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Severe Hypertension During Pregnancy: Considerations for Preventive Measures by Health Care Providers

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Abstract

Medical professionals advocate that getting good health care before, during, and after pregnancy (which occurs when a sperm fertilizes an egg after it is released from the ovary during ovulation) is very important. This practice can help baby grow and develop sound physical and mental health during later stages of their life. Further, it is equally important to ensure that pregnant women are not subjected to hypertension situations. Furthermore, severe hypertension (defined as severely elevated blood pressure) can be risky from reproductive health (RH) point of view. However, pregnancy-induced hypertension (PIH) is common among pregnant women in many countries, especially in regions characterized by acute poverty and resulting malnutrition situations. It has been reported that the PIH, a form of high blood pressure (BP) in pregnancy, occurs, on an average, in about 7–10% of all pregnancies. It has also been found that many women are confronted with another type of high BP: chronic hypertension, a medical condition, wherein high BP prevails before pregnancy begins. These situations make it significant that the issue of severe hypertension during pregnancy is addressed adequately. It is in this context that the present research paper has been authored, wherein attempts have been made to investigate into strategic interventions that health care providers need to envisage, while treating pregnant women with severe hypertension conditions. This forms the specific objective of this research. With regards to general objectives, this review paper will briefly (a) address the important considerations in management of hypertension during pregnancy, and (b) discuss the future directions in this field. In terms of research mythology employed here, the author has collected secondary data from sources, such as books, book chapters, journal articles, government publications, as well as publications (and policy documents) brought out by the inter-governmental organizations. Data sources are quoted under reference section of the research. Data used are largely 'qualitative' in nature. Method of data analysis is 'descriptive'. It involves desk-based research, as various research reports and other documents (including policy review reports) on subject areas related to hypertension during pregnancy have been studied by the author in order to derive conclusions and key findings (in accordance

with objectives). This paper concludes that health care providers should ensure that women with chronic hypertension undergo a pre-pregnancy evaluation, with a focus on medication profile.

Keywords: pregnancy-induced hypertension, preventive measures, strategic interventions, health care providers, treatment, complications, risk factors, blood pressure, reproductive health

Abbreviations: RH: reproductive health; PIH: pregnancy-induced hypertension; BP: blood pressure; WHO: World Health Organization; UNICEF: United Nations Children's Fund; HDP: hypertensive disorders of pregnancy; SDGs: sustainable development goals; GSG: Guideline Steering Group; HBPM: home BP monitoring

Introduction

Hypertension has been found to be one of the most common medical problem encountered during pregnancy, which occurs when a sperm fertilizes an egg after it is released from the ovary during ovulation. This situation results in complicating up to 10% of pregnancies world over. It is believed that a moment of unimaginable joy is what a mother feels when a new-born is placed on her arms. It is the joy that every mother should have the right to experience, with adequate medical care (before and after pregnancy). However, as against this belief, it has been found that for many pregnant women, in many countries and continents of the globe, this memory does not come to be true. Rather, the moment of birth is often frightening [1]. This particular situation, in turn, leads to higher rate of maternal mortality (also sometimes termed as maternal death), which needs to be addressed by policy makers and health care providers.

In terms of demographic and health benefits, maternal mortality defined by the World Health Organization (WHO) as annual number of female deaths from any cause related to or aggravated by pregnancy and childbirth; is considered a key health indicator. Importantly, the direct causes of maternal deaths are (a) well known, and (b) largely 'preventable' and 'treatable' [2]. Medical personnel report that the major complications that account for nearly two-thirds of all maternal deaths are comprised of:

- severe bleeding (mostly bleeding after childbirth)
- infections (usually after childbirth)
- high blood pressure (BP) during pregnancy (pre-eclampsia and eclampsia)
- complications from delivery and unsafe abortions [1]

The office of the United Nations Children's Fund (UNICEF) opines that the pregnancy-related complications are one of the major contributory factors that are responsible for death among girls between 15 and 19 years of age. This is because of the fact that adolescent girls are still growing themselves. They are, therefore, at greater risk of complications if they become pregnant. Another important dimension of pregnancy at younger age leads to a situation wherein (a) child births are less likely to receive proper medical care, and (b) pregnant women are less likely to deliver in a health facility, compared to women getting married and subsequently becoming pregnant as adults. The fact remains is that all women need access to (a) antenatal care during pregnancy, (b) skilled care during childbirth, and (c) care and support in the weeks after childbirth. It is because of these facts that it is argued that all births should be assisted by skilled health care workers. Timely management and treatment have the potential to make the difference between life and death for both:

- the mother
- the baby [1]

At this juncture, it is pertinent to note that much progress has been made in ending preventable maternal deaths over past two decades. According to the data published by the UNICEF in the year 2021, globally the number of women

and girls who die each year due to issues related to pregnancy and childbirth has dropped considerably from 451,000 in the year 2000 to 295,000 in the year 2017 (recording a 38% decrease). However, it is distressing to note that coverage of life-saving health interventions (and practices) continue to remain low in many countries, especially those with low per capita income and limited health infrastructure. This is because of gaps in knowledge, policies and availability of resources. Some of the regions (areas) have been found to witness a gap between "the rich and the poor" and "an urban and rural divide". Again, access to maternal health services is often dependent on a families' (or mothers') economic status and where they reside [1]. It is important to note that women can have hypertension before pregnancy or it can be diagnosed in the first 20 weeks (known as "chronic hypertension"), new onset of hypertension occurring in the second half of pregnancy ("gestational hypertension") or new hypertension with features of multi-organ involvement ("pre-eclampsia").

