Physician Experience is Associated with Greater Underestimation of Patient Pain

Talya Miron-Shatz, PhDa b, Maayan Ormianer, MDc, Jonina Rabinowitzb, Yaniv Hanoch, PhDd, Avi Tsafrir, MDe

a Winton Centre for Risk and Evidence Communication, Cambridge University, England

b Faculty of Business Administration,Ono Academic College, Kiryat Ono, Israel

c Faculty of Medicine, Hebrew University, Jerusalem, Israel

d Department of Psychology, Plymouth University, Plymouth, England

e Shaare-Zedek Department of Obstetrics & Gynecology, Hebrew University School of Medicine, Jerusalem, Israel

Corresponding author at: Prof. Talya Miron-Shatz, PhD, Faculty of Business Administration, 104 Zahal St. Kiryat Ono, Israel, 55000, Tel: +972-52-330-4417 E-mail: [talyam@ono.ac.il](mailto:talyam@ono.ac.il)

The authors have stated explicitly that there are no conflicts of interest in connection with this article. This study did not receive any specific funding.

Keywords: Pain assessment; empathy; pain, procedural; gynecology

**Abstract**

**Objective:** Procedural pain is unique in that physicians simultaneously cause and assess it. Experienced male physicians are known to underestimate their female patients’ pain more than other physicians. However, it is unknown whether this also occurs in obstetrics/gynecology, where all patients are females. This study addresses the gap in literature on procedural pain assessment accuracy.

**Methods:** The present research compares paired pain evaluations from 20 obstetricians/gynecologists and their 92 female patients.

**Results:** Our data demonstrate that patients’ reported pain levels (M=5.53, SD=2.7) were significantly higher than their physicians’ pain estimates (M=4.89, SD=2.19), t=2.64, p < 0.005. The gap between patients’ and physicians’ pain estimates was greatest among physicians with the greatest procedural experience (M=1.49, SD = 2.24), f=5.72, p < 0.005. Male physicians underestimated their patients’ pain significantly more than female physicians do, t=2.27, p < 0.05.

**Conclusion:** Our results shed light on systematic underestimation of procedural pain and highlight the significance of experience and sex differences in pain evaluation.

**Practice Implications:** Physicians’ experience influences their perception of patient pain while performing procedures. Experienced male physicians, even those who exclusively treat female patients, need to be aware of this ubiquitous bias in assessing their female patients’ procedural pain.

**Introduction**

Pain estimation is a complex phenomenon affected by patients’ [1,2]and health care providers’ judgment, recall, and perception of it [3]. Poor pain assessment accuracy can result in mistreatment of pain [4], yet only limited research exists on doctors’ estimation of pain during routine procedures—despite the fact that many routine procedures are painful. Here, we examined the differences between physicians’ and their patients’ pain estimates for obstetric and gynecological procedures they performed and experienced, respectively.

Previous research has shown that while physicians distinguish between high levels and low levels of pain [4], they systematically underestimate their patients’ pain, with most of the pain estimation studies focusing on chronic or acute pain [2,4,5,6,7,8,9,10]. Indeed, a review of healthcare provider pain assessment accuracy found that just half of the studies examined how precise physicians’ pain estimates were—with physicians’ accuracy ranging from “very poor” to “good” [11]. There is limited research on whether physician underestimation also occurs while performing a procedure [12,13].

Earlier research has shown that physician sex, patient sex, obviousness of the cause of pain, years of experience, and cultural gaps are key to understanding differences in pain estimation between patients and physicians [6,7,14,15]. In a recent review of the literature on pain perception in the physician-patient interaction, Samulowitz and colleagues [14] identified gender norms that influence how physicians treat and perceive their patients’ experiences and expressions of pain: men were mostly referred to as having high pain tolerance, and 'stoic' as in reluctant to report pain, whereas women were often described as exaggerating pain ('hysterical', or 'emotional'). This might be of particular interest in the gynecological domain—in which all patients are female while physicians are of either sex—since female patients are more likely than males to be perceived as experiencing less pain and as exaggerating their pain reports [8].

In this cross-sectional study, we investigated the relationship between women’s pain reports and their physicians’ estimates of their pain from obstetric and gynecological procedures.

Several predictions guided the present research. It was hypothesized that (i) physicians would systematically underestimate their patients’ pain, (ii) there would be an inverse relationship between experience and pain accuracy, and that (iii) male physicians would underestimate pain more so than their female counterparts.

1. **Methods**

**Participants**

**Patients**

This study included 92 patient-physician pairings of three elective procedural pain measures. The patients who participated in the study were referred for one of three elective procedures in the study to Shaare Zedek Medical Center in Jerusalem, Israel, where the procedures were performed between February and December 2016. The patients all were women between the ages of 20 and 47. The mean patient age was 32.7 (SD = 6.3).

**Physicians**

The 20 OB/GYNs (Mage= 43.43 SD=13.3) who participated were those physicians who performed one of the procedures on the 92 participating patients. All physicians were either doing or had completed their residency in OB/GYN. There were 8 female physicians and 12 male physicians. Physician ages ranged from 27 to 75, with a median age of 38. The mean number of years of physician experience was 9.2 (SD = 13.2).

