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STRATEGIES APPLICABLE DURING PREGNANCY TO REDUCE NEONATAL ADVERSE EFFECTS THROUGH AMBULAR FETAL MONITORING

PHD THESIS ABSTRACT

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INTRODUCTION

Pregnancy is a complex period marked by numerous transformations, during which, despite medical advances, the risk of neonatal complications—such as intrauterine fetal death or preterm birth—remains. To improve prenatal care, there is growing interest in complementary, accessible, and patient-centered methods, such as outpatient fetal monitoring using portable Doppler devices.

These technologies, used outside the hospital setting, can facilitate early detection of changes in fetal condition and enhance the emotional comfort of pregnant women, especially in high-risk pregnancies. However, the literature provides limited data on the perceptions and psychological impact experienced by women using such devices.

This research, conducted at the "Carol Davila" University of Medicine and Pharmacy in Bucharest, aims to investigate these aspects through a study involving pregnant women from all trimesters, who underwent fetal auscultation with a portable Doppler device, followed by the completion of a standardized questionnaire. The study explores whether this method contributes to reducing anxiety, increasing the sense of safety, and encouraging active involvement in pregnancy care.

To this end, three observational studies were conducted, and the collected data were statistically analyzed. The thesis offers an integrated perspective on maternal perception of fetal monitoring and investigates the potential of these tools to be incorporated into prenatal care, at the intersection of obstetrics, technology, and perinatal psychology.

I. GENERAL PART

1. Conceptual Framework and Technological Foundations of Outpatient Fetal Monitoring

1.1 Literature Review: From Traditional Monitoring to Modern Risk Prediction

Antenatal care (ANC) is essential in preventing adverse outcomes such as intrauterine fetal death, prematurity, or low birth weight [1]. Pregnancy monitoring has evolved significantly—from fetal auscultation with the Pinard stethoscope in the 19th century [2] to the use of EFM, CTG, and Doppler in the second half of the 20th century [3]. Recent advancements include the use of mobile technologies and portable devices for out-of-hospital fetal assessment [].

The WHO recommends a minimum of eight structured antenatal contacts [1], and for high-risk pregnancies, advanced techniques such as CTG, Doppler, and the biophysical profile are employed [5]. Fetal monitoring serves a predictive and preventive role in detecting fetal distress, particularly in settings with limited access to obstetric services [5].

The adoption of portable devices has enabled a decentralization of care [5], offering pregnant women a sense of control and involvement in their pregnancy [9]. At the same time, personalized monitoring protocols based on clinical scores and risk factors ensure adequate surveillance [7]. The psychosocial component is increasingly integrated into ANC, including screening for affective disorders [8].

Pilot programs in the Netherlands and the UK have demonstrated the effectiveness of self-monitoring in high-risk pregnancies [9]. Guidelines from ACOG, RCOG, and SMFM provide structured recommendations for prenatal monitoring [10], and telemedicine plays an increasingly important role in the post-pandemic context [11].

Historically, obstetric risk assessment has evolved from empirical observations (e.g., Naegele) [12] to structured models introduced in the 20th century (e.g., Ballantyne) [13]. Today, risk is assessed based on maternal, fetal, and placental factors [14–15], as well as socioeconomic [16] and ethnic factors [17].

The Fetal Medicine Foundation (FMF) has developed a complex predictive model for preeclampsia in the first trimester [18], while NICE guidelines propose a stepwise risk stratification [19]. Artificial intelligence and big data analysis are being implemented in predictive models [20–22], with applications in NIPT, advanced imaging, and wearable devices.

However, the application of these technologies must be adapted to the context—digital inequalities and resource limitations may hinder access [23]. The effectiveness of monitoring depends on personalization, integration of clinical and psychosocial components, and the extension of services beyond hospital settings.

1.2 Contemporary Tools for Screening and Risk Stratification

In-hospital fetal monitoring has progressed from rudimentary auscultation in the 19th century [24] to advanced methods such as CTG, NST, BPP, and Doppler [25–27]. Each technique plays a specific role depending on the obstetric risk profile. Involving pregnant women in the decision-making process increases satisfaction and adherence to monitoring [5].

