**Dataset Description**

The dataset is a collection of data undertaken by the members of BIO-Birth-1 project, funded by LIFE. This dataset contains participant demographics (n=20) with bed-body interface pressure at the head, shoulders, sacrum, and full body (average & peak pressure, & Peak Pressure Index [PPI]) during 5 different lying birthing positions (side lying, knees bent flat back, knees bent raised back, stirrups flat back, stirrups raised back).

**BIO-Birth-I STUDY**

***Background***

The World Health Organization (WHO) encourages women in labour to ambulate and assume upright positions shown to be associated with favourable childbirth outcomes. However, the literature shows that most women in developed and developing countries, give birth in recumbent or semi-recumbent positions, mostly due to available medical protocols and the low confidence in the limited scientific evidence on biomechanical properties of the pelvic depending on maternal birthing position. The overall up to date knowledge is based on old radiographic studies, and current magnetic resonance imaging (MRI) observations, with a technique known as pelvimetry, or computational models. Although, pelvimetry and computational modelling provided us with some knowledge that coccyx can rotate by 12.1o more during flexible sacrum positions, and that sitting or kneeling squat positions increase pelvic diameter, both methods have significant limitations and therefore this area remains a controversial topic among maternity care professionals. Pelvimetry involves either radiation (x-rays) or is not completely non-invasive (MRI)\*. In addition, the positions that can be assessed during pelvimetry are not representative of actual birthing positions due technical limitations [e.g., the 70 cm inner bore diameter of the MRI limited women to adopt only kneeling squat or conventional supine position (legs extended next to each other)]. Computational models use assumptions and simplifications, and do not include all the factors e.g., ligaments, position of legs etc. The aim of this study was to examine the pressure exerted on the bed-body interface in five frequently utilised birthing positions. The understanding of how different birthing positions affect the sacral and coccygeal ability to move and rotate during labour, will provide health care professionals (HCPs) with every confidence to offer better quality maternal care.

**Methodology**

**Study Design**

A within-subjects, repeated measures design was used to analyse changes in interface pressure parameters in five birthing positions. The study was planned 'with' and 'by' members of the public, not just 'to,' 'about,' or 'for' them, as per INVOLVE guidance. The Patient and Public Involvement and Engagement (PPIE) group consisted of four women who had given birth during the last 10 years and one clinical midwife. Together with the project's advisory board, they were involved in the methodological design and decided on the positions that would be assessed during this study, based on the Indian-specific context. They also considered the positions that are mostly used, taking into account the time needed for data recording from each participant, ensuring that the research was conducted in a manner that was relevant and sensitive to the needs and perspectives of the population being studied. As per INVOLVE guidance, one member of the PPIE group actively participated as a participant in order to provide critical feedback about the setup and assessment procedure. The researcher who conducted the data collection was not aware of which participant was also a member of the PPIE group, to ensure objectivity

**Participants:** Following established guidelines for pilot studies, which recommend a sample size of 12-20 participants, the research team determined that a sample size of n=20 participants would be sufficient for this exploratory study. Eligible participants were females of reproductive age (<49 years old) and over 18 years old, who were free from any injury, pain, illness, or medical condition that would limit their ability to lie on their back or left side. Participants were recruited through campus-based advertisements and social media posts and were required to actively opt into the study by contacting the researchers using the contact information provided in the advertisements. Those who expressed interest in the study were provided with a participant information sheet via a standardised email. Participants were given at least 24 hours to decide whether to participate in the study and were also given the opportunity to ask the research team any questions they may have had.

**Data Collection:** The XSENSOR pressure mapping system (XSENSOR Technology Corporation, Calgary, Canada) was used to capture interface pressure readings during the five lying positions. The system consisted of a full bed-size flexible pressure mapping pad (61cm x 183cm sensing area, 12.7mm resolution, 6,912 sensing points, 5-50mmHg & 10-200mmHg pressure ranges, accuracy rate of ±10% of the calibrated values) that connected to a laptop equipped with XSENSOR PRO v6.0 software, enabling real-time recording. The sampling rate was one frame per second. Calibration of the system adhered to the manufacturer's instructions, ensuring consistent data collection with heightened reliability, especially in contexts where robust repeatability and minimal creep characteristics are paramount.

All measurements were conducted in the University’s Clinical Skills Lab – Midwifery Suite, which is an exact replica of a birthing suite. The AVE 2 birthing bed was used for this study. The pressure mapping pad was placed on the bed and held in place with adhesive tape to ensure that it remained in the same position for the duration of each assessment period. The pad was always attached to the bed in the exact same position for all participants (Fig 1).  Participants' pelvis had to be positioned within the lines of the area designated for the recording of pelvic pressure.

Each participant was invited to partake in a single 75-minute data collection session. Upon arrival, participants were reminded of the testing protocol and given the chance to address any queries they might have had. Subsequently, participants filled out an electronic consent form. To optimise data accuracy, all participants were required to wear either leggings with a loose top or shorts with a t-shirt. Additionally, participants needed to remove any jewellery, hair ties, and other hair accessories before their age, height, and weight were documented.

