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MEETING ABSTRACTS Open Access

Proceedings of the Stillbirth Summit 2014

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MEETING ABSTRACTS

A1

Proceedings of 2014 Stillbirth Summit

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Stillbirth is a devastating pregnancy outcome that occurs once in every 160 pregnancies in the United States, [1] with similar rates in other developed nations around the world. Despite advances in medical knowledge and technology, there have been slow trends in stillbirth reduction in most high income countries over the past two decades relative to other declines in infant mortality [2]. Contributing to this lack of progress is the minimal amount of research activities dedicated to stillbirth etiologies and prevention methods.

As a follow-up to Stillbirth Summit 2011, Star Legacy Foundation hosted Stillbirth Summit 2014 in Minneapolis, MN (USA) June 19-21, 2014. The goals of the summit were to support current and emerging stillbirth research, promote collaboration among interested parties, and to encourage dialogue regarding the complex factors affecting stillbirth incidence and care. In attendance were researchers, health care professionals, stillbirth advocates, and bereaved families. The following oral papers offer an overview of the research presented and discussed at this event.

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Proceedings of 2011 Stillbirth Summit

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The previous Stillbirth Summit presented by the Star Legacy Foundation and supported by various organisations was held in October 2011 in Minneapolis to discuss emerging ideas in the field of stillbirth research and management. In particular the focus was on the placenta, cord, infection and inflammation, reduced fetal movements and maternal sleep. Attendees were invited researchers, stillbirth advocates and parents. One of the strengths of the meeting was the robust debate amongst the researchers, alongside the energy and passion of the parents.

Unlike some scientific meetings which are talkfest, the Summit in 2011 had tangible outcomes. The first of which was that the majority of the researchers summarised their presentations, which were published in the BMC Pregnancy and Childbirth, which is an open access journal allowing anyone to access the content online [1]. Several important collaborations developed. Jane Warland and Ed Mitchell had independently developed conceptual models for the mechanism of stillbirths, which were adapted from the SIDS triple risk model. These authors collaborated in developing their ideas further and this has been recently published [2].

In 2011 Tomasina Stacey summarised the findings from The Auckland Stillbirth Study, a case-control study, which identified maternal non-left position on going to sleep was associated with a two fold increase risk of late stillbirths. The researchers urged caution and identified the need for robust, peer reviewed supporting evidence before recommending change or public health campaigns. Alex Heazell took up the challenge and with the support of the Auckland group has developed the Midland and North of England Stillbirth Study (MiNESS), which is funded by Action Medical Research and Cure Kids [3].

The most notable outcome was the development of the STARS Study, led by Louise O'Brien and Jane Warland, and supported by the Star Legacy Foundation. In essence this is an internet survey of women who had lost a baby in late pregnancy (28+ weeks gestation). There were two components, the first was women who had lost their baby more than 3 weeks prior to completing the survey. "The experiences of 1310 mothers of late stillbirths" was presented at the Stillbirth Summit 2014 by Jane Warland. The second component was a case-control study. The cases are mothers who had a late stillbirth less than 3 weeks prior to completing the interview. They are compared with women who had live ongoing pregnancies also at 28+ weeks gestation. The survey was extensive covering a wide range of issues. Recruitment has been difficult and the expected number of cases and controls are less than expected. Ed Mitchell presented interim findings from 132 cases and 283 controls. As these analyses were interim, the results are not presented here.

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A3

Update from New Zealand

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The Auckland Stillbirth Study, a prospective population-based case control study, was the first study to report maternal sleep related practices as risk factors for stillbirth [1]. In brief there were 155 women with a singleton late stillbirth (at or greater than 28 weeks' gestation) without congenital

abnormality, born between July 2006 and June 2009 and booked to deliver in Auckland. They were compared with 310 women with single ongoing pregnancies and gestation matched to that at which the stillbirth occurred. The prevalence of late stillbirth in this study was 3.09/1000 births. No relationship was found between snoring or day time sleepiness and risk of late stillbirth. However, women who slept on their back or on their right side on the last night (prior to stillbirth or interview) were more likely to experience a late stillbirth compared to women who slept on their left side (back: aOR 2.54; 95% CI: 1.04 to 6.18; and right side: aOR 1.74; 95% CI: 0.98 to 3.01). Women who got up to the toilet once or less on the last night were more likely to experience a late stillbirth compared to women who got up more frequently (aOR 2.28; 95% CI: 1.40 to 3.71). Women who regularly slept during the day, in the last month, were also more likely to experience a late stillbirth compared to those who did not (aOR 2.03; 95% CI 1.26 to 3.27). If maternal sleeping position is causally related to stillbirth then 37% of stillbirths might be prevented if mothers slept on their left side. However, the authors urged caution as this was the first time that an association has been described between maternal sleep practices and late stillbirth risk. Further studies are needed to confirm or refute these findings before public health interventions are launched.

In New Zealand there is a multicentre case-control study, which began in 2012, led by Lesley McCowan, and in England there is the Midland and North of England Stillbirth Study (MiNESS), which began in 2014, led by Alex Heazell [2].

Despite urging caution, midwives appear to have accepted the findings and are advising their patients to sleep on the left side. This has resulted in a significant increase in left sided sleep position, from 35.9% in The Auckland Stillbirth Study (2006-9) to 62.5% in late 2011 (unpublished findings). This has been associated with a reduction in late stillbirth for New Zealand (excluding congenital abnormalities and multiple pregnancies).

2007 184.
2008 187.
2009 205.
2010 162.
2011 146.
2012 136.

Although we cannot exclude other reasons for the decline, it is tempting to believe that the declined is a consequence of more pregnant women sleeping on their left.

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A4

Maternal sleep position: what do we know where do we go?

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Good sleep is an essential component to health and wellbeing. It consumes one third of human existence; unhealthy sleep can severely impair the other two-thirds. An increasing amount of data now shows that poor sleep – such as sleep disordered breathing, poor sleep quality, and insomnia - has a negative impact on pregnancy outcomes [1-5]. Indeed, over half of the most important risk factors for stillbirth, such as maternal hypertension, gestational diabetes, and fetal growth restriction, have been shown to be associated with maternal sleep disruption [1,2,6-9]. Findings from recent studies have also suggested that maternal sleep position may be a risk factor for stillbirth [10,11]. It has long been recognized that posture in late pregnancy can have a profound effect on maternal hemodynamics. Studies in awake pregnant women have demonstrated reduced ejection fraction and cardiac output in the supine position compared to the left lateral position [12] that may reduce utero-placental blood flow to the fetus since the gravid uterus compresses the inferior vena cava. Failure to prevent this compression can lead to maternal supine hypotensive syndrome [13] and to an adverse effect on umbilical artery blood flow and gas exchange between mother and fetus, with consequent fetal heart rate decelerations [14] and fetal growth restriction [15].