Presented above is description on pregnancy and related health complications among pregnant women (and adolescent girls) confronted with hypertension (including severe hypertension). The author of this work makes a specific point at this juncture that maternal health is subjected to increased risks in situations wherein pregnant women are confronted with hypertension (or high BP, defined as BP greater than or equal to 130/80 mm Hg). Hypertension is considered as a serious concern for some pregnant women. In situations where hypertension is well-managed, high BP during pregnancy is not always a health risk. It can, however, sometimes cause severe health complications for both the mother and the developing baby [3]. There are several possible causes of high BP during pregnancy including:

- being overweight (or obese)
- not getting enough physical activity
- smoking
- drinking alcohol
- first-time pregnancy
- a family history of pregnancy-related hypertension
- carrying more than one child
- age (over 35)
- assistive reproductive technology (such as in vitro fertilization or IVF)
- having diabetes or certain autoimmune diseases [3]

It is obvious from the information presented above that the hypertension-induced risk factors are in place for women. They already have the predisposition to develop heart disease, whether it is due to their genetics or because of risk factors associated with lifestyle and (or) age. Stress is more alarming for pregnant women who are first timers. There is, thus, need for prevention initiatives (that should start early). Most importantly, medical experts are of the determined opinion that women should (and must) scientifically understand the risks associated with hypertension. Also, they should get their BP, cholesterol and blood sugar levels checked, as and when needed. Health care workers can play significant role in these matters, enabling pregnant women achieve better health outcomes both during and after pregnancy. Another aspect of equal significance is that the concept of "lifestyle intervention" should be emphasized. This concept envisages the consideration that eating healthy and exercising are the best medication for reducing risk factors and preventing cardiovascular diseases [4]. Also, health care workers should ensure that pregnant women are imparted with appropriately designed "lifestyle intervention program" even prior to getting pregnant. Discussion on important contribution that health care workers can make in addressing these issues, including other aspects connected with pregnancy-induced hypertension (PIH) forms part of primary objective of this work, which has been looked into in details in later part of this paper.

Addressing hypertension aspects of pregnancy, therefore, forms an integral part of reproductive health (RH). This scenario briefly presents the background in the context of which this research work has been authored. The context and rationale have been dealt with in greater details in later part. Following section outlines research methods used in the paper, including objectives.

Research Methods

In this section of the paper, attempt has been made to present the background in the context of which this review paper on addressing hypertension issues during pregnancy has been authored. Also, objectives (both general and specific objectives), nature and sources of data, methodology of data analysis, and significance and scope have been dealt with. The discussion follows below:

Context and rationale

In this section, the author presents rationale for and need of the present research work. As outlined above, risk factors during pregnancy is closely associated with hypertension. Researchers have found that women who experience complications (such as 'pre-term' births and 'pre-eclampsia') during their first pregnancy, are approximately twice more likely than women without complications to develop high BP during later stages in life. Some women experience complications, owing to high BP, as quickly as 3 years later. Some researchers advocate that there is need for health care workers to focus more aggressively on knowing the health histories (profile) of women. Also, they ought to address health profile both:

- during women's pregnancies in order to help prevent adverse outcomes
- afterwards to flag their risks for future cardiovascular events

Again, findings of past studies are indicative of the fact that adverse pregnancy outcomes (in terms of a smaller-than-average baby, a stillbirth, and a pre-term delivery) are associated with 3 prominent health outcomes, namely (a) a high risk for hypertension, (b) cardiovascular diseases, and (c) diabetes. These health risks or complications may be witnessed among women at younger ages than those without adverse outcomes [4]. This presents rationale for this review paper. Discussion below centers on objectives.

Objectives

Objective is most cherished part of any research study. It is important to scientifically design and specify objective(s) in research projects. It is suggested that objectives be presented in exact and precise terms that enables the research work to be more meaningful. The author of this work has divided the objectives into two parts, namely (a) general objectives, and (b) specific objectives. General and specific objectives are outlined below:

- General objectives

In terms of general objectives, this review paper outlines and addresses the management of hypertension during pregnancy. Also, it discusses the future directions for better outcomes in this field.

- Specific objectives

With regards to specific objectives, this research paper attempts to investigate into strategic interventions that health care providers need to envisage, while treating pregnant women with severe hypertension conditions. These strategic interventions have been developed by the WHO, in partnership with other collaborating agencies.

Type, nature and sources of data

In this section of the paper, the author attempts to give an insight into the type of data used. Also, the author discusses the nature of data and source (s) from where they (data) have been obtained. In terms of type of data, secondary data have been used. Data used are largely 'qualitative' in nature, which have been collected from the secondary sources, including books, book chapters, research reports, and government publications, including publications by the inter-governmental agencies, such as the UNICEF, the WHO, the National Institutes of Health (NIH), and the American College of Obstetricians and Gynecologists (ACOG).

In terms of duration of the study, secondary data were collected by the author from April, 2021 to June, 2021. As outlined above, data needed for this review research have been collected from secondary sources, mostly from online platforms (indicated under references).

Processing and analysis of data

In view of objectives and scope of the paper, data, which are largely 'qualitative' in nature, has been used here with by the author. An attempt has been made to analyze the data, collected from secondary sources (quoted under references) in a descriptive manner. In view of this fact, specific statistical techniques have not been used for the purpose of data processing.

Methodology of data analysis

The author has collected secondary data (largely qualitative in nature) from various sources, for instance, books, book chapters, government publications, etc. In terms of mythology of research employed here, method of data analysis is descriptive. Since this paper envisages secondary data collected from various sources, it involves "desk-based research". Under this methodology of data analysis, the author has, therefore, reviewed past research work done in the area of hypertension and pregnancy. Also, brief description of some of the key terms used in this research has been presented in the subsequent section.

Scope and significance

As it has been outlined under objectives, this paper aims to give a significant insight into framework of relationship between hypertension and pregnancy. It addresses the management of hypertension during pregnancy and discusses the future directions for better outcomes in this field (as specified under general objectives). Also, the author, in this research paper, aims to investigate into strategic interventions that health care providers need to envisage (while treating pregnant women with severe hypertension conditions). This forms the specific objective of the paper.

In terms of significance of this paper, the suggested strategic interventions will be guiding principles for health care workers for the purpose of providing medical care (and attention) to those confronted with hypertension during pregnancy. With regard to scope, this review paper looks into interventions that need to be addressed by health care providers working at community or grass root levels (and not other stakeholders, like policy makers and subject experts). In the light of this fact, this also forms limitation of this study. Importantly, the author does not wish to discuss the contribution of other stakeholders (other than health care providers) in tackling complications resulting from hypertension during pregnancy, as it does not come in line with the objective (both general and specific objectives) of this research. The two terms - "health care workers" and "health care providers" have been used interchangeably in this paper, both carrying the same meaning.

In the context of scope and significance, the author makes a specific point at this stage that although discussion on hypertension during pregnancy due to COVID-19 pandemic does not come within the objective of this review paper, brief description on this aspect has been presented. This is because of the fact that COVID-19 situation has added to the already existing hypertension-related complications among women and adolescent girls during pregnancy in almost all nations and regions of the globe. It is an uphill task and one of the greatest challenges for health care workers to address COVID-19 induced hypertension, including severe hypertension.

