2. Invited Commentary: "Exploring the complexity of stillbirth prevention: Insights from the RELEVANT Study on risk factors and implications for policy and practice'.

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Introduction

Stillbirth is one of the most devastating pregnancy outcomes that parents can face, and unfortunately, it is also one of the most common[1] and it is a global health burden that affects 2 million babies every year.[2] The global data on stillbirth rates show that the disparities between countries are enormous, with the highest national stillbirth rate being 20 times higher than the lowest stillbirth national rate in 2021.[3] The idea that no stillbirth is preventable is a myth;[4–6] since 2000, the rate of stillbirth has declined by a 35%, with the annual number of stillbirths decreasing from 2.9 million to 1.9 million.[3, 6] Although this progress seems promising, it is not sufficient to achieve global goals, and the progress over the last decade has been slower than in the first decade of the 21st century.[3] Ending preventable stillbirths is one of the main goals of the United Nations' Global Strategy for Women's, Children's and Adolescents Health (2016-2030)[7] and the Every Newborn Action Plan.[8]

Previous research has explored the psychological impact of stillbirth on bereaved parents. In a state of acute grief, mothers and fathers report feelings of guilt and blame, regret, stigma, and even suicidal ideation.[9] Stillbirth can be associated with different psychological symptoms such as anxiety, depression, distress and negative well-being, especially during the first few months post-stillbirth.[10] Stillbirth may result in social isolation due to bereaved parents avoiding activities where they might have to confront families with babies or explain their experience.[11] This might be explained by a phenomenon commonly named as disfranchised grief.[12] Parents do not feel allowed or supported to mourn the death of their baby due to stigma and societal taboo and it not being culturally acceptable.[11] This stigma experienced by bereaved parents can lead them to feel more isolated, blamed, silenced and not recognised as parents.[11, 12]

Despite its prevalence and strong impact that stillbirth can have on parents, previous research has shown that the population awareness of stillbirth in Ireland is poor. In a study conducted in 2017, only 17% of respondents correctly identified the incidence of stillbirth rates, and around 56% were unable to identify any risk factor for stillbirth.[13] This lack of population awareness around stillbirth contributes to bereaved parents' feelings of isolation, and it prevents the enhancement of prevention efforts through the early disclosure and identification of risks.

Issues with definitions, inclusion criteria and establishment of prevalence

In Ireland, stillbirth is defined as a baby born with no signs of life at 24 weeks gestation or later, or with a birthweight of 500 grammes or more.[14] However, stillbirth definitions differ depending on the country.[15, 16] These definitions can use different gestational thresholds and different birthweight thresholds which, in high-income countries, range from ≥22 to 28 weeks of gestation and from ≥500-1000 grammes. On the other hand, there are also differences in the inclusion of stillbirths and neonatal deaths occurring because of a Termination of Pregnancy for Fetal Anomaly (TOPFA) across different countries, which are inconsistently reported, and might result in an increase or decrease of perinatal rates. The inclusion or not of TOPFA in stillbirth rates, especially at early gestation, increases the difficulty to assess the variation of rates and trends of stillbirths across countries.[17, 18] Similarly, some regions exclude cases of stillbirth caused by major congenital anomalies in the reporting of their rates, this can also result in an

inaccurate representation of the rates and mask the need for targeted interventions to reduce stillbirths caused by fetal anomalies as well as public health efforts.[19] In Ireland, the rates of perinatal mortality are calculated including TOPFA with possibility to exclude them and are also reported including major congenital anomalies and corrected to exclude major congenital anomalies.

Using different definitions and inclusion criteria is problematic because it causes discrepancies and inaccuracies in international reporting and comparison, and potentially excludes some cases of stillbirths from the epidemiological data. The World Health Organisation (WHO) proposes different definitions for stillbirth depending on what purpose that definition is going to be used for. For international comparison and reporting, the WHO recommends using a gestational week threshold of ≥28 weeks and a birthweight of ≥1000 grammes.[16] However, the use of the WHO definition leads to an under-reporting of stillbirths that occur at less than 28 weeks, which represent those showing the least improvements in reductions in high-income countries (HIC).[20] Furthermore, the differences in definition also have implications for bereaved families, as their rights differ depending on the gestation of stillbirth. In Ireland, for example, women who have a stillborn child at ≥24 weeks gestation or a birthweight of ≥500 g currently can avail of 26 weeks of paid maternity leave.[21]

The rates of stillbirth globally decreased by over 35% in the last 20 years (21.4 per 1000 births in 2000 to 13.9 in 2019), mostly in east Asia and the Pacific, followed by Eastern Europe and Central Asia.[22] However, this rate reduction is slow when compared with the decreases in mortality rates of children younger than 5 and also compared with progress in reducing neonatal mortality rates.[22] In high-income countries, the rates of stillbirth have remained steady, showing very small reductions in the last decade.[23] The differences in stillbirth rates between different high-income countries and within the same high-income country show that there is a possibility to reduce the rates of stillbirth even further.[23]

Risk factors for stillbirth

There are multiple types of risk factors associated with an increased risk of stillbirth that have been discussed in the literature. These include sociodemographic factors, medical factors and behavioural and lifestyle factors (Please see Table 2.1).