For over 60 years it has been standard of care to place laboring pregnant women in the left lateral tilt position to displace the uterus from the inferior vena cava and improve maternal hemodynamics. Despite this knowledge, little attention has been paid to maternal sleep position during pregnancy even though we spend about one third of our life asleep. Given the known effects of inferior vena cava compression it is very possible that supine sleep could be a risk for stillbirth. Recent studies in Auckland, New Zealand [10], and Ghana, Africa [11] have both shown that supine sleep is independently associated with stillbirth; indeed Owusu et al [11] found that the effect of supine sleep on stillbirth was mediated via low birth weight. Both of the latter studies suggested that if supine sleep plays a causal role in stillbirth, altering the sleep position of pregnant women may reduce stillbirth by approximately 25%. Of note, we have recently demonstrated that the majority of pregnant women (about 80%) spend some time sleeping supine, with the median time being approximately one quarter of the night [16]. Supine sleep may therefore represent a maternal stressor in the unexplained late stillbirth triple risk model [17]. Thus, if supine sleep plays a role in stillbirth, the majority of pregnant women would benefit from education and potential intervention. Several potential methods to reduce supine sleep include the use of mattress wedges or pillows [18] or other interventions such as the 'tennis ball' technique [19] or even novel devices that could alert a pregnant women to change position. However, before intervention studies are launched, it is pertinent that the findings regarding sleep position are repeated and confirmed in other studies; several such studies are currently underway including small studies monitoring the fetus during maternal sleep (O'Brien and Warland, personal communication) and large studies such as the MiNESS study in the UK [20] that will either support or refute the sleep position hypothesis.

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A5

The placenta and adverse pregnancy outcomes – opening the black box?

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A healthy placenta is critical for a healthy pregnancy. Conversely, abnormal placental structure and function is seen in conditions which are associated with stillbirth including: fetal growth restriction, preeclampsia, placental abruption and obstetric cholestasis. Abnormalities can be seen ranging from a reduction in placental size in stillbirth to microscopic changes in placental villous architecture [1]. Placental examination is advocated after stillbirth by respected guidelines [2-4]; this recommendation is based upon the frequency of abnormalities seen in placentas after stillbirth [5,6], the reduction in unexplained stillbirths when placental histological examination is performed and the cost-effectiveness per abnormality detected [1,7].

The placenta has previously been referred to as a "diary of pregnancy" and it is tempting to compare examination of the placenta after stillbirth with the "black-box" flight data recorder used after aircraft accidents. To be certain that placental findings are significant in a case of stillbirth they should reflect (relevant) changes that occurred prior to fetal death. Thus, there should be no artefact from in-utero retention or storage. Placental findings should give information regarding conditions present and be specific for adverse pregnancy outcome (i.e. not occur in healthy pregnancy). Ultimately, the information obtained must be useful, aiding understanding of death by clinicians and inform future care.

Storage and fixation of placental tissue can alter findings on examination. Naeye et al. states that "troublesome artefacts" can appear after 48 hours of refrigeration [8]. This is supported by qualitative and quantitative assessment Garrod et al. demonstrated changes in villous vascularity after 48 hours refrigeration [9]. Thus, every effort should be made to minimise the time of storage prior to examination. The effects of retention *in utero* before birth are more difficult to assess as the time of fetal death is usually unknown. Genest estimated that *in utero* retention was associated with villous degeneration, particularly of fetal blood vessels and villous stroma [10].

A systematic review of histopathological assessment of the placenta found that a placental cause is reported in 11.2 - 64.9% and associated with stillbirth in 31.5% - 84% of cases [11]. The greatest influence on the proportion of stillbirths classified as having "placental" abnormalities was the classification system employed. The specificity of placental abnormalities for stillbirth has previously been questioned by the high incidence of histological lesions in apparently normal pregnancies and the large variation in agreement between pathologists when identifying lesions (Kappa – 0.25-0.91) [12,13]. These data highlight the importance of international consensus in the definition of placental lesions to improve study quality. Accurate description of lesions will also enable better understanding of their origins. One example of this is syncytial knots (also known as syncytial nuclear aggregates). The formation of syncytial knots are increased in hypoxia and oxidative stress *in vitro* [14], which supports the reported association between syncytial knots/nuclear aggregates and maternal vascular malperfusion [13,15].

Furthermore, evaluation of placental structure and function can be used to explore clinical scenarios relating to stillbirth such as maternal perception of reduced fetal movements, advanced maternal age and fetal growth restriction [16-18]. These clinical conditions are all associated with alterations in placental structure, specifically increased syncytial knots/nuclear aggregates, changes in trophoblast proliferation and alterations in amino-acid transport [14,19-21]. Importantly, these observations provide plausible biological association between these clinical scenarios and stillbirth from placental causes. These suggest that better appreciation of placental function *in utero* may provide an opportunity to identify pregnancies at risk of stillbirth to target intervention [22,23].

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A6

Toward better understanding of the human placenta: development of "disease-in-a-dish" models

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Many stillbirths result from pregnancy complications, whose root cause is abnormal development and function of the placenta [1]. In order to prevent stillbirths, we need to have a better understanding of how the human placenta develops, both in normal and abnormal pregnancies. This lack of understanding of the human placenta has recently been acknowledged, and "The Human Placenta Project" launched, by the National Institute of Child Health and Human Development (NICHD) [2]. In fact, the human placenta is difficult to study because of the lack of both "in vivo" animal models and placental cell lines able to be cultured "in vitro" in a tissue culture dish. Specifically, mice and rats have placentas which differ from the human both in structure and at the molecular level [3]; in addition, the human placental cell lines behave differently in culture, compared to the placental cells as they exist "in vivo" in the pregnant patient [4]. Over the last 5 years, our laboratory has set out to use human pluripotent stem cells (hPSCs) to model placental development in a dish [5]. "Pluripotent" stem cells have the ability to differentiate, or turn into, any cell type in the body, including the placental cell type, "trophoblast"[6,7]. While initially hPSCs had to be derived from human embryos, in 2007, Yamanaka et al. developed a method for generating such cells from any proliferative cell type [8]. hPSCs have now been derived from numerous cell types, including amnion cells of the placenta [9].

We have developed a method for step-wise differentiation of such hPSCs, first into trophoblast precursor cells and then into terminally differentiated, functional trophoblast, including multinucleated syncytiotrophoblast (STB) and invasive extravillous trophoblast (EVT). These two cell types are the functional units of the placenta: STB carry out nutrient and gas exchange, while the EVT invade the maternal uterus and establish blood flow to the feto-placental unit. Our differentiation method is both reproducible and highly efficient, with >95% of cells becoming trophoblast in the culture dish, based both on expression of specific genes and on functional assays such as secretion of the pregnancy hormone, hCG. We recently applied this method to hPSCs carrying a chromosomal aneuploidy, Trisomy 21 (T21). It is known that trophoblast isolated from T21 placentas have a defect in differentiation into multinucleated, hCG-secreting STB [10]. We asked whether this defect could be reproduced in culture when differentiating T21 hPSCs into trophoblast. We observed that T21 hPSCs indeed show delayed differentiation into functional STB, secreting significantly less hCG into the media compared to trophoblast derived from hPSCs with a normal karyotype. These results confirm the utility of hPSCs in modeling human placenta, both during normal development and in disease. We are currently collecting and banking amnion epithelial cells from placentas of patients with pregnancy complications, focusing on early-onset severe preeclampsia, which is highly associated with both maternal and neonatal morbidity and mortality. We believe that, once reprogrammed into hPSCs, these cells hold great promise, both in advancing our understanding of the mechanisms of placental dysfunction, and also in providing a platform for drug screening to reverse the disease phenotype.

