

# Challenges for Midwives' Healthcare Practice in the Next Decade: COVID-19 – Global Climate Changes – Aging and Pregnancy – Gestational Alcohol Abuse

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## Abstract

Midwives are multifaceted healthcare professionals whose competence spectrum includes a large variety of knowledge and skills going from antenatal care to education and research. The aim of this review is to suggest the future challenges midwives are going to face in the upcoming decade of this Century. COVID-19 and other infections will reasonably impact healthcare workers all over the world. Midwives are frontline healthcare professionals who are constantly at risk of contagion as their job implies close contact with women, physical support and hand touch. Also, menstruation waste plays a large role in the pollution of waters, severely impacting hygiene in the developing countries and fueling climate change. Appropriate disposal of used menstrual material is still insufficient in many countries of the world especially because of lack of sanitary education on girls. As educators, midwives will be more involved into preventing inappropriate disposal of menstrual hygiene devices by educating girls around the world about the *green* alternatives to the commercial ones. Despite the evidences about the fertility decrement that occurs with aging, women keep postponing reproduction and increasing their chance being childless or suffering complications related to the advanced maternal age. Teen pregnancies are as well an important issue for midwives who will be called to face more age-related issues and use a tailored case to case approach, enhancing their family planning skills. Another crucial role of midwifery regards the information about the risk of drinking alcohol during gestation. Alcohol assumption during pregnancy is responsible for serious damage to the fetus causing a wide range of pathological conditions related to Fetal Alcoholic Spectrum Disorder, leading cause of mental retardation in children of western countries. On the whole, midwives have demonstrated their willingness to expand their practice through continuing professional development, and through specialist and advanced roles especially in preventive and educational positions. *Clin Ter 2021; 172 (1):e30-36. doi: 10.7417/CT.2021.2277*

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## Midwives

Midwives are healthcare professionals who provide care to women during pregnancy, labour, and postpartum, as well as the newborn. Midwifery includes measures aimed at preventing health problems in pregnancy, the detection of abnormal conditions, the procurement of medical assistance when necessary, and the execution of emergency measures in the absence of medical help (1). Midwives are also involved in research, health education, promotion of healthy lifestyles and prevention of smoking, alcohol and drug abuse (2) (Fig. 1).

WHO entitled 2020 as the “International Year of the Nurse and Midwife” (3), acknowledging the importance of their roles for healthcare around the globe. Midwives healthcare activity over girls, women and new families is going to be more demanding in the future, especially considering the new challenges that will affect our World in the upcoming years. Infections, global warming, aged motherhood and alcohol drinking women are only a few of the issues that midwives are going to face in the next decade whose first signs are clearly visible nowadays.

In fact, 2020 is also the year of SARS-CoV-2 (4,5) causing the COVID-19 pandemic which is severely impacting all the healthcare workers both in their professional and private lives, often urging them to self-isolate themselves to protect their loved ones (6–8). All over the world several midwives died because of COVID-19 and several of them got infected while working. Midwives are frontline healthcare professionals who are constantly at risk of contagion. In fact, midwives' job implies close contact with women, physical support and hand touch, which was proved beneficial for pain relieve (9). Midwives' job has been highly impacted by COVID-19, as it implies social distancing, no touch and use of face masks and gloves. New protocols had to be studied by Governors and Healthcare Institutions to allow midwives continue supporting women while keeping themselves safe in such ever-changing context. We highly believe midwives

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Fig. 1. Roles of Midwives in stand-alone positions or in multidisciplinary teams

to be resilient and tireless healthcare professionals, capable to efficiently support women even in difficult circumstances but their job is going to be extremely modified by the new challenges that the World is going to face ahead.

The aim of this short review is to hypothesize what would be the future challenges for midwives' job in the upcoming decade of this Century.

### COVID-19

SARS-CoV-2, firstly isolated in Wuhan, Hubei Region, China at the end of 2019 (4,5) causes COVID-19 respiratory illness that predominantly affects the lungs. Based on current evidence, the COVID-19 virus is transmitted between people through droplets, fomites and close contact, with possible spread through feces and it is not airborne (10). SARS-CoV-2 refers to the viral causative agent responsible for SARS, also known as 2019 Wuhan novel coronavirus. The term SARS is the acronym for "Severe Acute Respiratory Syndrome" (11).

Although COVID-19's pandemic spread curves are showing a decreasing tendency in Europe (12), it is highly probable that humans will be living together with SARS-CoV-2 for some more time in the near future and midwives should be properly trained to deal with COVID-19 positive women and continue supporting them effectively.