Table 2.1: Main risk factors associated with stillbirth[24]

Categories		Main risk factors for stillbirth
Sociodemographic factors		Maternal Age Ethnic minorities Socioeconomic status
Medical factors	Maternal medical factors	Hypertension Diabetes Thyroid disorders Bacterial and viral infections
	Mental health conditions	
	Obstetric history	Parity Previous history of pregnancy loss Multiple pregnancies History of Caesarean Section Use of assisted reproductive technologies
	Pregnancy complications and fetal factors	Fetal growth restriction Placental insufficiencies Pregnancy length Changes in fetal movements
Behavioural and lifestyle factors		Smoking Alcohol and illicit drug use Use of medical drugs and supplements Maternal weight Sleeping habits Antenatal care attendance

Extracted from Escañuela Sánchez, T. 2022. Rethinking stillbirth through behaviour change. PhD Thesis, University College Cork.

Behavioural and lifestyle-related risk factors represent factors that have the potential to be modified, and therefore can be addressed to improve pregnancy outcomes and potentially reduce stillbirth rates. Although, behavioural and lifestyle-related factors often co-occur and are associated with other issues such as socioeconomic or sociodemographic factors,[25–28] most of these behaviours or lifestyle factors have been reported as independent risk factors for stillbirth.[29] However, they need to be understood taking into account all the potential interrelated influences over the risk of stillbirth.[30]

International Efforts to reduce stillbirth rates

Some initiatives have been put into place in various countries with the aim to prevent stillbirths through different approaches. These efforts acknowledge the preventability of a significant number of stillbirths in high-income countries. The two main international approaches are: (1) conducting perinatal mortality audits to identify causes and risk factors, and (2) raising awareness and changing clinical practice through public health initiatives. Currently, only four high-income countries (Ireland, UK, New Zealand, and the Netherlands) conduct national perinatal mortality audits,[31] while a few countries (UK, USA, Australia, New Zealand, and Canada) implement public health approaches.

Perinatal mortality audits, reviews and confidential enquiries

Using epidemiological data to identify risk factors and sub-optimal care is essential to produce recommendations that might enhance care in the future, hence, perinatal mortality audits, reviews and confidential enquiries are necessary to help preventive efforts.

There are four high-income countries that conduct national perinatal mortality clinical audits at the moment.[31] The Perinatal Mortality National Clinical Audit in Ireland is conducted by the NPEC,[32] the National Perinatal Clinical Audit is conducted in the UK by National Perinatal Epidemiology Unit (NPEU) and Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK (MBRRACE-UK and University of Lancaster); the New Zealand's National Perinatal Mortality Audit is conducted by the Perinatal & Maternal Mortality Review Committee (PMMRC)[31] and finally, the Netherlands has a system of national audits conducted by Perined, which is a merger organisation of PAN (Perinatal Audit Netherlands) and PRN (Perinatal Registry Netherlands).[33]

Internationally, initiatives like the Euro-PERISTAT Network and reports from UNICEF, WHO, World Bank Group, and the United Nations focus on reducing stillbirth rates through auditing and data analysis.[34, 35]

Care Bundles and public health approaches internationally

Some countries around the world have implemented care bundles and public health approaches that include components related to awareness about behavioural risk factors or behavioural modification components to reduce stillbirth rates. To date, there has not been any initiative involving behavioural risk awareness and/or modification components carried out in Ireland. The following are examples of initiatives conducted in different high-income countries that could serve as examples to inform the development of an initiative in Ireland.

Scottish Patient and Safety Program (SPSP) Maternity and Children Quality Improvement Collaboration (MCQIC)

The SPSP is a national initiative launched in 2008 with the objective of improving the whole of National Health service (NHS) Scotland. The SPSP MCQIC is currently focusing on reducing stillbirth rates, reducing postpartum haemorrhage rates, reducing neonatal mortality, and highlighting the importance of the essentials of safe care in maternity care.[36]

The stillbirth prevention component of the SPSP MCQIC programme focuses on assessing fetal wellbeing, monitoring fetal movements and fetal monitoring. The programme also aims to offer all women carbon monoxide monitoring when booking their antenatal care appointment,[37] to refer women who are smokers to smoking cessation services and to provide tailored packages of care to all women who continue to smoke. From inception in 2013, the programme has supported a national aggregated reduction in stillbirth rates of 22.5%.[38]

NHS Saving Babies' Lives Care Bundle (SBLCB), United Kingdom

The NHS Saving Babies' Lives Care Bundle (NHS SBLCB) is a comprehensive approach in the NHS aimed at reducing perinatal mortality. It includes elements such as reducing smoking during pregnancy, monitoring fetal growth, raising awareness of reduced fetal movements, and effective fetal monitoring during labour.[39] A later version

added reducing preterm births.[40] The care bundle includes a public education elements, carbon monoxide testing and training for healthcare professionals.[39]

The evaluation of this care bundle across different participating NHS Trusts concluded that stillbirth rates have declined by 20% over the period in which the SBLCB was implemented,[41] but the authors were not able to determine if the implementation of the SBLCB or any of its components per se was associated with the reduction in rates of stillbirth.[41] Regarding smoking, the authors found that the proportion of women recorded as smoking at delivery declined from 14.3% before SBLCB to 11.8% after SBLCB,[41] however, there was no evidence of an increase in smoking cessation rates.[41] These findings are supported by the latest UK national perinatal mortality report with 2020 data states that rates of stillbirth have reduced by 21% from 4.20 per 1,000 total births in 2013 to 3.33 per 1,000 total births in 2020.[42]

