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# Pyschological traumatic perinatal experiences during the Covid-19 pandemic, epigenetic hypothesis and protective suggestions

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**Abstract**
Whether Covid-19 will continue with different viral mutations it will last is not yet known. For this reason, correct management of the process becomes important in order to ensure that future generations are least affected by this experience. This literature review aims to discuss hypotheses for the epigenetic effect of perinatal experiences affecting mental health during the Covid-19 pandemic and protective intervention recommendations. A comprehensive understanding of epigenetic mechanisms can allow early risk detection and directed prevention and intervention strategies. There is a need for epigenetic studies that monitor the short- and long-term effects in women/infants going through the perinatal period during the Covid-19 pandemic. Epigenetic studies are costly and take a long time. At this time where the pandemic is still ongoing, it is predicted that the negative effects will be reduced by predicting epigenetic effects and taking protective approaches in line with the results obtained from previous studies. These will be possible with the collective work of multidisciplinary team members. Mental health care professionals should receive training on epigenetics in the perinatal period and should be able to integrate it into counseling processes.

**Keywords** Epigenetic hypothesis · Traumatic perinatal experience · Mental health nursing · Midwifery · Covid-19

## Introduction

The Covid-19 pandemic, which affected the whole world, has influenced individuals in a bio-psycho-social dimension. Countries have initiated several new practices in order to prevent the spread of the virus and to control the number of cases. With governments enforcing restrictions on travel, closing schools and workplaces, encouraging people to stay at home, and limiting social gatherings, families with young children face a series of multi-faceted and unanticipated challenges. The measures taken caused changes in the lifestyles of individuals, and they experienced difficulties in maintaining their physical, psychological, social, spiritual, and economic well-being (Otanga et al., 2022; Coppola et al., 2021; Amable, 2022).

In fact, many individuals mourned the loss of their old lifestyles and had difficulties adapting to new ones they did not prefer. Although the changing lifestyle affects all individuals, it has created more risks for persons in vulnerable and disadvantaged groups. Due to the nature of perinatal processes, women and directly/indirectly the fetus/newborn are in the vulnerable and disadvantaged group due to physical and psychological changes (Dashraath et al., 2020). In a study, it was determined that women who went through perinatal processes during the pandemic felt themselves in the vulnerable group, perceived themselves as a high-risk group, and were concerned that the virus would affect their own and their infant's health and perinatal experiences (Yassa, Birol et al., 2020; Thapa et al., 2020).

It is known that psychological deviations such as stress, depression, anxiety, and trauma increase during perinatal periods (Saccone et al., 2020; Brooks, Webster et al., 2020,

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Brooks, Weston et al., 2020). Although the evidence for the effect of the Covid-19 pandemic on maternal mental health and well-being is still limited, it is known that women in the perinatal period have significantly higher mental health problems compared to the general population, especially under additional stressors such as past natural disasters, and these problems can even lead to epigenetic changes (Cao-Lei et al., 2014).

The evidence-based research on the impact of the Covid-19 pandemic on maternal mental health and well-being has increased (Hessami et al., 2022; Bridle et al., 2022). Research has begun on the effects of the experiences in the Covid-19 pandemic on the epigenome, even longitudinal follow-up data on its effects on the maternal-infant epigenome have been published. Exposure to the Covid-19 pandemic has been determined to have high methylation levels of NR3C1 and SLC6A4 stress-related genes in the mother and infant in late pregnancy. In particular, high methylation in the NR3C1 gene has been associated with poor neurodevelopmental outcomes. Similarly, its methylation in the SCL6A4 gene has been associated with socio-emotional retardation and deficiencies in the stress regulation mechanism (Nazzari et al., 2022). There is a need for epigenetic studies that monitor the short and long-term effects in women/infants going through the perinatal period during the Covid-19 pandemic. Epigenetic studies are costly and take a long time. At this time where the pandemic is still ongoing, it is predicted that the negative effects will be reduced by predicting epigenetic effects on new generations and transmissions between generations and taking protective approaches in line with the results obtained from previous studies and new research. In this literature review, hypotheses for the epigenetic effect of perinatal experiences affecting mental health during the Covid-19 pandemic and protective and preventive intervention recommendations are discussed. It is thought that these hypotheses may also be an idea for future research.

