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New technologies to reduce medicalization of prenatal care : a contradiction with realistic perspectives.

Gyselaers W [1,2], Storms V [3], Grieten L [3]

Wilfried Gyselaers: Author for correspondence

[1] Dept. Physiology, Hasselt University, Hasselt Belgium

[2] Dept. Obstetrics and Gynaecology, Ziekenhuis Oost Limburg, Schiepse Bos 6, B3600 Genk Belgium

0032-89-327524

Wilfried.gyselaers@uhasselt.be

Valerie Storms: [3] Mobile Health Unit UHasselt

Hasselt University, Agoralaan Building D, 3590 Diepenbeek, Belgium

0032-89-268533

Valerie.storms@uhasselt.be

Lars Grieten: [3] Mobile Health Unit UHasselt

Ziekenhuis Oost Limburg, Schiepse Bos 6, B3600 Genk Belgium

0032-89-321512

Lars.grieten@uhasselt.be

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Summary

During the last decades, prenatal care has become involved with technology: pregnant women, also those with normal uncomplicated pregnancies, are encouraged to comply with medicalized care. Today, new technologies are emerging for simple non-invasive measurements of gestational parameters, allowing discrimination between pregnancies at high or at low risk for complications. Next to this, very simple remote monitoring devices become generally applicable and accessible to all pregnant women. Time has come now for health care providers to facilitate research into these new technologies in order to (1) ensure a rationalized, evidence based introduction of these devices into prenatal care, and (2) categorize pregnancies into those who benefit from normal, physiological midwife-led care and those who need medical follow-up. The organization of a structured and controlled prenatal application of these devices may be the key to reverse a continuing rise of medicalized care during pregnancy.

During the last decades - mainly since the introduction of obstetric ultrasonography - prenatal care in most industrialized countries has evolved from a mother-targeted paramedical discipline to fetus-targeted medical care [1]. With this, clinical decision making and practical skills have been replaced by technical assessments and measurements. As a consequence, prenatal care has moved – and still is today - from the physiologic field of midwife-led care at home, to the technical area of medicine led by obstetricians and neonatologists in hospitals. This evolution was accompanied with a marked reduction of maternal and perinatal mortality in most developed countries, however with persisting inequalities to access of care [2]. To achieve this, nearly all pregnant women and their unborns – even those at very low risk for adverse outcome - are encouraged to participate in a cascade of technical assessments throughout the course of pregnancy, several of which are evidence based beneficial, but others of no reported or proven relevance [3]. There are many aspects which can be considered responsible for this evolution. First of all, there is the technical revolution in health care itself, where digitalization, internet communication, automatization,… have been introduced even more swiftly than in public life. Next to this, there is a gradually reducing health condition of pregnant women over generations, with increasing rates of maternal obesity, advanced age, comorbidities, … and with intergenerational impact on population health [4]. In many countries, there is well organized private medical care, with reported higher intervention rates than in public health care [5]. Overall, there is also an ever growing psychological need for patients and health care workers to be in control - even more accentuated by social pressure - which induces fear for a natural event as childbirth, or for delivering or raising a disabled child [6]. This very much lowers the threshold for medicolegal litigation [7]. It is of no surprise that this technological revolution has raised the costs for public health care in most industrialized countries, with interregional differences not always well understood [8].

Fortunately, technological improvements sometimes also deliver more simplified tests, easily accessible to all patients at acceptable costs. One of the most striking examples in current prenatal care is the recent introduction of Non Invasive Prenatal Testing (NIPT) in screening for fetal Down