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A kick in the right direction - reduced fetal movements and stillbirth prevention

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Multiple studies using various approaches have associated reduced fetal movements (RFM) with stillbirth and small for gestational age infants [1,2]. More recently, RFM has been linked to neurodevelopmental delay and a lack of response to treatment for hypoxic-ischaemic encephalopathy [3,4]. The relationship between adverse pregnancy or infant outcome is thought to be mediated by placental dysfunction [5]; thus RFM represents a symptom of placental insufficiency, when a placenta cannot meet the metabolic demands of the growing fetus. This hypothesis is now supported by evidence of changes in placental structure, inflammation and function in women who present with RFM [6,7]. Critically, some of these changes in placental size, structure and pathology differentiate between pregnancies with RFM that end in healthy pregnancy or adverse outcomes [8,9]. Thus,

assessment of fetal growth and placental function in mothers presenting with RFM may offer new avenues to identify babies at risk of stillbirth to target intervention.

A prospective control study found that 67 out of 303 women (22%) presenting with RFM to St Mary's Hospital, Manchester, UK had adverse perinatal outcome. Significant predictors of adverse outcome were diastolic blood pressure, estimated weight centile, liquor volume and log [human placental lactogen (hPL)] [10]. Four cases had abnormalities on cardiotocography and 20 cases had abnormal ultrasound findings and 24 had an hPL <0.8 MoM; further work is needed to predict remaining adverse pregnancy outcomes in women with RFM. Recent interest in placental biomarkers, particularly placental growth factor (PlGF), shows encouraging data to predict adverse outcomes (e.g. true fetal growth restriction) in late pregnancy and should be explored in high-risk mothers with RFM [11]. A feasibility study of 120 women found that an intensive approach to the management of RFM using a biomarker was well adhered to and women's anxiety decreased after investigation irrespective of the management strategy [12]. Encouragingly, the rate of composite adverse perinatal outcome reduced from 29% to 12%. This indicates that a larger definitive trial should be conducted [12].

Current data, based on a large quality improvement study, suggest that mothers should be educated about reporting changes in fetal movements and units should provide standardised care including cardiotocography/non-stress test and ultrasound scan [13]. However, implementing these changes into clinical practice has been more challenging. The UK Royal College of Obstetricians and Gynaecologists (RCOG) introduced a guideline for the management of RFM in 2011 [14]. A cross-sectional survey of UK maternity units in 2013 found that 12% of units had no guideline, and where guidelines were in place they contained a median of 7/12 recommendations ranging from 3-11. Two key challenges i) to improve maternal education about fetal movements and ii) to standardise high-quality care when women present with RFM need to be addressed to reduce stillbirths using a RFM-based approach. The AFFIRM study, a stepped-wedge customised trial will address the hypothesis that education for mothers and professionals, in combination with a standard management plan can reduce stillbirth [15]. It is hoped that this strategy understanding the associations with RFM, developing effective investigations in combination with intervention will reduce stillbirth.

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Stillbirth surveillance consortium

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Stillbirths have an estimated prevalence of 6 per 1,000 live births and fetal deaths combined in the United States (U.S.), yet major risk factors for these adverse birth outcomes remain elusive [1,2]. Historically in the U.S., surveillance information about stillbirth has come from fetal death certificates maintained by the National Vital Statistics System.

Data collection within the National Vital Statistics System is guided by the Model State Vital Statistics Act and Regulations (Model Law), which defines fetal loss as showing no signs of breath or cardiac activity after expulsion [3]. The Model Law also recommends reporting a fetal loss as a stillbirth if the fetus weighs 350 grams or greater, or if no birth weight is available, the fetus is at least 20 weeks in gestational age.

Each state in the U.S. develops its own definition, reporting criteria, and fetal death certificate, which can produce variability in reporting across states [4]. Additionally, previous studies suggest that fetal death certificate data are limited in utility as a source for national stillbirth surveillance due to under- or over-reporting and the completeness and quality of recorded data [5].

An alternative approach to surveillance of stillbirths is the use of established birth defect surveillance systems to incorporate active case finding for stillbirths. This approach permits population-based identification of affected pregnancies and characterization of the epidemiology of these pregnancies. In 2005, the Centers for Disease Control and Prevention established projects for stillbirth surveillance using the established infrastructures of the Metropolitan Atlanta Congenital Defects Program and the Iowa Registry for Congenital and Inherited Disorders, two premier birth defect surveillance systems in the U.S.

The goals of our Iowa project, the Iowa Stillbirth Surveillance Project (ISSP), were to: evaluate the feasibility of expanding the Iowa Registry for Congenital and Inherited Disorders to incorporate data from existing records on stillbirths; monitor and report, as feasible, on the occurrence of stillbirths in the state of Iowa; serve as a registry for etiologic studies of stillbirths; and serve as a resource for education and evaluation of prevention programs that aim to reduce the occurrence of stillbirths.

Active case finding and record abstraction approaches, originally developed for birth defect surveillance in Iowa, were used by the ISSP for state-wide ascertainment of stillbirths. We ascertained 1,301 reportable stillbirths (≥20 weeks gestation or ≥350 grams delivery weight) delivered from January 1, 2005 through December 31, 2011. Surveillance data collected are being used to estimate population-based prevalence estimates for stillbirths in Iowa and to examine fetal and parental characteristics associated with stillbirths. Also, these data are being used to conduct individual-level geospatial surveillance of stillbirths. Knowledge of the spatial patterns of stillbirths may provide important insights into possible links to environmental exposures and the opportunity to plan detailed etiological investigations.

We continue to monitor stillbirths among the approximately 40,000 deliveries in Iowa annually. In 2012, we also expanded active case finding

and record abstraction for stillbirths to include birth defect surveillance systems in Colorado, Hawaii, and New York State. This Stillbirth Surveillance Consortium (SSC) uses similar surveillance methods and tools to provide a systematic approach to population-based surveillance of stillbirths and covers more than 120,000 deliveries annually with a diverse racial/ethnic composition. To date, the SSC has ascertained 784 reportable stillbirths delivered from January 1, 2010 through December 31, 2011. Surveillance data collected by the SSC will expand ongoing analyses by the ISSP for prevalence estimation, examination of fetal and parental characteristics, and individual-level geospatial surveillance. The methods developed by the SSC can serve as a model for other states to expand birth defect surveillance programs to include active case finding and record abstraction for stillbirths.