Qualitative studies have shown that while CTG provides reassurance, it can also induce anxiety or a perceived loss of autonomy [26, 28]. Emerging technologies—such as wireless CTG, artificial intelligence, and automated interpretation—promise improved accuracy and comfort [29–30].

Risk assessment has become increasingly sophisticated. It has evolved from simple scoring systems (based on age, parity, comorbidities) to integrated models including biochemical and biophysical markers [31–32]. The FMF algorithm has proven effective in predicting preeclampsia, while NICE guidelines, though more simplified, remain widely used [33–34].

AI applications show promise, but most are still in the experimental phase [35]. In aneuploidy screening, combining nuchal translucency, serum markers, and cfDNA achieves an accuracy greater than 99% [36]. However, cost, infrastructure, and digital literacy remain significant barriers to implementation [37–38].

Challenges include inter-observer variability, limited access to testing, and geographical inequalities. Screening must be validated and adapted to real-world clinical practice [39], especially in complex cases (e.g., twin pregnancies, IVF, autoimmune disorders) [40].

Globally, there are significant disparities between high-income countries and resource-limited settings. WHO and FIGO advocate for scalable and equitable algorithms [41]. The future envisions the integration of multi-omic technologies and real-time monitoring for dynamic and adaptive prenatal care [42].

1.3 Outpatient and Home-Based Monitoring: Methods, Benefits, and Innovations

Out-of-hospital fetal monitoring has become a key component of modern prenatal care, particularly following the COVID-19 pandemic and advancements in digital health technologies [43]. Portable Doppler devices and increased awareness of fetal movements have encouraged active involvement of pregnant women [44–46].

mHealth solutions and telemonitoring systems (e.g., home-based CTG, wearable sensors) enable surveillance of high-risk pregnancies and help reduce unnecessary clinical visits [47–50]. These tools are commonly used in multiple pregnancies and in settings with limited access to healthcare services.

Mobile applications vary in quality, and only a portion are clinically validated [43]. Programs featuring real-time interaction and alert systems show the best outcomes in reducing anxiety and improving adherence to monitoring protocols [43].

2. Ethical, clinical, and psychological implications

2.1 Professional Supervision and the Limits of Home Monitoring

Home monitoring technologies should be used as a supplement, not a substitute for clinical obstetric assessment [54]. Data obtained from Doppler devices or questionnaires cannot replace comprehensive clinical evaluations (e.g., ultrasound, amniotic fluid assessment, fetal biometry) [55].

Studies show that unguided use may induce anxiety or lead to dangerous delays in seeking medical care [56]. Cases from the UK have highlighted the incorrect use of Doppler devices by pregnant women, where the presence of fetal heart sounds was mistakenly interpreted as an indicator of safety [57].

Guidelines from RCOG, SMFM, and WHO emphasize that outpatient monitoring must be integrated into a coordinated care plan to prevent inequities and protect vulnerable pregnant women [1, 58, 59].

2.2 Psychological Aspects of Prenatal Surveillance

Fetal monitoring has a profound impact on the pregnant woman’s emotional state.

Ultrasound and Doppler examinations can strengthen maternal-fetal attachment and foster a sense of safety [60], but may also heighten anxiety in high-risk pregnancies or when misinterpreted [61–62].

Women with a history of pregnancy loss are at increased risk for anxiety during monitoring [63]. Empathetic communication, counseling, and involvement in decision-making are essential to reducing distress [64].

Increased monitoring in complicated pregnancies can lead to psychological fatigue and a perception of over-medicalization. Integrating mental health screening and applying trauma-informed care principles are recommended [65].

Cultural differences and past experiences shape how monitoring is perceived. It is crucial for care to be personalized and respectful of the pregnant woman's values [66].

II. PERSONAL CONTRIBUTIONS

3. Working Hypothesis and General Objectives

The working hypothesis of this research is based on the premise that simple, non-invasive, and accessible methods of outpatient fetal monitoring—such as portable hand Doppler and pulse oximetry—can be integrated into routine prenatal care. These technologies have the potential to contribute to the early detection of pathological changes in fetal condition, even in pregnancies that appear to be low-risk.

