

Adolescents' Health Implies Their Own Adult Health and that of Their Offspring

La salud de los adolescentes implica su salud adulta y la de sus descendientes

Every hour of time wasted during youth creates a chance for future misfortune..

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INTRODUCTION

Over the past years, the importance of health has not only become apparent during the critical period of adolescence, but the physiological responses and health behaviors continue in adulthood. The epigenetic changes in adolescence suggest that it is a crucial period for establishing long-term health risk, and even for determining the potential health of the next generation. (1, 2)

Low- and middle-income countries are home to more than 1,600,000,000 (90%) of the world's adolescents, where pregnancy is common and up to 50% of them experience restricted fetal growth. (1)

Adolescents have a strong desire for autonomy with the feeling that diseases are distant, so they are not a sensitive group to traditional messages and reject instructions on health education, (3) prioritizing the immediate over the long-term. Therefore, effective interventions with adolescents need to empower and encourage them by giving, rather than taking away, responsibility.

As mature young adults, the development of goals, such as completing formal education and building intimate relationships with a partner, generally has priority over becoming parents. Consequently, preconception health will have little motivation during this phase if pregnancy is not planned. Effective methods of commitment at this stage should be highly context-specific. (4)

J. Stephenson et al. reported that "cohort studies have suggested that dietary patterns up to 3 years before pregnancy, characterized by high intake of fruits, vegetables, legumes, nuts, and fish, and low intake of red and processed meat, are associated with reduced risk of gestational diabetes, hypertensive disorders of pregnancy, and preterm birth. Since few people will plan a pregnancy 3 years in advance, this highlights the need for interventions at a population level". (5)

The health effects of smoking on the mother are known from studies conducted during pregnancy, and include miscarriage, intrauterine growth restriction, and low birth weight.

Although there are no clinical trials showing that tobacco cessation before conception improves these

outcomes, there is indirect evidence since the introduction of smoke-free legislation in different countries. A meta-analysis including 1,366,862 pregnant women found that smoke-free legislation was associated with reductions of preterm birth (-10.4%; 95% CI -2.00 to -18.8). (6)

The authors propose "... novel definitions of the preconception period relating to embryo development and actions at individual or population level. From a biological perspective, the critical period spans the weeks around conception when gametes mature and fertilisation occurs, and the developing embryo forms... For prevention of neural tube defects, a minimum of 4-6 week folic acid supplementation is required to reach adequate concentrations before neurulation begins 3 weeks after conception.

In relation to an individual, the preconception period starts whenever a woman or couple decide they want to have a baby because the time to conception is unknown. Since about a third of fertile couples having regular sex without contraception will conceive within one month, optimizing nutrition, including folic acid supplementation, should coincide with the decision to become pregnant... Maternal motivation to improve health at this stage can be strong. From a public health perspective, the preconception period can be viewed as a sensitive phase in the life-course, such as adolescence, when health behaviors affecting diet, exercise and obesity, along with smoking and drinking, become established before the first pregnancy". (6)

TIME OF CONCEPTION AND NON-COMMUNICABLE DISEASES

It seems that maternal physiology, body composition, diet, and lifestyle during pregnancy have profound and enduring effects on the long-term risk of disease in adulthood: "...the Developmental Origins of Health and Disease concept has emerged, suggesting that poor developmental experience can increase the risk of non-communicable diseases in later life, including cardiovascular and metabolic comorbidities (such as hypertension, obesity, and type 2 diabetes), atopic conditions, cancer, and neurological impairment...". (7)

Developmental conditions around conception occur over a period of few weeks and cover the completion of meiotic oocyte maturation, spermatozoid differentiation, fertilization, and resumption of mitotic cell cycles in the zygote, marking the transition from

the parental to the embryonic genome and the onset of morphogenesis up to implantation.

Distinct embryonic and placental cell lineages emerge, genomic reorganization as DNA methylation occurs in order to regulate lineage-specific gene expression in the first weeks of pregnancy and homeostatic regulators for growth and energy supply are established (7)

On initial stages of development, few cells are involved and are fully exposed to environmental conditions. Therefore, the cells are vulnerable to disturbance of epigenetic mechanisms, leading to an altered profile of embryonic gene expression that persists throughout subsequent cell cycles, and drives modified developmental progress.

It is well-known that maternal health before conception influences the eventual outcomes of pregnancy and birth.

This developmental conditioning is seen in the global rise in maternal obesity, which is associated with reduced female fertility and greater risk of obesity in the offspring.

The metabolic effect elevates maternal glucose and insulin concentrations, driving fetal growth, adiposity and increased birth and childhood weight, with the addition of increased risk of allergic conditions, confirmed in animal models.

Maternal undernutrition remains highly prevalent in low-income and middle-income countries and produces poor uterus nutrition and low birth weight, which is followed by accelerated weight gain during infancy. These changes are associated with increased risk of chronic diseases in later life across diverse human populations and have been reproduced in animal models. In rodents fed a low protein diet during the final 3 days of oocyte maturation or during the 3–4 day window of embryo development before implantation, with normal nutrition at all other times, the offspring usually show hypertension associated with increased adiposity.

In summary, there is sufficient evidence in both human and animal research showing that the periconception period is a critical window during which poor maternal or paternal physiology, body composition, metabolism and diet can increase the risk of chronic diseases in the offspring. This situation is becoming one of the major risk factors for health in the 21st century, especially when similar consequences could result from the current practice of assisted reproduction.

DEFINING THE PRECONCEPTION PERIOD AND PREGNANCY PLANNING

In relation to an individual, the preconception period starts whenever a woman or couple decide they want to have a baby because the time to conception is unknown.