National Stillbirth Action and Implementation plan and the Safer Baby Bundle, Australia

The National Stillbirth Action and Implementation plan in Australia aims to achieve a sustainable reduction of preventable stillbirths by 20% or more over five years.[43] The plan focuses on five priorities: ensuring high-quality prevention and care, raising awareness and education, improving bereavement care and support, enhancing stillbirth reporting and data collection, and prioritizing research.[43]

Implementation of the Safer Baby Bundle, a key component of priority one focusing on prevention and care, has shown promising results in reducing stillbirth rates and increasing smoking cessation rates among pregnant women.[44] The bundle includes interventions such as smoking cessation support, monitoring fetal growth, promoting awareness of fetal movements, advising on maternal sleep positions, and facilitating shared decision-making on birth timing.[45] Results of the effectiveness of this approach in reducing stillbirth are currently available for the 15 Victorian health services that completed both phases of the Safer Baby collaborative. Results show a decrease in stillbirth rates by 21%, from an average rate of 0.24% to 0.19%. The days between stillbirths increased by 131%, from an average of 3.5 days to 8.1 days, including periods of 42 and 32 days without a stillbirth occurring at any of the reporting sites.[46] The rates of smoking cessation of women during pregnancy increased by 200%, from an average rate of 11% to 33%.[46]

Public health approaches

Other initiatives implemented in different countries have focused on raising awareness and addressing behavioural risk factors through public health messaging. In Australia, the "Still six lives" campaign focuses on smoking cessation, monitoring fetal movements, and side sleeping after 28 weeks gestation.[47] The "Count the Kicks" campaign in the USA educates mothers about monitoring their babies' movements.[48, 49, 50] The "Sleep on Side" campaign in New Zealand promotes side sleeping during late pregnancy.[50] In Canada, the Canadian Collaborative for stillbirth prevention seeks to adapt the Australian stillbirth prevention plan to their context through a petition to the government.[51]

Potential for improvement in Ireland

In Ireland, there has been some focus on stillbirth reduction, largely through the establishment of the Perinatal Mortality National Clinical Audit. This Audit was endorsed by the National Clinical Effectiveness Committee (NCEC) in 2022.[52] The NPEC has repeatedly recommended in their reports that "A public health education programme on perinatal deaths and modifiable risk factors should be developed"[53, 54] and advocates for the introduction of a "Care Bundle" approach in an attempt to reduce the perinatal mortality rates in Ireland.[55] Amongst other elements, the care bundle proposed by the NPEC includes a public health awareness programme focusing on reducing smoking in pregnancy, weight management to achieve adequate BMI, raising awareness of stillbirth and reduced fetal movements, and increasing awareness of HCP on modifiable risk factors for PM.[55] The proposed bundle also includes elements of staff training and surveillance for fetal growth restriction using a standard national approach, as well as advocating for effective monitoring of the baby during labour for a reduction in Neonatal Brain Injury and intrapartum deaths.[55] Such a care bundle, together with all of the other efforts made to date, could have the potential to reduce the rates of stillbirth in Ireland.[55]

Recently, a National Clinical Practice Guideline focusing on all aspects relating to stillbirth was developed and published in Ireland.[56] This guideline focuses on risk factors, diagnosis, investigations, management, classification, audit and review, follow-up care, and future research priorities.[56] The

guideline includes a section on the identification of risk factors and proposes best clinical practice and has numerous related recommendations.[56]

Evidence from the evaluation of the care bundles and public health campaigns in other countries has shown that stillbirth rate reductions are possible and can serve as learning points to develop new approaches in countries like Ireland.[40, 45] Although Ireland's stillbirth rates are comparable to other high-income countries, they are rising rather than falling and there is much scope for improvement.[53] To date, no public health campaigns in Ireland exist despite the availability of research showing the lack of awareness about stillbirth of the Irish population.[13] Further, the National Standards for Antenatal Education in Ireland do not include any information regarding communication about the risks of stillbirth nor education on how to support women with behaviour change[57] and the information available on Irish and UK websites around stillbirth and risk factors is very poor.[58] Hence, additional efforts need to be considered.

The RELEVANT project

The development and implementation of potentially effective and appropriate behaviour change interventions to prevent stillbirth by addressing the behavioural risk factors for stillbirth must be based on a good understanding of the behaviours that need to be addressed, as well as behavioural theory.[59]

The Rethinking Stillbirth through behaviour change (RELEVANT) project aimed to enhance the understanding of modifiable behavioural risk factors for stillbirth and pregnancy and it was funded by Science Foundation Ireland from 2018 to 2022. The project employed both qualitative and quantitative methods to build an evidence base to be used to inform the future development of an intervention to address the behavioural risk factors for stillbirth.