The hypothesis is supported by the fact that many obstetric complications can occur unpredictably, and therefore providing pregnant women with access to home monitoring tools could enable more timely medical intervention when needed. Furthermore, the ease of use and accessibility of these devices raise important questions regarding their validation and standardization for use outside clinical settings.

This study aims to evaluate pregnant women's perception of these technologies, depending on gestational trimester and maternal age, as well as to analyze the emotional impact of their use, with a focus on maternal anxiety and perceived psychological comfort. A distinct objective is to determine the gestational age from which fetal heartbeats can be consistently detected using a portable Doppler—an important element for formulating potential clinical recommendations.

The general objective of the thesis is to investigate the potential of outpatient fetal monitoring in facilitating early identification of fetal distress and in encouraging proactive healthcare-seeking behavior. In parallel, the study examines the value of standardized questionnaires as tools for exploring the pregnant woman's subjective experience, perception of utility, and associated psychological impact.

4. General Research Methodology

This research was designed as an analytical observational study, conducted between January 1, 2019, and December 31, 2023, at the "Polizu" Clinical Hospital in Bucharest—a level III facility affiliated with the "Alessandrescu-Rusescu" National Institute for Mother and Child Health. The study protocol was approved by the institutional ethics committee (approval no. 26084), and participation required informed consent.

Included in the study were pregnant women with confirmed intrauterine pregnancies, regardless of gestational trimester, who agreed to complete standardized questionnaires (Annexes 2–4). Ectopic pregnancies were excluded. The evaluation was performed exclusively during outpatient prenatal consultations at the hospital.

Fetal heart rate was recorded using two models of portable Doppler devices with 2 MHz probes (Sonoline C and VComin FD200D), while maternal pulse was measured with a digital pulse oximeter (iMDK C101A2). Participants then completed a questionnaire that included demographic and clinical data (age, height, weight, BMI, preexisting conditions), obstetric history (births, miscarriages, last menstrual period), and personal perceptions regarding the tested devices.

Data were compiled in a Microsoft Excel file and statistically analyzed using IBM SPSS Statistics v.29.0. The analyses included: descriptive statistics for continuous and categorical variables, independent samples t-test, ANOVA with Bonferroni post-hoc test, and Pearson correlation coefficient. The threshold for statistical significance was set at $p < 0.05$.

5. Non-Invasive Monitoring Solutions in the First Trimester of Pregnancy

5.1.Introduction

The first part of the research focused on pregnant women in the first trimester, aiming to evaluate the perceived usefulness of portable hand Doppler devices for monitoring fetal heart rate, as well as to explore possible associations between maternal anxiety levels and attitudes toward home-based fetal monitoring.

The working hypothesis of this sub-study was that first-trimester pregnant women using hand Doppler devices may perceive these tools as offering reassurance and emotional support, especially in the context of heightened anxiety. It was also hypothesized that the level of maternal anxiety might influence both the interpretation and emotional impact of the home monitoring experience.

The specific objectives of this study were:

• To identify the main reasons for using such a device and the subjective benefits reported by users;

• To assess the gestational age at which fetal heartbeats were successfully detected for the first time using the hand Doppler device.

5.2. Patients and Methods

This sub-study was conducted on a group of 100 pregnant women in their first trimester, recruited at the “Polizu” Clinical Hospital in Bucharest between January 2019 and December 2023. A total of 2,130 patients met the inclusion criteria, which required a confirmed intrauterine pregnancy in the first trimester, absence of major psychiatric disorders, and the ability to provide informed consent.

Out of the 130 eligible participants, 100 women completed the questionnaire on the use of portable hand Doppler devices for fetal heart rate monitoring. This structured questionnaire collected data on the gestational age at which fetal heart sounds were initially detected using the Doppler device, as well as subjective opinions regarding its usefulness in the home setting. Participants were allowed to select one or more reasons they found the device beneficial, including personal reassurance, history of pregnancy loss, or increased involvement of the partner or family.