It is aimed to (1) differences in perinatal experiences, (2) effects of differences in perinatal experiences on maternal mental health, (3) epigenetic changes effects of early life factors that may occur in disasters, and (4) hypotheses and recommendations for preventing/reducing perinatal mental health and epigenetic effects during the Covid-19 pandemic.

## Method

The study focused on the epigenetic impact of perinatal psychological traumatic experiences, especially during the Covid-19 pandemic period, and searched the databases of "Google Scholar, PubMed, EBSCO, and PsycInfo" using the keywords "Covid 19, perinatal mental health, epigenetic, psychological trauma, stress, hypothesis". In this article, it was aimed to develop some possible hypotheses, identify risk factors, and suggest protective approaches to reduce epigenetic exposure to them, based on epigenetic changes that occurred in past disaster situations, due to the very limited results of epigenetic research. Due to the lack of data on the epigenetic results of perinatal traumatic experiences during the Covid 19 process, an unsystematic literature review was conducted.

## Differentiating perinatal experiences during the Covid-19 pandemic

The pandemic has differentiated women's experiences during perinatal processes and made it difficult for them to maintain their physical and psychological well-being. With the start of the pandemic, country administrators took measures to prevent the number of cases that would strain the health system. Particularly, individuals with advanced age, chronic disease, and women in the perinatal period were determined to be at risk. Although the perinatal period is one of the natural life stages of women, it directly affects the health of the fetus/newborn, family, and community. For this reason, women in the perinatal period have been kept at the forefront of the health agenda as various difficulties and worries arose, and more measures have been taken (Karavadra et al., 2020). Although the measures taken were protective, they caused deviations from normal "healthy" life experiences and even undesirable risks.

Home isolation, which has been emphasized the most as part of preventive measures, has caused an increase in the number of unplanned/unwanted pregnancies and it is known that unwanted pregnancies increase perinatal stress and mental health problems (Kumar, 2020). The meta-analysis provides evidence that the Covid-19 pandemic significantly increases the risk of anxiety among women during pregnancy and the perinatal period (Hessami et al., 2022). The pandemic caused this stress to be experienced at a higher level. Accordingly, an increase in pregnancy termination rates has been reported (Juan et al., 2020). There have been changes in the normal lifestyles of women with home isolation and these have created risks during the perinatal period. A systematic review of 16 studies from 9 countries found that home isolation adversely affects perinatal mental health (Wall & Dempsey, 2023).

The ratio of fat and carbohydrates increased in diet due to the increase in time spent at home (Zhang et al., 2020). It has been determined that nutrition management becomes more difficult in risky groups such as gestational diabetes in home quarantine, and maternal/fetal negative outcomes increase especially after the second trimester (Cai et al., 2023). Due to the restrictions, physical mobility was

limited, and subsequently, posture and musculoskeletal disorders increased, and weight gain became a problem (Atkinson et al., 2020). In this respect, restrictions during the pandemic period caused more physical symptoms or deviations in perinatal processes and decreased the quality of life of women (James et al., 2020; Zeng et al., 2020). During home isolation, there were also changes in sleep patterns and increased insomnia rates (Alan et al., 2020; Zeng et al., 2020).

Social/physical distance, social isolation or lockdown, or another measure taken, resulted in women in the perinatal period not benefiting from social support resources effectively, and consequently, they had difficulties in maintaining their psychological well-being. Women in the perinatal period apply to health institutions more frequently due to follow-up. However, during the pandemic, women preferred not to go to routine follow-ups due to the concern of infection, and for this reason, they had to experience risky situations in terms of mother and infant health (Güner & Öztürk, 2022). In particular, women and infants who need to be monitored closely due to risky pregnancy and women who needed to change their drug doses and their infants were exposed to more complications due to lack of effective monitoring, and an increase in pregnancy complications, preterm labor, and even maternal and neonatal deaths have been reported (Zaigham & Andersson, 2020; Ronnje et al., 2020). In order to reduce the number of individuals in hospital waiting rooms, an appointment system was introduced.