Initially, a narrative review of the literature was conducted to identify key behavioural risk factors[60] associated with stillbirth. To conduct this review, a non-systematic search was performed using different databases such as Pubmed and Google scholar. Relevant articles regarding the different selected risk factors were reviewed and organised using Mendeley, however, the search progressed as the work was being completed. The strongest evidence linked substance use, smoking, heavy drinking, illicit drug use, lack of antenatal care attendance, weight-related risks, and sleep position.[60] These factors were prioritised for the project. A quantitative analysis of UK and Irish websites followed, revealing limited information on stillbirth and behavioural risks,[64] with only one site offering comprehensive information.[58]

To understand the factors influencing behaviour change, three qualitative meta-syntheses were conducted,[61–63] focusing on pregnant women's experiences. Five main concerns emerged: 1) health literacy, awareness of risks and benefits; 2) insufficient and overwhelming sources of information; 3) lack of opportunities and healthcare professionals' attitudes interfering with communication and discussion; 4) social influence of environment; and 5) social judgement, stigmatisation of women, and silence around stillbirth.[61–63] Additionally, a qualitative semi-structured interview study was carried out with postpartum women,[64] revealing ease of behaviour change driven by baby's well-being. Limited awareness of stillbirth and lack of discussion during antenatal care were noted.[64] Yet, women expressed openness to receiving sensible information, valuing knowledge.[64]

Lastly, a systematic review of interventions designed for stillbirth prevention and targeting behavioural risk factors was conducted.[65] Nine relevant interventions were identified. The review focused on identifying the behaviour change techniques (BCTs) employed in these interventions. A BCT is an observable, replicable and irreducible component of an intervention, an "active ingredient", designed to alter or redirect causal processes that regulate behaviour.[66] The most common BCTs used were "information about health consequences" and "adding objects to the environment," as revealed through BCT coding.[65]

The findings from the different studies can be grouped using these four main overarching topics, which move from more person-centred specific aspects to broader societal aspects:

1. Health literacy and sources of information.
2. Relationship with healthcare providers.
3. Healthcare system structural barriers.
4. Interpersonal and social factors: silence around stillbirth and societal stigma.

More detail on the research findings of each study can be found in Table 2.2.

Table 2.2 Summary of research findings from the RELEVANT Study based on overarching topics

Study	Main findings	Overarching topics			
		Health literacy and sources of information	**Relationship with HCPs[56] and communication issues**	**Healthcare service structural barriers**	**Interpersonal and social factors: silence around stillbirth and societal stigma**
Escañuela Sánchez, T., Meaney, S., & O'Donoghue, K. (2019). Modifiable risk factors for stillbirth: a literature review. Midwifery, 79(102539).	Four main modifiable risk factors with a behavioural component were found to have the strongest evidence: • Substance use (smoking, alcohol, illicit drugs) • Maternal weight • Attendance & compliance with antenatal care. • Sleep position.	• The evidence regarding some of the behavioural modifiable risk factors for stillbirth is conflicting (e.g., small amounts of alcohol, some prescription drugs, herbal and dietary supplements, gestational age at first booking, sleeping less than 6hrs per night).	NA	NA	NA
Escañuela Sánchez, T., Meaney, S., & O'Donoghue, K. (2020). Stillbirth and risk factors : an evaluation of Irish and UK websites. Journal of Communication in Healthcare, 0(0), 1–10.	• <50% of websites contained information about stillbirth • <30% of websites contained information about risk factors for stillbirth • Only one website contained all the information sought about stillbirth (e.g. definition, prevalence, etc.) & risk factors.	• Online resources have been underused to provide information about stillbirth and risk factors.	NA	• Professional body health services websites are not being used to provide information about stillbirth and risk factors. • Professional body websites and health body websites rely heavily on providing links to clinical guidelines, which are not user friendly.	• The lack of information about stillbirth and behavioural risk factors for stillbirth in general websites directed at the general pregnant population might be a consequence of the stigma and taboo associated with these topics.
Escañuela Sánchez, T., Linehan, L., O'Donoghue, K., Byrne, M., & Meaney, S. (2022). Facilitators and barriers to seeking and engaging with antenatal care in high-income countries: A meta-synthesis of qualitative research. Health & Social Care in the Community, 00(1), 1–19. **Escañuela Sánchez, T., Matvienko-Sikar, K., Linehan, L., Donoghue, K. O., Byrne, M., & Meaney, S. (2021). Facilitators and barriers to substance-free pregnancies in high-income countries: A meta-synthesis of qualitative research. Women and Birth, 35(2), e99–e110.** **Escañuela Sánchez, T., Meaney, S., O'Connor, C., Linehan, L., O'Donoghue, K., Byrne, M., & Matvienko-Sikar, K. (2022). Facilitators and barriers influencing weight management behaviours during pregnancy: a meta-synthesis of qualitative research. BMC Pregnancy and Childbirth, 22(682), 1–21.**	Identified areas of concern: • Health literacy, awareness of risks & benefits. • Insufficient & overwhelming sources of information. • Lack of opportunities & HCPs' attitudes interfering with communication & discussion. • Social influence of the environment • Social judgement, stigmatisation of women. *A search to identify facilitators and barriers influencing sleep position was also conducted at two different points in time during this PhD, however, no qualitative research was identified.	• Lack of reproductive knowledge acted as a barrier for care seeking behaviour as it delayed women's recognition of their pregnancies. • The lack of reliable sources of information led some women to rely on anecdotal evidence and creating misconceptions about the risks of their behaviour. • A lack of satisfaction with education and advice received during antenatal care was identified. • Advice during antenatal care was too general and not individualised to specific needs. • Women's levels of health literacy have an influence on their perception of risk and incentives, which will influence their engagement in behaviour change.	• HCPs attitudes (stigmatisation, racism, lack of empathy, insensitivity) had an influence on women's willingness to engage with antenatal care. • Non-judgemental, supporting, and empathetic HCPs were highly valued. • Communication problems with healthcare professional were identified (contradictive messages, having concerns dismissed, feeling uninformed, being confused due to jargon). • Authoritarian or coercive communication styles. • Active listening from HCPs, taking time to address concerns, and empowerment of patients were perceived as positive communication.	• Negative clinical experiences affected women's behaviour negatively. • These might be rushed appointments, administrative delays, problems with referral, lack of flexibility and of continuity of carer, lack of individualised care, complexity of the application process for care. • Cultural inappropriateness and language barriers were identified as barriers to behaviour change. • Limited financial resources of healthcare systems resulting in shortage of staff, closure of clinics and limitations associated with government health programmes and cost of care.	• Social position and lifestyle factors such as homelessness, living in deprived areas, low economic resources were identified as barriers for behaviour change. • Social discrimination of certain collectives (ethnic minorities, socioeconomic status). • Lack of social support influenced women's behaviour. • Social pressure and stigma generated feelings of shame and guilt, that acted as a stressor for women and prevented engagement in behaviour change. • Environmental barriers such as lack of access to sports facilities, or distance to maternity services or clinics.

