

# Identifying the barriers to universal cervical length screening for preterm birth prevention at a tertiary hospital in Thailand (physician perspectives): implementation research

Saifon Chawanpaiboon (✉ [saifon.cha@mahidol.ac.th](mailto:saifon.cha@mahidol.ac.th))

Mahidol University, Faculty of Medicine, Siriraj Hospital <https://orcid.org/0000-0002-3207-6187>

Vitaya Titapant

Mahidol University Faculty of Tropical Medicine

Sanitra Anuwutnawin

Mahidol University, Faculty of Medicine, Siriraj Hospital

Attapol Kanjanapongporn

Mahidol University, Faculty of Social Science and Humanities

Julaporn Pooliam

Mahidol University Faculty of Medicine Siriraj Hospital

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## Research

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# Abstract

**Background:** To identify physicians' perspectives of the barriers to cervical length screening to prevent preterm births.

**Methods:** A prospective, descriptive, implementation study was carried out at the official rooms, tertiary hospitals. Ethics approval was obtained from the Siriraj Ethics Committee of the Faculty of Medicine Siriraj Hospital, and the work was registered at the Thai Clinical Trials Registry (TCTR20190813003). Physicians at 52 tertiary hospitals throughout Thailand were recruited. In Phase I of this prospective descriptive implementation study, 20 physicians were interviewed. Phase II comprised questionnaire development and data validation. The questionnaire was administered to 120 Phase-III participants.

**Results:** Virtually all respondents (118/120 [98.3%]) were obstetricians or gynecologists, with 25/120 (20.8%) specializing in maternal and fetal medicine. The large majority (108 [90.0%]) reported that their tertiary hospitals have action plans to prevent preterm births. Most physicians (99 [82.5%]) participated in the formulation of policies for preterm-birth prevention. Most obstetricians (96 [80.0%]) also have heavy workloads. At most hospitals, the obstetricians (96 [80.0%]) can perform cervical length measurements via vaginal ultrasound without having the related certification. Moreover, at two-thirds of the tertiary hospitals, the obstetricians (73/120 [60.8%]) stated that screening is performed in the absence of clear guidelines for high-risk cases. Ways suggested to reduce the obstacles facing obstetricians are providing them with knowledge, skills, and training (68/120 [56.7%]) and reducing unnecessary workloads (51/120 [42.5%]).

**Conclusions:** From the physicians' perspectives, the barriers to performing cervical length measurements are heavy workloads and a lack of government funding for hormone-usage programs. High-risk pregnant women threatening preterm deliveries should be considered for screening.

**Trial registration:** the work was registered at the Thai Clinical Trials Registry (TCTR20190813003), registered 14 August, 2019, [http://www.thaiclinicaltrials.org/page\\_user/#](http://www.thaiclinicaltrials.org/page_user/#).

## Contributions To The Literature

- Barriers to performing cervical length measurements are heavy workloads and a lack of government funding for hormone-usage programs.
- Cervical length screening in high-risk pregnant women should be considered.
- Ways suggested to reduce the obstacles facing obstetricians are providing them with knowledge, skills, and training.

## Background

The chief cause of death globally among children younger than 5 years of age is complications associated with preterm birth; in 2016, they accounted for 35% of neonatal deaths and approximately

16% of deaths occurring in children up to age 5 worldwide. (1) Preterm births represented 12.98% of deliveries at Siriraj Hospital, Thailand, in 2008, (2) and the estimated global preterm birth rate for 2014 was 10.6%. (3)

Surviving premature newborns are at high risk of both short- and long-term illnesses. The common complications of preterm birth include respiratory distress syndrome, bronchopulmonary dysplasia, necrotizing enterocolitis, sepsis, periventricular leukomalacia, seizures, intraventricular hemorrhage, cerebral palsy, infections, feeding difficulties, hypoxic ischemic encephalopathy, and visual and hearing problems. (4, 5)

Preterm birth has significant cost implications for the health system and families. (6) About two-thirds of premature deliveries result in emotional and financial difficulties for the parents. (6) Only approximately 15% of spontaneous preterm deliveries occur among women with a history of a previous preterm delivery. (7, 8) Given that pregnant women identified as having a short cervix between 20–24 weeks of gestation are at an increased risk of preterm labor (9), the development of effective strategies for cervical length screening and the consequential prevention of preterm births is needed. One study found that progesterone usage by vaginal route can reduce the incidence of preterm birth before 34 weeks gestation in approximately 45% of women with a short cervix. (10)

In Thailand, there are an estimated 15,000 cases of preterm births annually. (11) Expenditure on preterm neonatal hospital care has been calculated to be in the order of 170,000 Baht/case (US \$5,312/case), which equates to a total of 255,000,000 Baht/year (US \$79,680,000/year). These figures exclude the long-term care costs incurred following hospital discharge. (11)

Based on current evidence, the Society for Maternal-Fetal Medicine (12), the American College of Obstetricians and Gynecologists (13), and the National Institute for Health and Care Excellence (14) have recommended that cervical length screening between 20–24 weeks of gestation can help screen for women who are at risk of preterm delivery. The International Federation of Gynaecology and Obstetrics has recommended that screening should be performed for all pregnant women. (15)

In accordance with the Thai Ministry of Public Health policies on the prevention of preterm births that were introduced in 2016, all public health facilities in Thailand have standardized and comprehensive maternal and child health services, utilize efficient referral systems, and offer a standard quality of antenatal care. Under the policies, all pregnant women should be screened to lower the incidence of preterm births; when a woman at risk is identified, preterm birth prevention should proceed. In addition, the prescribed policies require that preterm newborns are provided with standardized care appropriate to the potential of each hospital. Promoting community awareness and participation in measures designed to prevent preterm births is also required. (16)

Performing universal cervical length measurements at the gestational age of 20–24 weeks is one of the national health policies relating to the prevention of preterm births in Thailand. (16) Pregnant women with a short cervix (< 25 millimeters) are deemed to be at high risk for a preterm delivery, and the

administration of micronized progesterone vaginal suppositories is indicated to prevent preterm delivery, according to the guidelines of the Royal College of Obstetricians of Thailand, (16)

Obstetricians play a significant role in the antenatal care of pregnant women. Pregnant mothers generally trust their obstetricians to inform them of all of the necessary details relating to screening for, and preventing, preterm births. Unfortunately, despite the policy for universal screening having been in place for over 4 years, its implementation has been largely unsuccessful, with most pregnant women not undergoing screening. The objective of this research was to determine the obstacles to the performance of screening for preterm birth prevention from the perspective of physicians.