In this period, women did not benefit from health services equally. Some women could not go to perinatal follow-up because they could not get an appointment and some women did not have the transportation means that would provide isolation. While receiving services from health institutions, women were worried about the transmission of the virus from healthcare workers with a high risk of infection or from common hospital equipment (Güner & Öztürk, 2022). In addition, the limitation of visitors and companions as part of the rules determined by hospitals within the scope of isolation measures resulted in women not benefiting from social support resources. This has been a serious stressor for pregnant women on absolute bed rest during their pregnancy and women who are in the postpartum period and have difficulty in self-care. In particular, women with other children and no safe place or someone to leave the children while staying in the hospital ended up not receiving health services and taking risks (Sarwer et al., 2020). For these reasons, women could not effectively access or benefit from prenatal services during the Covid-19 pandemic (Onwuzurike et al., 2020).

Within the scope of hygiene measures as part of pandemic measures, there was an increase in the amount and frequency of disinfectant and chemical product use, which are recommended to be limited due to health hazards, especially during pregnancy, and pregnant women were frequently exposed to these chemicals via skin absorption or as aerosol (Rai et al., 2020). In addition, suggestions made within the scope of hygiene measures have caused the development of anxious and repetitive obsessive behaviors in some individuals (Yassa, Yassa et al., 2020. More sterilization applications were carried out in hospitals to prevent viral transmission. In line with the changing protocols, all surfaces were cleaned with more intense and effective disinfectants, sprays were used for air disinfection, and rooms were converted to negative pressure in units with high risk. Accordingly, protocols were also applied in maternity units, and it was thought that these prevented the passage of the protective natural microbiota that occurs during birth.

In the postpartum period, skin-to-skin contact between infants and their mothers was not allowed or kept within the recommended period. In particular, infants of mothers with suspected Covid-19 were separated from their mothers and isolated in incubators in intensive care units. Abandoning vaginal birth, skin-to-skin contact, and breastfeeding, which play an important role in the formation of a healthy microbiota after birth, it was thought that it could adversely affect the future microbiota and immune system of the infant and these will lead to epigenetic changes. Future research on this is needed.

There have also been changes in the experiences of maternal health services during the pandemic (Choi et al., 2020; Onwuzurike et al., 2020; Matvienko-Sikar et al., 2020). Although every pregnant woman was admitted to the clinic after body temperature checks, they were accepted as suspected Covid-19 cases, and although the ICM called for the protection of women's rights at birth, pregnant women were not provided with continuous supportive care due to contact isolation and partners who could support the women were not admitted to the clinic. In addition to the negative pregnancy experience women had with the concern that they and their infant would be harmed due to the pandemic, they were also left alone during labor and were very afraid of experiencing the possibilities such as not being able to make their voices heard, giving birth alone, experiencing more pain than expected, falling, etc.

There are not enough studies yet, the consensus is that Covid-19 infection does not require obstetric intervention at birth; however, clinical observations reveal that more interventions occur in births during the pandemic and even the rate of cesarean section increases (Juan et al., 2020). The mother and the infant experienced difficulties in feeding, mobilization and self-care needs due to the separation of the mother and the infant in the postnatal period, the inability to receive social support in hospitals, the low number of healthcare personnel and their inability to support them due

to social distance measures. Many women demanded early discharge, declaring that they assumed responsibility for all risks. In all perinatal processes, women could not benefit from social support sources due to social isolation, and this had a negative effect on the family with respect to meeting physical and psychological care needs (Farewell et al., 2020).

## The effect of differentiating perinatal experiences on mental health during the Covid-19 pandemic

During the Covid-19 pandemic, women in the perinatal period and their infants have been affected emotionally and mentally due to many stressors and therefore they have been accepted as a vulnerable group (Brooks, Webster et al., 2020a, b; Hessami et al., 2022; Wall & Dempsey, 2023). Perinatal experiences are formative, require adaptation because of change, and are inherently stressful (Dahlen et al., 2016). However, exposure to additional stressors due to the pandemic has caused difficulties in maintaining perinatal mental well-being.