Table 2.2 continued on the next page

[56] Healthcare professionals

Table 2.2 continued

Study	Main findings	Overarching topics			
		Health literacy and sources of information	**Relationship with HCPs[56] and communication issues**	**Healthcare service structural barriers**	**Interpersonal and social factors: silence around stillbirth and societal stigma**
Escañuela Sánchez, T., Meaney, S., O'Connor, C., Linehan, L., O'Donoghue, K., Byrne, M., & Matvienko-Sikar, K. (2022). Facilitators and barriers influencing weight management behaviours during pregnancy: a meta-synthesis of qualitative research. BMC Pregnancy and Childbirth, 22(682), 1–21.	• Behaviour change during pregnancy perceived as easy and natural. • Women had high level of awareness regarding health advice, but very limited regarding stillbirth. • There is a lack of discussion with HCPs about stillbirth & risks, so women rely on their own information-seeking behaviours. • Women had a general positive attitude towards receiving information about stillbirth; knowledge perceived as key.	• Women were aware of what habits are recommended and encouraged during pregnancy for better health. • Awareness about stillbirth and the link of the behavioural risk factors with stillbirth was very limited. • Women reported lack of discussion regarding stillbirth and risk factors during their antenatal care. • Lack of advice regarding health behaviours and behavioural risk factors during antenatal care. • Women were not informed about the reasons why those behaviours were relevant. • Women relied on their own information seeking behaviours to raise their own awareness about health habits during pregnancy. • Most women perceived receiving information about stillbirth as helpful to support prevention efforts.	• The importance of communication with HCPs was highlighted, encouraging the use of sensitive and non-blaming language.	• Women expressed a preference for interventions delivered in group settings, rather than targeted at one-on-one level.	• Stillbirth was perceived as a taboo work for some women, and it was described as a difficult topic to talk about.
Escañuela Sánchez, T., O'Donoghue, K., Byrne, M., Meaney, S., & Matvienko-Sikar, K. (2023). A systematic review of behaviour change techniques in the context of stillbirth prevention. Women and Birth.	• 9 interventions were included in analysis. • The most common BCT used was "Information about health consequences", followed by "Adding objects to the environment". • The maximum number of BCTs was 11 and the minimum was 2.	• The behaviour change interventions conducted to date in the context of stillbirth prevention have a high focus on information provision.	NA	• The interventions do not take into consideration potential structural barriers, and the ones that have shown effects on stillbirth rates require great investment at system level.	• The very limited number of behaviour change interventions highlights how this is an issue that has been neglected in the research agenda, potentially in part due to the stigma associated with the topic.

Implications of the RELEVANT Study findings for policy and practice

The findings from the RELEVANT Study have developed the evidence base necessary to comprehensively understand the modifiable behavioural risk factors associated with an increased risk of stillbirth in pregnancy and has some implications related to policy and practice.

Implications for policy:

- Improving education and information sources is crucial. Consistent, reliable, evidence-based information sources are needed for women and healthcare professionals (HCPs) regarding stillbirth risk factors and prevention.
- Pregnancy-specific supports should be enhanced and informed by the current evidence, addressing barriers such as fear, misconceptions, and lack of awareness. Services like smoking cessation, alcohol reduction, drug addiction support, and weight management should be tailored to meet the specific needs of women in antenatal care.
- Pre-conceptual education plays a vital role in promoting healthy maternal and pregnancy outcomes. Early education in schools and universities can improve health literacy and awareness of risks and recommendations.
- Behaviour change is affected by multiple factors from the individual to the societal level. Policymakers should consider addressing behavioural risk factors for stillbirths in terms of health, education, employment, housing and social equality.
- Community services, such as public health nurses, can be utilised to support behaviour change during pregnancy. However, staff shortages and limitations within the services need to be addressed.
- Developing a care bundle to reduce the risk of stillbirth is necessary. The evidence from this project, along with international initiatives, can inform the development of public health approaches and interventions.