The author here makes a point that based on findings and data analysis, significant lessons can be learnt that health-care providers need to necessarily take into consideration. Again, some of the lessons learnt will be applicable to societies with demographic indicators showing significant number of women faced with hypertension like situations during pregnancy. Importantly, some of the experiences and lessons learnt (based on analysis of data in the present research work) can be replicated elsewhere. Most significantly, the author in this section of the paper mentions that in this work, these words have been used inter-changeably (a) work, (b) research work, (c) research paper, (d) review paper, (e) manuscript, (f) research note, and (g) policy paper. All these words carry the same meaning. This is standard

research practice that several authors use in their work in order to avoid repetition of same words in same section (or paragraph). This practice ensures that meaning of inherent (or intended) sentences are not lost, as required under "Ethics of Addressing Grammar in Writing Sentences".

Review of literature

Review of literature forms an integral part in research studies, especially in the field of social science research. It is for this reason that, description on review of literature related to objectives of the research paper needs to be presented. However, the author of this work did not find much meaningful research work (in the area of role of health care providers in addressing hypertension among pregnant women) that can form part of review of literature in this work. In view of this consideration, no information under review of literature (of this research work) has been presented. However, some past research work (that matches objective of this paper) have been briefly quoted in appropriate sections of the text.

Description of Key Terms

In the language of research, it is a good idea to describe the key words, technical in nature, that have been used in different (and relevant) sections of the work. This realization has come into being due to fact that some terms carry different meanings in different contexts. The authors are, therefore, expected to outline meaning (s) of selected key term (s) used (in the context of scope, significance, and objectives, as outlined in the work). In view of these facts, the author presents below meaning and conceptual framework of some of technical key terms (arranged alphabetically) used in different sections of this paper:

a) Blood pressure: The author of this review makes a specific point here that elevation of BP is termed as hypertension. The BP is the pressure of the blood within the arteries, which is produced primarily by the contraction of the heart muscles of the human body. Its measurement is recorded by two numbers. The first, "systolic pressure" is measured after the heart contracts and is highest. On the other hand, the second, "diastolic pressure" is measured before the heart contracts and is lowest. A BP cuff is used to measure the pressure [5].

b) Disease: This term refers to "an abnormal condition (which is particular in nature) that negatively affects the functioning mechanism of all or part of an organism" (that is not due to any immediate external injury). Importantly, diseases, in medical terminology, are often known to be conditions (medical in nature) that are associated with specific signs and symptoms [6]. There are two other terms associated with disease (a) illnesses, (b) ailment.

c) Essential medicines: The term essential medicines are defined in many ways. However, the author of this research makes a point that the definition provided by the WHO is more scientific (and more meaningful) and has been universally accepted. The conceptual framework of the term essential medicines, according to the WHO, refers to those that "satisfy the priority health care needs of the target population". Further, in terms of criteria adopted for selection of essential medicines, researchers should note that essential medicines are selected with due considerations, as outlined below:
    - prevalence of disease, including public health
    - evidence of clinical efficacy, and safety
    - comparative costs, and cost-effectiveness

    With regard to preparing essential medicines list, it is pertinent to note that "essential medicines are intended to be available within the context of functioning health systems at all times in adequate amounts". Other important considerations in essential medicines list include (a) the appropriate dosage forms with assured quality, (b) a price the individual and the community can afford [7]. In the context of today's world order

(including changing health pattern, including emergence of the COVID-19 pandemic crisis), the conceptual framework of essential medicines is forward-looking in nature. It is because of this fact that it (essential medicines list) attempts to envisage following 3 significant aspects:

- the need to regularly update selection of medicines to reflect new therapeutic options (including changing therapeutic needs)
- the need to ensure drug quality
- the need for continued development of better medicines (including medicines for emerging diseases, and medicines to meet changing resistance patterns) [7]

d) Health care provider: It is also sometimes written as "healthcare provider". It refers to a person or a company that provides health care service to people. Stated differently, health care provider takes care of health of people who are within the reach of the system. Importantly, the health care providers are people who are most familiar with are primary care physicians (PCPs). The PCPs are sometimes termed as "family physician or family doctor" in India or as "specialists" whom people normally approach in case of need for certain specific medical care. One must note that there are different types of health care providers [8]. The author, at this juncture, does not wish to elaborate more on types of health care providers, as it does not fall within the scope and framework of objectives of this research paper. Nevertheless, any type of health care service people might need is essentially provided by some type of health care provider. Also, one should note that some societies and nations have what is known as "non-physician health care providers" whose contribution in ensuring better health outcomes is significant. Examples of such health care providers are (1) family therapists, (2) visiting nurses, (3) urgent care centers or walk-in clinics in the neighbourhood, and (4) outpatient department (OPD) [8]. As outlined in the previous section of this research work, the author has used both terms, health care workers and health care providers interchangeably.

e) Hypertension: Hypertension (also, sometimes termed as high BP or raised BP) is reflection of overall health status of individuals. In medical language, it refers to a situation which is characterized by two prevailing indicators: a systolic BP (SBP) of 140 mmHg or more; or a diastolic BP (DBP) of 90 mmHg or more. Stated differently, BP is created by the force of blood pushing against the walls of blood vessels (arteries) as it is pumped by the heart. It has been found that the higher the pressure, the harder the heart has to pump. In this context, it is pertinent to note that blood is carried from the heart to all parts of the body in the vessels in a manner that keeps the health parameters of an individual stable. Equally important is the fact that every time the heart of an individual beats, it results in a situation wherein it pumps up blood accordingly into the vessels of the human body. Hypertension has been found to be a serious medical condition by the expert team of the WHO. The WHO, in its publication in the year 2021, has found that hypertension can increase the risk of several diseases, especially those connected with heart, brain, and kidney. Its burden on health parameters is evident more in low- and middle-income countries [9].