All data were collected anonymously and stored in a secure database. Participants gave informed consent prior to inclusion, and the study was approved by the ethics committee of the “Alessandrescu-Rusescu” National Institute for Mother and Child Health. Statistical analysis was performed using IBM SPSS Statistics for Windows, version 29.0.

5.3.Results

Descriptive analysis was conducted on a cohort of 100 pregnant women in the first trimester. The average age of participants was 29.5 years, with a standard deviation of ±6.08 years. The youngest participant was 15 years old, while the oldest was 44, reflecting considerable age variability among women who chose to use the hand Doppler device for fetal monitoring.

Regarding anthropometric parameters, the average height was 1.66 m (±0.06 m), ranging from 1.50 m to 1.82 m. The mean weight was 75.03 kg, with a dispersion of ±11.6 kg, ranging between 38 kg and 104 kg. These values allowed for the calculation of the body mass index (BMI), which had a mean value of 27.19 kg/m², placing most participants in the overweight category according to WHO classification. BMI ranged from 15.22 kg/m² to 38.28 kg/m², with a standard deviation of 3.71.

From a medical history perspective, only 4% of participants reported preexisting conditions, while 96% indicated none, which is relevant for assessing the influence of anxiety or attitudes toward monitoring in otherwise uncomplicated pregnancies.

The average gestational age at the time of questionnaire completion was 9.88 weeks, ranging from 5 to 13 weeks, with a standard deviation of 2.08 weeks. This is important for interpreting the effectiveness of fetal heartbeat detection, as Doppler device utility is directly influenced by gestational age.

Parity analysis revealed an average of 0.49 births, indicating that most women were primiparous. The maximum number of births was 4. The average number of miscarriages was 0.83 (range: 0–4), while the average number of total pregnancies (gravidity) was 1.32, reflecting a moderate obstetric history.

A central focus of the study was the detection of fetal heartbeats (FHR) using the hand Doppler device in the first trimester. Fetal heartbeat was successfully detected by 67% of the women, while 33% were unsuccessful. This detection rate is significant, considering physiological limitations such as fetal size and echogenicity in early pregnancy.

Regarding the perceived usefulness of the Doppler device, most women reported that its use provided emotional reassurance, indicating an added emotional benefit. Specifically, 67% of participants said the device gave them psychological comfort, 20% noted increased involvement from their partner or family, and 12% had a history of miscarriage, suggesting a connection between prior obstetric experiences and the need for reassurance. Approximately 30% of women did not find the device useful, which may reflect technical difficulties or a lack of perceived benefit.

Correlation analysis offered further insight into variables potentially influencing perceived utility or maternal and fetal biometric parameters. A statistically significant positive correlation was found between maternal age and BMI ($r = 0.292$; $p = 0.003$), though the strength was low. The relationship between age and total number of pregnancies was moderate and significant ($r = 0.475$; $p < 0.001$), as was that between age and number of births ($r = 0.413$; $p < 0.001$), confirming a cumulative reproductive profile with advancing age.

Other variables did not show significant associations. No statistically significant correlation was found between maternal age and fetal or maternal pulse, nor between gestational age and these parameters. There was also no significant relationship between maternal age and fetal heart rate. Although women who failed to detect FHR had a slightly higher average BMI (27.84 vs. 26.87), this difference was not statistically significant ($p = 0.223$). However, a significant correlation was observed between BMI and maternal pulse ($r = 0.224$; $p = 0.025$), suggesting that a higher BMI is associated with increased maternal heart rate.

In terms of perceived usefulness, no significant differences were found based on maternal age ($p = 0.420$), number of pregnancies ($p = 0.834$), miscarriages ($p = 0.523$), or births ($p = 0.696$). However, a significant relationship was identified between gestational age and perceived utility: women in more advanced weeks (mean of 10.46 weeks) considered the device more reassuring than those in earlier pregnancy stages (mean of 8.67 weeks), as confirmed by ANOVA ($F = 6.132$; $p = 0.001$). This can be explained by the increased likelihood of successful FHR detection later in the first trimester, which subjectively validates the device's effectiveness and safety.