## Methods

This was a prospective, descriptive, implementation study. Before its commencement of the study, ethics approval was obtained from the Siriraj Ethics Committee of the Faculty of Medicine Siriraj Hospital, and the work was registered at the Thai Clinical Trials Registry.

This survey study utilized questionnaires. To ensure an adequately sized dataset, with a proportion of the results of interest of 50% ( $P = 0.5$ ), an estimation error of  $\leq 5\%$ , and a 95% confidence level (type I error = 0.05, 2-sided), the number of physicians needing to be surveyed was calculated to be 120.

The research was divided into 3 phases.

### ***Phase I: in-depth interviews***

This phase collected information about 4 areas: (1) general physician information; (2) physician attitudes to the performance of cervical length measurements and the provision of care for preterm births; (3) the decision-making process for performing measurements; and (4) frustrations experienced when deciding whether to prevent a preterm labor when a short cervix is detected.

Physicians who had previously expressed a willingness to participate in the research project were invited to a private counselling room. After the details of the proposed project were described, the physicians were invited to ask questions and given time to consider whether they wished to formally enroll in the trial. The physicians were informed that they could decline to participate in the research and, if they did agree to proceed, they could withdraw at any stage. Twenty physicians subsequently volunteered as a research subject; they were asked to sign an informed consent form before being interviewed at length.

The participants were asked for their permission for the structured interview to be audio-recorded. The subjects initially completed an attitude assessment questionnaire: this dealt with the methods used to measure cervical length and the assessment of the degree of care to be provided in the event of preterm births. Several other aspects were then investigated in a structured interview. One related to any frustrations that might be felt prior to performing a cervical length measurement. The total time from the commencement of the questionnaire until the completion of the comprehensive interview was about 30 minutes. The data integrity of the research questions was later verified.

## **Phase II: development and validation of questionnaire**

The data obtained from the questionnaire and in-depth interviews were analyzed to determine the means and standard deviations. This enabled the questionnaire and interview questions to be refined. The revised questionnaires and interview questions were tested for validity and reliability before being used in the next phase.

## **Phase III: administration of questionnaire**

The validated questionnaires were given to 120 physicians in tertiary hospitals during the final phase of the study.

## **Statistical analysis**

Demographic data were summarized using descriptive statistics. Categorical data are presented as numbers and percentages and continuous data are presented as mean  $\pm$  standard deviation or median and range. The statistical analyses were performed using PASW Statistics for Windows (version 18.0; SPSS Inc., Chicago, Ill., USA).

# **Results**

The average age of the participants was 38.8 years (26–60 years), and they had worked as physicians for a mean of 14.3 years (2–36 years). Nearly all of the respondents (118/120 [98.3%]) were obstetricians or gynecologists, with 25/120 (20.8%) having subspecialized in maternal and fetal medicine. Over half of the respondents (61 [50.9%]) worked at tertiary centers that had a total bed-capacity of > 500. The majority of respondents (94 [78.3%]) performed additional duties other than routine administrative work (e.g., teaching and research; Table 1).

Fifty-five respondents (45.8%) reported that a specific policy for cervical length screening to prevent preterm births is in place at most of the tertiary hospitals. However, only some personnel (52 [43.3%]) are assigned to a working group or committee responsible for the implementation of preterm birth prevention measures. The vast majority of respondents (108 [90.0%]) indicated that their hospitals have established action plans to prevent preterm births, and 58 physicians (48.3%) stated that meetings are held monthly, quarterly, or yearly to review implementation performance. In recognition of their role as service deliverers, most of the physicians (99 [82.5%]) participate in the formulation of national policies relating to preterm birth prevention. About two-thirds of the respondents (78 [65.0%]) believe that the centrally located Maternal and Child Health Board (run by the Thai Ministry of Public Health) is involved in cervical length screening programs. Nevertheless, over half of those physicians (46/78 [59.0%]) are of the view that, in practice, the Board only supports preterm birth prevention through the provision of micronized progesterone vaginal soft-gel capsules (Utrogestan). Moreover, half of all of the respondents (59/120 [49.2%]) have the opinion that the Maternal and Child Health Board has a limited role in the prevention of preterm births. Half of the surveyed physicians (59/120 [49.2%]) would like the Maternal and Child Health

Board to be responsible for providing medicines and medical equipment to all hospitals throughout Thailand (Table 2).

About two-thirds of the respondents (76 [63.3%]) consider that their hospitals regularly employ an adequate number of obstetricians, while a half of the physicians (60 [50.0%]) stated that the hospitals have obstetricians on hand who can accurately perform cervical length measurements. In addition, half of the physicians (62 [51.7%]) indicated that their hospitals have a specific individual (a Project Manager) who has been assigned responsibility for disseminating information on each hospital's preterm birth prevention program. Nonetheless, almost all of the respondents (107 [89.2%]) reported that their hospitals have no specific budget for screening. This was despite ultrasound machines having been specifically provided for routine cervical screening, according to nearly two-thirds of the physicians (61 [50.8%]; Table 3).

Most obstetricians claimed to have a heavy workload (96 [80.0%]). The large majority (101 [84.2%]) were of the opinion that a preterm birth results in considerable hospital expenses, with most physicians (93 [77.5%]) opining that this was primarily due to the long length of hospital stay needed (Table 4). Most also suggested that the families of preterm babies face substantial financial burdens (96 [80.0%]), difficulties coping with newborn care (111 [92.5%]), and consequential problems in their family and work lives (107 [89.2%]; Table 4).