f) Medicine: Medicines (also called drugs or medication) can be defined as "substances that have potential to treat diseases and improve peoples' health". People (both male and female, of all ages), mostly, need to take medicine at some point of time in their life. Further, they may need to take medicine (s) every day, or may need to take medicine (s) once in a while, as and when needed. Furthermore, it is pertinent to note that health care workers (including drug regulatory authorities) should ensure that medicines provided to people are safe and that they will help people get better. Several countries have drug regulatory bodies (or authorities) who are entrusted with the responsibility of ensuring that prescription and over-the-counter medicines are safe and effective. They are overall in-charge of overseeing safety, efficiency and price affordability aspects of medicines. This aspect gains increased significance because of the fact that there are always risks associated with taking medicines. It is, therefore, important to efficiently address these risks before medicines are consumed by people. Most importantly, it has been found that even safe medicines can, sometimes, result in

unwanted side effects with food, alcohol, or other medicines that people might be taking for treatment of other ailments. For instance, some medicines may not be safe during pregnancy. Similarly, some children can be more vulnerable to the undesirable effects of medicines [10]. There, is, thus, need, on the part of health care providers, to be careful while prescribing medicines for pregnant women confronted with hypertension (including acute hypertension). In view of need for reducing the risk of side effects (or reactions), it is important for drug regulatory authorities to ensure efficiency aspects of medicines, especially in view of approving medicines for the treatment of COVID-19 infected persons.

g) Medication: With regards to definition and conceptual framework of the term medication, it is pertinent to note that medications are often found to be, in all nations and societies, one of the main options in the cure, treatment, and prevention of existing health complications of people of all ages. In this context, medical experts have attempted to look into the subjective experience of medications for patients, typically within the illness experiences (of individual patients). Stated differently (in simple terms), a medication is a substance that is taken into or placed on the body for required treatment purposes. Most medications are used, as indicated above, to cure a disease (or condition). Antibiotics are administered, for example, in order to cure an infection [11].

h) Pregnancy: It is the term used to indicate the period during which a foetus (also sometimes written as ‘fetus’) develops inside a woman's womb (or uterus). Period of pregnancy usually lasts for nearly 40 weeks (or over 9 months). This period of pregnancy is measured from the last menstrual period to delivery. In this context, it is significant to note that the events that lead to pregnancy begin with conception (the process in which a sperm penetrates an egg). As a part of second state of the pregnancy process, the fertilized egg (known as zygote) travels through the woman's fallopian tube to the uterus (where it implants itself in the uterine wall). Importantly, the zygote is comprised of a cluster of cells. It is these cells that later form the fetus and the placenta. During the final stage, the placenta connects the mother to the fetus and provides nutrients, and oxygen to the fetus [12].

i) Pregnancy-induced hypertension: It refers to a health condition marked by high BP during pregnancy. This health condition is reported to be prevailing in approximately 7–10% of all pregnancies. Another type of high BP is chronic hypertension, a situation wherein high BP is present before pregnancy begins. Importantly, PIH (also termed as toxemia or pre-eclampsia) is evident in several pregnancies (in all nations and societies). Three primary characteristics of PIH have been found:
    - high BP (a blood pressure reading higher than 140/90 mmHg, or a significant increase in one or both pressures)
    - protein in the urine
    - edema: swelling caused by excess fluid trapped in body's tissues [13]

    Eclampsia is considered as a severe form of PIH. Women confronted with this condition (*i.e.*, eclampsia) have seizures resulting from the condition. It has been reported that in most cases, eclampsia occurs in about 1 in 1,600 pregnancies and develops near the end of pregnancy [13].

j) Preventive measures: This term, in the context of present study, implies measures or steps taken for prevention of a disease as opposed to disease treatment. There is another related term, namely, preventive health measures (PHMs). This encompasses a variety and combination of interventions that need to be undertaken in order to prevent (or delay) the occurrence of disease (s). Such measures are also aimed at reducing further transmission of or exposure to the disease (s). It has been reported that diseases are affected by:

- environmental factors
- genetic predisposition
- disease agents
- lifestyle choices

Notably, medical reports have indicated that diseases are dynamic processes. They occur before people realize that they are affected. The 2030 Agenda for Sustainable Development views health as vital for the future of the planet, with a commitment to achieve Goal 3. This Goal calls on all UN Nations stakeholders to ensure healthy lives and promote well-being for all at all ages [14].

k) Reproductive health: The conceptual framework of reproductive health (RH) is defined as a state of complete physical, mental and social well-being. Most importantly, another significant dimension of the RH is that it does not indicate merely the absence of disease (or infirmity), in all matters relating to the reproductive system (including to its functions and processes). It, in its true sense, implies that people are able to have a satisfying and safe sex life and they have the capability to reproduce and the freedom to decide. Reproductive disorders affect millions of people from across the regions of the globe each year [15]. Exposure to environmental factors could affect RH in several ways. The author does not wish to outline details of how RH (of both men and women) are influenced by environmental factors, as this discussion is beyond scope of this research.

l) Severe hypertension: This term refers to a short course situation that is characterised by very high values of BP corresponding to grade 3 hypertension. People with severe hypertension have an increased cardiovascular morbidity. This situation requires closer clinical monitoring. Significantly, these severe forms of hypertension, from an economic point of view, involve higher cost of health care. This is primarily because of the fact that such situations need:
    - more frequent specialized referrals
    - several radiological examinations (including pathological investigations)
    - frequent hospitalizations [16]

m) Strategic interventions: The term intervention, on one hand, implies sequence of planned activities, actions, and events aimed at enabling an organization to improve its performance and effectiveness. Strategic intervention, on the other hand, of the spectrum indicates an enabling intervention that is aimed at effecting a suitable fit among a firm's strategy, including structure, culture and external environments. The author of this manuscript makes a specific point here that from the management point of view, targets of interventions are (1) strategic interventions (transforming a company or organization), (2) techno-structural interventions (dividing work into departments and coordination), (3) Human Resource Management interventions (overall organizational performance by improving organizational members' performance), and (4) human process interventions (enhancing organizational members in ways in which they work together). In the context of health demography, 5 strategic interventions are:
    - evidence-based policy advocacy for stronger political commitment
    - institutionalization of national international co-operation, and networking mechanism
    - knowledge management, experience sharing, and pilot initiatives
    - capacity building, and technical cooperation
    - improving strategic partnerships, and resource mobilization [17]