No significant relationship was found between fetal heart rate and maternal pulse ($r = 0.035$; $p = 0.576$), and although BMI showed a weak negative trend with fetal heart rate ($r = -0.235$), it was not statistically significant ($p = 0.056$). These findings support the idea that fetal signal detection is not directly influenced by physiological variations in maternal heart rate or body weight alone, but rather by a combination of technical, biological, and psychological factors.

In conclusion, the results highlight that the hand Doppler device is perceived as useful primarily by pregnant women in later weeks of the first trimester, especially those seeking emotional reassurance, regardless of age, parity, or obstetric history. Significant correlations between maternal age and reproductive characteristics (pregnancies and births) validate the biological profile but do not directly influence perceptions of technological utility. Thus, non-invasive fetal monitoring at home remains an emotionally beneficial intervention, with more clearly defined subjective benefits as pregnancy progresses.

5.4.Discussion

Participant profiles varied widely in age (15–44 years) and BMI, allowing the results to be extrapolated to a heterogeneous maternal population. Most women were clinically healthy, and the average gestational age at evaluation was 9.88 weeks. Fetal heartbeats were detectable in 67% of cases using the hand Doppler, with no significant correlation to gestational age, though perceived usefulness was greater in more advanced pregnancies.

The device was appreciated mainly for its calming effect and ability to promote family involvement, with no significant influence from maternal age, parity, or obstetric history. No correlations were identified between fetal and maternal pulse, though a significant relationship was found between BMI and maternal pulse. While BMI was not significantly associated with successful detection of FHR, it may influence detection capabilities, warranting further research.

5.5.Conclusions

The hand Doppler device proved feasible for use in the first trimester, with successful fetal heartbeat detection in two-thirds of cases, including as early as 5 weeks gestation. Perception of utility was determined by gestational stage rather than demographic or obstetric characteristics. The correlation between BMI and maternal heart rate supports the influence of body weight on cardiovascular function. These findings support the integration of home-based monitoring into early prenatal care, tailored to the pregnant woman's psycho-emotional profile.

6. Non-Invasive Monitoring Solutions in the Second Trimester of Pregnancy

6.1.Introduction

This stage of the research focused on pregnant women in their second trimester, aiming to assess perceptions regarding the usefulness of hand Doppler devices for outpatient fetal heart rate monitoring. It was hypothesized that the use of such devices, together with the perception of active fetal movements, may help reduce maternal anxiety and enhance the sense of control over the pregnancy. The potential of these devices to promote family involvement in prenatal monitoring was also explored. Additionally, the study aimed to identify maternal characteristics that could influence the effectiveness of home-based monitoring methods.

6.2 Patients and Methods

The sub-study included 101 pregnant women in the second trimester, selected from 1,127 who met the inclusion criteria between 2019 and 2023 at the "Polizu" Clinical Hospital. All participants had pregnancies between 14 and 27 weeks and 6 days, no major psychiatric disorders, and the ability to provide informed consent. They completed a questionnaire assessing hand Doppler usage and its perceived usefulness in the home setting, also considering subjectively perceived fetal signals (such as fetal movements). Reported motivations included the need for emotional reassurance, past negative obstetric experiences, and increased family involvement. The study was conducted in accordance with ethical standards, and statistical analysis was performed using SPSS v29.

6.3 Results

The study included 101 pregnant women in the second trimester, whose demographic, anthropometric, clinical characteristics, and perceptions related to fetal monitoring at home were analyzed.

The average age of participants was 30.82 years, ranging from 16 to 47 years. The average height was 1.67 meters, and the mean weight was 80.61 kg. The average body mass index (BMI) was 28.79 kg/m^2, with values ranging from 19.29 to 40.03. A total of 10.9% of participants reported preexisting medical conditions.

From an obstetric perspective, the average number of births was 0.50, and the average number of miscarriages was 0.92. The mean number of pregnancies was 1.43. The average gestational age at the time of evaluation was 21.60 weeks, and nearly one-third (31.7%) reported issues in the current pregnancy.

About 73.3% of women stated they had perceived active fetal movements (AFM), with a mean gestational age of 17.70 weeks at the time of first perception.

