- All women in the control group gave birth in the same day and medical personal shift as the study group. First shift: 07:00-15:00, second: 15:00-23:00 third: 23:00-07:00.
- Inclusion criteria: singleton fetus, no MRI exposure during pregnancy, normal vaginal delivery, no pregnancy or birth complications.
- Exclusion criteria: are similar as the study group.

Inclusion Criteria (study group)

- MRI performed due to non-serious indication and without or subtle findings
- Singleton
- Childbirth in Sheba medical center
- Existence of newborn's medical information

Exclusion Criteria (study grope)

- Significant findings in the MRI results
- Birth complications
- Pregnancy complications
- CMV infection during pregnancy
- Multifetal pregnancy

Data

Mother:

- Age
- Background disease
- Medications
- Previous pregnancies and their progression
- Conception method
- Findings on Routine fetal organ Scan
- Amniocentesis
- Pregnancy diseases (such as diabetes, hypertension…)
- MRI protocol and results

Data

Birth data:

- Week at birth
- Hour of birth
- Fetal sex
- Weight
- Mode of delivery
- Complications

Data

Newborn Data:

- Apgar score
- Duration of hospitalization
- Abnormal findings on physical examination
- Abnormal findings on laboratory examination
- Hearing examination
- Neurological examination
- Developmental milestones (vineland score)

Indication for the MRI scan

Maternal:

- Appendicitis
- Back\abdominal pain
- Headaches

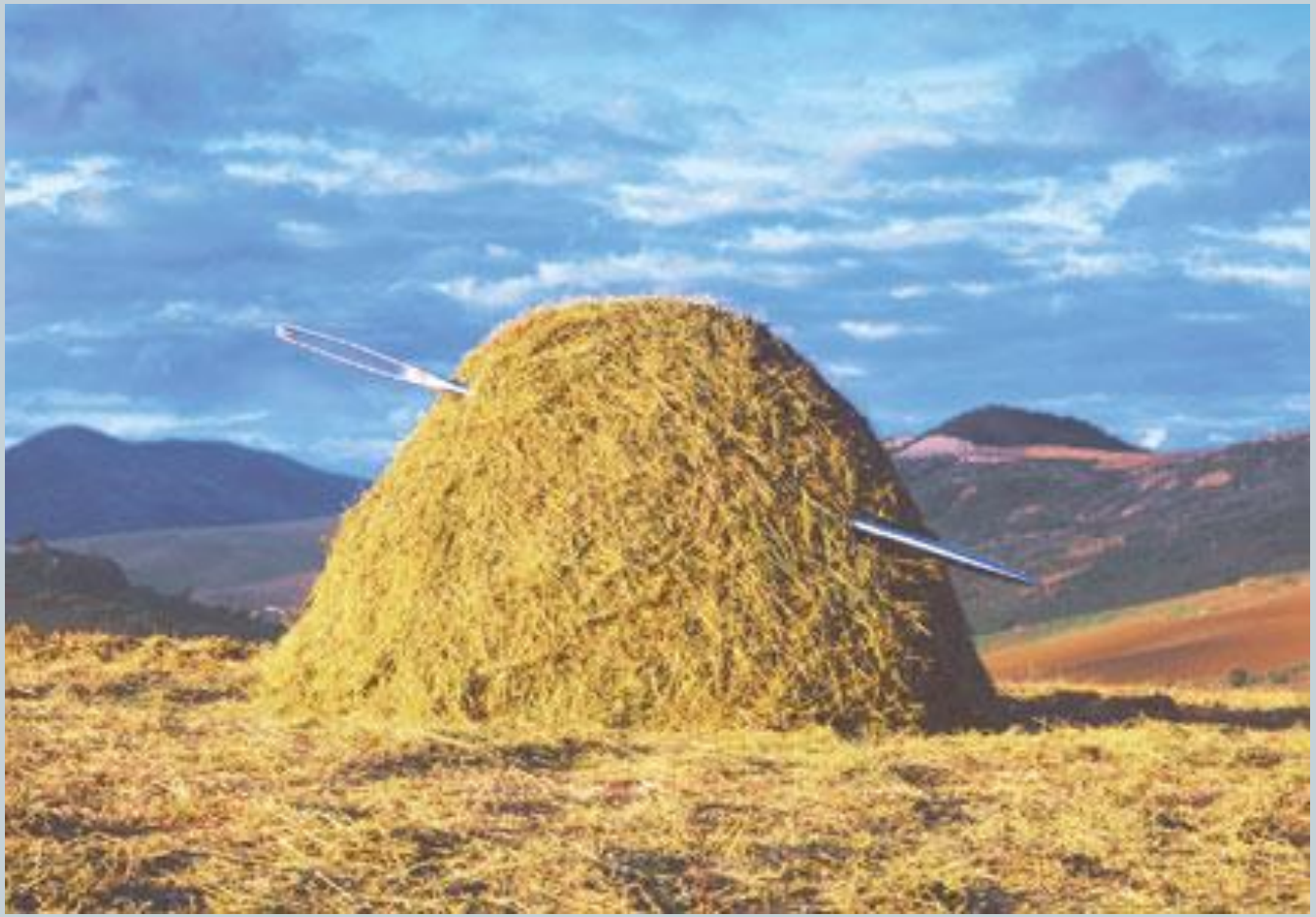
Fetal:

- Asymmetric lateral ventricle
- Low head circumference
- brain Cyst
- Lack of Amniotic fluid

Others:

For example: abnormalities in previous pregnancies

Where are we now?



Study Progress

- We examined over 2,500 files and selected 133 suitable women
- Completed the study group database
- Completed the study group Vineland telephone questionnaire
- Completed selecting and matching the control group and started building the database

Study group

First trimester- 8 subjects

Second trimester-28 subjects

Third trimester- 97 subjects

Telephone questionnaire- 105/133

14 women **were exposed to** more then 1 MRI **during pregnancy**

MRI protocols

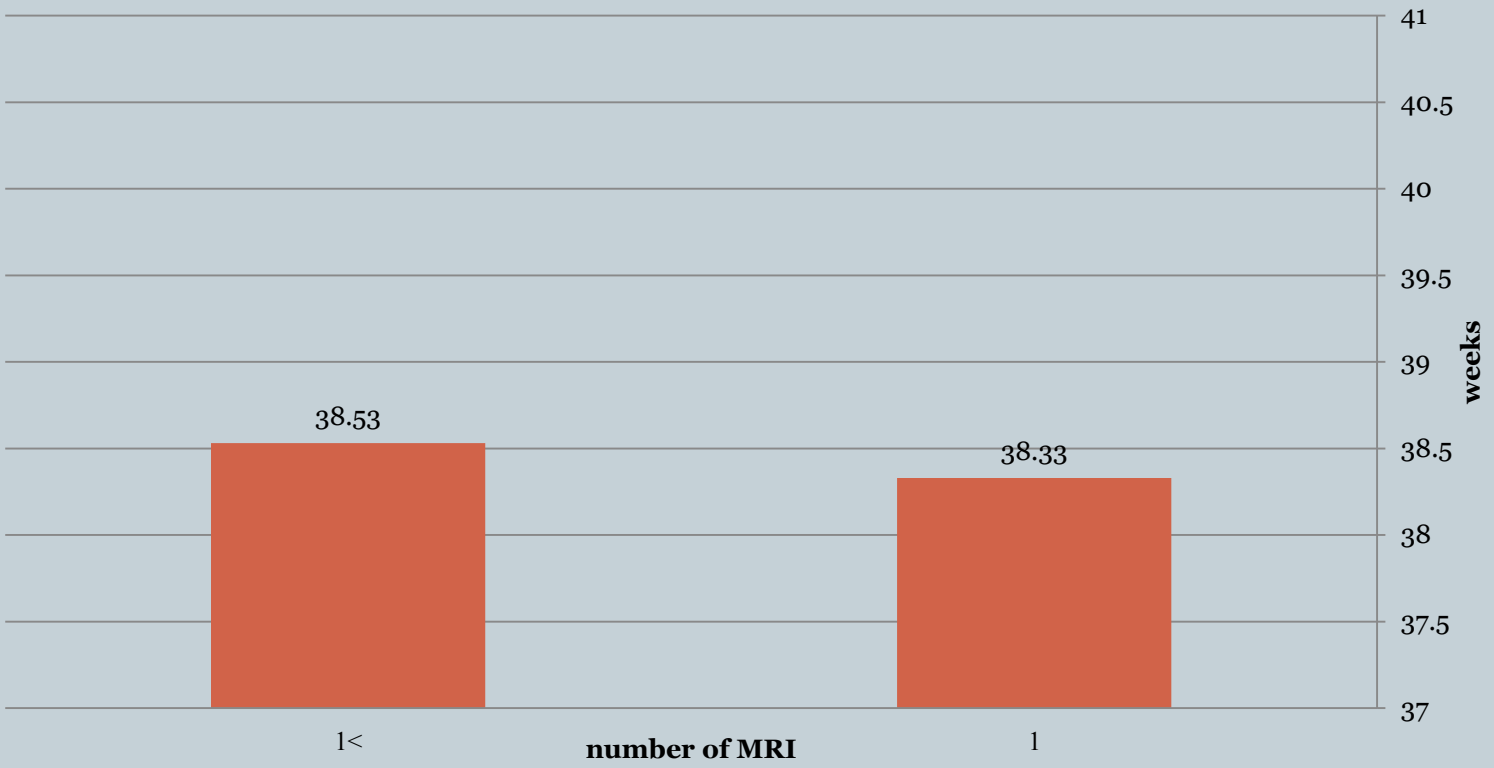
- Fetal neuro- 69
- Mother abdomen- 40
- Mother brain- 20
- Other-4