Nearly all of the physicians (119 [99.2%]) stated that their hospitals realize that preterm births present problems to the hospital, with two-thirds of the respondents (63 [52.9%]) suggesting that the problems are regarded as having a high degree of severity. Most obstetricians (96 [80.0%]) are permitted by their hospital to obtain measurements by vaginal ultrasound without their having the related certification for the performance of such measurements. Most of them (90 [75.0%]) also believe that it is especially useful to obtain measurements to prevent preterm births, with three-quarters (76/116 [65.5%]) of the view that the screening procedure does help to reduce the preterm birth rate. A sizeable majority (88 [73.3%]) are aware of the Thai Ministry of Public Health policy that universal cervical measurements should be provided; many (55/88 [62.5%]) agree with that policy; and most (94 [78.3%]) expressed their willingness to work on a project to promote the policy's full implementation. Most (91 [75.8%]) also opined that the ultrasound screening should be provided to pregnant women free of charge (Table 5).

A substantial majority of physicians (73 [60.8%]) stated that cervical length screening is performed for high-risk cases at their hospitals, but with unclear guidelines. However, most respondents (89 [74.2%]) indicated that their hospitals are currently taking actions to prevent preterm births, in accordance with the current Thai Ministry of Public Health guidelines. Nearly two-thirds of physicians (74 [61.7%]) claimed that problems are found when performing screening tests for high-risk pregnant women; they include long waiting times, and patients being shy, fearing pain, and feeling anxious about the examination procedure (Table 6).

From the physicians' perspectives, the chief possible barriers to providing universal screening are doctors already having excessive routine tasks (78 [65.0%]), and doctors being unsure about the correct

procedures for obtaining the measurements (50 [41.7%]). A sizeable minority of obstetricians (37 [30.8%]) also do not believe that having a policy of universal screening to prevent preterm births can justify the labor and funding investment needed. The physicians' key perceived problems relating to other personnel (nurses and administrative staff) are an insufficient number of personnel to support the performance of the procedure (75 [62.5%]); support staff are already burdened with excessive routine tasks (72 [60.0%]); and a lack of confidence that the collecting, recording, and analyzing of data by non-medical personnel will be accurate (51 [42.5%]). Finally, the major problems associated with hospitals are, firstly, a lack of screening funding from government agencies (67 [55.8%]) and, secondly, the absence of cost-free drugs that prevent preterm deliveries for administration to pregnant women with short cervixes (62 [51.7%]; Table 7).

Two major approaches that were suggested to surmount the obstacles relevant to obstetricians are the provision of knowledge and skills training for obstetricians (68 [56.7%]), and a reduction in their extraneous duties (51 [42.5%]). Ways that were suggested to overcome the obstacles relevant to hospitals are providing adequate and regular funding from relevant agencies (92 [76.7%]); and educating patients about the benefits of obtaining cervical length measurements to prevent preterm births (78 [65.0%]). A sizeable majority of physicians (84 [70.0%]) also proposed that screening should be extended to secondary centers (i.e., community hospitals) to reduce the workloads of physicians at tertiary centers (Table 8).

## Discussion

Our research found that most obstetricians follow the policies of the Ministry of Public Health in that they perform screening even if they have not received formal certification in the conduct of the procedure. However, the main problem they face are huge workloads; therefore, most tertiary hospitals only carry out the examinations for high-risk pregnant women.

The current effective preventative measure for preterm deliveries is the use of progesterone. (17) Much research supports the position that obtaining cervical length measurements is an effective way of screening for pregnant women with a short cervix; the procedure has proven to be highly cost-effective and presents limited risk. (18, 19) As only a small proportion of women who have a preterm birth have risk factors, and a substantial number of preterm deliveries occur in nulliparous women, universal transvaginal cervical length screening is recommended to identify women at risk of a preterm birth. (20) The American College of Obstetricians and Gynecologists and the Society of Maternal and Fetal Medicine have published clinical guidelines for universal transvaginal cervical length screening, and for the administration of either vaginal progesterone or a cervical cerclage to treat pregnant women with a short cervix. (18, 19)

Nevertheless, there remains some controversy about the performance of cervical length measurements for low-risk women. There are also questions about the standards to be used for, and the repeatability of, measurements. Even though clinical trials have demonstrated that the use of the screening method and

progesterone therapy significantly reduces the risk of preterm deliveries and is worthwhile, the invasive nature of the procedure raises concerns for some patients. While the benefits of conducting additional cervical length screening through a universal program and providing what may prove to be unnecessary progesterone treatment still need to be substantiated, cervical length measurement is currently used very extensively. (21) One of the key barriers to the full implementation of universal screening in Thailand is the excessive volume of routine, urgent, and necessary tasks of physicians and nurses. Other major barriers are (1) some physicians do not believe that the provision of universal screening can justify the requisite labor and funding; and (2) there is inadequate funding by government agencies for both screening and the provision of cost-free progesterone. Therefore, careful reconsideration of the need to perform universal screening is warranted.

Work by Temming et al. (22) found that cervical length measurements tended to be rejected by women with one or more of the following characteristics: African, American, or Hispanic; obese; multiparous; younger than age 35; and a smoker. Their research also revealed that the rate of early spontaneous preterm births was higher among those women than other groups. In addition, the researchers established that the incidence of pregnant women with a cervical length of  $\leq 20$  millimeters was 1.1%, with no significant differences in the preterm delivery rates of women who underwent, and those who did not undergo, the measurements. (22)

Pregnant women with a full-term delivery have a low incidence of short cervixes. (23) Miller et al. reported that the incidence of a cervical length  $\leq 25$  millimeters was only 0.9% among 18,250 women who underwent transvaginal screening. (24) Similarly, in several institutional studies, Facco and colleagues found that a short cervix was less common among women with a low risk of preterm delivery. (25) Therefore, it appears reasonable to restrict transvaginal cervical-length measurements to pregnant women with a high risk of a short cervix or a preterm delivery (24) in order to decrease the workloads of physicians and nurses.

Adequate human resources and ultrasound machines for cervical screening are on hand at nearly all tertiary hospitals in Thailand. On the other hand, no government funding is presently made available to women to cover the costs of their examinations nor the provision of progesterone. Reserving transvaginal cervical screening for high-risk groups would release funds that could then be used to support the introduction of cost-free progesterone. A cost-effectiveness analysis of providing transvaginal screening only to such groups would need to be conducted.