Hand Doppler monitoring allowed fetal heart rate (FHR) detection in 92.1% of cases, with a mean heart rate of 146.78 bpm. The mean maternal pulse was 81.88 bpm.

Most women (79.2%) considered the tested device useful. Among them, 76.2% stated it provided emotional reassurance, 22.8% noted increased involvement of the partner or family, and 3% reported previous miscarriages.

Correlation analysis revealed a statistically significant positive relationship between maternal age and BMI ($r = 0.305$), number of pregnancies ($r = 0.372$), and number of births (r = 0.242). Women with preexisting conditions had significantly higher maternal age and BMI than those without such conditions. Additionally, women with complications in the current pregnancy tended to be older.

A significant relationship was found between BMI and the ability to detect FHR: women with higher BMI had a lower probability of detecting fetal heart sounds. Regarding perceived usefulness, women who found the device helpful had, on average, fewer previous births than those who did not.

No statistically significant correlations were identified between FHR and maternal age, maternal pulse, BMI, or gestational age. Also, no significant differences were found between perceived device usefulness and variables such as maternal age, number of miscarriages, or number of pregnancies.

These results support the notion that home-based fetal monitoring is positively perceived by most pregnant women, and that certain demographic and clinical features may influence both the perception of usefulness and the technical efficiency of the devices used.

6.4 Discussion

Data collected from second-trimester pregnant women reveal a diverse demographic profile, with an average age of around 31 years and a tendency toward overweight status, reflected by a mean BMI close to 29. Most participants had no chronic illnesses, but the presence of preexisting conditions was associated with higher maternal age and BMI. Active fetal movement was most frequently reported around 18 weeks, and fetal heart sounds were detectable in over 90% of cases, confirming the outpatient applicability of the device.

Notably, nearly 80% of women found the hand Doppler device useful, mainly attributing to it a role in reducing anxiety. Perceived usefulness was not influenced by age, gestational age, number of miscarriages, or BMI, suggesting broad applicability regardless of individual obstetric profiles. However, an inverse relationship was observed between the number of births and positive perception of usefulness, which may reflect a greater need for reassurance among first-time mothers.

Overall, the data suggest that portable fetal monitoring is well accepted and perceived as beneficial, especially by primiparous women or those with a perceived high-risk pregnancy, offering significant emotional support during the prenatal period.

6.5 Conclusions

Second-trimester pregnant women had an average age of 30.82 years, with a wide distribution reflecting the diversity of the obstetric population. Anthropometric data indicated a trend toward overweight status, and the presence of preexisting conditions was associated with a more unbalanced somatic profile and higher maternal age. The mean gestational age was 21.60 weeks, while active fetal movements were commonly perceived around 17.7 weeks. Fetal heartbeats were detected in the vast majority of cases, with an average rate of 146.78 bpm, and the average maternal pulse was 81.88 bpm.

The device was perceived as useful by nearly four out of five women, mainly for its calming effect. This perception was not influenced by age, maternal pulse, BMI, or obstetric history related to miscarriages. However, first-time mothers were more likely to find the device helpful, suggesting a stronger need for reassurance and emotional support. In conclusion, the use of portable hand Doppler devices is well accepted and may represent a simple, effective, and accessible intervention for reducing pregnancy-related anxiety—particularly among women with no previous obstetric experience or with perceived increased risk.

7. Non-Invasive Monitoring Solutions in the Third Trimester of Pregnancy

7.1 Introduction

This stage of the research aimed to analyze the perception of pregnant women in the third trimester regarding the usefulness of the portable hand Doppler for out-of-clinic fetal heart rate monitoring. The impact of this method on maternal emotional safety and family involvement during the final stage of pregnancy was assessed. The working hypothesis was that autonomous monitoring may be perceived as a means of psychological reassurance and enhanced maternal control over fetal well-being, while also fostering partner involvement.