Due to the pandemic and preventive measures, women were worried about themselves and their unborn/newborn infant and had stressful perinatal experiences due to many undesirable factors such as quarantine, physical distance, isolation at home, meeting with healthcare professionals on different platforms (phone, online, etc.), not getting expected support and care, job loss/decreased income and financial difficulties (Thapa et al., 2020; Corbett et al., 2020; Panahi et al., 2020). In addition, the stress and anxiety levels of women and their families increased due to the risk of having a fetus with anomalies, miscarriage during the perinatal period, or the possibility of unexpected complications in the infant after birth due to insufficient information about the placental transmission and teratogenic effects of Covid-19 virus (Qiao, 2020; Yan et al., 2020; Schwartz et al., 2020; Penna et al., 2023). Results showed that women who were pregnant or had just given birth displayed various symptoms of poor mental health including those relating to depression (24.9%), anxiety (32.8%), stress (29.44%), Post Traumatic Stress Disorder (PTSD) (27.93%), and sleep disorders (24.38%) during the Covid-19 pandemic (Delanerolle et al., 2023). It has been determined that the stress experienced during pregnancy negatively affects maternal mental health outcomes after birth and even causes affective disorders in the first 6 months of the infant's life (Sacchi et al., 2023).

Women who went through their perinatal period during the Covid-19 pandemic had to adapt to the changing lifestyle and the new situations it brought about. Especially, social distancing/isolation measures affected perinatal mental health to a significant degree. Human-human interaction and attachment is our instinctive need. Social bonding helps us cope with stress and endure. Although technological applications were used in maintaining social relations during the pandemic, women could not benefit from face-to-face interaction and support (Bavel et al., 2020).

All these experiences actually led to disappointment because they were not included in the perinatal experience plans of women and caused difficulties, especially in maintaining psychological well-being. Studies have shown increased risk perception of the Covid-19 pandemic in women in the perinatal period and negative mental health outcomes due to changes in vital routines, disruption of prenatal care, inability to use social support resources, increased economic difficulties, increased domestic violence, and idea or experience of their relatives, children, and unborn infants getting sick (Moreno et al., 2020; Corbett et al., 2020; Yassa, Birol et al., 2020, (Moyer et al., 2020; Brooks et al., 2020a, b).

Measures taken to protect public health during a pandemic are inevitable, but the negative effects of these practices on mental health should not be ignored (Brooks, Webster et al., 2020; Brooks, Weston et al., 2020). It is known that maternal mental health has an impact on the health of mothers and children (Tol et al., 2020). However, in times of crisis such as a pandemic, new threats to women and infants in the perinatal period are not emphasized enough, especially mental health needs are delayed or ignored due to other urgent problems (Frey et al., 2019). Changes in maternal health services during the pandemic and lack of access to services and expected support also negatively affected mental health (Güner & Öztürk, 2022). As a result, it was determined that perinatal mental health problems such as stress, anxiety, depression, and post-traumatic stress symptoms increased during the Covid-19 pandemic (Saccone et al., 2020; Brooks, Webster et al., 2020; Brooks, Weston et al., 2020; Hessami et al., 2022; Farrell et al., 2020; Berthelot et al., 2020; Thapa et al., 2020). It has been determined that especially Covid-19 pandemic-related health worries and grief experiences exacerbate the symptoms (Liu et al., 2021).

## Hypotheses for the epigenetic effects of perinatal mental health outcomes in the Covid-19 pandemic

Early life troubles are associated with physical and mental health later in life, although the mechanism is not clear. Epigenetics is important to understand the course of the human life cycle and how resistance and susceptibility to disease develop. There is evidence showing that the stress experienced in the perinatal period such as exposure to life stress, dietary changes, and exposure to environmental toxic

substances has long-term consequences on the future well-being of both mother and infant, fetal endocrine programming and brain development is affected through altered epigenetic regulation, and increases the risk of neurological and psychiatric disorders in future generations (DeSocio, 2018). It is also suggested that altered epigenetic memory will affect the behavioral and mental health status of the next two to three generations. The term "epigenetics" refers to a series of chemical modifications to chromatin that regulates genomic transcription. Epigenetic modifications can be stable and passed on to future generations, but they can also be dynamic and change in response to environmental stimuli (Cao-Lei et al., 2020).