Midwives should be aware that main COVID-19 signs and symptoms, such as fever, cough, sore throat, dyspnea might be mild during pregnancy and atypical symptoms like abdominal pain could be displayed (13). Midwives who works in emergency rooms, triage stations or first welcoming services should complete a fast pre-triage anamnesis for COVID-19, check body temperature, oxygen saturation and blood pressure (14). Use of disposable personal protection equipment (PPE), such as face masks and gloves, is highly recommended even with pre-triage negative patients to reduce the risk of contagion (15). The International Federation of Gynaecology and Obstetrics (FIGO) recently published a guidance on COVID-19 infection in pregnancy and puerperium (16). The contents of this guide refer to what is recommended by the main international health agencies that deal with SARS-CoV-2 epidemic in pregnancy. The document presents organizational and care modalities in the outpatient setting, in obstetric triage, during intrapartum care of women with confirmed or suspected COVID-19 infection and during assistance to the puerperium and the newborn.

### COVID-19 and Delivery

A review conducted on 13 articles and 37 pregnancies (17) showed that over the 37 women included, 29 underwent a caesarean section and 8 had a vaginal delivery.

According to the Royal College of Obstetrics and Gynaecology (RCOG), it is suggested for midwives to wear head-to-toe protections. The recommended PPE include face masks, disposable coats, gloves and protective glasses (18).

WHO and RCOG do not recommend elective caesarean section in women suspected to be infected with SARS-CoV-2 or COVID-19 positive (19). In fact, at the best of our knowledge, no sample of vaginal swab proved positive to SARS-CoV-2 (20). An effort should be made to reduce to the minimum the number of professionals who attend the birth and to allow the mother to have a person of trust near her during labor and delivery (19). Extra caution has to be paid to the fetal wellbeing using cardiotocography (CTG) (19).

Midwives are called to provide women with assistance, respect and privacy, trying to keep birth a safe and positive experience (21). Pain relief strategies, mobility during labor and choice of the birth position whenever possible should be guaranteed to women amidst COVID-19 condition.

#### *COVID-19, Postpartum and Breastfeeding*

Midwives should encourage breastfeeding after the birth. Breastfeeding is indeed highly beneficial for both mother and child and it is recommended starting as early as possible after the birth (22). Based on current scientific knowledge, breast milk of COVID-19 positive mothers proved safe and it should be administered to the baby. If maternal general conditions do not allow breastfeeding, she should be encouraged and supported to express breast milk and feed it to her child (23). If it is not possible, a donor's milk could be a good option (24). Midwives should support COVID-19 positive mothers in early breastfeeding their nurslings. In order to reduce the risk of transmission to the child, the Italian National Institute of Health (2020) advises preventive procedures, such as hand cleaning and the use of a face mask during feeds. Moreover, the RCOG suggests to keep mother and baby together, unless the mother is critically ill (25).

A multi-disciplinary approach, discussion and planning, should be arranged as soon as possible following admission of mothers with COVID-19 infection, involving a consultant physician (infectious disease specialist where available), consultant obstetrician, pediatrician, midwife-in-charge and consultant anesthetist responsible for obstetric care (19).

#### **Global Warming and Water Pollution**

The climate changes are one of the greatest threats the World is going to face in the next decades but its repercussions on health and healthcare are often downrated (26,27). The 2019 report of The Lancet Countdown on Health and Climate Change (28), has left no doubt about global warming and the dreadful effects it will have if it continues on its current path. The Lancet report (28) highlights extensive damage to health as a result of global warming, including increased burden of malnutrition, increased rates of infectious diseases, higher rates of respiratory disease because of air pollution, increased traumatic injury and subsequent hardship because of extreme weather events.

#### *Menstruation Waste*

Menstruation waste plays a large role in the pollution of waters. Menstruation wastes are defined as "Wastes that are generated by a female in her reproductive years" (29). These wastes are produced during menstruation and differ a lot depending on geographical area, personal preferences, social conformities, economic status, education, social and cultural believes (30). The choice of absorbents varies among rural and urban women and girls. In rural areas, the most preferred absorbents are reusable cloth pads while in urban areas women prefer to use commercial sanitary pads (30). Chlorine-bleached craft or sulphate pulp is used by manufacturers to produce a soft pulp as absorbent and chemicals like organochlorines are used as antibacterial. Due to their chemical composition, these products kill the soil's microflora when buried in the ground and the process of decomposition is delayed (31). Tampons are not easily degradable in nature as well and, hence, not very green.

Appropriate disposal of used menstrual material is still insufficient in many countries of the world. Lack of sanitary education on girls all around the world, especially over menstrual hygiene (32), leads most of the women to dispose of their sanitary pads or other menstrual articles improperly into domestic solid wastes or flushing into the toilets. In urban areas, where modern disposable menstrual products are available, they dispose of them by flushing in toilets (33), but, in rural areas, they are more likely buried, burned or thrown in latrines (30).