Risk Factors Associated with Hypertension During Pregnancy

In terms of risk factors for high BP during pregnancy, there are a few risk factors that could make high BP more likely during different stages of pregnancy among women and adolescent girls [3]. Prominent among risk factors are (a) lifestyle, (b) type of pregnancy, and (c) age. Brief description of these 3 risk factors is presented below:

a) Lifestyle: It has been noted that unhealthy lifestyle practices (or choices) may lead to high BP during pregnancy. In this context, it is pertinent to note that being overweight or obese, or not staying active are major risk factors for high BP [3].

b) Type of pregnancy: It is pertinent to note that women experiencing their first pregnancy are more likely to have high BP. There is, however, a lower chance of this condition in subsequent pregnancies. Most importantly, carrying multiples can make it more likely for a woman to develop hypertension. This is because of the fact that a woman's body is working harder to nourish more than one baby. Again, according to the data published by the American Society for Reproductive Medicine, using assistive technologies (such as IVF) during the conception process can increase chances of high BP among some pregnant women [3].

c) Age: Age is also considered to be a risk factor. For instance, pregnant women over the age of 35 are normally at increased risk. Again, women who had high BP before pregnancy are at higher risk for related complications during pregnancy than those with normal BP [3].

In addition to the points made above, it is pertinent to note that the risk factors associated with hypertension during pregnancy also include socio-demographic variables. Such variables include personal (and lifestyle) factors, obstetric related factors, family history, and medical aspect related considerations. More specifically, nulliparity (a situation depicting never having been pregnant), obesity, a family history of hypertension, high energy diet, gestational diabetes, mental stress during pregnancy, long inter-pregnancy interval, and lower socio-economic status have been found to be associated with higher risk of developing hypertensive disorders of pregnancy (HDP). Maternal mortality due to HDP is high in countries with lower income levels among people and inadequate health infrastructure [18]. HDP represents a group of conditions associated with high BP during pregnancy. There are, thus, several risk factors for an increased hypertension among women and adolescent girls during their pregnancy [19].

In view of the facts presented above, national governments, policy makers and inter-governmental organizations opine that there is, today, increased need to adequately address the issues and health complications connected with hypertension during pregnancy. In fact, the issue of PIH (also known as toxemia or pre-eclampsia) needs to be looked into by the health care providers in the broader context of socio-economic and demographic perspective.

According to the data published by the WHO (in the document titled "WHO Recommendations for Prevention and Treatment of Pre-eclampsia and Eclampsia") in the year 2011, improving care for women and adolescent girls during pregnancy and around the time of childbirth to prevent and treat pre-eclampsia and eclampsia is a necessary step towards the achievement of health targets [reflected in terms of Sustainable Development Goals (SDGs)]. Efforts to prevent and reduce morbidity and mortality due to PIH conditions can help address maternal health globally [20]. Importantly, in order to achieve this goal of preserving maternal health, all concerned stakeholders need evidence-based guidelines on "addressing hypertension during pregnancy".

Types of Pregnancy-Related Blood Pressure Conditions

With respect to types of pregnancy-related BP conditions, high BP during pregnancy can be divided into 3 different conditions [21]. They are outlined below:

a) Chronic hypertension: Sometimes a woman has pre-existing high BP, or hypertension, before she gets pregnant. This may be referred to as chronic hypertension, and is usually treated with BP medication. Also,

health care providers consider hypertension that occurs in the first 20 weeks of pregnancy to be chronic hypertension [21].

b) Gestational hypertension: Gestational hypertension develops after the 20th week of pregnancy. It usually resolves after delivery. The author of this paper makes specific point here that when diagnosed before 30 weeks, there's a higher chance that it will progress to pre-eclampsia [21]. There are few words of caution for health care workers in this context. They should ensure that pregnant women undergo medical check-up, as clinically required.

c) Chronic hypertension with superimposed pre-eclampsia: Women who have chronic hypertension before becoming pregnant can develop pre-eclampsia. This occurs when women experience protein in their urine or additional complications as the pregnancy progresses [21]. This particular health condition (resulting from chronic hypertension with superimposed pre-eclampsia) among women must be addressed by health care workers in an effective and timely manner.

Parameters of Normal Blood Pressure During Pregnancy

Information presented above gives important insight into pregnancy and its related risk factors. At this section of the present study, the author attempts to outline discussion in response to question "what is considered normal BP during pregnancy?" Normal BP is considered anything less than 120/80 mmHg. Again, in response to question on "what is considered high BP during pregnancy?", a BP that is greater than 130/90 mmHg (or that is 15 degrees higher on the top number from where it started before pregnancy) may be cause for concern, in terms of health risk. In this context, it is equally important to look into the question: what is considered low BP during pregnancy? While there is not a definitive number that is too low, it is believed that there are symptoms that are associated with low BP. Some of the symptoms are:

- headache
- dizziness
- nausea
- feeling faint
- cold
- clammy skin

Importantly, changes in BP during pregnancy occur. As a woman progresses in her pregnancy, her BP may change or return to pre-pregnancy levels. There are a few possible reasons for this. One of the reasons is that the amount of blood in a woman's body increases. A woman's blood volume increases by as much as 45% during pregnancy. As per the medical science evidence, this is extra blood that the heart must pumps throughout the body. It is advocated that the kidneys release increased amounts of vasopressin (a hormone that leads to increased water retention). It has been found that in most cases, high BP during pregnancy will decrease after the baby is delivered. In cases where BP remains elevated, doctors prescribe medication to get it back to normal [22]. Some women have high BP even before they get pregnant, whereas others develop it for the first-time during pregnancy. A serious high BP disorder (called pre-eclampsia) also can happen during pregnancy (or soon after childbirth). BP changes often during the day [2].

Discussion

Discussion presented above aimed at (a) introductory part, (b) research methodology employed, (c) description of key terms used, (d) risk factors associated with hypertension (including severe hypertension) during pregnancy, (e) types of BP-related pregnancy conditions, and (f) parameters of normal BP during pregnancy. The author, in this section of the paper, attempts to investigate into:

- trends in extent of complications (including maternal mortality) due to hypertension during pregnancy globally
- role of health care workers in addressing PIH
- management of hypertension during pregnancy
- future directions for better outcomes in the field

The discussion presented here (on 4 aspects, as indicated above) is in accordance with general and specific objectives of this paper. Discussion follows:

Quick look at data on maternal deaths due to pregnancy-induced hypertension

According to estimates published by the WHO in the year 2018, approximately 3,03,000 women (including adolescent girls) died owing to pregnancy and childbirth-related complications in the year 2015. Nearly 99% of these maternal deaths occurred in countries with low-resources. According to the study published by the WHO in the year 2018, haemorrhage and hypertensive disorders (including sepsis) are responsible for more than half of all maternal deaths worldwide [21]. The term sepsis implies a serious health condition resulting from the presence of harmful microorganisms in the blood or other tissues, and the body's response to their presence. Health conditions of this type are reported to potentially result in three events, namely:

- malfunctioning of various organs
- shock
- death [21]

In addition to what has been specified above, data published by the WHO are indicative of the fact that HDP are responsible for severe morbidity, long-term disability, and death among both mothers and their babies. Notably, they are contributory factors for nearly 14% of all maternal deaths worldwide [21].