The Barker hypothesis, also known as the DOHaD hypothesis, suggests that the environment that a developing fetus is exposed to in the womb may program the health and disease of this child from birth to death (Barker, 2003). Extended Hygiene Hypothesis (EHH) and the Epigenetic Impact of Childbirth (EPIIC) hypothesis state that factors occurring in the intrapartum and early postnatal period may lead to fetal epigenomic remodeling abnormalities that have an effect on abnormal gene expression (Dahlen et al., 2016). In the EHH hypothesis, the use of antibiotics in the perinatal period, cesarean delivery, induction of birth, postpartum skin contact, and inability to maintain effective breastfeeding prevents the transition of gut microbiota from mother to infant, causing changes in DNA methylation, and this in turn leads to immune system defects. In the EPPIC hypothesis, it is suggested that moderate stress experienced at birth shapes the epigenetic structure normally, but undesirable epigenetic changes occur at very high stress or very low stress (Dahlen et al., 2016). It is known that exposure to stressors during the intrauterine period causes broad, functional, and lasting changes in DNA methylation, and this change affects the exposure-phenotype relationship and leads to immune, cardiovascular, and metabolic disorders (Cao-Lei et al., 2020).

There are many studies showing that stressful events in the perinatal period such as pandemics, earthquakes, or famines affect the physical and psychological health of the mother and infant in the short and long term. In line with the Dutch famine study and Project ice storm, it has been determined that physical stress experienced in the perinatal period increases the maternal psychological stress level and DNA methylation in different tissue models occurs in relation to this The Quebec ice storm study provided preliminary information on the causality link between perinatal stress, DNA methylation, and phenotypic changes (Cao-Lei et al., 2014). Increased NR3C1 exon 1 F DNA methylation was reported in leukocytes in the intrauterine cord blood taken from the fetuses of mothers who were exposed to stressful life events, anxiety, depression, post-traumatic stress disorder, and psychopathologies during the prenatal period, and this was also associated with increased saliva cortisol level in these infants after birth (Mulligan et al., 2012).

It is known that epigenetic changes occur after psychotraumatic experiences, there are placental DNA methylations in the FKPB5 gene, also known as the glucocorticoid gene, which is particularly associated with stress and plays an important role in the immune system, there are changes in the FKBP5 gene, this is related to the height of perceived maternal stress and decreased fetal attachment, and these changes are passed on to the next generation (Paquette et al., 2014). The Covid-19 pandemic has been a stressor for each individual and has led to different experiences for different people. Perinatal women in the vulnerable group experienced more mental health problems than at other times (Saccone et al., 2020; Brooks, Webster et al., 2020; Brooks, Weston et al., 2020; Hessami et al., 2022; Farrell et al., 2020; Berthelot et al., 2020; Thapa et al., 2020).

Although the Covid 19 pandemic did not create an acute destructive effect like a natural disaster, it caused individuals to be exposed to stressors for a long time. Especially in women who went through their perinatal period in a pandemic and their infants, it is thought that epigenetic changes will occur in a manner similar to other natural disasters, and these changes will be transmitted through intergenerational gene transfer and their long-term effects will continue. Applying protective approaches in line with the predictions will allow the well-being of the next generation to increase. In addition, further human studies examining the epigenetic changes of individuals who went through the perinatal period during the Covid-19 pandemic are needed.

## Hypotheses for the epigenetic effects of early life factors in the Covid-19 pandemic

It is known that the first 1000 days from fetal conception in human life are very important. Any perinatal complications experienced in these processes or situations deviating from the normal have long-term side effects and are defined as a lifelong health trajectory (Linner & Almgren, 2020). It is known that psychosocial stress, infection, nutrition and microbiome, and pollutant exposure are effective in the early period of life (Grova et al.,2019). It may be difficult to differentiate the short and long-term effects of these factors in perinatal processes with human studies because the individuals' previous exposures may be different. There is a well-established literature on the role of the overall trajectory from early life through to adulthood and it is known that stressful experiences in the early period of life trigger diseases related to the immune system (Khalatbari-Soltani et al., 2020).

Exposure to infection in the early period of life increases mortality and morbidity. It is known that infections in the early period of life have long-term effects on stress activities and cytokine production. It has been determined that the cytokine storm experienced in the early period of life affects long-term memory in the hippocampus (Figueiredo et al., 2021). It is known that the microbiome acquired in the birth canal in the early period of life has an immunostimulating potential, and it is confirmed by the more frequent presence of asthma or allergic diseases in infants born by cesarean section (Wampach et al., 2018; Keag et al., 2018).