Nowadays, most of women prefers commercial sanitary pads and tampons which are made up of super absorptive materials like polyacrylate. These pads and tampons when flushed in the toilets they get saturated with liquid and swell up, thus resulting in leakage backflow causing a serious health hazard. Moreover, adhesive wings and the perforated plastic layers in the commercial sanitary napkins are not easily biodegradable. Deodorized sanitary products used by girls contain chemicals used in bleaching such as organochlorines which when buried in the soil disturb the soil microflora and decomposition takes time (31). People living alongside riverbanks throw menstrual waste into water bodies which contaminate them. These materials soaked with blood were breeding places for germs and pathogenic microbes (34). Incineration is a better technique to dispose of menstrual waste but burning of pads releases harmful gasses that effects health and environment. Burning of inorganic material at low temperature releases dioxins which are poisonous and oncogenic in nature.

As sanitary educators, midwives will be more involved into preventing inappropriate disposal of menstrual hygiene devices by educating girls around the world about the green alternatives to the commercial ones. Use of natural sponges, menstrual cups or washable pads would help reducing the impact every woman has on Earth every month, especially over the pollution of waterflows.

#### **Age, Motherhood and Infertility**

After the well-known 'baby boom' era, happened in the Western World between 50s and 60s of the last century, the

fertility rate has constantly dropped down (35). According to Italian CedAP Report (36) the mean age of primiparous mothers is increased to 32.8 years old for Italian citizens and 30.2 for non-Italian citizens. Similar data can be found in the US (37,38) and Canada (39). This rise in the age of the first pregnancy may be related to the augmentation of life expectancy over time, around 80 in Europe between 2020 and 2025 (40) but it might be related also with economic, social issues, personal choices or even social pressure (35).

Despite the evidences about the fertility decrement that occurs with aging, women frequently overestimate the age at which a significant decline in fertility occurs and overestimate the success of assisted reproductive technologies. Postponing reproduction can increase the chance of a woman remaining involuntarily childless, as well as an increase in complications during pregnancy in those that do achieve pregnancy at advanced maternal age (41).

Mothers over 35 years of age are more at risk of developing hypertension, preeclampsia, diabetes, intra-uterine-growth-restriction, placenta previa, placental abruption, operative deliveries and caesarean sections (42–45). Moreover, those mothers are more likely to conceive a fetus with genetic impairments: in fact, aged motherhood is a well-known risk factor of conceiving a baby with Down Syndrome as Trisomy 21 and mosaicism are not inherited, but originate from errors in cell divisions during the development of the egg, sperm or embryo (46).

By the other hand, teenage mothers in Italy are around 3‰ with prevalence in the Southern regions where they are around 10‰ (47). Although the teen birth rate declined 64% between 1991 and 2015 from 61.8 to 22.3 per 1,000 female adolescents aged 15–19 years (48,49), the United States continues to have one of the highest teen pregnancy rates among developed nations (50), and racial/ethnic and geographic disparities in teen birth rates persist (51). Those mothers and their children often face poorer prospects in life than women who delay motherhood. Early sexual experiences are an important predictor of early fertility, as is poor educational accomplishments. Family background is also powerfully influential on teenage fertility as the most important factor determining the chances of teenage motherhood seems to be the quality of communication about sexual matters. Teenage mothers are more likely to live in social housing, are less likely to be in paid employment and have larger than average sized families. Children of teenage mothers are more likely to experience early parenthood themselves, entering a cycle of social vulnerability. Primary preventive efforts will be needed to reduce the rates at which teenage pregnancy occurs so to reduce the cycle that means the children of young mothers themselves enter parenthood early. Then, efforts must also be made to mitigate the effects of teenage fertility for both mother and children (52).

Midwives will be more and more involved in providing aged mothers with assistance they need. Midwives should be educated to face more age-related issues and use a tailored case to case approach. Moreover, midwives will be called to action as family planning consultants, especially supporting teenage moms and their children.

## Alcohol Abuse and Gestation

Alcohol misuse can be considered one of the most relevant challenges in the Western Countries (53–62). Indeed, around 2.3 billion people in the world drink alcoholic beverages (63) that may induce physiological and cognitive disruptions (64,65) and more than 3 million people died as a result of harmful use of alcohol in 2016 (63). It is well known that women are physiologically more vulnerable to the effects of alcohol and drinking alcohol during pregnancy exposes the unborn child to a toxic substance to which the fetus has no tolerance (66). Indeed, alcohol assumption during pregnancy is responsible for serious damage to the fetus causing a wide range of pathological conditions like miscarriage (67–69), stillbirth (69,70), morphology (71) and growth impairments (72), premature birth (69,70) and neonatal sequelae related to Fetal Alcoholic Spectrum Disorder (FASD) (73,74).

Alcohol can also disrupt metabolism of neurotrophins which are a family of proteins influencing the proliferation, differentiation, survival and death of neuronal and non-neuronal cells (75–81) which are also responsible of neuroprotection in mammals (82) as also shown in animal models (79,81,83–88). This condition can result in physical abnormalities and neurodevelopmental impairments such as typical facial deformities (89), behavioral disorders (90), and poor performances at school (91). Fetal Alcohol Syndrome (FAS) is a completely avoidable form of developmental disability (92) resulting from alcohol consumption during pregnancy. Data from different study groups showed that even father's alcohol assumption is relevant in an animal model (88,93). Nowadays, it is not possible to establish a safe threshold of alcohol consumption, therefore, the safest recommendation for pregnant women and couples that are looking for a pregnancy (2,71,94,95) is to totally avoid alcohol use during pregnancy (96) and breastfeeding (97).