7.2 Patients and Methods

The study was conducted between January 2019 and December 2023 at the "Polizu" Clinical Hospital in Bucharest on a sample of 103 pregnant women at 28 weeks of gestation or more, who completed a standardized questionnaire. Out of 2,341 eligible women, only those who provided informed consent and had no major psychiatric disorders were included. The questionnaire explored motivations for using the device, such as negative obstetric history, the need for safety, or the desire for family involvement. Data were collected anonymously, processed using SPSS v29.0, and analyzed according to approved ethical standards.

7.3 Results

The average age of the participants was approximately 29 years, ranging from 16 to 42 years. The mean height was 1.67 m, and the average weight was 82 kg. The average BMI was 29.25 kg/m². Around 19% of the women had preexisting conditions, and the mean gestational age was 34 weeks. Most women were primiparous (mean = 0.51 births), with an average of 0.74 miscarriages and 1.25 pregnancies. A total of 96% reported perceiving active fetal movements, typically around 18 weeks of gestation.

Fetal heart rate (FHR) detection using the Doppler device was possible in 97% of cases, with a mean FHR of 142 bpm. The average maternal pulse was approximately 92 bpm. About 76.9% of participants considered the device useful, most stating it provided reassurance. Other responses highlighted increased family involvement or negative obstetric histories (miscarriages, stillbirth).

Statistical analyses revealed significant correlations between maternal age and the number of pregnancies and births, as well as between BMI and maternal pulse. Additionally, older women were more likely to have preexisting conditions and complications in the current pregnancy. No significant relationships were found between maternal age and FHR, BMI and perception of fetal movements, or between preexisting conditions and the number of miscarriages.

Perceived usefulness of the device was higher among women with fewer pregnancies, births, and miscarriages. No significant differences were found based on age or gestational age at the time of device use. However, a significant correlation was observed between maternal pulse and fetal pulse.

7.4 Discussion

Third-trimester pregnant women showed high receptivity to the use of the hand Doppler, perceiving it as useful particularly for its psychological reassurance and the sense of control it provides over the pregnancy. Positive perception was more frequent among first-time mothers without a history of loss, reflecting a heightened need for reassurance. The correlation between maternal and fetal pulse suggests that the device may be sensitive to the mother's overall physiological state. Reports of increased family involvement by some women highlight the psychosocial benefits of the technology. Although some correlations were not statistically significant, the findings support the device's value in patient-centered outpatient monitoring.

7.5 Conclusions

The hand Doppler was considered useful by the majority of participants, especially for its emotional support. Women with less obstetric experience more clearly perceived its benefits. No significant relationships were found between gestational age and physiological parameters, but the correlation between maternal and fetal pulse suggests an important physiological link. Partner involvement and the comfort provided by self-monitoring support the integration of this technology into outpatient prenatal care.

8. Conclusions and Personal Contributions

Part I – Conclusions

This study demonstrated the feasibility and positive impact of using a hand Doppler device for self-monitoring during pregnancy across all three trimesters. The device was perceived as useful by over 70% of participants, contributing to psychological reassurance and partner involvement. Relevant correlations were observed between maternal characteristics (age, BMI, parity) and the perception of the device, as well as significant physiological variations across trimesters in maternal pulse, fetal heart rate, and BMI. The hand Doppler offers advantages in terms of accessibility, safety, and emotional support, but requires standardization and integration into clinical protocols. Future research directions include comparisons with other monitoring methods, long-term psycho-emotional evaluation, and optimization of patient training.

Part II – Personal Contributions

An original methodology was designed, structured by trimester, involving the application of a standardized questionnaire. Data from 308 respondents were analyzed, highlighting relevant correlations and physiological variations useful for personalized care. The study is practical, replicable, and provides trimester-specific recommendations. The entire approach was centered on the pregnant woman's experience, promoting the responsible and effective use of technology in outpatient pregnancy monitoring.

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LIST OF PUBLISHED SCIENTIFIC PAPERS

1. Piron-Dumitrașcu M., Crețoiu D., Suciu. N., *The Integral Role of Pregnant Women in Pregnancy Monitoring: Empowering Maternal Health Through Active Engagement,* Journal of Mind and Medical Sciences, 2025,12(2), 1-12, FI-1.6/2023, Q2, Capitolul 5, pag.33-55
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