Implications for practice:

- Antenatal education standards and healthcare professionals' training programmes should provide guidance to support healthcare professionals in promoting health with their patients, and also be able to discuss risk factors for stillbirth or other potential adverse pregnancy outcomes.
- Healthcare professionals require further training to understand the complexities of the behavioural risk factors for stillbirth. Training should include aspects of identification of risks and sensitive communication.
- Health promotion should be prioritised during antenatal care, alongside medical needs. Allocating additional time to discuss health habits and providing training programs for HCPs can enhance care.
- Healthcare professionals should incorporate risk factors, health habits and stillbirth in their routine discussions with women, especially in terms of outcomes for their babies, to motivate women to engage in behaviour change.

The RELEVANT project has contributed to the understanding of the maternal behaviours associated with an increased risk of stillbirth, and it provides a necessary evidence-base to inform future prevention strategies to reduce rates of stillbirth in Ireland and in similar healthcare settings. The identified priorities might also serve to help funders and researchers to design and conduct policy-relevant research.

The RELEVANT Study – Next Steps

The evidence base developed from this research has the potential to inform the development of a behaviour change intervention to prevent stillbirth.

The future development of behaviour change interventions to tackle the modifiable behavioural risk factors for stillbirth will utilise the Behaviour Change Wheel (BCW). The BCW is a methodology that allows researchers to systematically design behaviour change interventions underpinned by a theoretical model to explain behaviour called the COM-B model (Capability, Opportunity, Motivation-Behaviour).[59]

In Stage 1, the behaviours are analysed in terms of their agents, content, context, temporal aspects, and frequency using the findings of the RELEVANT Study. The research findings are organized and interpreted within the COM-B model.[59] In Stage 2, the focus is on producing strategies to modify these behaviours during pregnancy. The Behaviour Change Wheel (BCW) framework will allow here to systematically select appropriate strategies for behaviour change.[59] The prioritisation of strategies is guided by various criteria, including affordability, practicality, effectiveness, acceptability, safety, and fairness. Throughout the completion of the BCW framework, engagement with diverse stakeholders, including healthcare professionals and pregnant women will be ensured. These stakeholders contribute their perspectives and expertise in shaping the interventions, and their input is vital in prioritising the different intervention options based on their perceived importance. To identify specific techniques for behaviour change, the researchers will utilise the Behaviour Change Technique Taxonomy version 1 (BCTTv1) tool.[66] The selected techniques are subsequently translated into practical applications, incorporating stakeholder input and the prioritisation criteria.

Conclusion

Strategies have been successfully implemented internationally to reduce stillbirth rates by designing and implementing care bundles that, amongst other elements, take into consideration the modifiable/behavioural risk factors for stillbirth. However, in Ireland, no such initiatives have been developed, although recommendations have been made that support their development. For behaviour change interventions or public health initiatives to have the best possible success in reducing the rates of stillbirth, they need to be designed with a solid evidence base. Hence, the overall objective of the RELEVANT Study was to build the evidence base to enhance the understanding of the modifiable behavioural risk factors for stillbirth.

The RELEVANT Study makes a significant contribution to the knowledge base on the modifiable behavioural risk factors for stillbirth and identified key areas for future work in practice, policy and research. Importantly, the findings provide the groundwork for the future development and/or adaptation of interventions to promote behaviour change during pregnancy to reduce women's individual risk of stillbirth and help national efforts at stillbirth rate reduction.