Addressing severe hypertension during pregnancy by health care workers

The author, herewith, discusses what role health care providers can play in adequately and efficiently addressing health issues of pregnant women confronted with hypertension, in general, and with acute hypertension, in particular. This forms part of primary (or specific) objective of the paper.

As it is obvious from the description presented in previous sections of this research work, hypertension is one of the most commonly encountered health disorder during pregnancy among women and adolescent girls. High BP has a negative impact on the mother and the foetus. It is for this reason that early diagnosis and proper control are mandatory to avoid complications. There are many forms of hypertension-related disorders during pregnancy [23]. Health complications of pregnant women become more disordered in case of severe hypertension.

As the author has indicated in previous sections, severe hypertension refers to a short course situation that is characterised by very high values of BP corresponding to grade 3 hypertension. Health situation of this type results in an increased cardiovascular morbidity. These severe forms of hypertension from an economic point of view, involve higher cost of health care [16]. It is because of these reasons that this aspect requires closer clinical monitoring and special attention by health care workers. Discussion on role of health care workers in handling severe (acute or chronic) hypertension conditions during pregnancy follows:

It has been found that some women (including adolescent girls) may be subjected to chronic hypertension (either essential or secondary). They are at increased risk of pregnancy related complications. They should, therefore, be observed and monitored frequently during pregnancy by health care workers. It is essential that such workers are equipped with medical skills needed for the management of hypertension during pregnancy [24]. The frequency of required review visits by health care providers should be determined by factors such as:

- how successfully BP is controlled
- associated disorders (*e.g.*, renal disease, proteinuria, etc.)
- the gestation [24]

However, it is recommended (by the WHO and other inter-governmental agencies) that the number of review visits should be increased during the second half of all pregnancies. This is because of the fact that this is the state of pregnancy when acute hypertension related complications are more likely to occur among women and adolescent girls [24].

In cases of situations where pregnancy-induced chronic hypertension prevails, the health care workers may need to use home BP monitoring (HBPM) equipment. This group of patients require specific and personalized care. It is recommended that low-dose aspirin (LDAs) can be initiated ideally prescribed:

- at 12 weeks' gestation
- in any cases prior to 16 weeks' gestation [24]

Further, it is recommended that health care workers should carry out serial surveillance for fetal growth restriction. This is because of the fact that the risk for fetal growth restriction is higher in women and adolescent girls with chronic hypertension conditions. Furthermore, health care workers must be vigilant for super-imposed pre-eclampsia in women with chronic hypertension conditions [21]. In case of pregnant women with chronic hypertension, they (health care workers) should consider treatment with anti-hypertensives if:

- women are already on pre-pregnancy medication
- moderate to severe hypertension develops [24]

Also, health care workers must note that mild hypertension does not normally require any treatment interventions. There is an analysis of research data that suggest that in the presence of end organ damage, tighter BP control is beneficial. In addition to these aspects, therapy should be used by health care providers in order to keep systolic BP below 140 mm Hg and diastolic BP at 80–90 mm Hg [24].

In a BP reading, the systolic pressure is typically the first number recorded. For example, with a BP of 120/80, the systolic pressure is 120. The term diastolic, on the other hand, implies the time when the heart is in a period of relaxation. The diastolic BP is typically the minimum arterial pressure recorded during relaxation of the ventricles of the heart (when the ventricles fill with blood). In practice of BP reading, the diastolic pressure is the second number that is recorded. With BP of 120/80, for example, the diastolic pressure is 80 [25]. It is important that women with new onset gestational hypertension should be categorically cared for by health care workers [24]. Health parameters of such category of women should be handled with utmost care. Description presented below pertains to precautions (in terms of strategic interventions) that health care providers need to take into account while dealing with pregnant women confronted with 3 types of hypertension: (a) mild hypertension, (b) moderate hypertension, and (c) severe hypertension. Discussion is presented below:

a) Mild hypertension: It has been advocated by experts that women and adolescent girls with mild hypertension do not (always and necessarily) need treatment by health care workers. Rather workers (health care workers) should make review visits to attend pregnant women on weekly basis for (1) BP assessment, and (2) screening for proteinuria. Also, in cases of mild hypertension, blood tests should be performed. But health care workers should ensure that blood tests are not repeated unless clinically indicated (or required). Again, ultrasound for fetal assessment should be carried out. But such ultrasound practices need not be repeated in case normal and clinical surveillance are satisfactory [24].

b) Moderate hypertension: Health care workers should ensure that women with moderate hypertension conditions are (1) commenced on medication, and (2) reviewed at least twice a week in order to assess BP.

Importantly, urine should be checked for proteinuria during each visit. Equally important is the fact that bloods tests should be performed. But tests should not be repeated unless required clinically. Health care workers should carry out ultrasound for fetal assessment, but they should not repeat it if normal and clinical surveillance are found to be satisfactory [24].

c) Severe hypertension: Health care workers should ensure that women and adolescent girls confronted with severe hypertension related health complications are (1) commenced on medication, and (2) admitted to hospital until BP stabilizes. In this context, it is important to note that an inpatient BP needs to be assessed regularly and urine needs to be checked for proteinuria on daily basis. However, these practices of BP assessment and pathological investigation needs to be reduced from daily to twice weekly in cases where health conditions of pregnant women are stabilized and they are discharged to home. Health care workers should, therefore, undertake review and assessment of health conditions associated with severe hypertension among pregnant women and adolescent girls [24].