Control group

- Size- 413 women
- 5 women from study grope didn't have any match
- 7 women from study group had only one match

Some numbers

mean gestational age at birth



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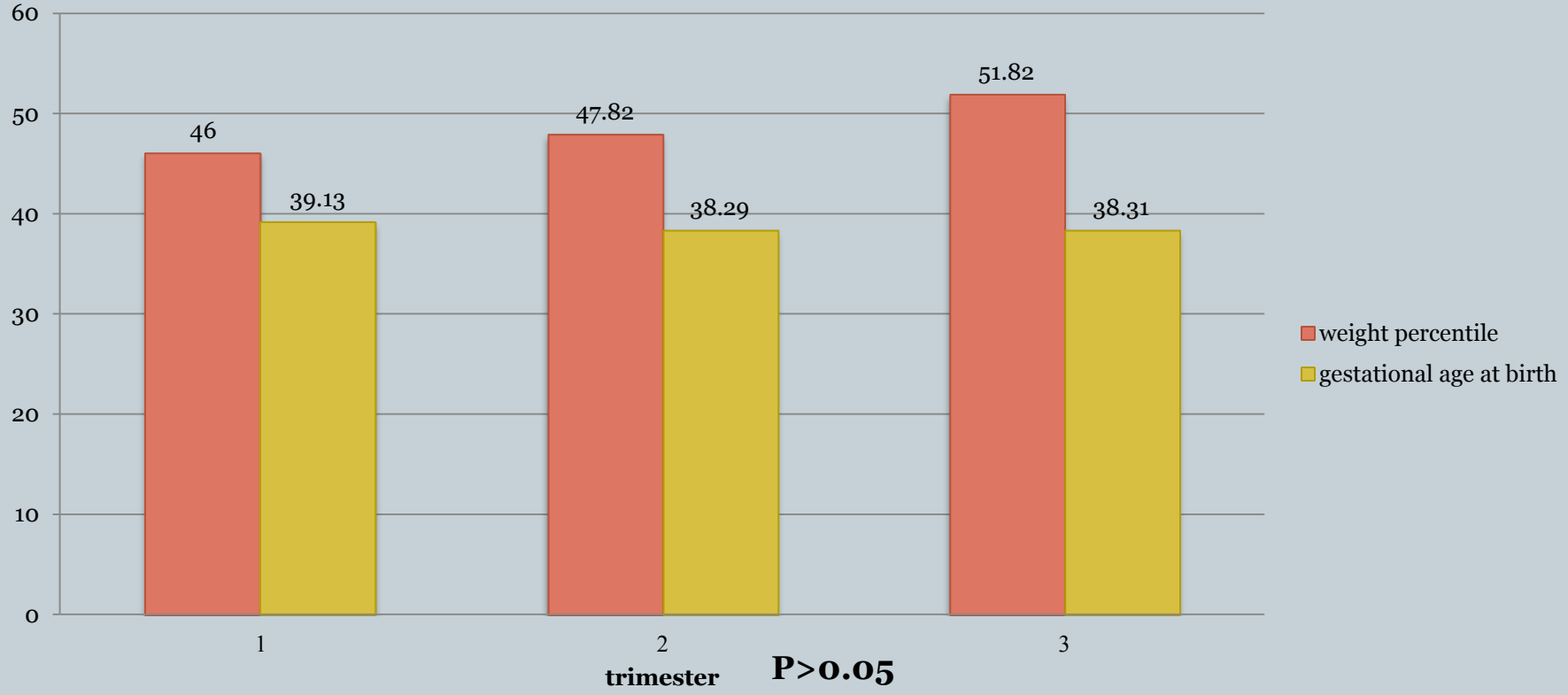
weight percentile & gestational age differences between trimesters