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Bibliography

1. Lawn, J. E. *et al.* Stillbirths: Rates, risk factors, and acceleration towards 2030. *Lancet* **387**, 587–603 (2016).
2. Lawn, J. E. *et al.* Stillbirths: Where? When? Why? How to make the data count? *Lancet* **377**, 1448–1463 (2011).
3. Report of the United Nations Inter-agency Group for Child Mortality Estimations. *Never Forgotten. The sitution of stillbirth around the globe.* (2022).
4. Fouks, Y. *et al.* Can We Prevent Stillbirth? *Am. J. Perinatol.* **37**, 534–542 (2020).
5. De Bernis, L. *et al.* Stillbirths: Ending preventable deaths by 2030. *Lancet* **387**, 703–716 (2016).
6. World Health Organization and the United Nations Children's Fund (UNICEF). *Every Newborn Progress Report 2019*. (2020) doi:CC BY-NC-SA 3.0 IGO.
7. World Health Organization. *The global strategy for women's, children's and adolescents' health (2016 - 2030). World Health Organization* www.everywomaneverychild.org (2015).
8. World Health Organization and Unicef. *Every newborn: An action plan to end Preventable deaths: Executive summary Geneva: World Health Organization.* (2014).
9. Murphy, S. & Cacciatore, J. The psychological, social, and economic impact of stillbirth on families. *Semin. Fetal Neonatal Med.* **22**, 129–134 (2017).
10. Campbell-Jackson, L. & Horsch, A. The psychological impact of stillbirth on women: A systematic review. *Illn. Cris. Loss* **22**, 237–256 (2014).
11. Pollock, D. *et al.* Voices of the unheard: A qualitative survey exploring bereaved parents experiences of stillbirth stigma. *Women and Birth* **33**, 165–174 (2019).
12. Burden, C. *et al.* From grief, guilt pain and stigma to hope and pride - a systematic review and meta-analysis of mixed-method research of the psychosocial impact of stillbirth. *BMC Pregnancy Childbirth* **16**, 9 (2016).
13. Nuzum, D., Meaney, S. & O'Donoghue, K. The public awareness of stillbirth: an Irish population study. *BJOG An Int. J. Obstet. Gynaecol.* **125**, 246–252 (2018).
14. O'Farrell, I. *et al. Perinatal mortality in Ireland. Biennial Report 2018/2019*. vol. 30 (2021).
15. Kelly, K., Meaney, S., Leitao, S. & O'Donoghue, K. A review of stillbirth definitions: A rationale for change. *Eur. J. Obstet. Gynecol. Reprod. Biol.* **256**, 235–245 (2021).
16. Tavares, F. *et al.* Stillbirth: Case definition and guidelines for data collection, analysis, and presentation of maternal immunization safety data. *Vaccine* **34**, 6057–6068 (2016).
17. Smith, L. K. *et al.* Producing valid statistics when legislation, culture and medical practices differ for births at or before the threshold of survival: report of a European workshop. *BJOG An Int. J. Obstet. Gynaecol.* **127**, 314–318 (2020).
18. Garne, E. *et al.* Termination of pregnancy for fetal anomaly after 23 weeks of gestation: a European register-based study. *BJOG An Int. J. Obstet. Gynaecol.* **117**, 660–666 (2010).
19. Boyle, B. *et al.* Estimating Global Burden of Disease due to congenital anomaly: an analysis of European data. *Arch. Dis. Child. - Fetal Neonatal Ed.* **103**, F22–F28 (2018).
20. Flenady, V. *et al.* Stillbirths: Recall to action in high-income countries. *Lancet* **387**, 691–702 (2016).
21. Department of Social Protection. Maternity Leave. Stillbirths and Miscarriages. https://www.gov.ie/en/service/apply-for-maternity-benefit/#stillbirths-and-miscarriages (2018).
22. Hug, L. *et al.* Global, regional, and national estimates and trends in stillbirths from 2000 to 2019: a systematic assessment. *Lancet* **398**, 772–785 (2021).
23. Flenady, V. *et al.* Stillbirths: the way forward in high-income countries. *Lancet* **377**, 1703–1717 (2011).
24. Escañuela Sánchez, T. Rethinking stillbirth through behaviour change. (University College Cork, 2022).
25. Roustaei, Z., Räisänen, S., Gissler, M. & Heinonen, S. Associations between maternal age and socioeconomic status with smoking during the second and third trimesters of pregnancy: A register-based study of 932 671 women in Finland from 2000 to 2015. *BMJ Open* **10**, (2020).
26. De Wolff, M. G. *et al.* Prevalence and predictors of maternal smoking prior to and during pregnancy in a regional Danish population: A cross-sectional study. *Reprod. Health* **16**, 1–9 (2019).
27. Lepper, L. E. T. *et al.* Socioeconomic Status, Alcohol Use, and Pregnancy Intention in a National Sample of Women. *Prev. Sci.* **17**, 24–31 (2016).
28. Metz, V. E., Brown, Q. L., Martins, S. S. & Palamar, J. J. Characteristics of drug use among pregnant women in the United States: Opioid and non-opioid illegal drug use. *Drug Alcohol Depend.* **183**, 261–266 (2018).
29. Marufu, T. C., Ahankari, A., Coleman, T. & Lewis, S. Maternal smoking and the risk of still birth: systematic review and meta-analysis. *BMC Public Health* **15**, (2015).
30. Heazell, A. E. P. *et al.* Associations between social and behavioural factors and the risk of late stillbirth – findings from the Midland and North of England Stillbirth case-control study. *BJOG An Int. J. Obstet. Gynaecol.* **128**, 704–713 (2021).
31. Helps, Ä., Leitao, S., Gutman, A., Greene, R. & O'Donoghue, K. National perinatal mortality audits and resultant initiatives in four countries. *Eur. J. Obstet. Gynecol. Reprod. Biol.* **267**, 111–119 (2021).
32. National Perinatal Epidemiology Centre. Perinatal Mortality National Clinical Audit. *2022* https://www.ucc.ie/en/npec/npec-clinical-audits/perinatalmortality/.
33. Perined. Wat is perinatale audit? https://www.perined.nl/onderwerpen/audit/watisaudit.
34. Euro Peristat. About EURO-PERISTAT. https://www.europeristat.com/index.php (2018).
35. UNICEF, WHO, World Bank Group & United Nations. *A neglected tragedy: the global burden of stillbirths - Report of the UN inter-agency Group for Child Mortality Estimation, 2020*. https://data.unicef.org/resources/a-neglected-tragedy-stillbirth-estimates-report/ (2020).

36. Healthcare Improvement Scotland. SPSP Maternity and Children Quality Improvement Collaborative (MCQIC). https://ihub.scot/improvement-programmes/scottish-patient-safety-programme-spsp/spsp-programmes-of-work/maternity-and-children-quality-improvement-collaborative-mcqic/maternity-care/ (2021).

37. Hanley, D., Cunningham, A., Love, C., Pound, C. & McInally, D. Fetal movement awareness: Reducing stillbirth in Scotland. *Scottish Patient and Safety Programme* vol. 17 2014 (2017).

38. Healthcare Improvement Scotland. Reducing Stillbirth in Scotland. Scottish Patient Safety Programme Maternity and Children Quality Improvement Collaborative. https://ihub.scot/improvement-programmes/scottish-patient-safety-programme-spsp/spsp-programmes-of-work/maternity-and-children-quality-improvement-collaborative-mcqic/maternity-care/stillbirth/ (2021).