Another important dimension in addressing severe hypertension issues during pregnancy is that health care workers should ensure that blood tests are performed daily, and inpatient and an ultrasound for fetal assessment are carried out at diagnosis. Again, serial ultrasound surveillance should be undertaken on every fortnight basis. Also, health care workers should ensure use of corticosteroids for fetal lung maturation in cases of less than 36 completed weeks' gestation. Again, in cases where intrauterine growth restriction (IUGR) is identified, the frequency of surveillance needs to be increased. In terms of few words of caution for health care workers, the author, in this section of the research, makes a specific point that they must be vigilant, at all times, for progression to pre-eclampsia in women and adolescent girls with gestational hypertension and reassessment. Pre-eclampsia needs to be considered if clinically indicated (or required) [24].

Management of hypertension during pregnancy - important considerations

In this section of the research, the author outlines important considerations in addressing PIH among women and adolescent girls. Also, mention has been made of the efforts made by the international non-governmental bodies (such as the WHO) in management of hypertension during pregnancy. Policy level management issues have been looked into.

HDP have been found to be an important cause of severe morbidity, long-term disability and death among both pregnant women and their babies. Initiatives aimed at improving the quality of maternal healthcare for women is therefore, a necessary step towards the achievement of health targets of the SDGs. The SDGs were adopted by all United Nations (UN) Member States in the year 2015 in response to a universal call to (a) end poverty, (b) protect the planet from environmental degradation, and (c) ensure that all people enjoy peace and prosperity by the year 2030 [21].

At this juncture of the present research, the author finds it appropriate to note that there are internationally-accepted human rights laws and legislations to protect women from complications due to hypertension (including severe or acute hypertension) during pregnancy. Such legislations envisage fundamental commitments (by member states) in order to enable women and adolescent girls to survive pregnancy and childbirth [21]. These international commitments form part of (a) rights of women and girls to their enjoyment of sexual and reproductive health (SRH), (b) rights for living a life of dignity [21].

In addition to above mentioned international conventions and commitments, one must note that the WHO envisions a world with better health outcomes for women faced with hypertension related complications. Such a vision for the future aims to ensure that "all pregnant woman and new-born receive quality health care throughout pregnancy, childbirth, and post-natal period" [21]. Health care workers, at all levels (and at all times) are expected to make very significant contribution in shaping a future world of this type.

In terms of efficient and timely management of hypertension during pregnancy, the author of this research note makes a point herewith that the WHO, in the year 2011, published 22 recommendations for the prevention and treatment of pre-eclampsia and eclampsia, including two recommendations on the use and choice of anti-hypertensive drugs for the treatment of severe hypertension during pregnancy [21]. It should be noted by health care workers that these recommendations were developed according to the WHO guideline development standards, including (a) synthesis of available research evidence, (b) use of the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology, and (c) formulation of recommendations by a guideline panel of international experts [21].

There are research evidences that are indicative of the fact that there is a need for effective interventions at reasonable cost for the purpose of prevention or treatment of virtually all life-threatening maternal complications. On the basis of the analysis of data, the WHO argues that almost two-thirds of the global maternal and neonatal disease burden could be alleviated through optimal adaptation of intervention measures by the health care workers. The author of this paper is of the determined view that in order to provide good quality care during pregnancy, health care workers, at all levels (and at all times) need to have access to appropriate medications and training in relevant procedures. This is required more particularly in low and middle-income countries, with limited resources (including health infrastructure). Equally important is the fact that health care workers, health managers, policy makers, and other stakeholders also need to have access to up-to-date and evidence-based recommendations. They need to be informed and updated on a regular basis about the clinical policies and practices. These initiatives, in turn, will enable them to optimize quality of care and improve health care outcomes. Today, it is a proven fact that concerted efforts to prevent and reduce morbidity and mortality during pregnancy and childbirth have the potential to reduce the inequities in maternal and perinatal health the world over [21].

Future directions for better outcomes in addressing pregnancy-induced hypertension

This section of the review paper aims to research into future directions and suggested plan of action for ensuring better outcomes in addressing PIH. Complications related to PIH have been found to be an important cause of severe morbidity, long-term disability and death among both pregnant women and their babies. This accounts for nearly 14% of all maternal deaths globally. It is, therefore, necessary to improve care for women around the time of childbirth. This health outcome is considered as an important tool that can facilitate achievement of the health targets of the SDGs [21]. It is for this reason that series of efforts have been made worldwide to look into future directions for ensuring better outcomes. Policy level dialogues and academic and research interactions have taken place in the past.

The Executive Guideline Steering Group (GSG) on WHO maternal and perinatal health recommendations, in the year 2017, prioritized updating of the existing WHO recommendations on anti-hypertensive drugs for severe hypertension in pregnancy. This development took place in response to important and new evidence on these interventions. It is pertinent to note that these recommendations are a revalidation of the previous recommendations issued in the year 2011 in the WHO recommendations. One should note that these recommendations pertain to “prevention and treatment of pre-eclampsia and eclampsia” [21].

Another important development in the field of future plan and directions in the area of effectively addressing PIH issues took place in the year 2017 when the WHO established a renewed process for prioritizing and updating maternal and perinatal health recommendations pertaining to the PIH. As a part of this policy level project, an Executive GSG oversaw and reviewed a systematic prioritization of maternal and perinatal health recommendations that required urgent updating [21]. It is interesting to note that the recommendations (on maternal and perinatal health) were prioritized on the basis of new uncertainties in the underlying evidence based on:

- benefits
- harms
- values placed on outcomes
- acceptability

- feasibility
- equity
- resource use
- cost-effectiveness (or factors affecting implementation) [21]

On the basis of parameters, as outlined above, the Executive GSG prioritized updating of the existing WHO recommendations on anti-hypertensive drugs for severe hypertension during pregnancy. This important development of prioritization and updating took place in response to new and potentially important evidences. These recommendations (on anti-hypertensive drugs for severe hypertension during pregnancy) are primarily aimed at improving the quality of care and outcomes for pregnant women. Notably, the recommendations placed increased emphasis on providing required services by health care workers to particularly those women (and adolescent girls) who are confronted with HDP. Stated differently, these recommendations attempt to provide an insight into a basis or foundation for the future sustainable implementation of drug treatment for PIH (including severe hypertension in pregnancy) globally [21].