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The 39-week rule and term stillbirth: beneficence, autonomy, and the ethics of the current restrictions on early-term labor induction in the US

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The cumulative risk of term stillbirth, i.e., the death of a fetus in utero on or after 37 weeks 0 days of gestation, increases with increasing gestational age throughout the term period (37 weeks 0 days – 41 weeks 6 days)[1]. Despite this fact, a rule – called **the 39-week rule** – was established in 2009 that restricts labor induction in the 37th and 38th week of pregnancy (i.e., in the "early-term period") unless an accepted/approved "indication" is present (Table 1). [2] The 39-week rule is now a strict clinical guideline that is enforced by professional organizations, governmental agencies and the medical insurance industry [3-5]. The 39-week rule means that a pregnant woman who has an identifiable risk factor for stillbirth but who does not have an accepted "indication" for labor induction has no choice but to wait until at least 39 weeks 0 days before she can be delivered. Unfortunately, the strict application of the 39-week rule has probably led to hundreds early-term stillborn infants in the US over the past few years [6,7].

The purpose of this presentation was to disclose major problems with the development, application and ethics of the 39-week rule. Firstly, the evidentiary foundation of the 39-week rule is composed almost entirely of observational studies (i.e., Level 2 evidence) that contain a variety of serious flaws including confounding by indication, [8-10] confounding by situation, [10-12] selection bias, [13] misclassification bias, [14] incorrect modelling, [8-10] and the use of data from pre-37 week deliveries [10,15] and/or pre-labor cesarean deliveries.[16,17]. Secondly, these observational studies report magnitudes of association between early-term non-indicated labor induction and adverse birth outcomes (as measured in relative risk [RR], odds ratio [OR]) that are not large enough to be used to claim the identification of an underlying "truth" (i.e., that early-term non-indicated labor inductions per se *cause* adverse birth outcomes). [18] Thirdly, the evidentiary foundation ignores recent higher-quality research that suggests that early-term non-indicated labor induction might provide significant benefits[19-21]. Fourthly, the 39-week rule was created by a process that chose the relatively arbitrary "cut-point" of 39 weeks 0 days of gestation [22], failed to consider the potential importance of intermediate levels of prenatal risk [23], ignored the opinions and experience of non-academic providers [24], and excluded input from the general public. Fifthly, the 39-week rule ignores the primary importance of the medical ethical principle of Autonomy [25,26]. Autonomy represents the concept that a patient, given that she has a reasonably good understanding of risk and benefit, has the right to either request or refuse any given reasonable medical therapy. The 39-week rule prevents a woman from requesting and receiving a non-indicated induction of labor in the early-term period of pregnancy. The reason given for this restriction on patient autonomy in the setting of early-term non-indicated labor induction is the application of another medical ethical principle called Beneficence [2]. Beneficence represents the concept that a provider has the obligation to provide a patient with the best treatment(s) available. However, as noted above, it is unclear if the use of labor induction in the absence of an accepted "indication" in the early-term period of pregnancy provides more harm than benefit. The 39-week rule is not supported by the type of evidentiary foundation that is generally needed to restrict patient Autonomy [27,28].

In summary, the 39-week rule is not supported by high-quality evidence, its strict application unjustifiably obstructs patient autonomy, and it may actually cause harm in the form of early-term stillbirth. Because of these problems the 39-week rule should be modified, made optional, or withdrawn. Patients should be able to request and receive early-term labor induction if they believe that such an intervention is in the best interest of themselves and/or their fetus.

Table 1(abstract A9) Accepted Indications for Labor Induction

Late-term pregnancy (> 41 weeks 0 days of gestation)
Severe fetal growth restriction (fetus not growing, < 5%)
Rupture of membranes without labor
Severe pre-eclampsia (hypertension of pregnancy)
Chorio-amnionitis (amniotic fluid infection)
Failed antenatal testing (possible fetal compromise)
Significant oligohydramnios (AFI < 6)

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A10

Reducing risks of fetal injury and stillbirths caused by infection/ inflammation using healthy behaviors

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Background: Potentially preventable morbid or lethal vertical infections are more common in pregnancy than is recognized [1]. Research suggests about 11% of stillbirths (SBs) in developed countries are caused by infection versus WHO-sponsored estimates of 38% worldwide [2,3]. Advances in diagnostic technologies, pregnancy immunology, and systematic surveys ("Human Microbiome Project") have enabled new understanding of primary prevention of pregnancy/lactation-associated infection [3,4]. What is lacking is a systematic vigorously designed and adequately funded research agenda to provably reduce risks of individual or population-based risks of pregnancy infection. Lacking such "evidence-based" recommendations, some researchers suggest that, except for syphilis and vaccine-preventable infections, there are no satisfactory proven approaches to prevent infection-caused stillbirth [3]. Therefore, we used accumulated knowledge to formulate behavioral "no/low cost" and practicable/actionable pathobiologically and behaviorally informed recommendations to allow families and policy makers to reasonably reduce risks of maternal and pregnancy infection that cause SB. Evidence-based recommendations await controlled trials in suitable populations.

Changes in personal ("lifestyle") behaviors are now demonstrated to be cost-effective means to enhance individual and population measures of complex chronic diseases. The Institute of Medicine strongly recommends behavioral approaches for preventing common complex diseases such as coronary artery disease (CAD) and stroke [5].

Using short slogans, such as "safe sex", or acronyms, such as "DASH", as well as providing mnemonic prompts, can be helpful for remembering to change personal behaviors. In this paper, we propose the mnemonic, "HYGIENE", to assist in promoting safe pregnancy behaviors to reduce risks of common infections associated with stillbirth (Figure 1). ("HYGIENE" also denotes the Greek mythologic goddess of health and healthy behaviors.) Some of these behaviors are listed with the associated potentially preventable illness/agent in Table 1. This list is not meant to be comprehensive, but identifies "high impact pathogens" commonly listed as causing fetal death. Importantly, the commonest is malaria and the most lethal is the hemorrhagic Ebola virus infection.

"H" prompts the personal imperatives of handwashing to reduce risks of multiple infections (listeriosis, toxigenic *E. coli*, and many enteropathogens as well as hand-to-hand spread of influenza viruses) acquired by fecal handling. Handwashing is strongly suggested (without formal evidence) for prevention of cytomegalovirus (CMV) infection during pregnancy, especially among medical personnel and caretakers of toddlers [6].

"Y" prompts the slogan's "yes" to walking and exercise, but "no" to insect bites including both 1) mosquitoes which can cause malaria, malaria-like parasitemias, dengue fever agents, West Nile virus and other viral encephalopathies, and 2) multiple tick vectors for Rocky Mountain spotted fever and Lyme disease (*Borrelia burgdorferi*). The CDC widely recommends means to avoid tick bites (such as avoiding tick-infested areas), routine examination for ticks, and prompt, safe removal if found [7]. Means to prevent mosquito bites include elimination of possible breeding areas and mosquito bed netting in malarial areas [8].