39. O'Connor, D. *Saving Babies' Lives A care bundle for reducing stillbirth*. https://www.england.nhs.uk/wp-content/uploads/2016/03/saving-babies-lives-car-bundl.pdf (2016).

40. NHS England. *Saving Babies' Lives Version Two*. https://www.england.nhs.uk/mat-transformation/saving-babies/ (2019).

41. Widdows, K., Roberts, S., Camacho, E. & Heazell, A. E. P. *Evaluation of the implementation of the Saving Babies ' Lives Care Bundle in early adopter NHS Trusts in England*. (2018).

42. Draper, E. S. *et al. MBRRACE-UK Perinatal Mortality Surveillance Report, UK Perinatal Deaths for Births from January to December 2020.* (2022).

43. Commonwealth of Australia as represented by the Deparment of Health. *National Stillbirth Action and Implementation Plan*. (2020).

44. Andrews, C. J. *et al.* Implementation and evaluation of a quality improvement initiative to reduce late gestation stillbirths in Australia: Safer Baby Bundle study protocol. *BMC Pregnancy Childbirth* **20**, 694 (2020).

45. Andrews, C. J. *et al.* Stillbirth in Australia 2: Working together to reduce stillbirth in Australia: The Safer Baby Bundle initiative. *Women and Birth* **33**, 514–519 (2020).

46. Safer baby collaborative | Safer Care Victoria. *Safer Baby Victoria* https://www.safercare.vic.gov.au/improvement/projects/mbc/safer-baby (2022).

47. The Together We Can Stop Stillbirth: Public Awareness Campaign. Still Six Lives Website Development and PR Campaign - Icon Agency. https://iconagency.com.au/work/still-six-lives (2019).

48. Meet the Founders - Count the Kicks. https://countthekicks.org/about-us/meet-the-founders/.

49. Count the Kicks. Save 7,500 Babies - Count the Kicks. https://countthekicks.org/get-involved/save-7500-babies/.

50. Isburg, K. Researchers Announce Preliminary Results of Count the Kicks App User Study - Count the Kicks. https://countthekicks.org/2020/10/mobile-app-impacts-birth-outcomes/ (2020).

51. Canadian Collaborative for Stillbirth Prevention (CC4SP). https://www.cc4sp.ca/.

52. gov.ie. Minister for Health publishes the National Clinical Effectiveness Committee's National Clinic Audit No.2 Perinatal Mortality. https://www.gov.ie/en/press-release/ee7c9-minister-for-health-publishes-the-national-clinical-effectiveness-committees-national-clinic-audit-no2-perinatal-mortality/ (2022).

53. Corcoran, P. *et al. Perinatal Mortality in Ireland. Annual Report 2014. National Perinatal Epidemiology Centre* (2016).

54. Manning, E. *et al. Perinatal Mortality in Ireland Annual Report 2016*. www.ucc.ie/en/npec/ (2018).

55. Grant, A., Morgan, M., Gallagher, D. & Mannay, D. Smoking during pregnancy, stigma and secrets: Visual methods exploration in the UK. *Women and Birth* **33**, 70–76 (2020).

56. McDonnell, A. *et al. National Clinical Practice Guideline: Stillbirth: Prevention, Investigation, Management and Care.* (2023).

57. Nurture Programme Antenatal to Postnatal Implementation Team. *National Standards for Antenatal Education in Ireland. Health Service Execuetive* https://www.lenus.ie/handle/10147/627247 (2020).

58. Escañuela Sánchez, T., Meaney, S. & O'Donoghue, K. Stillbirth and risk factors : an evaluation of Irish and UK websites. *J. Commun. Healthc.* **0**, 1–10 (2020).

59. Michie, S., Atkins, L. & West, R. *The Behaviour Change Wheel: A Guide to Designing Interventions.* (Silverback Publishing., 2014).

60. Escañuela Sánchez, T., Meaney, S. & O'Donoghue, K. Modifiable risk factors for stillbirth: a literature review. *Midwifery* **79**, (2019).

61. Escañuela Sánchez, T. *et al.* Facilitators and barriers to substance-free pregnancies in high-income countries: A meta-synthesis of qualitative research. *Women and Birth* **35**, e99–e110 (2021).

62. Escañuela Sánchez, T. *et al.* Facilitators and barriers influencing weight management behaviours during pregnancy: a meta-synthesis of qualitative research. *BMC Pregnancy Childbirth* **22**, 1–21 (2022).

63. Escañuela Sánchez, T., Linehan, L., O'Donoghue, K., Byrne, M. & Meaney, S. Facilitators and barriers to seeking and engaging with antenatal care in high-income countries: A meta-synthesis of qualitative research. *Health Soc. Care Community* **00**, 1–19 (2022).

64. Escañuela Sánchez, T., Matvienko-Sikar, K., Meaney, S. & O'Donoghue, K. Exploring first time mothers' experiences and knowledge about behavioural risk factors for stillbirth. *Heal. Expect.* 1–14 (2022) doi:10.1111/hex.13662.

65. Escañuela Sánchez, T., O'Donoghue, K., Byrne, M., Meaney, S. & Matvienko-Sikar, K. A systematic review of behaviour change techniques in the context of stillbirth prevention. *Women and Birth* (2023).

66. Michie, S. *et al.* The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Ann. Behav. Med.* **46**, 81–95 (2013).