Midwives should take responsibility in spreading correct information, detecting signs of vulnerability and support women during pregnancy in order to prevent alcohol assumption. Midwives have demonstrated their willingness to expand their practice through continuing professional development, and through specialist and advanced roles. We do believe midwives could have a crucial function in the prevention of alcohol consumption during pregnancy in order to counteract or reduce the main cause of mental retardation in western countries.

## Conclusions

Midwives are going to face new and complex challenges impacting their job during the upcoming decade of the Century. Covid-19 demonstrated that every healthcare professional should be properly trained dealing with infections and their spread.

Statistics showed an increase in aged motherhood and teen pregnancies which might be considered two faces of the same problem, urging midwives to address age-related problems and program interventions tailored on the single patient.



Climate change and its repercussions are too often ignored or downrated, but the effects of pollution on the Planet will inevitably affect health. Pollution of waters will be relevant for health especially in third world countries where water access is limited, and hygiene conditions are poor.

By the other hand, substance abuse during pregnancy is already burdening nowadays and it's a critical issue of our times. Around 2.3 billion people in the world drink alcoholic beverages (63) and more than 3 million people died as a result of harmful use of alcohol in 2016 (63). Midwives could effectively impact on the alcohol drinking mothers, educating them about the negative effects of alcohol assumption during pregnancy and preventing harmful behaviors.

Midwives are highly trained professionals who can efficiently sensitize people and educate women about the upcoming relevant issues of our times. They may have an impact over public health and climate just enhancing their interventions in the antenatal period, especially improving their roles in education and prevention. Although, they will need more political, institutional and financial support.