"G" prompts prevention of gastrointestinal illness, including reducing risks of listeriosis (*Listeria monocytogenes*) and toxoplasmosis (*Toxoplasma gondii*) [9,10] as well as enteropathogens, not only by handwashing, but also by safe food selection, preparation, and handling [11].

"I" prompts performance of CDC-recommended immunizations, including rubella, tetanus, influenza, pertussis, viral hepatitis, and yellow fever, in travellers to endemic areas. Newer vaccines such as the tetrapotent vaccine for dengue fever are proven effective, but not yet recommended in pregnancy. Vaccines against multiple other stillbirth-causing infections, including herpes viruses (HSV 1 and 2), cytomegalovirus, other microorganisms including group B *Streptococcus*, *Leptospira*, the agents of Q fever and malaria, and common sexually transmitted infections as well as Ebola and human parvovirus (HPV-B19), may hold considerable promise if they become available [12,13].

"E" mandates consideration of avoiding exposure to infectious stillbirth agents including CMV and human parvovirus (HPV-B19) among susceptible women (daycare providers, teachers, medical personnel, and others who care for children with potentially infectious secretions and coughs). Other infections potentially preventable by eliminating exposure include malaria, malaria-like infections, Lyme disease, and multiple other mosquito and tickborne vector-transmitted infections. Importantly, meth mothers and their sexual partners can prevent infections including syphilis and other sexually transmitted infections/diseases (STIs/STDs) and HIV by avoiding unsafe sexual practices [14].

"N" stands for "natal" ("pregnancy") and prompts recognition of pregnancy providers' "standard of practice" responsibilities to complete recommended screening and indicated treatment of stillbirth-implicated infections including syphilis, rubella, urinary tract infections and bacteriuria, and abnormal vaginal microflora including bacterial vaginosis (BV) and group B *Streptococcal* infection or colonization [15].

New expert clinical suggestions for early pregnancy GBS screening by routine antenatal urine culture are increasingly voiced. Some experienced clinicians recommend routine GBS bacteriuria testing for every pregnant woman and, if positive, treatment with oral penicillin. Treatment for any infection in pregnancy is to be followed by a confirmatory "test of cure". Other obstetrical checklist items are listed in Table 1. New clinical

H	Handwashing
Y	Yes to walking; no to bug bites (mosquitoes, ticks, bugs)
G	Gastrointestinal safety (food selection, cooking)
I	Immunizations (recommended)
E	Exposure avoidance of infectious stillbirth agents
N	Natal ("Pregnancy"): standard medical practices
E	Enteroviruses

Figure 1(abstract A10) "HYGIENE" as a students' mnemonic for healthy behaviors to reduce risk of infection-caused stillbirth or fetal injury

Table 1(abstract A10) Primary behaviors for prevention of infection-caused fetal injury or death (stillbirth)

Behavior	Agents/Illness
1. "Safe food" (selection, preparation, handwashing)	*Listeria monocytogenes* Enteropathogens (*E. coli, Salmonella ssp.*) *Toxoplasma gondii* Enteroviruses Ebola (per the CDC, Ebola is not spread in general by food; however, in Africa, Ebola may be spread as a result of handling bushmeat)
2. "Safe sex" (no new partners)	HSV (herpes) 1 and 2 STIs, HIV Syphilis Chlamydia Gonorrhea CMV Ebola
3. "No (bug) bites" (zoonosis, mosquitoes, ticks, flies) and "avoid exposure to infectious animals"	Malaria Malaria-like infections Dengue West Nile Virus Tickborne infections (Rocky Mountain spotted fever, etc.) Q fever Lymphocytic choriomeningitis virus (LCMV) Leptospirosis Ebola
4. "Hygiene and oral health" (reduce body fluid exposure and bad mouth bacteria/inflammation)	CMV HSV 1-6 Hepatitis A, B, C Periodontal microorganisms Ebola
5. "Pregnancy" (follow CDC-recommended protocols)	Group B *Streptococcus* (GBS) Influenza
6. "Optimize pregnancy and birth management to reduce/ eliminate ascending infections"	Vaginal/cervical infections GBS protocols Chorioamnionitis Transfusions

recommendations to prevent "ascending" intrauterine infection include optimizing labor care to prevent "dystocia" and vigorous screening and treatment of all abnormal vaginal bacteria "dysbiosis". Intrusive "stripping of membranes" to induce labor is both clinically ineffective and may transmit potential cervico-vaginal pathogenic microorganisms into the uterus. Avoidance of this practice is recommended by some experts.

Finally "E" reminds families and practitioners of the increasing role of microbes' ability to induce damaging placental and fetal inflammation. Work by Nuova and others have shown that multiple types of microorganisms that cause placental inflammation, including enteroviruses (especially Coxsackie viruses), are increasingly implicated in both abortion and stillbirth [16].

Except for syphilis and both influenza and viral hepatitis which are vaccine-preventable, neither enteroviruses or the more common clinically recognizable infection causes of fetal death have reliably proven primary prevention strategies. In the absence of proven vaccination practices, "HYGIENE"-prompted "healthy pregnancy behaviors" by both families and pregnancy providers offer potentially powerful protection against stillbirth-associated infections until more specific prevention strategies including vaccination are demonstrated in well-controlled trials and authoritatively recommended.

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A11

The stillbirth 'scandal'

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The scope of stillbirth has been overlooked by many, few would estimate that in high income countries that, late stillbirths (pregnancies 28 weeks or later) occurs twice as often as death due to HIV/ AIDS; ten times more common than deaths due to Hepatitis B; twice a common as deaths due to congenital anomalies; twice as common as deaths due to preterm complications, and ten times more common that Sudden Infant Deaths (SIDS) [1].

Perinatal audit is the key to identifying potentially modifiable factors that contribute to stillbirth: higher than expected intrapartum deaths should trigger a review of labor and delivery procedures; higher than expected number of losses of multiples should trigger a review of advanced reproductive technologies services [2]. Stillbirth prevention strategies in developed countries do share some similarities to those in developing countries, for example ensuring that poor and less educated women have access to contraception, timely access to good prenatal care. The most demonstrable effect of early prenatal care is the accurate dating of the pregnancy, screening for infection and the prenatal screening for chromosomal and congenital anomalies. In a setting where there is the availability of abortion for affected pregnancies, the number of stillbirths related to anomalies can be reduced significantly [3].

Suboptimal care has been shown to occur in 10 to 60% of stillbirths in developed countries [2]. The most common errors are failure to identify emerging clinical disorders, (such as fetal growth restriction), failure to use up-dated "best practice protocols", poor communication or non-compliance of the members of the team (including those responsible to follow up with patients when appointments are missed).