Cervical length measurements can be safely performed during the period of fetal structural examination, at 20–24 weeks of gestation. A transabdominal cervical length measurement should be offered to pregnant women who have serious reservations about undergoing a transvaginal measurement. (23, 24) Unfortunately, transabdominal measurements can be used only with some pregnant women. (26) When the procedure is performed, the cervical length will be longer than that determined by a transvaginal measurement because the pregnant women must have a full bladder in order for the ultrasound operator to obtain a clear vision. (26) Therefore, the cervical measurement should be routinely performed using the

transvaginal route because it is currently the most effective method. Transabdominal measurements should be reserved for women who are clearly reluctant to undergo a transvaginal assessment.

As to the cost-effectiveness of screening programs, a transabdominal ultrasound should be performed for low-risk women with a fetal anatomy survey at 19–20 weeks gestation, while the more accurate but relatively costly transvaginal ultrasound may be worthwhile reserving for high-risk populations. (27) The benefits of this approach are, firstly, the additional costs associated with transvaginal screening can be avoided (28) and, secondly, the use of the dual methodologies improves the possibility that screening can be affordably performed for all pregnant women.

Vaginal progesterone administration to women with a cervical length of  $\leq 25$  millimeters has been shown to significantly reduce the risk of preterm births. (29) Providing funding to make the supply of progesterone free of charge should be considered as a national policy to prevent preterm births. However, one of many barriers to universal screening is the limited knowledge of the physicians involved in counseling pregnant women. If physicians do not believe in the prevention strategies, the need for universal screening, and the benefits of progesterone treatment, the utilization of screening will be impaired. (30, 31)

A physician's expertise in performing a measurement will greatly affect the results of the examination. Wrong results may lead to unnecessary treatment or missed opportunities to prevent preterm births through the administration of vaginal progesterone. The performance quality and the learning curve associated with obtaining accurate measurements are of critical importance. (32, 33)

In summary, in recognition of the heavy workloads of physicians, transvaginal cervical-length measurements should be reserved for pregnant women at high-risk of a preterm delivery. A public health education campaign should also be conducted to promote the advantages of universal transabdominal cervical-length measurements at 20–24 weeks of gestation for low-risk cases. The incidence of short cervixes is not high in the low-risk population, and fewer hospital costs are incurred with the transabdominal procedure than a transvaginal ultrasound. Physicians should be trained in the execution of both procedures. In addition, pregnant women must be fully advised about the benefits and risks of cervical length screening to help them in their decision-making regarding the selection of treatment. Moreover, the availability and prompt usage of vaginal progesterone needs to be reviewed. To achieve successful implementation of universal screening, the incidence and significant complications associated with preterm births should be communicated to all pregnant women. Continuous monitoring of preterm birth rates is essential in areas where universal screening is implemented to ensure that positive results are achieved.

## Conclusions

From the perspectives of physicians, the chief barriers to the performance of universal cervical length measurements are heavy staff workloads and a lack of monetary support for hormone usage from government agencies.

# Declarations

- Ethics approval and consent to participate

Ethics approval was obtained from the Siriraj Ethics Committee of the Faculty of Medicine Siriraj Hospital (Si480/2019) and the work was registered at the Thai Clinical Trials Registry (TCTR20190813003).

- Consent for publication

All participants were asked to sign an informed consent form before being participated in the study.

- Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

- Competing interests

The authors declare that they have no competing interests.

- Funding

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- Authors' contributions

Saifon Chawanpaiboon and Vitaya Titapant contributed to the conception and design of the research; the acquisition, analysis, and interpretation of the data; the drafting and critical revision of the manuscript; and the approval of the final manuscript.

Sanitra Anuwutnawin contributed to the recruitment of the patients, revision of the manuscript, and approval of the final manuscript.

Attapol Kanjanapongporn contributed to the transcription of the data from the audio recordings, and approval of the final manuscript.

Julaporn Pooliam contributed to the analysis and interpretation of the data, critical revision of the manuscript, and approval of the final manuscript.

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## References

1. WHO: recommended definitions, terminology and format for statistical tables related to the perinatal period and use of a new certificate for cause of perinatal deaths. Modifications recommended by FIGO as amended October 14, 1976. *Acta Obstet Gynecol Scand.* 1977;56(3):247–53.
2. Chawanpaiboon S SA. Preterm Birth at Siriraj Hospital : A Seven-Year Review (2002–2008). *Thai Journal of Obstetrics and Gynaecology.* 2009;17:204–11.
3. Chawanpaiboon S, Vogel JP, Moller AB, Lumbiganon P, Petzold M, Hogan D, et al. Global, regional, and national estimates of levels of preterm birth in 2014: a systematic review and modelling analysis. *Lancet Glob Health.* 2019;7(1):e37–e46.
4. Mwaniki MK, Atieno M, Lawn JE, Newton CR. Long-term neurodevelopmental outcomes after intrauterine and neonatal insults: a systematic review. *Lancet.* 2012;379(9814):445–52.
5. Ramenghi LA. Late preterm babies and the risk of neurological damage. *Acta Biomed.* 2015;86 Suppl 1:36–40.
6. Petrou S, Abangma G, Johnson S, Wolke D, Marlow N. Costs and health utilities associated with extremely preterm birth: evidence from the EPICure study. *Value Health.* 2009;12(8):1124–34.
7. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *Lancet.* 2008;371(9606):75–84.
8. Parry S, Simhan H, Elovitz M, Iams J. Universal maternal cervical length screening during the second trimester: pros and cons of a strategy to identify women at risk of spontaneous preterm delivery. *Am J Obstet Gynecol.* 2012;207(2):101–6.
9. Medley N, Poljak B, Mammarella S, Alfirevic Z. Clinical guidelines for prevention and management of preterm birth: a systematic review. *BJOG.* 2018;125(11):1361–9.
10. Hassan SS, Romero R, Vidyadhari D, Fusey S, Baxter JK, Khandelwal M, et al. Vaginal progesterone reduces the rate of preterm birth in women with a sonographic short cervix: a multicenter, randomized, double-blind, placebo-controlled trial. *Ultrasound Obstet Gynecol.* 2011;38(1):18–31.
11. Lin K, Fajardo K, Force USPST. Screening for asymptomatic bacteriuria in adults: evidence for the U.S. Preventive Services Task Force reaffirmation recommendation statement. *Ann Intern Med.* 2008;149(1):W20–4.
12. Society for Maternal-Fetal Medicine Publications Committee waoVB. Progesterone and preterm birth prevention: translating clinical trials data into clinical practice. *Am J Obstet Gynecol.* 2012;206(5):376–86.
13. Committee on Practice Bulletins-Obstetrics TACoO, Gynecologists. Practice bulletin no. 130: prediction and prevention of preterm birth. *Obstet Gynecol.* 2012;120(4):964–73.
14. Lee JW, Brancati FL, Yeh HC. Trends in the prevalence of type 2 diabetes in Asians versus whites: results from the United States National Health Interview Survey, 1997–2008. *Diabetes Care.*