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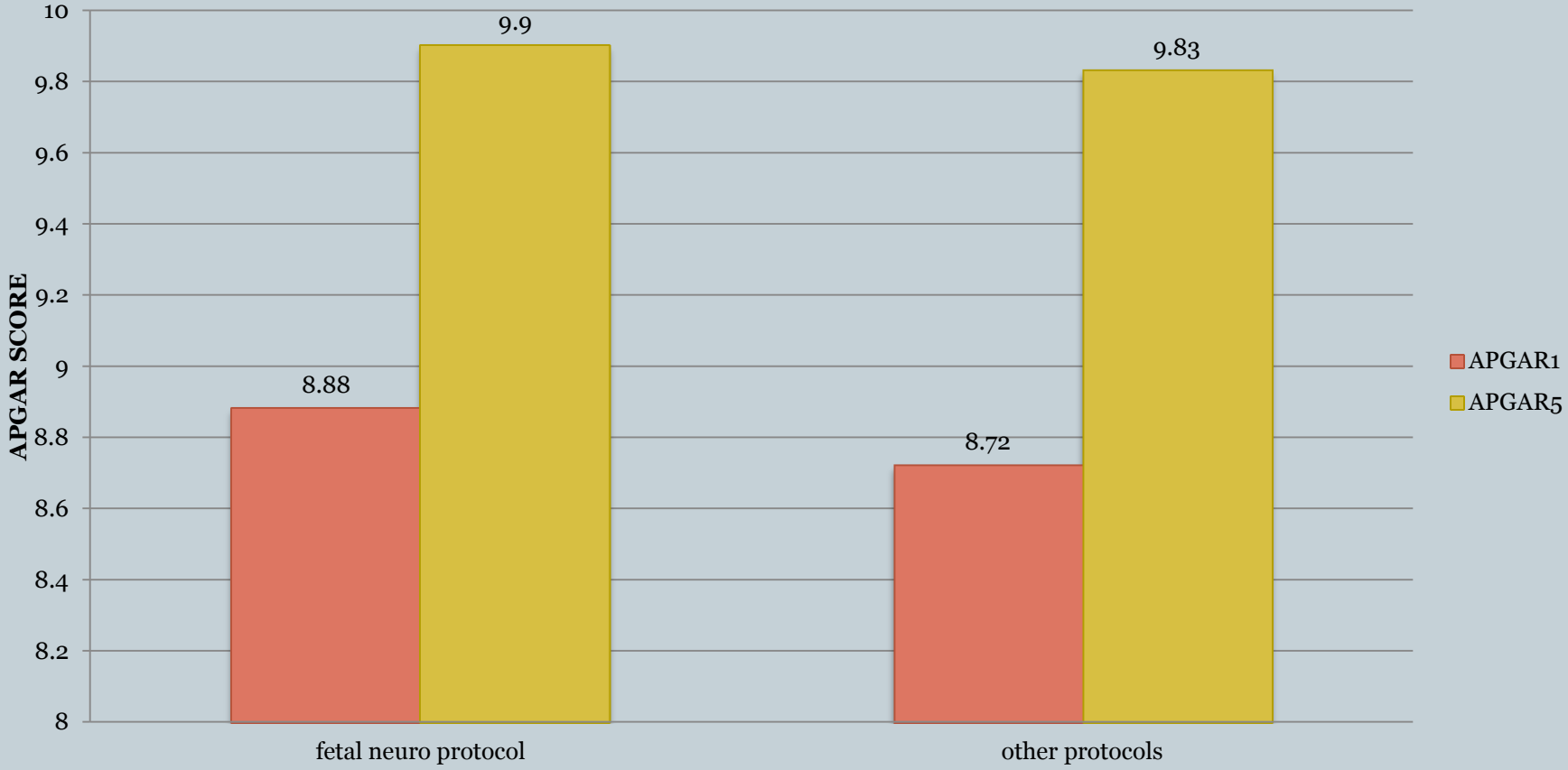
Mean APGAR scores according to MRI protocol