By focusing some light on the problem of stillbirth there has evolved a number of new and potentially helpful observations. The appreciation that advanced maternal age, racial minority (specifically within the United States non-Hispanic black status), and severe obesity all are associated with an increased risk of stillbirth after 39 weeks of gestation, providers have the opportunity to either increase fetal surveillance or offer induction, thus treating these women as post-dates sooner than their low risk peers. A program of increasing awareness of the importance of fetal movement as well as the optimal management of decreased fetal movement has been shown to reduce the overall stillbirth rate by 30%. [4].

Other interesting recent observations that may modify stillbirth risk are that that the habit of left-lying during sleep may reduce the risk of late pregnancy [5]; that significant maternal stress has been associated with and increased risk of stillbirth [6], and that the evolution of genetic testing to include the evaluation of microarrays (which detects a single-nucleotide polymorphism or duplications or deletions of 500kb or greater) is more sensitive than standard karyotype to a detect potential cause of stillbirth [7].

Hopefully with on-going research we will develop a greater understanding of the elephant in the room and fewer parents will end up in the "stillbirth club".

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A12

Talking to pregnant women about stillbirth

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It is recognised that consumer awareness of stillbirth is one strategy, in raft of measures, which may reduce stillbirth cases [1]. Raising awareness of the existence of a health issue is often an important first step to take in reducing cases. For example, as a result of the SIDS risk reduction awareness campaigns, the rate of SIDS in high income countries has reduced by as much as 83% [2]. The outstanding success of the SIDS public education campaigns demonstrates that increasing public awareness, alongside an education campaign about protective behaviors, can result in dramatic reduction in prevalence [3]. Therefore, educating women about incidence of stillbirth and encouraging them to be more aware of protecting their unborn baby in order to minimise their risk, is both a potentially feasible and sensible next step in attempting to reduce the occurrence of stillbirth.

Maternal awareness of stillbirth is pre-dedicated on someone making them aware. This responsibility naturally rests with maternity care providers such as midwives and obstetricians. Stillbirth is generally considered a taboo subject in society but also, of concern, by those providing antenatal care [4]. Unfortunately maternity care-providers often avoid discussing the possibility of stillbirth with women in their care. The reluctance to discuss this kind of poor outcome could be to try to avoid "scaring the woman" however, not to do so is missing an opportunity to educate and alert the woman to adopt behaviours to help keep her unborn baby safe [5].

This presentation reported the results of a research project which aimed to educate midwifery care providers about stillbirth incidence, common risk factors as well as how to raise and discuss stillbirth with women

during prenatal care. This was done through the delivery of a half-day education package for midwives which provided participants with information about stillbirth. The workshop also provided an opportunity to practice a range of strategies to assist participants to become confident in raising and discussing the topic of stillbirth. The project used a quasi-experimental approach through use of pre and post intervention surveys to determine the effectiveness of the midwife education campaign.

Seventy-two participants completed the pre-workshop questionnaire with 69 participants completing the post workshop questionnaire and 25 completing the 3-month follow-up questionnaire. Responses at the three times points (pre, post, and 3 months) were compared using either Kruskal-Wallis (interval data) Wilcoxon (ordinal data) or Chi–Square (Nominal data) with significance set at $p \leq 0.05$. There was significant improvement in knowledge of the definition of stillbirth, causes and modifiable risk factors as well as knowledge about fetal movements across the participant group. Regarding participant willingness to discuss stillbirth with pregnant women in their care, prior to the workshop 28% of the participants confessed that they never raised or discussed stillbirth with women in their care with a further 64% revealing that they only discussed this with women "sometimes". Only 4% stated that they "usually" discussed stillbirth with women and no-one indicated that they "always" did. When asked if they planned to change this answer immediately following the workshop 86% replied "yes" with 4% saying no and another 10% unsure. Three months following the workshop there was a statistically significant change ($p \leq 0.001$) in attitude to discussing stillbirth with pregnant women with 16% stating that they always did, 12% citing usually and 56 % selecting sometimes with only 4% stating that they still never did.

The project was very effective in raising awareness of the incidence of stillbirth as well as knowledge of risk factors for stillbirth. We anticipate this type of education could ultimately make a difference to stillbirth rates, because if midwives and other maternity care providers raise and discuss stillbirth with women when they are providing antenatal care then this will in turn result in improved maternal awareness of the possibility of stillbirth. This may well lead to women adopting protective behaviors, such as closely monitoring fetal movements and immediately reporting concerns whilst pregnant.

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A13

Mediocre or excellent-where does your facility stand? Becoming a perinatal loss gold standard hospital

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During times of limited funding and health care challenges, hospitals and clinics must continue their commitment to give excellent, 'gold standard' care to bereaved families. Since families only get one chance to "do it right" when their baby dies in miscarriage, stillbirth, and infant death, they deserve excellent care. A premier perinatal loss program needs solid leadership; administrative support; financial resources; system-wide communication and coordination; and well-trained and supported staff, who can then offer individualized patient-based, comprehensive, and compassionate care to bereaved families. [1,2].

Hospital management that supports the development, continuity, and ongoing financial support of a well-planned and implemented hospital-wide perinatal loss program, is the first component found in a Gold Standard program. All areas of the hospital that work with perinatal loss, clinics, emergency departments, surgical services, and the birth center, must be included in the program. Financial support allows for staff hours dedicated for bereavement support and budget for education, training, materials, resources and events. [1].

The second component of the program is that all staff is appropriately and routinely trained, mentored, and supported, and that the program is based on comprehensive national standards, protocol, and policies [3]. Annual, mandatory education of staff, frequent updates, area workshops, and clear guidelines are essential [1,4]. Mentoring of new or unsure staff, support with paperwork, and help with memory making activities are important areas of focus. Recognition and support of staff is also essential for a successful program.

The final component of the program is that there is an integrated process that offers seamless, excellent care to each and every family from the time of their diagnosis, during their hospital stay, and with ongoing care by their medical provider team, including clinic points of contact. Initial communication and referral upon diagnosis is critical for informing and educating families regarding their options [2]. When possible, slowing hospital admittance and sharing practical resources is recommended to assist families in preparation for the birth of their baby. This strategy usually results in lessened shock and more control for the parents. Birth planning and companioning, which is presently being offered by trained hospital/clinic staff, local care companions, and by Baby Loss Advisors™, can provide families with individualized, culturally specific care [5]. This care and support occurs prior to induction, throughout the process of meeting and saying goodbye to the baby, and continues post hospital discharge. When this type of adjunct care paradigm is utilized, parents have a better chance of receiving comprehensive, consistent, and ongoing care.

Bedside care of the family includes involvement of extended family and friends, sibling care, memory making, and education of parents regarding handling of baby's body and funeral planning [6,7]. Consistent, informed caregivers are critical during this difficult time for the family. The time of saying good-bye to the baby has been found to be one of the most difficult times during the family's bereavement experience. Bereavement and medical discharge planning allows for a time to provide education, resources and a transition to home after the loss. Follow-up care involves supportive phone calls, support groups, and other touch points such as community memorial events [8]. Such ongoing care may help the family continue to heal.