- 2011;34(2):353–7.
15. Figo Working Group On Best Practice In Maternal-Fetal M, International Federation of G, Obstetrics. Best practice in maternal-fetal medicine. *Int J Gynaecol Obstet.* 2015;128(1):80–2.
  16. Schneeberger C, Erwich J, van den Heuvel ER, Mol BWJ, Ott A, Geerlings SE. Asymptomatic bacteriuria and urinary tract infection in pregnant women with and without diabetes: Cohort study. *Eur J Obstet Gynecol Reprod Biol.* 2018;222:176–81.
  17. Cahill AG, Odibo AO, Caughey AB, Stamilio DM, Hassan SS, Macones GA, et al. Universal cervical length screening and treatment with vaginal progesterone to prevent preterm birth: a decision and economic analysis. *Am J Obstet Gynecol.* 2010;202(6):548 e1–8.
  18. Berghella V. Universal cervical length screening for prediction and prevention of preterm birth. *Obstet Gynecol Surv.* 2012;67(10):653–8.
  19. Werner EF, Han CS, Pettker CM, Buhimschi CS, Copel JA, Funai EF, et al. Universal cervical-length screening to prevent preterm birth: a cost-effectiveness analysis. *Ultrasound Obstet Gynecol.* 2011;38(1):32–7.
  20. Celik E, To M, Gajewska K, Smith GC, Nicolaidis KH, Fetal Medicine Foundation Second Trimester Screening G. Cervical length and obstetric history predict spontaneous preterm birth: development and validation of a model to provide individualized risk assessment. *Ultrasound Obstet Gynecol.* 2008;31(5):549–54.
  21. Northen AT, Norman GS, Anderson K, Moseley L, Divito M, Cotroneo M, et al. Follow-up of children exposed in utero to 17 alpha-hydroxyprogesterone caproate compared with placebo. *Obstet Gynecol.* 2007;110(4):865–72.
  22. Temming LA, Durst JK, Tuuli MG, Stout MJ, Dicke JM, Macones GA, et al. Universal cervical length screening: implementation and outcomes. *Am J Obstet Gynecol.* 2016;214(4):523 e1–e8.
  23. Orzechowski KM, Boelig R, Nicholas SS, Baxter J, Berghella V. Is universal cervical length screening indicated in women with prior term birth? *Am J Obstet Gynecol.* 2015;212(2):234 e1–5.
  24. Miller ES, Tita AT, Grobman WA. Second-Trimester Cervical Length Screening Among Asymptomatic Women: An Evaluation of Risk-Based Strategies. *Obstet Gynecol.* 2015;126(1):61–6.
  25. Facco FL, Simhan HN. Short ultrasonographic cervical length in women with low-risk obstetric history. *Obstet Gynecol.* 2013;122(4):858–62.
  26. Marren AJ, Mogra R, Pedersen LH, Walter M, Ogle RF, Hyett JA. Ultrasound assessment of cervical length at 18–21 weeks' gestation in an Australian obstetric population: comparison of transabdominal and transvaginal approaches. *Aust N Z J Obstet Gynaecol.* 2014;54(3):250–5.
  27. Franca C, Carraca T, Monteiro SB, Rodrigues T, Montenegro N, Severo M, et al. Inter- and intra-observer variability in cervical measurement by ultrasound in the first and second trimesters of pregnancy: does it matter? *J Perinat Med.* 2015;43(1):67–73.
  28. Friedman AM, Srinivas SK, Parry S, Elovitz MA, Wang E, Schwartz N. Can transabdominal ultrasound be used as a screening test for short cervical length? *Am J Obstet Gynecol.* 2013;208(3):190 e1–7.

29. Conde-Agudelo A, Romero R. Vaginal progesterone to prevent preterm birth in pregnant women with a sonographic short cervix: clinical and public health implications. *Am J Obstet Gynecol.* 2016;214(2):235–42.
30. Lim AC, Goossens A, Ravelli AC, Boer K, Bruinse HW, Mol BW. Use of progesterone treatment for the prevention of recurrent preterm birth: identification of obstacles to change. *Am J Perinatol.* 2010;27(3):241–9.
31. Ramos M, Esteva M, Almeda J, Cabeza E, Puente D, Saladich R, et al. Knowledge and attitudes of primary health care physicians and nurses with regard to population screening for colorectal cancer in Balearic Islands and Barcelona. *BMC Cancer.* 2010;10:500.
32. Vahanian SA, Gallagher K, Chavez MR, Kinzler WL, Vintzileos AM. Does educational intervention affect resident competence in sonographic cervical length measurement? *J Matern Fetal Neonatal Med.* 2016;29(15):2481–4.
33. van Os MA, van der Ven AJ, Bloemendaal PM, Pajkrt E, de Groot CJ, Mol BW, et al. Effect of e-learning on quality of cervical-length measurements. *Ultrasound Obstet Gynecol.* 2015;46(3):327–31.