Syndrome [9]. The application of NIPT in a selected high risk population allows reducing strongly the rate of invasive prenatal procedures (amniocentesis or chorionic villus sampling), with intrinsic risk for iatrogenic miscarriage or hospital admission for bleeding or leakage of liquor. The cost per NIPT has reduced markedly since its introduction a few years ago, and when this evolution would continue, it will soon be possible to offer NIPT to every pregnant women requesting prenatal fetal aneuploidy screening [9]. Another example in evolution today is the exploration of new non-invasive technologies to measure cardiovascular function in pregnant women. It is well known that gestational hypertensive disorders and premature birth, with or without fetal growth retardation, are related to gestational maladaptation of the maternal cardiovascular system [10], and link maternal hemodynamic dysfunction to cardiovascular diseases in later life [11]. It is also well known that adults, who were born dysmature or premature, are at higher risk for hemodynamic complications during their own pregnancies, and as such for transmitting this risk to their offspring [12]. Up till recently, hemodynamic assessments in pregnant women were technically difficult because of their invasive nature requiring monitoring at intensive care units, and usually were reserved for the exceptional case where the mothers' life was at risk [13]. Whether or not related, there has also been a very slow evolution during the last decades in management of gestational hypertensive diseases, which is illustrated by the older types of drugs and treatments still used today to for these conditions [14]. A new generation of non-invasive methods for hemodynamic assessment is emerging now, which have outgrown their childhood diseases: impedance cardiography, bio-reactance, bio-conductance, Doppler sonography, … [15]. Several research groups are currently exploring the possibilities and limitations of these technologies and mostly conclude that reliabilities are high enough for application into research programs and clinical practice [16]. The main advantage of these technologies is their simplicity: the application of electricity-based devices measuring impedance, reactance or conductance, do hardly require any training at all and can easily be performed by technicians, nurses or midwives. As such, these techniques become very accessible

to all pregnant women at all places, which opens perspectives to explore their potential role in improving access to medical care and in population screening for gestational disorders.

One such research program is currently ongoing at Hasselt University, Belgium under the name LimPrOn. Eight regional hospitals refer pregnant women to one central unit for cardiovascular profiling in early pregnancy [17]. This allows early discrimination between normal or abnormal maternal hemodynamic adaptation, long before any clinical presentation of disease. The most fundamental problem to solve in this project was : “What to do with those women, identified with maladapted cardiovascular functionality and classified in the high risk group?”. For this, another technological evolution is being explored in the same project : remote monitoring of cardiovascular parameters in pregnant women at risk [18]. In their normal life situation at home, women with high-risk pregnancies use digital enabled blood pressure monitors to self-measure their systolic and diastolic pressures and have wearable sensors to track their physical activity on a daily basis. These data are transferred automatically via modern digital communication systems (smart phone, wifi, blue tooth, …) to a clinical observation post at the hospital. Here, a team of midwife-researchers evaluate these data online, discuss abnormal measurements and evolutions with the responsible obstetricians or perinatologists, and close the loop by providing structured feedback on management options to the patients at home. This approach not only allows for a timely diagnosis of onset of gestational hypertensive disease, it also avoids extra outpatient antenatal visits and/or hospital admissions for presumed hypertension, and opens the perspective to timely initiate and monitor antihypertensive treatments, which is currently a grand-challenge. Today, the remote observations are limited to parameters of hypertension, but the aims are to expand with clinical grade wearable sensors to measure uterine and fetal activity, enabling the obstetrician to look beyond the in-office visits and unlock a revolutionary eagle-eye view over the most important gestational complications [19].

The organization of health care as explained above is not only very realistic and feasible in its set- up today, it also opens perspectives to reverse the current evolution of antenatal interventions leading to more interventions and as such to ever increasing medicalized antenatal care. Offering remote home monitoring of obstetric parameters, on top of routine antenatal care offered by midwifes to all pregnant women, allows timely identification of an abnormal course of pregnancy without increasing ambulatory or in-hospital interventions, meanwhile preserving a physiologic approach of antenatal care to normal pregnancies. The authors strongly believe that time has come now for health organizations to facilitate research on a structured and organized medical implementation of simple technological innovations, which worldwide may offer accessible and individualized prenatal care to all pregnant women, without increasing the costs for public health care through reduction of interventions or hospitalizations for presumed or missed diagnoses.

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