Barriers to the Gold Standard program are related to a lack of financial resources, staffing issues and needs, healthcare provider's lack of interest, and communication challenges. However, a designated individual, who is responsible for advocating and directing the program, can work with leaders and providers to put bereaved families first and help them honour the lives of their babies. [2].

A *Perinatal Loss Gold Standard* manual, which includes checklists, assessment tools, and policy templates, was presented as one option to aid hospitals in developing and improving their own program [9]. The RTS program was also offered as another resource for hospital program training and development [1].

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Improving support in pregnancy after stillbirth or neonatal death: IMPs study

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The death of a baby before or shortly after birth is associated with profound long lasting grief for parents, similar to any child death [1]. The majority of women who suffer a stillbirth will embark on another pregnancy, with around 50% becoming pregnant within a year of the loss [2]. Subsequent pregnancies are characterised by elevated maternal anxiety and emotional vulnerability which often extends beyond the postnatal period, increasing the risk of adverse pregnancy outcomes and disrupted attachment, a potential cause of parenting and social difficulties in the longer term [2-4]. Recent evidence suggests the effects are not limited to mothers and that fathers also experience psychological distress during this period [5].

A recent metasynthesis of the qualitative literature surrounding parents' experiences of care highlighted the value of additional emotional and psychological support from healthcare providers in improving care in pregnancy after stillbirth or neonatal death [6]. However, there is a dearth of evidence to whether parents' needs for emotional and psychological support are being met by current maternity services in the UK. This programme of research aimed to explore current UK practice and provision of support in pregnancy for parents following stillbirth or neonatal death. An action research approach was utilised with stakeholder involvement central to the design and conduct of the study [7]. Online surveys, including open and closed questions, provided an overview of current service provision in UK maternity units and women's experiences. Qualitative phenomenological interviews provided an in-depth exploration of the lived experiences of women and health professionals. Data from 138 maternity units (≈60% total) demonstrated variable provision, emphasis on surveillance and monitoring with less attention to psychological and emotional support. A few units had developed innovative services/programmes targeted at this group, but lack of evaluation and dissemination was a barrier to sharing good practice. Analysis of the responses of 547 women, across all UK regions, demonstrated high levels of engagement and utilisation of maternity care. Many women reported positive experiences and recognised professionals who demonstrated empathy and compassion in providing high-quality care which often exceeded their expectations. However, a significant minority of women recounted poor experiences. Insensitive communication was often related to the attitudes and behaviours of individual professionals; however, organisational factors particularly a lack of continuity of care provider and service fragmentation common in standard UK model of 'high-risk' antenatal care were consistently and repeatedly associated with decreased satisfaction with care. Ongoing qualitative work will explore these issues in greater depth. Interim findings of this programme raise the issue of equity in provision of appropriate and sensitive care for parents in subsequent pregnancies who utilise UK maternity services. Data suggests that many parents receive inadequate emotional and psychological support and therefore there is a need to improve the evidence base underpinning care. The findings of this study will directly inform the development of specific interventions to improve antenatal support and promote positive birthing experiences and the development of a clinical care pathway to improve the care of women and their families in pregnancy following perinatal loss.

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A15

Subsequent pregnancy: healing to attach after perinatal loss

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The paralysing feelings of grief after perinatal loss can cause an overwhelming feeling of being abandoned, creating confusion, disorientation and hopelessness, altering future pregnancies for parents, children alive at the time and those that follow. Research with parents' pregnant following loss, elderly bereaved parents with no intervention, and children born after loss, some now adults, show the importance of guided intervention in the pregnancy that follows.

Parents who suffered losses fifty or more years ago were offered little guidance or rituals in healing [1], followed doctors' advice and, even those that requested to see their baby were told it was for the best if they didn't. The message was to "buck up," get pregnant again, frequently living a life time in the shadow of the experience. Parents' unresolved grief and tendency to not share what happened often became an emotional burden carried by siblings into adulthood [2-4].

The professional's goal is not to sever parents bond with the deceased baby but to help them create memories that recognize the psychological/spiritual dimensions of the relationship that does not end [5] to integrate the deceased baby into their lives [5,7] as they embrace a new unborn baby; important in lieu of the research that fear of loss can hinder attachment to the child born after [6,8].

A framework for understanding pregnancy loss and the pregnancy that follows is integration of the models of attachment and loss that honours their parenting relationship with both the deceased baby and new unborn baby [7]. Research in maternal fetal medicine and prenatal psychology suggests there is a deep connection developing during pregnancy, maternal/fetal programming occur in parallel [9-11] and are bidirectional [11,12]. Prenatal diagnostics, genetic screening, and fetal surgery have changed the medical and cultural status of the maternal-fetal relationship, suggesting attachment begins at an earlier stage. Investment is a more active process of involvement in the pregnancy [13] whereas attachment is concerned with the development of feelings for the baby as the parent seeks: to know, to be with and interact with, to protect, to avoid separation or loss and to gratify needs of the unborn child [14]. It is not just prenatal caregiving [15] but developing a relationship as unresolved histories of early relational trauma or loss often remain actively dysregulated in the intra-psychic mind of a parent, becoming a powerful source for some prenate's stress [10]. A prenatal attachment framework alters representations of the unborn child in parental behaviors using the message that "the baby is already here" while sustaining a continued bond to the deceased baby [7] as a family member in order to attach to the child that follows.

Parents' need information on how to tell surviving children about their deceased sibling. Children need to know it's okay to cry, be given appropriate information at their developmental age, reminded it's not their job to take care of the parent, involved in family rituals, find a meaningful symbol to connect, and someone who will listen to their feelings [16]. Adults who were a subsequent child and research with parents raising children after a loss all shared surprisingly common themes; sensitivity/nurturing to others, curious and sadness of not knowing sibling; a deep understanding of death and were not afraid to be present to grieving people [2,3]. The theme that was different reflected children whose parents had supportive intervention at the time of loss or in the pregnancy that followed who described feeling loved and overprotective verses adults whose parents lacked support; half felt loved and cherished while others felt invisible in their families [17]. Parents who have support and guidance are very intentional in raising their children [17,18]. Within the context of loss common patterns and reactions of grief emerge

throughout the continuum of life as we all rework pieces of our grief. Reconciling and healing is a process, not an event.

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A16

The rules of bereavement work: emotion work in online perinatal loss support groups

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The success of pregnancy and infant loss support groups in helping parents, especially mothers, deal with the emotional trauma of stillbirth is well established in sociological and psychological research literature. More recent studies have focused on the emergence of virtual perinatal loss support groups and communities which offer a convenient means of accessing an extensive group of supporters who can help participants navigate self-care during bereavement, in addition to providing opportunities to engage in the collective grief work of traditional face-to-face groups [1,2].