To minimise the effect of order bias or sequence-related influences, the order of the positions was randomised using the online Research Randomizer Tool. Based on randomisation, the researcher collecting the data informed the participant about the order of the positions they had to adopt. Participants had to maintain each position for 10 minutes. At the end of the 10 minutes in each position, participants were asked to perform closed-glottis pushing (holding their breath while pushing-involuntary pushing) for a duration of 8 seconds to reflect the bearing down activity of labour [g]. Before the beginning of any recording, participants were coached on how to perform closed-glottis pushing: to take a deep breath, hold their breath, and push very hard downwards to the perineum for 8 seconds. There was a minimum of 1-minute interval between each position, and participants were offered breaks between conditions and allowed to pause for a break where required.

The five birthing positions investigated were:

* Lying flat on the back with knees bent and feet flat on the bed: The back of the bed was adjusted to 180o (flat). Participants were instructed to lie flat on their back with their knees bent and their feet placed flat on the bed (shoulder width apart). No specific instructions were given regarding the hip-knee angles, due to inter-participant differences in femoral/tibia length ratios and other anatomical variations. The only condition was to have the feet completely flat on the mattress. Participants were free to choose how far apart they placed their knees to maintain a comfortable position. Participants were asked to rest their hands across their stomach, in their lap.
* Lying on the back with knees bent and feet flat on the bed, with the head of the bed raised by 45o degrees: Participants were instructed to lie on their back with their knees bent and their feet placed flat on the bed (shoulder width apart). Then the back of the bed was raised to 45o, , after which participants had to confirm that they were in a comfortable position. No specific instructions were given regarding the hip-knee angles, due to inter-participant differences in femoral/tibia length ratios and other anatomical variations. The only condition was to have the feet completely flat on the mattress. Participants were free to choose how far apart they placed their knees to maintain a comfortable position. Participants were asked to rest their hands across their stomach, in their lap.
* Lying flat on the back with legs in stirrups: The back of the bed was adjusted to 180o degrees (flat). Participants were instructed to place the lower part of their calves and ankles on the stirrups in a position that felt comfortable for them to maintain for 10 minutes. Stirrups were adjusted as per each participant's anatomical needs. Participants were asked to rest their hands across their stomach, in their lap.
* Lying on the back with legs in stirrups, with the head of the bed
raised by 45o degrees: Participants were instructed to place the lower part of their calves and ankles on the stirrups in a position that felt comfortable for them to maintain for 10 minutes. Stirrups were adjusted as per each participant's anatomical needs. Then the back of the bed was raised to 45o, after which participants had to confirm that they were in a comfortable position. Participants were asked to rest their hands across their stomach, in their lap.
* Left side lying position: The back of the bed was adjusted to 180o (flat). A pillow was placed under the participant's head and neck so that the spine could maintain a straight and natural horizontal alignment. Then the participant was instructed to place the calf and ankle of the upper leg on a stirrup that was positioned to replicate the support that would ordinarily be provided by the health professional. Participants were asked to place their hands in a comfortable position to the side of their head.

**Data Treatment and Analysis:** The Advanced Medical Mode of XSensor X3 Medical v6 was used for data processing. Considering the mattress type on the AVE 2 birthing bed, the initial 240 frames (4 minutes) were removed from the recorded data. This period accounts for the time necessary for the mattress to adapt to body pressure, commonly referred to as the settling period. The subsequent 360 frames (6 minutes) were utilised for data processing and were merged using the average peak pressure. Furthermore, the initial 8 frames beyond the 600-frame mark (>10 minutes) were utilised to calculate the effects of closed glottis pushing tasks, by identifying the peak value.

Regions of interest (RoI) were manually identified due to anatomical variances and defined as follows:

* Head RoI: This encompasses the minimal rectangular area containing all activated sensors in the head region.
* Shoulder RoI: An oblong area extending from the uppermost shoulder region (encompassing all activated sensors) to the horizontal line of the armpit.
* Pelvic RoI:
	+ In the supine position: This includes the rectangular area from the belt line to the lower buttocks region.
	+ In the left side-lying position: This involves the rectangular area from the belt line to the knee joint.
* Full Body: This encompasses the entire activated area on the mat, including all activated sensors.

For each region of interest, average and peak pressure (mmHg), contact surface area (cm2), and peak pressure index (PPI) (mmHg) were input into Microsoft Office Excel 365 (Microsoft Corp, USA) and then exported to SPSS v28 for windows (IBM Corp., USA) for analysis. For the closed glottis pushing task, peak pressure (mmHg) and PPI (mmHg) for each region of interest were reported. The PPI is considered more reliable for assessing the pressure-redistributing capabilities of a support surface as it examines a surface area of XXcm2 and not just the peak pressure registered by one single sensor.

Descriptive statistics were used to describe the demographic characteristics of the study participants. As the left side lying position was not directly comparable with the other 4 positions, descriptive statistics were also used to describe this data. A repeated measures linear mixed model analysis was used to determining the effect of leg and back position on the reported variables. Where a significant main effect was identified, post-hoc pairwise comparisons were explored to determine exact differences. Statistical significance was set at p<0.05**.**

**ETHICS**

The University of Central Lancashire (UCLan) Committee for Ethics and Integrity (Health Review Panel) approved this study (HEALTH\_0377).

**GEOGRAPHICAL COVERAGE**

United Kingdom

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**Scientific Advisory Board**

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**PPI Group**

3 members (women who gave vaginal birth)