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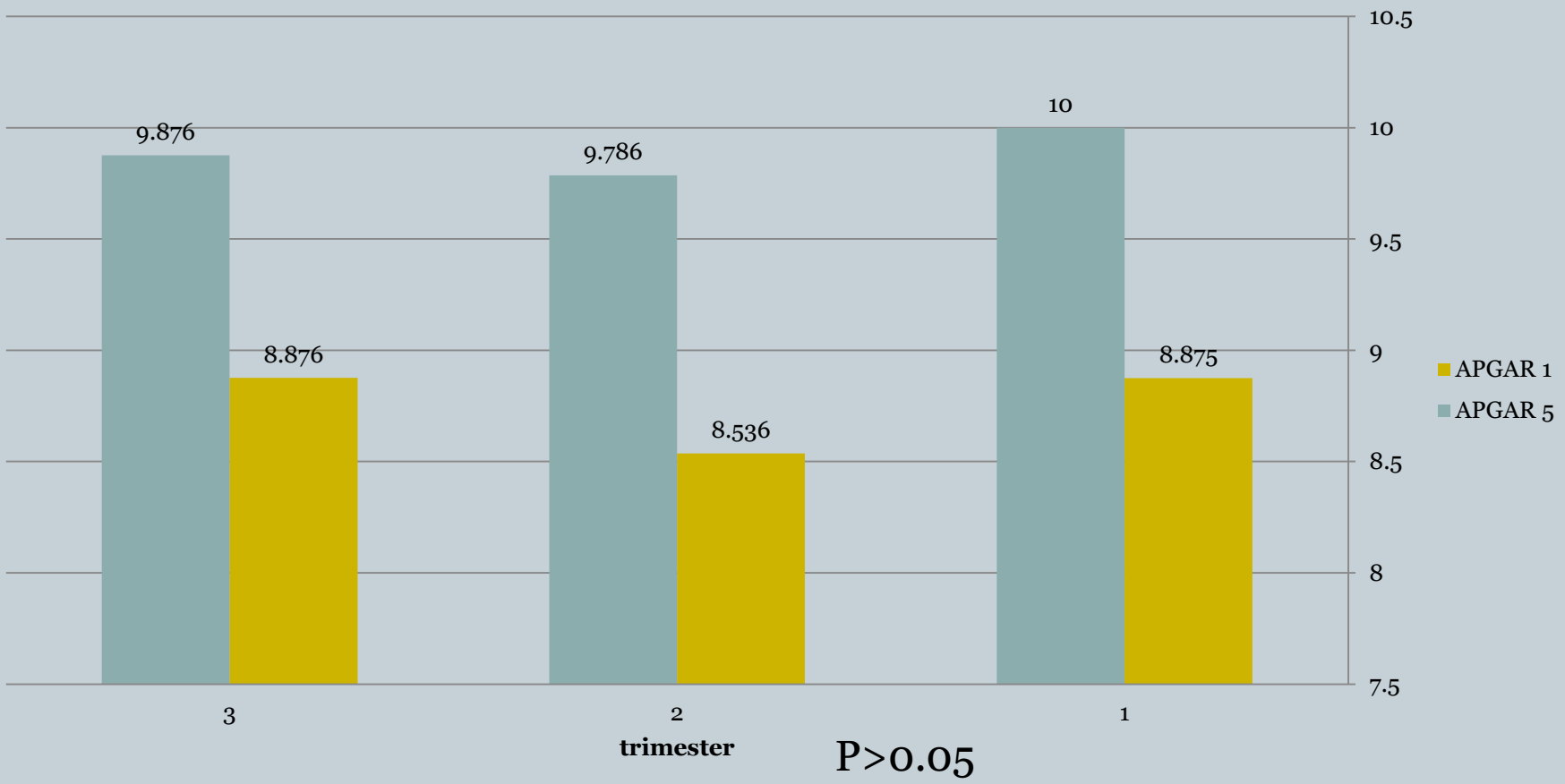
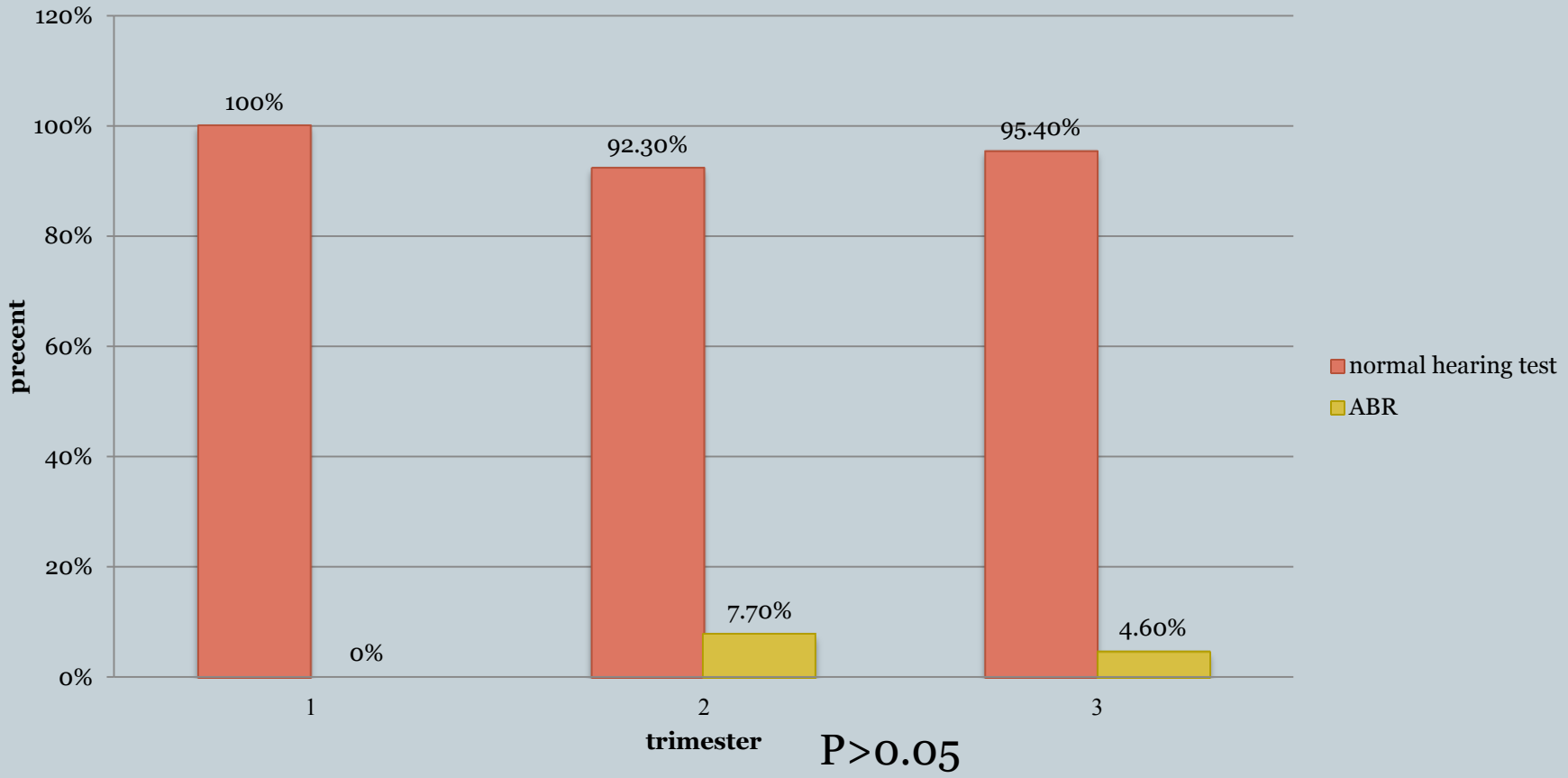
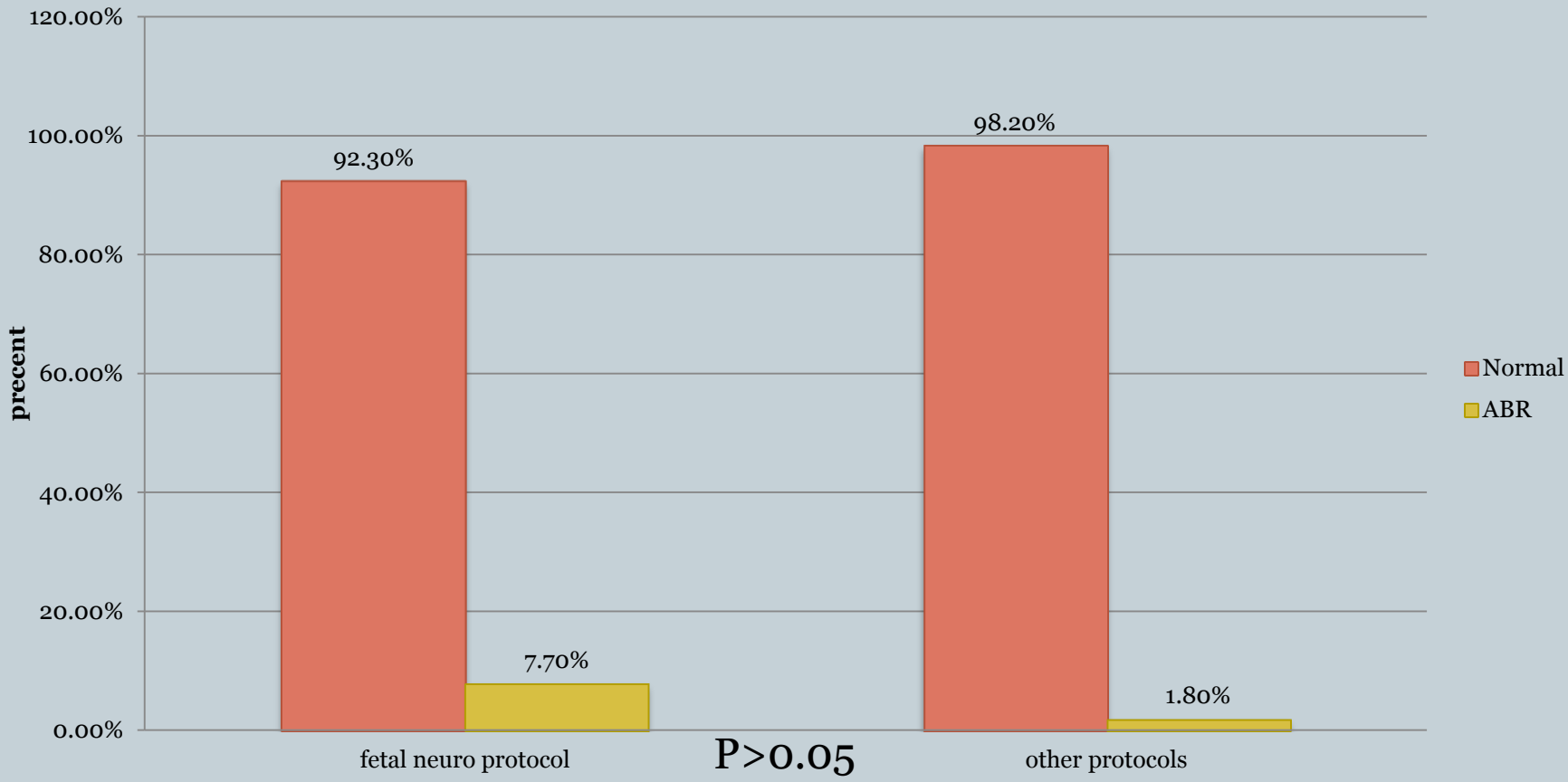

mean APGAR scores in the different trimesters
10.5
10
9.5
9
8.5
8
7.5
9.876
8.876
9.786
8.536
10
8.875
APGAR 1
APGAR 5
3
2
1
trimester
P>0.05


hearing test results in different trimesters
120%
100%
80%
60%
40%
20%
0%
precent
100%
0%
92.30%
7.70%
95.40%
4.60%
1
2
3
trimester
normal hearing test
ABR
P>0.05


Hearing test result according to MRI protocol
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
precent
92.30%
7.70%
98.20%
1.80%
fetal neuro protocol
P>0.05
other protocols
Normal
ABR

What is next

- Completing the control group database
- Vineland Telephone questionnaire to control group
- Statistical analysis


thank you!