Building on previous research into online perinatal support, the initial findings from an exploratory research study of mothers who have experienced the stillbirth of a child were reported, in particular the way in which bereaved mothers, both within and outside of online perinatal loss support groups, manage common emotional reactions to stillbirth. Mothers' responses to emotions in themselves and in others which are identified as socially and personally problematic – guilt, shame and envy [3] were examined, in addition to the sociological concepts 'feeling rules' and 'emotion work' [4].

The usefulness of these concepts for a sociological understanding of guilt, shame and envy among bereaved mothers in online perinatal loss support groups was proposed. Just as therapists and scholars have identified the importance of grief work in the aftermath of a personal loss, sociologists have employed the concepts of 'feeling rules' and 'emotion work' to describe the way in which our culture dictates who may grieve, as well as where, when and how grief can occur. Stillbirth often involves changes to the social status and identity of the expectant mother, leading to 'disenfranchised grief'. This is a situation in which emotions are inevitably in flux and support is most needed. However, the cultural restrictions or 'feeling rules' [4] around the open, public expression of mothers' grief make the safety, privacy and validation of online support groups all the more necessary.

Furthermore, while the unwillingness of our culture to fully acknowledge the emotional trauma of stillbirth is well established in the research literature, it is not as well known how bereaved mothers apply these feeling rules to their own emotion work and to the emotional labor of other mothers, both within the online support community and outside of it. Examples drawn from a closed facebook perinatal support group of mothers who had experienced a stillbirth illustrate that there are clear feeling rules established within the group in relation to the emotions of guilt, shame and envy which are maintained by individuals and the group as a whole. Feeling rules are applied by the mothers to their own expressions of guilt, shame and envy, to other group members' emotions and to the broader culture. Emotion work is undertaken on mothers' own emotions as well as on the emotions of others in the group, which acts as a means of establishing trust within the group. As evidenced by excerpts from group members' online exchanges, bereaved mothers comply with cultural feeling rules which suggest that stillbirth is a taboo subject while also desiring to challenge these rules.

As the research study is in the initial stages of data collection, the extent to which online support groups facilitate or challenge feeling rules around perinatal bereavement remains unclear. Preliminary data suggests that many bereaved mothers consider feelings of shame and envy unacceptable to share outside the support community, and these beliefs are reinforced by external cultural disapproval and internal validation within the group. However, it was concluded that further research is needed in this area.

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Ripples in the pond: caring for extended family members after a perinatal loss

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Parents who have lost a baby during pregnancy, delivery, or shortly after birth are commonly offered time to see their baby, memory items, and support. Grandparents are often forgotten mourners, frequently relegated to supporting the bereaved parents, rather than being recognised as mourners in their own right. Family dynamics can often be severely disrupted following a perinatal loss [1]. Care providers and society in general can expect grandparents to provide comfort to their bereaved adult child, which in effect disenfranchises grandparents from their own grief [2,3]. Grandparents may feel isolated and overwhelmed as they struggle to support their bereaved child while grieving the loss of their

grandchild [1]. In challenge to past practice, families are encouraged to remember and talk about their deceased baby [4]. Current theoretical beliefs about grief emphasize the importance of rebuilding meaning as part of the healing process [5].

This paper reported an IRB-approved research study which used a survey to explore how grandparents incorporated the existence of a deceased grandchild into their family history. Eighteen grandmothers completed the survey. Seventeen of the eighteen stated they had pictures of their grandchild. All of them said they conducted some kind of ritual on the birth and/or death day, such as lighting a candle, a balloon release, or a cake at the cemetery. Twelve of the grandmothers wear jewellery that symbolizes their grandchild, and four have had tattoos to help them memorialise their grandchild. Twelve of the eighteen responded that they always include their deceased grandchild when asked how many grandchildren they have, and another five said it depended on the situation.

Although the sample size was relatively small, and homogenous i.e. Caucasian grandparents living in the USA, this survey confirms that grandparents feel a need to memorialize and include their deceased grandchildren into their life story [6]. Implications for practice are that stillbirth has a devastating and disruptive impact on all members of the immediate family including the baby's grandparents. Therefore bereavement support both at the time of death and later needs to include the extended family.

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Beyond the 6-week check-up: exploring the use of physical activity to improve depressive symptoms in women after perinatal loss

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The labor, birth, and postpartum periods of women who experience stillbirth are physically similar to women with live birth; however, the negative effects are significantly greater [1]. Women with stillbirth are at three times the risk of depressive symptoms when compared to women with live birth [2]. Depressive states may contribute to weight retention or gain, increased risk of chronic disease (i.e., heart disease), and poor quality of life, and can negatively impact the health of babies born subsequent to loss [3]. Unfortunately, inter-conception interventions to improve the mental and physical health of women after stillbirth are marginal. Treatment may include psychiatric medications and a referral to loss support groups [1,4]. However, these modalities do not consider the unique mental and physical health needs of bereaved mothers, nor do they take into consideration that a majority of women with stillbirth are pregnant or seeking pregnancy within the first year [6-8], and subsequently desire non-pharmacological interventions to cope with their symptoms.

Little is known about using physical activity as a non-pharmacological intervention to cope with stillbirth, despite its known efficacy in improving depressive symptoms in pregnant and postpartum women [8,9]. Women who are active during and after pregnancy have fewer depressive symptoms and report better mood as compared to inactive pregnant and post-partum women [10,11]. This may also be true for women with stillbirth. In a recent qualitative study [12] women with stillbirth who reported regular physical activity participation experienced mental, emotional, and physical benefits that helped them cope with their grief. Even those that were not regularly active reported that when they were active they felt better, had a better mindset and more energy. In the same study, women with stillbirth reported barriers to physical activity participation different than those typically reported in women with live births. Women attributed their lack of activity to emotional symptoms and diminished motivation, being tired and feeling guilt, having a post-pregnant body with no baby, and being confronted with other babies (i.e., exercise in public settings, outside the home). Understanding specific physical activity preferences for these women could inform targeted inter-conception physical activity interventions.

In another study, 175 women with a stillbirth in the preceding year completed a survey to determine women's preferences for physical activity after loss [12]. Almost 40% were using activity as a means to cope with depressive symptoms, anxiety, and/or grief associated with the death of their baby. Women with stillbirth reported depressive symptoms, weight loss, and better overall physical health (i.e., fitness) as the most important reasons for participating in physical activity. Most preferred activities for coping included walking, jogging, and yoga. Although less than one fourth of the sample reported using yoga as a means to cope with depressive symptoms, half were interested in using yoga to cope and preferred yoga in their homes.

The aforementioned studies provide information necessary for healthcare providers to target inter-conception interventions to improve the mental and physical health of women with stillbirth. Interventions may include: (1) education from health care providers about the benefits of physical activity, (2) exercise groups that incorporate social support from other women with stillbirth, (3) strategies to help women overcome specific barriers related to physical activity and encourage and guide women to use physical activity to cope with their grief, and (4) home-based interventions that incorporate yoga as a means to cope with depressive symptoms. More research is warranted.

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