## References

1. WHO | Midwifery. WHO 2019.
2. Messina MP, D'Angelo A, Battagliese G, et al. Fetal alcohol spectrum disorders awareness in health professionals: Implications for psychiatry. *Riv Psichiatr* 2020;55:79–89. doi:10.1708/3333.33022
3. Demarinis S. 2020 Year of the nurse and the midwife. *Explore* 2020. doi:10.1016/j.explore.2020.05.002
4. Ashour HM, Elkhatib WF, Rahman MM, et al. Insights into the Recent 2019 Novel Coronavirus (SARS-CoV-2) in Light of Past Human Coronavirus Outbreaks. *Pathogens* 2020;9:186. doi:10.3390/pathogens9030186
5. Zhao S, Lin Q, Ran J, et al. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. *Int J Infect Dis* 2020; 92:214–7. doi:10.1016/j.ijid.2020.01.050
6. Chidiebere Okechukwu E, Tibaldi L, La Torre G. The impact of COVID-19 pandemic on mental health of Nurses. *Clin Ter* 2020;171:e399–400. doi:10.7417/CT.2020.2247
7. Gold J. The hidden Covid-19 crisis: health care workers' mental health - STAT 2020. <https://www.statnews.com/2020/04/03/the-covid-19-crisis-too-few-are-talking-about-health-care-workers-mental-health/>
8. Al-Mandhari A, Gedik FG, Mataria A, et al. 2020 – the year of the nurse and midwife: A call for action to scale up and strengthen the nursing and midwifery workforce in the eastern mediterranean region. *East Mediterr Heal J* 2020;26:370–1. doi:10.26719/2020.26.4.370
9. World Health Organization. Intrapartum care for a positive childbirth experience 2018:212
10. WHO. Infection Prevention and Control for the safe management of a dead body in the context of COVID-19. vol. 104. 2020. doi:10.1016/j.jhin.2020.01.022
11. Davanzo R, Moro G, Sandri F, et al. Breastfeeding and Coronavirus Disease-2019. Ad interim indications of the Italian Society of Neonatology endorsed by the Union of European Neonatal & Perinatal Societies. *Matern Child Nutr* 2020:e13010. doi:10.1111/mcn.13010
12. European Center for Disease Control. COVID-19 situation update for the EU\_EEA and the UK, as of 7 June 2020. *Ecdc* 2020. <https://www.ecdc.europa.eu/en/cases-2019-ncov-eueea>
13. Indraccolo U. A pregnant woman and the SARS-CoV-2 infection: How are barriers easily crossed? *Recenti Prog Med* 2020;111:259–60. doi:10.1701/3347.33190
14. Ferrazzi EM, Frigerio L, Cetin I, et al. COVID-19 Obstetrics Task Force, Lombardy, Italy: executive management summary and short report of outcome. *Int J Gynaecol Obstet* 2020. doi:10.1002/ijgo.13162
15. Kabesch M, Roth S, Brandstetter S, et al. Successful containment of COVID-19 outbreak in a large maternity and perinatal center while continuing clinical service. *Pediatr Allergy Immunol* 2020. doi:10.1111/pai.13265
16. Poon LC, Yang H, Kapur A, et al. Global interim guidance on coronavirus disease 2019 (COVID-19) during pregnancy and puerperium from FIGO and allied partners: Information for healthcare professionals. *Int J Gynaecol Obstet* 2020. doi:10.1002/ijgo.13156
17. Panahi L, Amiri M, Pouy S. Risks of Novel Coronavirus Disease (COVID-19) in Pregnancy; a Narrative Review. *Arch Acad Emerg Med* 2020;8:e34. doi:10.22037/aaem.v8i1.595
18. Donati S, Giusti A. COVID-19 in gravidanza, parto e allattamento 2020
19. Royal College of Obstetricians and Gynaecologists. Coronavirus (COVID-19) Infection in Pregnancy Information for healthcare professionals. *Centers Dis Control Prev* 2020:1–35. doi:10.1037/0033-2909.126.1.78
20. Qiu L, Liu X, Xiao M, et al. SARS-CoV-2 is not detectable in the vaginal fluid of women with severe COVID-19 infection. *Clin Infect Dis* 2020. doi: 10.1093/cid/ciaa375
21. WHO. All Women have the right to a safe and positive childbirth experience, whether or not they have a confirmed COVID-19 infection 2020. <https://www.who.int/reproductivehealth/publications/emergencies/Pregnancy-3-1200x1200.png?ua=1>
22. Davanzo R, Romagnoli C, Corsello G. Position Statement on Breastfeeding from the Italian Pediatric Societies. *Ital J Pediatr* 2015;41. doi:10.1186/s13052-015-0191-x
23. World Health Organization. WHO Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected. *Who* 2020;2019:12. [https://www.who.int/internal-publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected%0Ahttp://apps.who.int/iris/bitstream/10665/178529/1/WHO\\_MERS\\_Clinical\\_15.1\\_eng.pdf](https://www.who.int/internal-publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected%0Ahttp://apps.who.int/iris/bitstream/10665/178529/1/WHO_MERS_Clinical_15.1_eng.pdf)
24. Wang L, Shi Y, Xiao T, et al. Chinese expert consensus on the perinatal and neonatal management for the prevention and control of the 2019 novel coronavirus infection (First edition). *Ann Transl Med* 2020;8:47–47. doi:10.21037/atm.2020.02.20
25. Royal College of Obstetricians and Gynaecologists, Royal College of Midwives and Royal College of Paediatrics and Child Health, with input from the Royal College of Anaesthetists PHE and HPS. COVID-19 Virus Infection and Pregnancy. *R Coll Obstet Gynaecologists UK* 2020:1–8
26. De Paula Baer A, Sestili C, Cocchiara RA, et al. Perception of climate change: Validation of a questionnaire in Italy. *Clin Ter* 2019;170:E184–91. doi:10.7417/CT.2019.2131
27. Catton H. Global challenges in health and health care for nurses and midwives everywhere. *Int Nurs Rev* 2020;67:4–6 doi:10.1111/inr.12578