Early stressful or traumatic events during the first 1,000 days, particularly during pregnancy, can leave signs on the epigenome of mothers and infants (Provenzi et al., 2016). It has been suggested that DNA methylations occurring in some regions, especially in the early days of life, interact with other epigenetic mechanisms and contribute to the emergence of increased or decreased transcriptional sensitivity (Nazzari et al., 2022). It is predicted that exposure to the Covid-19 pandemic in perinatal processes and/or the pandemic-compelling lifestyle changes may have an epigenetic effect on the phenotypes of the mother and fetus/infant, and the main reason for this is stress. Under normal circumstances, epigenetic studies in perinatal processes are rare. However, stressful events such as pandemics can be an opportunity to conduct epigenetic studies of stress in the perinatal period.

During the Covid-19 pandemic process, it is known that maternal-fetal stressors increase in perinatal processes for different reasons during perinatal processes (Penna et al., 2023). However, the effects of these exposures on long-term health outcomes or on the epigenome are unknown. As seen in The Ice Storm Project Disaster and The Hunger Winter in the Netherlands, the Covid-19 pandemic can also be regarded as a natural experiment that causes psycho-socio-economic changes and directly or indirectly affects individuals' well-being. Of course, it is not ethical to conduct experimental research that interferes with the nature of early life, but, if this natural experimental environment is transformed into opportunity and data is collected, it can be very valuable in the process of dealing with the long-term effects of the pandemic (Holuka et al., 2020).

## Recommendations for preventing/reducing perinatal mental health and epigenetic effects during the Covid-19 pandemic

With close monitoring, early diagnosis, and approaches in the perinatal period, the well-being of women and their infants can be increased and maintained. Since the fear, anxiety, stress, grief, and other psychological distress symptoms experienced by women can potentially increase during a pandemic; the symptoms should be closely monitored and evaluated (Choi et al., 2020). Integrative approaches are recommended to increase the compatible response to stressors in order to maintain the biopsychosocial well-being of women who go through their perinatal period during the pandemic (Ayers & Sawyer, 2019).

In the perinatal period, keeping a diary, understanding emotions and thoughts, awareness, and relaxation exercises are used as preventive practices in maintaining perinatal psychological well-being (Yan et al., 2022). It has been determined that pregnant women who exercise during the Covid-19 pandemic have lower rates of anxiety and depression (Lebel et al., 2020). Internet-based screening tools, virtual online consultations/counseling, and web-based psychological support and therapeutic interventions may have an important role in this regard (Thapa et al., 2020). In addition, yoga, mindfulness, and relaxation exercises can be practiced as self-care at home by pregnant women during the pandemic and improve their mental health and well-being (Shidhaye et al., 2020; Nadholta et al., 2020).

Recognizing the effects of the Covid-19 pandemic on birth and early parenting experiences, identifying women's mental, physical, emotional and social needs, and addressing these with appropriate approaches is important. During pregnancy, necessary precautions should be taken and professional support should be provided to women either face-to-face or via telehealth services. At birth, the birth plan determined by the family in line with their value judgments should be respected, the fear and anxiety associated with the Covid-19 pandemic should be evaluated, the family should be informed according to their needs and supportive care should be provided. Postnatal attachment is protective for perinatal well-being. Therefore, support and encouragement should be ensured in the breastfeeding process, the mother and infant should not be separated, skin-to-skin contact and kangaroo care, and the mother assuming maximum role in the infant's care should be ensured.

In addition, the woman should be closely monitored in terms of psychological symptoms and support resources (Choi et al., 2020). It is predicted that the proposed practices will allow for increasing and maintaining the psychological well-being of women who go through their perinatal period during a pandemic, thus reducing epigenetic effects (Thapa et al., 2020). It is predicted that there may be long-term effects, especially in women and infants whose perinatal period coincides with the Covid 19. Although there is very little research on the biological effects of deviations from normality in maternal and infant mental health, preliminary results show that there are DNA methylations in women and infants who experience pandemic-related stress, especially during late pregnancy (Nazzari et al., 2022). For

this reason, it may be recommended to closely monitor the stress regulation mechanism, socio-emotional development, and neurodevelopmental outcomes of infants whose perinatal processes coincide with the pandemic and whose mothers experience intense stress. The limitation of this study is that it could not be conducted as a systematic review due to the lack of sufficient research on epigenetic changes of perinatal maternal stress in Covid 19. Therefore, there is a need for epigenetic studies evaluating the expression of different genes of perinatal stress in the pandemic.