## Tables

**Table 1. Personal information (more than 1 option able to be selected)**

Details of personal information	Number (%) (n = 120)
Age (years) (mean $\pm$ SD [range])	38.8 $\pm$ 7.9 (26, 60)
Years since graduating with a medical degree (mean $\pm$ SD [range])	14.3 $\pm$ 7.8 (2, 36)
Postgraduate Diploma in Obstetrics and Gynecology n (%)	118 (98.3%)
Postgraduate Diploma in Maternal and Fetal Medicine (n [%])	25 (20.8%)
Years worked in the field of obstetrics and gynecology (mean $\pm$ SD [range])	9.1 $\pm$ 7.6 (1, 30)
Years worked in the position of head of department/unit of obstetrics and gynecology (median [range])	3.0 (0.1, 30.0)
Total bed-capacity of the hospital (n [%]):	
· 120–300	· 7 (5.8%)
· 300–500	· 52 (43.3%)
· > 500	· 61 (50.9%)
Duties other than administrative work (n [%]):	
· Teaching	· 29 (24.2%)
· Service	· 94 (78.3%)
· Research	· 21 (17.5%)
· Other (Adolescent Clinic, Maternal and Child Health Board, etc.)	· 11 (9.2%)

**Table 2. Context evaluation of tertiary hospitals (more than one option able to be selected)**

Relevant content	Number (%) (n = 120)
<p>Concrete hospital policy for cervical length screening to prevent preterm births:</p> <ul style="list-style-type: none"> <li>· There is a specific operating policy</li> <li>· Screening is done in parallel with other duties (e.g., teaching; research; etc.)</li> <li>· No policy</li> </ul>	<ul style="list-style-type: none"> <li>· 55 (45.8%)</li> <li>· 32 (26.7%)</li> <li>· 33 (27.5%)</li> </ul>
<p>Working group or committee in place to implement preterm birth prevention:</p> <ul style="list-style-type: none"> <li>· Working group established</li> <li>· Only some personnel are assigned</li> <li>· No assignment</li> </ul>	<ul style="list-style-type: none"> <li>· 31 (25.8%)</li> <li>· 52 (43.3%)</li> <li>· 37 (30.9%)</li> </ul>
<p>Action plan to prevent preterm births in the hospital:</p> <ul style="list-style-type: none"> <li>· Yes</li> <li>· No</li> </ul>	<ul style="list-style-type: none"> <li>· 108 (90.0%)</li> <li>· 12 (10.0%)</li> </ul>
<p>If action plan is established (n = 108/120):</p> <ul style="list-style-type: none"> <li>· There is a monthly/quarterly/yearly operational planning meeting</li> <li>· There is a meeting to report performance monthly/quarter/yearly</li> <li>· A meeting or an activity is held occasionally</li> </ul>	<ul style="list-style-type: none"> <li>· 54/108 (50.0%)</li> <li>· 58/108 (53.7%)</li> <li>· 27/108 (25.0%)</li> </ul>
<p>Have a role as a working physician in formulating policies relating to preterm birth prevention:</p> <ul style="list-style-type: none"> <li>· Yes</li> <li>· No</li> </ul>	<ul style="list-style-type: none"> <li>· 99 (82.5%)</li> <li>· 21 (17.5%)</li> </ul>
<p>Encouragement is given by the Maternal and Child Health Board for the conduct of a</p>	

cervical length screening program at the hospital:	
· No	· 42 (35.0%)
· Yes	· 78 (65.0%)
Support is provided by the Maternal and Child Health Board for the implementation of a program of preterm birth prevention (n = 78/120):	
· Micronized Progesterone vaginal soft-gel capsules (Utrogestan)	· 46/78 (59.0%)
· Progesterone pessaries (Cyclogest)	· 0 (0%)
· 17-OHPC (Proluton Depot)	· 37/78 (47.4%)
· Funding for training of medical personnel in cervical length measurement	· 19/78 (24.4%)
· Funding for the purchase of ultrasound equipment	· 14/78 (17.9%)
· Other	· 2/78 (2.6%)
Perception of the current role of the Maternal and Child Health Board in a cervical length screening program to prevent preterm births:	
· No role at all	· 24 (20.0%)
· Limited role	· 59 (49.2%)
· Very active	· 37 (30.8%)
Roles of the Maternal and Child Health Board that you would like to see or receive:	
· Act as a policy maker and provide the main operation plans so that all hospitals operate in the same way and their performances can be compared	· 32 (80.0%)
· Be the leader or individual responsible for an academic training program of cervical length screening for staff at a district hospital	· 24 (20.0%)
· Responsible for providing medicines and medical supplies to all hospitals	· 59 (49.2%)
· Other	· 37 (30.8%)

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**Table 3. Availability of resources**

Resources	Number (%) (n = 120)
Hospital regularly employs an adequate number of obstetricians to meet workloads: <ul style="list-style-type: none"> <li data-bbox="99 306 204 338">· No</li> <li data-bbox="99 369 204 401">· Yes</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1365 306 1471 369">· 44 (36.7%)</li> <li data-bbox="1365 401 1471 464">· 76 (63.3%)</li> </ul>
Hospital has obstetricians who can accurately perform cervical length measurements: <ul style="list-style-type: none"> <li data-bbox="99 562 204 594">· No</li> <li data-bbox="99 625 440 657">· Yes, but not enough</li> <li data-bbox="99 688 334 720">· Yes, enough</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1365 625 1455 688">· 3 (2.5%)</li> <li data-bbox="1365 720 1471 783">· 57 (47.5%)</li> <li data-bbox="1365 814 1471 877">· 60 (50.0%)</li> </ul>
Hospital has a person responsible for providing information on a preterm birth prevention program (Project Manager): <ul style="list-style-type: none"> <li data-bbox="99 1010 204 1041">· Yes</li> <li data-bbox="99 1073 204 1104">· No</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1365 1041 1471 1104">· 62 (51.7%)</li> <li data-bbox="1365 1136 1471 1199">· 58 (48.3%)</li> </ul>
Hospital has a specific budget for cervical length measurement screening: <ul style="list-style-type: none"> <li data-bbox="99 1297 829 1329">· Yes (funds are sourced from the district budget)</li> <li data-bbox="99 1360 204 1392">· No</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1365 1297 1471 1360">· 13 (10.8%)</li> <li data-bbox="1365 1392 1487 1455">· 107 (89.2%)</li> </ul>
Hospital has enough ultrasound machines that can be used for routine tasks: <ul style="list-style-type: none"> <li data-bbox="99 1556 326 1587">· Not enough</li> <li data-bbox="99 1619 269 1650">· Enough</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1365 1556 1471 1619">· 44 (36.7%)</li> <li data-bbox="1365 1650 1471 1713">· 76 (63.3%)</li> </ul>
Hospital has an ultrasound machine that can be used specifically for a cervical length measurement screening program: <ul style="list-style-type: none"> <li data-bbox="99 1843 204 1875">· No</li> <li data-bbox="99 1906 204 1938">· Yes</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1365 1875 1471 1938">· 59 (49.2%)</li> </ul>