Since about a third of fertile couples having regular sex without contraception will conceive within one month, (8) optimizing nutrition, including folic acid supplementation, should coincide with the decision to

become pregnant.

As maternal motivation to improve health at this stage is strong, from a public health perspective the preconception period can be seen as a sensitive phase in the life-course to improve health behaviors affecting diet, exercise, and obesity, along with smoking and drinking before the first pregnancy.

The National Survey of Family Growth of the USA defined pregnancy as intended, mistimed or unwanted, and these definitions are included in all the surveys worldwide. A combination of the information of all the surveys estimated that 60% of the 213 million pregnancies worldwide were intended during 2012. (9)

The global standard for identifying the three categories of pregnancy is the American survey, in which women are asked: “When you became pregnant, did you want to have a baby at that moment?” If the answer is yes, the answer is categorized as “intended pregnancy”; if the answer is no, the following question is asked: “did you want to have a/another baby later in the future or did you not want any (or another) child?” If the answer was later, pregnancy was classified as “mistimed”; if the answer was no, pregnancy was “unwanted”.

In Malawi, intentional pregnancy is higher with these questions (69%, 95% CI: 65-73) than with the London Measure of Unplanned Pregnancy, (10) widely used and validated in 9 languages (40%, 95% CI 36-44) in the same group of 623 women after one year follow-up.

Therefore, some degree of pregnancy planning is common in both high-income and low- and middle-income countries. This offers the perspective of a crucial moment to make routine interventions before pregnancy.

A dual strategy is needed to have a substantial impact on preconception health, one that improves the health status of all women of childbearing age and over the course of their lives, and also focusses particularly on those women who are thinking of conceiving.

PRECONCEPTION STRATEGIES AND HEALTH BEHAVIORS

M. Barker et al. reported that: “We identified 14 controlled primary studies evaluating three strategies: supplementation and fortification, cash transfers or incentives, and behavior change intervention. We did not identify enough good quality studies conducted in the preconception period to enable us to perform a meta-analysis or draw firm conclusions about effectiveness; however, epidemiological and biological evidence pointed to the value of intervening prior to conception...” (4)

Supplementation interventions are generally acceptable to women, but intake and effectiveness are often hampered by poor adherence. Several solutions have been proposed, including a contraceptive pill containing folic acid available in the USA; however, the impact of this solution depends on the contraceptive method used, which is specific and varies widely between countries.

Fortifying with folic acid foods such as flour or rice has wide potential reach, and is currently mandated in 87 countries, with reductions in the prevalence of neural tube defects, as in Canada, USA, South Africa, Costa Rica and Chile.

The WHO has also issued a guideline for the fortification of salt with iodine, which can prevent irreversible mental impairment of the fetus. (4)

None of the studies identified investigated the effects of cash transfers on birth. However, this strategy was included in the model because cash transfers are effective in improving school attendance among children, the access to preventive health care, and food consumption in low-income settings. (11)

Reviews of 12 preconception trials identified possible improvements in health behaviors, including alcohol consumption and smoking, and mediators of intervention effects, such as maternal self-efficacy and perceived control. Neither review reported maternal nutritional status as an outcome.

Low resource households cannot change their behavior, simply because they do not have money to buy food. Thus, strategies must combine behavioral change with food access, as was done in the CARING Trial in East India. (12)

The study used an approach based on participatory learning and action through women groups, facilitated by health care professionals trained in group management focused on maternal and newborn problems, including nutrition. In the CARING trial, this approach improved secondary outcomes, including dietary diversity and hand-washing, but did not significantly increase child linear growth.

Promoting adolescent health produces a triple benefit: their health in adolescence, but also their health in the future, as physiological responses, epigenetic changes and health behaviors established during adolescence continue into adulthood. The third benefit is even more important from the public health viewpoint, as it implies the health of the next generation.

A key intervention in improving outcomes for mothers and babies is to delay the first pregnancy beyond 18 years, when nutrients are no longer needed to support maternal growth.

Individual motivation is a necessary but not a sufficient condition for changes in behavior, particularly among adolescents. Adolescents typically disengage with traditional health messages, prioritizing the immediate over the long-term, and having a strong desire for autonomy, causing them to reject personal instructive health education. Thus, the power of social influence on adolescent behavior through peer support needs to be harnessed to empower them, prevent them from running away and encourage them to take up their responsibilities. Physicians and community health workers within the health care system should be trained to support problem-solving and capitalize on adolescents' need for autonomy; moreover, adolescent-friendly health services to deliver gender and context-specific interventions should be created.

Training of health-care professionals in "healthy

conversation skills" is necessary for promoting the use of open questions, to discover, listen, reflect, and goal-set the woman or couple to prepare for pregnancy, and support them in finding their own solutions to future challenges. This will thus provide care that is responsive to women's personal, social, and cultural environment.

CONCLUSIONS

It would be important to create a "social movement" to optimize preconception health, involving the whole population in a clear health policy direction, even though this social movement is very different from social marketing campaigns.

If the focus of the campaign is building stronger and healthier mothers and babies, reducing the burden of non-communicable diseases in the next generation, it would deliver an uncontroversial message, easy for the public to engage with emotionally. (4)

The campaign could be used to neutralize lobbying by some members of the food industry such as those who argue against the tax on sweetened drinks, the reduction of big portions and extra-large bottles, and of fat and salt in processed foods, as well as the State regulation to ensure the legitimacy of campaigns and health actions of the food industry.

Independent monitoring of the food industry by medical schools, scientific societies and the community would be crucial to build support from the society to channel the actions of the government and of the responsible industry regarding preconception health.

Local, regional and national political systems, as well as the international community, should work together to strengthen this social movement.

The health of this new generation and of the next one is implicit in this struggle.

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