28. Watts N, Amann M, Arnell N, et al. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet* 2019;394:1836–78. doi:10.1016/S0140-6736(19)32596-6
29. Swenson I, Havens B. Menarche and Menstruation: A Review of the Literature. *J Community Health Nurs* 1987;4:199–210. doi:10.1207/s15327655jchn0404\_3
30. Kaur R, Kaur K, Kaur R. Menstrual Hygiene, Management, and Waste Disposal: Practices and Challenges Faced by Girls/Women of Developing Countries. *J Environ Public Health* 2018;2018. doi:10.1155/2018/1730964
31. Kroesa R. The Greenpeace Guide to Paper 1990
32. Upashe SP, Tekelab T, Mekonnen J. Assessment of knowledge and practice of menstrual hygiene among high school girls in Western Ethiopia. *BMC Womens Health* 2015;15:84. doi:10.1186/s12905-015-0245-7
33. Ashley R, Blackwood D, Souter N, et al. Sustainable Disposal of Domestic Sanitary Waste. *J Environ Eng* 2005;131:206–15. doi:10.1061/(ASCE)0733-9372(2005)131:2(206)
34. Shoemaker D. Proper procedure for sanitary napkin disposal. *Clean Maint Manag* 2008;45:33–7
35. Bellieni C. The Best Age for Pregnancy and Undue Pressures. *J Fam Reprod Heal* 2016;10:104–7
36. Boldrini R, Cesare M Di, Tamburini C. Certificato di Assistenza al parto (CeDAP). Analisi dell'evento nascita–Anno 2006. 2009
37. Mathews TJ, Hamilton BE. Mean age of mother, 1970–2000. *Natl Vital Stat Rep* 2002;51:1–13
38. Mathews TJ, Hamilton BE. Mean Age of Mothers is on the Rise: United States, 2000–2014. *NCHS Data Brief* 2016:1–8
39. Government of Canada. Census Program. Stat Canada 2011. <https://www12.statcan.gc.ca/census-recensement/index-eng.cfm%0Ahttp://www.census.gc.ca/census-recensement/index-eng.cfm>
40. Come sta cambiando la popolazione mondiale: invecchiamento, longevità e megalopoli n.d. <https://www.insuranceup.it/it/scenari/come-sta-cambiando-la-popolazione-mondiale-invecchiamento-longevita-e-megalopoli/>
41. Fritz R, Jindal S. Reproductive aging and elective fertility preservation. *J Ovarian Res* 2018;11. doi:10.1186/s13048-018-0438-4
42. Hoffman MC, Jeffers S, Carter J, et al. Pregnancy at or beyond age 40 years is associated with an increased risk of fetal death and other adverse outcomes. *Am J Obstet Gynecol* 2007;196. doi:10.1016/j.ajog.2006.10.862
43. Jacobsson B, Ladfors L, Milsom I. Advanced maternal age and adverse perinatal outcome. *Obstet Gynecol* 2004;104:727–33. doi:10.1097/01.AOG.0000140682.63746.be
44. Laopaiboon M, Lumbiganon P, Intarut N, et al. Advanced maternal age and pregnancy outcomes: a multicountry assessment. *BJOG* 2014;121 Suppl:49–56. doi:10.1111/1471-0528.12659
45. Bayrampour H, Heaman M. Advanced maternal age and the risk of cesarean birth: A systematic review. *Birth* 2010. doi:10.1111/j.1523-536X.2010.00409.x.
46. Coppèdè F. Risk factors for Down syndrome. *Arch Toxicol* 2016;90:2917–29. doi:10.1007/s00204-016-1843-3.
47. World Bank Group. Adolescent fertility rate (births per 1,000 women ages 15–19) | Data. World Bank Gr 2019. <https://data.worldbank.org/indicator/sp.ado.tfrt>.
48. Mueller T, Tevendale HD, Fuller TR, House LD, Romero LM, Brittain A, et al. Teen Pregnancy Prevention: Implementation of a Multicomponent, Community-Wide Approach. *J Adolesc Heal* 2017;60:S9–17. doi:10.1016/j.jadohealth.2016.11.002