Addressing Hypertension Among Pregnant Women Due to COVID-19 Pandemic

This section of the paper presents brief description on strategies to be adopted by health care providers in addressing hypertension among pregnant women due to COVID-19 pandemic. Although this discussion does not form part of objectives of the present work, the author briefly outlines how material health is impacted by the coronavirus infection 2019 pandemic (termed as COVID-19) as this situation has posed added challenges for community level health care providers across the regions of the globe.

The COVID-19 pandemic has posed challenges both for global economy and health infrastructure worldwide. Also, this health crisis has resulted in transition to virtual health care during pregnancy. Both those in need of health care and service providers are constrained to resort to virtual platform in order to reduce dependence on hospital-based care and minimize the risk of being exposed to coronavirus infection. This infection is found to carry a similar risk during pregnancy compared with that in non-pregnant adults. The risk of getting infected is true for all women, including nearly 10% who have pregnancy induced hypertension and receive specialist hypertension care [26].

Some countries have formulated guidelines for health care workers while treating hypertensive pregnant women during the COVID-19 pandemic. Significantly, focus in guidance (guidelines) has been placed on provision of self-monitoring at home and virtual consultation, whenever possible. Reasons for this arrangement (*i.e.*, dependence on self-monitoring and virtual platform) have already been outlined above by the author. Such situations are applicable for women with chronic or gestational hypertension. It is assumed (in the guidelines) that they (pregnant women confronted with hypertension) can self-monitor BP at home, undertake proteinuria testing, and receive remote review by the maternity-care team [26].

It is important to note that while some women with pre-eclampsia medical conditions can be cared for as outpatients, experts still advise them to attend face-to-face visits, as frequently as possible, due to COVID-19 induced travel restrictions. Also, it is recommended that key aspects of PIH care must be provided for all women within the existing constraints and limitations [26].

Further, in view of COVID-19 health crisis, more emphasis is being placed today on the concept of HBPM. Health care providers opine that the HBPM strategy is a key in remote monitoring during pregnancy. This strategy is recommended primarily based on three considerations, namely (a) acceptability of straggly to women, (b) widespread informal use, and (c) lack of safety concerns. In this context, one must note that women with (a) gestational hypertension are also capable of undertaking the HBPM approach, and (b) chronic hypertension are suited for the HBPM (and may have practiced the HBPM before pregnancy) [26].

Although this concept (of the HBPM) was already in existence informally in maternity care previously, the COVID-19 pandemic situation has facilitated further and rapid implementation of this practice. Today, several countries are placing more attention on this practice. The HBPM is being, for example, facilitated for use in the United Kingdom (UK). As a part of this initiative, first, the Royal College of Obstetricians and Gynaecologists (RCOG) provides guidance on BP monitoring devices. These devices have been designed in such a manner that they are appropriate for home use by pregnant women with hypertension-related complications. They are validated for use in pregnancy and pre-eclampsia specifically, along with clear and detailed instructions for monitoring. In the second phase of the initiative, the UK Government agencies have procured BP monitor devices for domiciliary use by hypertensive pregnant women [26].

Conclusion

The author in this review paper has primarily aimed to investigate into strategic interventions that health care providers need to envisage while treating pregnant women with severe hypertension conditions. Description provided above outlined (a) the linkage between hypertension (high BP) and health status of pregnant women, and (b) contribution provided by health care workers in addressing issues pertaining to hypertension, including severe hypertension during pregnancy. The author makes a specific point here that "hypertensive disorders of pregnancy is an umbrella term". This term, in the context of present paper includes (a) pre-existing and gestational hypertension, (b) pre-eclampsia, and (c) eclampsia.

In conclusion, the author states that there is an increased need to adequately address complications resulting from hypertension during pregnancy. National governments and inter-governmental organizations of the United Nations (UN), including the WHO have emphasized this aspect during series of consultations and research interactions. Both severe hypertension and non-severe hypertension (especially with evidence of "end-organ damage") need to be controlled with required medical interventions effectively by health care workers [27]. Importantly, many of the pregnancy related complications among women and girls faced with hypertension conditions are preventable. This will require interventions and renewed management strategies that health care providers and all concerned stakeholders will need to envisage at all times and at all levels. Efficient management of PIH is pre-requisite for meeting overall SDGs by the year 2030. Despite global commitments for addressing PIH (including preventing maternal mortality during and after pregnancy), not much success has been made over the years in all countries. There are varied reasons for this situation improvement which will require strategic interventions, including societal interventions.

Efficient management of hypertension during pregnancy is therefore necessary. However, this action involves many challenges. In addition to key points to be noted by health care providers while meeting health requirements of pregnant women with hypertension, mitigating challenges will also require collaboration between obstetricians, cardiologists, and community level health care providers (including nurses) [28]. Further, author makes a specific point here that empowering women through various initiatives (in a manner that aligns with country and region-specific social, economic and demographic characteristics) will go a long way in preserving health and general well-being.

It is advocated that overall empowerment (including autonomy) of women and girls in all spheres of development is necessary in order to enable them to better manage their RH, especially during pregnancy. In fact, improvement of their political, social, economic and health status is an important end in itself for all nations across the regions of the globe. Also, empowerment is essential for the achievement of SDGs. In the context of overall empowerment of women, education is considered as one of the most important tools. It is imparting education, accompanied by disseminating relevant health knowledge and information, which empowers women with skills necessary for understanding and addressing their concerns during pregnancy, especially when they are exposed to added risk of hypertension. The office of the United Nations Population Fund (UNFPA) urges that all countries should strive to

empower women. Also, sustained efforts are needed in order to eliminate inequalities between men and women, as soon as possible, in all nations and societies [29].

The paper concludes that health care providers should ensure that women with chronic hypertension undergo a pre-pregnancy evaluation. Such an evaluation should envisage focus on hypertension-induced health indicators of pregnant women with enhanced emphasis on aspects such as (a) end-organ damage, (b) medication profile, (c) potential secondary causes of hypertension, and (d) counselling on the risks of pregnancy (including the development of superimposed pre-eclampsia) [28].

To sum up, women must be followed carefully during pregnancy and in the intra and post-partum settings. Most importantly, there is ongoing research focusing on two important aspects, namely (a) the appropriate management of hypertension in pregnancy, and (b) the long-term consequences for women. These considerations may influence future recommendations in the field. In addition to these points, more sustained and meaningful efforts, in coordination with all health developmental partners (both in governmental and non-governmental sectors), need to be made at both macro and micro levels.

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Conflicts of Interest

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