**Table 4. Impact of preterm births on hospitals and pregnant women and families**

<b>Hospital aspect</b>	<b>Number (%) (n = 120)</b>
Workload of the personnel involved:	
· No effect	· 2 (1.7%)
· Little effect	· 22 (18.3%)
· Heavy effect	· 96 (80.0%)
Expenses that the hospital has to bear:	
· No effect	· 3 (2.5%)
· Little effect	· 16 (13.3%)
· Heavy effect	· 101 (84.2%)
Length of hospital stays:	
· No effect	· 7 (5.8%)
· Little effect	· 20 (16.7%)
· Heavy effect	· 93 (77.5%)
<b>Pregnant women and family aspects</b>	
Family expenses:	
· No effect	· 2 (1.7%)
· Little effect	· 22 (18.3%)
Heavy effect	96 (80.0%)
Problems with caring for the newborn:	
· No effect	· 1 (0.8%)
· Little effect	· 8 (6.7%)
Heavy effect	111 (92.5%)
Problems in the life and work of the family members:	
· No effect	· 2 (1.7%)
· Little effect	· 11 (9.2%)
Heavy effect	107 (89.2%)

**Table 5. Assessment of project inputs**

Input evaluation	Number (%) (n = 120)
Realization at the hospital that preterm births present problems: <ul style="list-style-type: none"> <li>· Yes</li> <li>· No</li> </ul>	<ul style="list-style-type: none"> <li>· 119 (99.2%)</li> <li>· 1 (0.8%)</li> </ul>
Overall degree of severity of the problems: <ul style="list-style-type: none"> <li>· Low</li> <li>· Moderate</li> <li>· High</li> </ul>	<ul style="list-style-type: none"> <li>· 4 (3.4%)</li> <li>· 52 (43.7%)</li> <li>· 63 (52.9%)</li> </ul>
Physicians can perform cervical length measurements by vaginal ultrasound: <ul style="list-style-type: none"> <li>· Yes (with related certification)</li> <li>· Yes (without related certification)</li> <li>· No</li> </ul>	<ul style="list-style-type: none"> <li>· 19 (15.8%)</li> <li>· 96 (80.0%)</li> <li>· 5 (4.2%)</li> </ul>
Usefulness of cervical length measurements to prevent preterm births (physicians' perspectives): <ul style="list-style-type: none"> <li>· Useless</li> <li>· Somewhat useful</li> <li>· Very useful</li> </ul>	<ul style="list-style-type: none"> <li>· 0 (0%)</li> <li>· 30 (25.0%)</li> <li>· 90 (75.0%)</li> </ul>
If cervical length measurements to prevent preterm births are deemed somewhat useful or useless (physicians' perspectives; n = 30/120): <ul style="list-style-type: none"> <li>· Perform cervical length measurements only in high-risk cases</li> <li>· Use other screening tests; advise bed rest and drug usage</li> <li>· Other</li> </ul>	<ul style="list-style-type: none"> <li>· 8/30 (26.6%)</li> <li>· 3/30 (10.0%)</li> <li>· 19/30</li> </ul>

	(63.4%)
If cervical length measurements to prevent preterm births are deemed very useful (physicians' perspectives; n = 90/120):	
· Establish a hospital policy to do as a stand-alone task	·
· Establish a hospital policy to do in conjunction with other screening tasks	40/90 (44.4%)
· A hospital policy not required; screening can be performed as needed	·
	46/90 (51.1%)
	· 5/90 (5.6%)
Universal cervical length screening helps to reduce preterm births (n = 116/120):	
· Agree; it would reduce the rate of preterm births	·
· Disagree; it would not affect the rate of preterm births	76/116 (65.5%)
	·
	40/116 (34.5%)
Awareness of the policy for universal cervical measurements for premature birth prevention included in the 2017 policy guidelines of the Ministry of Public Health:	
· Aware	· 88 (73.3%)
· Was not aware	· 32 (26.7%)
If aware of the policy, level of agreement with the policy (n = 88/120):	
· Agree	·
· Disagree	55/88 (62.5%)
· Other	·
	20/88 (22.7%)
	·
	13/88 (14.8%)
A fee for ultrasound screening:	
· Should not be charged to pregnant women	· 91 (75.8%)
· Should be charged to pregnant women	· 29 (24.2%)
Willingness to work on a project to promote full implementation of universal cervical	

length screening:	
· Not willing	· 26 (21.7%)
· Willing	· 94 (78.3%)
If not willing to work on the project (n = 26/120):	
· Already have too much, or enough, full-time work	· 20/26 (76.9%)
· Already have a substantial workload other than the regular job	· 14/26 (53.8%)
· Do not think the preterm birth rate is such a severe problem that a program is needed	· 2/26 (7.7%)
· Do not believe that cervical length screening plays a role in preventing preterm births	· 3/26 (11.5%)
· Do not believe that cervical length screening to prevent preterm births is worth the requisite labor or funding	· 10/26 (38.5%)
· Unsure of the accuracy of cervical length measurements	· 7/26 (26.9%)
· Other	· 4/26 (15.4%)

**Table 6. Process evaluation of universal cervical length screening program**

Process evaluation	Number (%) (n = 120)
<p>With reference to the policy of the Ministry of Public Health for universal cervical length screening to prevent preterm births, the situation in the hospital is:</p> <ul style="list-style-type: none"> <li>· Screening is performed for every case</li> <li>· Screening is performed for high-risk cases only</li> <li>· No screening tests are performed</li> </ul>	<ul style="list-style-type: none"> <li>· 29 (24.2%)</li> <li>· 73 (60.8%)</li> <li>· 18 (15.0%)</li> </ul>
<p>With reference to hospital guidelines for the performance of cervical length screening to prevent preterm births:</p> <ul style="list-style-type: none"> <li>· Hospital guidelines are systematic and clear</li> <li>· The content of hospital guidelines is inadequate or unclear (e.g., because of an over-reliance on an unhelpful format, such as a flow chart)</li> <li>· No hospital guidelines have been established</li> </ul>	<ul style="list-style-type: none"> <li>· 33 (27.5%)</li> <li>· 73 (60.8%)</li> <li>· 14 (11.7%)</li> </ul>
<p>If systematic guidelines or documentation is provided by the hospital, the situation with the real practice of following those guidelines and documents is (n = 106):</p> <ul style="list-style-type: none"> <li>· They are not observed</li> <li>· Only some parts are observed, or they are observed in whole only occasionally</li> <li>· They are strictly observed</li> </ul>	<p>(n = 106)</p> <ul style="list-style-type: none"> <li>· 1/106 (0.9%)</li> <li>· 79/106 (74.5%)</li> <li>· 26/106 (24.5%)</li> </ul>
<p>If systematic guidelines or documentation is provided by the hospital, specific workloads are set for each physician (n = 106):</p> <ul style="list-style-type: none"> <li>· Yes</li> <li>· No</li> </ul>	<p>(n = 106)</p> <ul style="list-style-type: none"> <li>· 49/106 (46.2%)</li> <li>· 57/106 (53.8%)</li> </ul>