49. Hamilton BE, Martin JA, Osterman MJK, Curtin SC. Births: Preliminary data for 2014. *Natl Vital Stat Reports* 2015;64:1–18
50. Sedgh G, Finer LB, Bankole A, Eilers MA, Singh S. Adolescent pregnancy, birth, and abortion rates across countries: Levels and recent trends. *J Adolesc Heal* 2015;56:223–30. doi:10.1016/j.jadohealth.2014.09.007
51. Romero L, Pazol K, Warner L, et al. Reduced disparities in birth rates among teens aged 15–19 years — United States, 2006–2007 and 2013–2014. *Morb Mortal Wkly Rep* 2016;65:409–14. doi:10.15585/mmwr.mm6516a1
52. Wellings K, Wadsworth J, Johnson A, et al. Teenage fertility and life chances. *Rev Reprod* 1999;4:184–90. doi:10.1530/ror.0.0040184
53. Ciafrè S, Carito V, Tirassa P, et al. Ethanol consumption and innate neuroimmunity. *Biomed Rev* 2017;28:49–61. doi:10.14748/bmr.v28.4451
54. Ciafre S, Fiore M, Ceccanti M, et al. Role of neuropeptide tyrosine (NPY) in ethanol addiction. *Biomed Rev* 2016;27:27–39. doi:10.14748/bmr.v27.2110
55. Coriale G, Battagliese G, Pisciotta F, et al. Behavioral responses in people affected by alcohol use disorder and psychiatric comorbidity: correlations with addiction severity. *Ann Ist Super Sanita* 2019;55:131–42. doi:10.4415/ANN\_19\_02\_05
56. Ciafre S, Carito V, Ferraguti G, et al. How Alcohol Drinking Affects our Genes: an Epigenetic Point of View. *Biochem Cell Biol* 2019;97:2018-0248. doi:10.1139/bcb-2018-0248
57. Ledda R, Battagliese G, Attilia F, et al. Drop-out, relapse and abstinence in a cohort of alcoholic people under detoxification. *Physiol Behav* 2019;198:67–75. doi:10.1016/j.physbeh.2018.10.009
58. Coriale G, Gencarelli S, Battagliese G, et al. Physiological Responses to Induced Stress in Individuals Affected by Alcohol Use Disorder with Dual Diagnosis and Alexithymia. *Clin Ter* 2020;171:e120–9. doi:10.7417/CT.2020.2201
59. Mancinelli R, Binetti R, Ceccanti M. Woman, alcohol and environment: Emerging risks for health. *Neurosci Biobehav Rev* 2007;31:246–53. doi:10.1016/j.neubiorev.2006.06.017
60. Coriale G, Fiorentino D, Porrari R, Battagliese G, Capriglione I, Cereatti F, et al. Diagnosis of alcohol use disorder from a psychological point of view. *Riv Psichiatr* 2018;53:128–40. doi:10.1708/2925.29415
61. Coriale G, Fiorentino D, De Rosa F, et al. Diagnosis of alcohol use disorder from a psychological point of view. *Riv Psichiatr* 2018;53:128–40. doi:10.1708/2925.29416
62. Attilia F, Perciballi R, Rotondo C, et al. Pharmacological treatment of alcohol use disorder. Scientific evidence. *Riv Psichiatr* 2018;53:123–7. doi:10.1708/2925.29414
63. Who. Global status report on alcohol and health. *World Heal Organ* 2014. doi:/entity/substance\_abuse/publications/global\_alcohol\_report/en/index.html
64. Ceccanti M, Hamilton D, Coriale G, et al. Spatial learning in men undergoing alcohol detoxification. *Physiol Behav* 2015;149:324–30. doi:10.1016/j.physbeh.2015.06.034
65. Ceccanti M, Coriale G, Hamilton DA, et al. Virtual Morris task responses in individuals in an abstinence phase from alcohol. *Can J Physiol Pharmacol* 2018;96:128–36. doi:10.1139/cjpp-2017-0013
66. Mancinelli R, Barlocchi E, Ciprotti M, et al. Blood thiamine, zinc, selenium, lead and oxidative stress in a population of male and female alcoholics: Clinical evidence and gender differences. *Ann Ist Super Sanita* 2013;49:65–72. doi:10.4415/