## Conclusion

Whether the Covid-19 pandemic will continue with different viral mutations or how long it will last is not yet known. For this reason, correct management of the process becomes important in order to ensure that future generations are least affected by this experience. A comprehensive understanding of epigenetic mechanisms can allow early risk detection and directed prevention and intervention strategies. At this time where the pandemic is still ongoing, it is predicted that the negative effects will be reduced by predicting epigenetic effects and taking protective approaches in line with the results obtained from previous studies. Therefore, presenting evidence-based hypotheses and making protective recommendations until epigenetic research results emerge is very important for the well-being of current and future generations. Hypothetical articles are rarely encountered in the literature. For this reason, it is thought that the article will contribute to clinician health workers, academicians, researchers, educators, and health organization leaders. In health policies developed for the Covid-19 pandemic, increasing and sustaining perinatal well-being should be a priority in order to protect the health of future generations.

## Implications

### Future research

The Covid-19 pandemic has affected almost the whole world. The stress effect of the pandemic may be experienced differently in different societies or geographies, and therefore the epigenome effect may differ. Therefore, there is a need to compare the epigenetic effects of women and their infants who experienced perinatal processes during the pandemic in different countries. In addition, there is a need to investigate the epigenetic effects of the factors affecting nutrition and lifestyle during the pandemic. Finally, it may be suggested to future researchers to use the Online Photovoice method for qualitative, quantitative, or mixed method research in order to evaluate the hypotheses, especially in the time periods such as pandemics, when it is difficult to reach individuals, in qualitative research on mental health issues (Tanhan & Strack, 2020).

### Mental health professional and midwifery practice

There may be unpredictable stressors in the lives of individuals, and their effects can be seen in future generations due to epigenome changes. The Covid-19 pandemic has affected the whole world and caused intense stress. Following epigenetic effects and taking necessary precautions in the early period is very important in terms of protecting the health of future generations. These will be possible with the collective work of multidisciplinary team members including mental health professionals, midwives, and epigenetic professionals.

Mental health care midwives are competent in genetic counseling, similarly, they should receive training on epigenetics in the perinatal period and should be able to integrate it into counseling processes. During their epigenetic counseling, mental health care midwives can offer counseling to individuals, especially on the effects of stress on the epigenome, and the transfer of experiences to future generations. Mental health care midwives can offer counseling on protection from physical, psychological, and sociological stressors in the perinatal period. They evaluate the stress-coping systems of individuals in the perinatal period and can offer counseling on practices that increase and strengthen flexibility when needed. They evaluate the newborn in terms of lifelong mental health risk factors in the postnatal period. Especially in the early period of life, they plan and implement protective approaches such as providing skin-to-skin contact at birth, maintaining breastfeeding, increasing attachment and bonding, and increasing maternal well-being. In addition, it takes a role in the process of collecting the material and transmitting it to the laboratory in biology-based research that evaluates epigenetic influence. In addition, all healthcare professionals who care for perinatal processes should know and provide trauma-informed care at all times, but they should prioritize it when the stress level increases, such as pandemic.

It directs individuals in the risk group to mental health professionals. After the evaluation of mental health professionals, an appropriate treatment counseling process is applied. In addition, epigenetic studies can be initiated from individuals in the risk group. After the epigenetic examination, the multidisciplinary team plans the appropriate approaches and informs the individuals so that the gene change can be positive.

## Educators

Epigenetic effects of stressful life events and traumas experienced in the perinatal period and protective approaches in the prevention of this effect and trauma-informed care should be included in the undergraduate and graduate education program curricula of mental health professionals, midwives, and obstetricians. Similar training should be held at regular intervals after graduation and reminded or reinforced with in-clinic multidisciplinary case discussions. In addition, women and their families should be informed about stress and epigenetic effects in antenatal education classes and counseling.

## Organizations

Organizations should be aware of the impact of the stress during the perinatal period on the epigenome, and be aware of the impact of this impact on the health of the individual, family, society, and future generations. Organizations should make plans to ensure that the health services provided are protective against the effects of trauma, the results should be evaluated statistically, and it is recommended to develop laws and policies especially when the stress level rises unusually, such as a pandemic.

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