With reference to the broad policies of the Ministry of Public Health relating to the prevention of preterm births, the hospital has implemented those policies:	
· Yes, it has	· 89 (74.2%)
· No, it has not	· 31 (25.8%)
There are problems when screening is performed for the target group (pregnant women who are at risk):	
· No	· 46 (38.3%)
· Yes	
Problems encountered:	· 74 (61.7%)
§ Long waiting times	
§ Unsatisfactory service	§ 54 (45.0%)
§ Cost	
§ Shyness/fear of examination/fear of pain	§ 12 (10.0%)
§ Other (e.g., the patient declined a transvaginal ultrasound; late antenatal care; unable to attend appointment; delays associated with patient-preparation)	§ 24 (20.0%)
	§ 40 (33.3%)
	§ 14 (11.7%)

**Table 7. Possible barriers to universal cervical length screening at hospitals**

Possible barriers	Number (%) (n = 120)
Problems related to the physicians:	
· Insufficient number of doctors available to perform the procedure	· 51 (42.5%)
· Doctors have other urgent and necessary tasks	· 63 (52.5%)
· Doctors have excessive routine tasks	· 78 (65.0%)
· Doctors do not think that premature births are such a severe problem that the scheme is required	· 4 (3.3%)
· Doctors do not think that cervical length screening plays a role in preventing preterm births	· 28 (23.3%)
· Doctors do not believe that universal cervical length screening to prevent preterm births can justify the requisite labor and funding	· 37 (30.8%)
· Doctors are unsure about the correct procedures for the measurements	· 50 (41.7%)
· Other	· 9 (7.5%)
Problems related to other personnel, such as nurses and administrative staff:	
· Insufficient number of personnel to support the performance of the procedure	· 75 (62.5%)
· There are other tasks that are more urgent	· 38 (31.7%)
· The staff already have an excessive volume of routine tasks to perform	· 72 (60.0%)
· Lack of confidence that the collecting, recording, and analyzing of the data by non-medical personnel will be accurate	· 51 (42.5%)
· Other	· 2 (1.7%)
Problems related to the hospital:	
· Hospital administrators ignore the issue	· 21 (17.5%)

· Lack of support for operating funds from government agencies	· 67 (55.8%)
· Lack of cost-free drug support (progesterone) for pregnant women with short cervixes to prevent preterm births	· 62 (51.7%)
· Other	· 14 (11.7%)

**Table 8. Possible approaches to surmounting obstacles**

Possible ways	Number (%) (n = 120)
<p>Relevant to physicians and/or related persons:</p> <ul style="list-style-type: none"> <li data-bbox="99 331 1409 403">· Add/request additional doctors who have the potential to screen cervical lengths using various methods <span style="float: right;">· 42 (35.0%)</span></li> <li data-bbox="99 430 1409 501">· Provide regular training to physicians to enable them to confidently measure cervical lengths <span style="float: right;">· 68 (56.7%)</span></li> <li data-bbox="99 529 1409 625">· Provide knowledge and skills relating to cervical length measurements for doctors who perform routine work so that they can become certificated and undertake examinations confidently <span style="float: right;">· 68 (56.7%)</span></li> <li data-bbox="99 653 1409 783">· Provide reliable research results/demonstrations of the procedure/examples of screening results, and present doctors/nurses/other stakeholders with a detailed and convincing case for the cost-effectiveness of implementing universal cervical length screening <span style="float: right;">· 68 (56.7%)</span></li> <li data-bbox="99 810 1409 846">· Reduce extraneous duties for doctors</li> <li data-bbox="99 873 1409 945">· Other <span style="float: right;">· 48 (40.0%)</span></li> </ul>	<p style="text-align: right;">· 51 (42.5%)</p> <p style="text-align: right;">· 5 (4.2%)</p>
<p>Relevant to hospitals:</p> <ul style="list-style-type: none"> <li data-bbox="99 1415 1409 1486">· Provide hospitals with adequate and regular funding from relevant agencies <span style="float: right;">· 92 (76.7%)</span></li> <li data-bbox="99 1486 1409 1522">· Extend screening to community hospitals to relieve workloads at tertiary centers <span style="float: right;">· 84 (70.0%)</span></li> <li data-bbox="99 1549 1409 1621">· Educate patients about the benefits of cervical length measurements to prevent preterm births <span style="float: right;">· 78 (65.0%)</span></li> <li data-bbox="99 1648 1409 1719">· Other (providing adequate ultrasound machines and, in high-risk cases, administering appropriate preventative medications) <span style="float: right;">· 4 (3.3%)</span></li> </ul>	
<p>Monitoring of the systems related to, and evaluation of the results of, providing universal cervical length screening by the abovementioned approaches:</p> <ul style="list-style-type: none"> <li data-bbox="99 1963 1409 1999">· No aspects identified</li> </ul>	

· Some aspects identified (n = 53)	· 56 (46.7%)
§ Objective	· 53 (44.2%)
§ Monitoring system	§ 27/53 (50.9%)
§ Evaluation of screening results	§ 9/53 (17.0%)
§ Treatment evaluation	§ 16/53 (30.2%)
§ Assessment of the incidence of preterm births after project completion	§ 15/53 (28.3%)
· All aspects	§ 15/53 (28.3%)
	· 11 (9.2%)