- ANN-13-01-11
67. Avalos LA, Roberts SCM, Kaskutas LA, et al. Volume and type of alcohol during early pregnancy and the risk of miscarriage. *Subst Use Misuse* 2014;49:1437–45. doi:10.3109/10826084.2014.912228
  68. Nybo Andersen AM, Kragh Andersen P, Feodor Nilsson S, et al. Authors' reply: Risk factors for miscarriage from a prevention perspective: A nationwide follow-up study. *BJOG An Int J Obstet Gynaecol* 2014;121:1440. doi:10.1111/1471-0528.12857
  69. Bailey BA, Sokol RJ. Prenatal alcohol exposure and miscarriage, stillbirth, preterm delivery, and sudden infant death syndrome. *Alcohol Res Heal* 2011;34:86–91
  70. O'Leary C, Jacoby P, D'Antoine H, et al. Heavy prenatal alcohol exposure and increased risk of stillbirth. *BJOG An Int J Obstet Gynaecol* 2012;119:945–52. doi:10.1111/j.1471-0528.2012.03333.x
  71. Ferraguti G, Merlini L, Battagliese G, et al. Fetus morphology changes by second-trimester ultrasound in pregnant women drinking alcohol. *Addict Biol* 2019. doi:10.1111/adb.12724
  72. Strandberg-Larsen K, Poulsen G, Bech BH, et al. Association of light-to-moderate alcohol drinking in pregnancy with preterm birth and birth weight: elucidating bias by pooling data from nine European cohorts. *Eur J Epidemiol* 2017;32:751–64. doi:10.1007/s10654-017-0323-2
  73. Mamluk L, Edwards HB, Savović J, et al. Low alcohol consumption and pregnancy and childhood outcomes: Time to change guidelines indicating apparently "safe" levels of alcohol during pregnancy? A systematic review and meta-analyses. *BMJ Open* 2017;7:e015410. doi:10.1136/bmjopen-2016-015410
  74. Ruisch IH, Dietrich A, Glennon JC, et al. Maternal substance use during pregnancy and offspring conduct problems: A meta-analysis. *Neurosci Biobehav Rev* 2018;84:325–36. doi:10.1016/j.neubiorev.2017.08.014
  75. Ceci FM, Ferraguti G, Petrella C, Greco A, Ralli M, Iannitelli A, et al. Nerve Growth Factor in Alcohol Use Disorders. *Curr Neuropharmacol* 2020;18. doi:10.2174/1570159x18666200429003239
  76. Carito V, Ceccanti M, Ferraguti G, et al. NGF and BDNF Alterations by Prenatal Alcohol Exposure. *Curr Neuropharmacol* 2017;17:308–17. doi:10.2174/1570159x15666170825101308
  77. Kim H, Li Q, Hempstead BL, et al. Paracrine and autocrine functions of brain-derived neurotrophic factor (BDNF) and nerve growth factor (NGF) in brain-derived endothelial cells. *J Biol Chem* 2004;279:33538–46. doi:10.1074/jbc.M404115200
  78. Sornelli F, Fiore M, Chaldakov GN, et al. Brain-derived neurotrophic factor: A new adipokine. *Biomed Rev* 2007;18:85–8. doi:10.14748/bmr.v18.72
  79. Aloe L, Alleva E, Fiore M. Stress and nerve growth factor: Findings in animal models and humans. *Pharmacol Biochem Behav* 2002;73:159–66. doi:10.1016/S0091-3057-(02)00757-8
  80. D'Angelo A, Ceccanti M, Petrella C, et al. Role of neurotrophins in pregnancy, delivery and postpartum. *Eur J Obstet Gynecol Reprod Biol* 2020;247:32–41. doi:10.1016/j.ejogrb.2020.01.046
  81. Fiore M, Messina MP, Petrella C, et al. Antioxidant properties of plant polyphenols in the counteraction of alcohol-abuse induced damage: Impact on the Mediterranean diet. *J Funct Foods* 2020;71:104012. doi:10.1016/j.jff.2020.104012
  82. Namiki J, Kojima A, Tator CH. Effect of brain-derived neurotrophic factor nerve growth factor and neurotrophin-3 on functional recovery and regeneration after spinal cord injury in adult rats. *J Neurotrauma* 2000;17:1219–31. doi:10.1089/neu.2000.17.1219
  83. Sornelli F, Fiore M, Chaldakov GN, et al. Adipose tissue-derived nerve growth factor and brain-derived neurotrophic factor: Results from experimental stress and diabetes. *Gen Physiol Biophys* 2009;28:179–83
  84. Ciafrè S, Carito V, Ferraguti G, et al. Nerve growth factor in brain diseases. *Biomed Rev* 2018;29:1–16. doi:10.14748/bmr.v29.5845
  85. Ceccanti M, De Nicolò S, Mancinelli R, et al. NGF and BDNF long-term variations in the thyroid, testis and adrenal glands of a mouse model of fetal alcohol spectrum disorders. *Ann Ist Super Sanita* 2013;49:383–90. doi:10.4415/ANN-13-04-11
  86. Fiore M, Mancinelli R, Aloe L, et al. Hepatocyte growth factor, vascular endothelial growth factor, glial cell-derived neurotrophic factor and nerve growth factor are differentially affected by early chronic ethanol or red wine intake. *Toxicol Lett* 2009;188:208–13. doi:10.1016/j.toxlet.2009.04.013
  87. Fiore M, Laviola G, Aloe L, et al. Early exposure to ethanol but not red wine at the same alcohol concentration induces behavioral and brain neurotrophin alterations in young and adult mice. *Neurotoxicology* 2009;30:59–71. doi:10.1016/j.neuro.2008.11.009
  88. Ceccanti M, Mancinelli R, Tirassa P, et al. Early exposure to ethanol or red wine and long-lasting effects in aged mice. A study on nerve growth factor, brain-derived neurotrophic factor, hepatocyte growth factor, and vascular endothelial growth factor. *Neurobiol Aging* 2012;33:359–67. doi:10.1016/j.neurobiolaging.2010.03.005
  89. Denny LA, Coles S, Blitz R. Fetal Alcohol Syndrome and Fetal Alcohol Spectrum Disorders. *Am Fam Physician* 2017;96:515–22. doi:10.1002/0471695998.mgs020
  90. Hoyme HE, Kalberg WO, Elliott AJ, et al. Updated Clinical Guidelines for Diagnosing Fetal Alcohol Spectrum Disorders. *Pediatrics* 2016;138:e20154256–e20154256. doi:10.1542/peds.2015-4256
  91. Lubbe M, van Walbeek C, Vellios N. The Prevalence of Fetal Alcohol Syndrome and Its Impact on a Child's Classroom Performance: A Case Study of a Rural South African School. *Int J Environ Res Public Health* 2017;14. doi:10.3390/ijerph14080896
  92. Clarke ME, Gibbard WB. Overview of fetal alcohol spectrum disorders for mental health professionals. *Can Child Adolesc Psychiatr Rev* 2003;12:57–63
  93. Ceccanti M, Coccarello R, Carito V, et al. Paternal alcohol exposure in mice alters brain NGF and BDNF and increases ethanol-elicited preference in male offspring. *Addict Biol* 2016;21:776–87. doi:10.1111/adb.12255
  94. Coriale G, Fiorentino D, Lauro FDI, et al. Fetal Alcohol Spectrum Disorder (FASD): Neurobehavioral profile, indications for diagnosis and treatment. *Riv Psichiatr* 2013;48:359–69. doi:10.1708/1356.15062
  95. Ferraguti G, Ciolli P, Carito V, et al. Ethylglucuronide in the urine as a marker of alcohol consumption during pregnancy: Comparison with four alcohol screening questionnaires. *Toxicol Lett* 2017;275:49–56. doi:10.1016/j.toxlet.2017.04.016
  96. Ceccanti M, Iannitelli A, Fiore M. Italian Guidelines for the treatment of alcohol dependence. *Riv Psichiatr* 2018;53:105–6. doi:10.1708/2925.29410
  97. Gibson L, Porter M. Drinking or Smoking While Breastfeeding and Later Cognition in Children. *Pediatrics* 2018;142:e20174266. doi:10.1542/peds.2017-4266