**Material and procedure**

Prior to data collection, ethical approval for the study was obtained from the Shaare Zedek Medical Center Institutional Review Board. Each patient was included in the study only once for one procedure. Physicians, on the other hand, could be included multiple times in the study for performing more than one procedure. Some physicians performed the same procedure on different patients, some physicians only performed one procedure on one patient and some physicians performed two kinds of procedures on multiple patients. The three elective procedures were: i) amniocentesis, ii) hysterosalpingography (HSG), (a radiologic procedure in which contrast material is injected into the uterus), and iii) external cephalic version (ECV) from breech presentation.

We chose these three procedures since they are relatively common and are associated with low/moderate levels of pain [13,16]and because the patients are fully conscious and could express pain if and when they felt it. Immediately after the procedure was performed, patients and physicians who consented to the research protocol completed the questionnaire about the procedure.

**Pain evaluation**

Participant assessment of pain was on a 10-point numerical rating scale (NRS), which is closely correlated with VAS, the Visual Analogue Scale [17]. At point 1 on the scale it was written “does not hurt at all” and at point 10 was written “the worst pain possible”, (translated from the Hebrew). Patients assessed how much pain they felt in the procedure and physicians estimated how much pain their patient felt in the procedure.

**Previous experience**

The patients indicated whether they had undergone this procedure previously and if so, how many times. The physicians estimated how many times they had previously performed this procedure: fewer than 50 times, between 50 and 200 times, or more than 200 times. This grouping was done to make it easier for physicians to provide an estimate in a range rather than with a precise number. They were also asked to complete information about their residency status and the number of years they had been practicing medicine.

**Demographics**

The patients listed their age, while the physicians listed their age and sex.

**Statistical Analyses**

The main aim of this study was to examine differences between the patient and the attending physician's pain ratings. To this end, we created a variable termed ‘pain gap’ by subtracting the physician’s pain estimate from the patient’s pain report. Thus, a positive value for 'pain gap' meant that the physician underestimated the patient’s pain and a negative gap value meant that the physician overestimated the patient’s pain.

For the purpose of data analysis, we did not differentiate between the three procedures, as the primary objective of the investigation was the difference between patients’ and physicians’ pain estimates, regardless of procedure. Furthermore, all these procedures are performed on women who are either pregnant or trying to become pregnant and are known to cause a certain amount of pain which is directly inflicted by the doctor and yet the pain is not considered to be high enough to require analgesia. There was also variability in number of times each procedure was performed (37 amniocentesis, 41 hysterosalpingography (HSG), and 14 ECV), as such we decided to analyze these three procedures together. To confirm that there was no statistically significant difference between the three procedures, we used regression analysis to show the effect of procedure on gap, while controlling for physician experience.

All statistical analysis for this study was done using an alpha level of .05. Descriptive statistics, correlation analysis, t-tests, ANOVAs, and regression analysis were executed using Excel, including the Data Analysis Toolpak for t-tests, ANOVA and regression and the Real Statistics Add-in for post-hoc analyses. We also used WinPepi version 11 for power analysis. We first tested the correlation between all the variables of interest and looked for their significance levels. We then calculated the percentage of agreement between patients and their physicians and ran paired t-tests to investigate whether physicians’ pain estimates were lower than their patients’. Single factor ANOVA was used to investigate the effect of experience level on gap. We then ran a t-test to analyze whether there was a significant difference between male and female physician gaps and then used power analysis of 80% power to investigate the differences we found.

1. **Results**

There was a positive correlation between patient pain report and physician pain estimate, r = 0.56, n = 92, p < .001, which, according to Cohen’s classifications is good (above moderate) [12].There was exact agreement between patient and physician for only 18% of the cases in our sample. The physicians underestimated their patients’ pain 50% of the time and overestimated their patients’ pain approximately 32% of the time, indicating a greater tendency for underestimation than either agreement or overestimation. Using a paired t-test, we found that the patients’ reported pain levels (M = 5.53, SD = 2.7) were significantly higher than their physicians’ pain estimates (M = 4.89, SD = 2.19), t(91)=2.64, p < 0.005. Further, Cohen’s effect size value (*d* = .275) suggested a small to moderate effect.

Using regression analysis, we found that procedure type did not add value to predicting the gap between patients’ and physicians’ pain estimates beyond the experience level of the physicians performing the procedures. Therefore, we did not differentiate further between procedure type, and instead looked at physician experience and seniority.

We performed a series of 1-way ANOVAs for patient pain, gap (patient – physician), and physician pain estimate by physician experience level to see if having greater experience was associated with any differences in these variables in our model. The results are displayed in Table 1 below.

Table 1 Mean and significance of patient pain, gap (patient - physician), and physician pain estimate by physician's experience level (using single factor ANOVA as method of analysis). N refers to the number of procedures performed by physicians at that experience level.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Mean | | | Significance | | |
|  | < 50 times  n = 6 | 50 to 200 times  n = 44 | > 200 times  n = 42 | F | P-value | F-crit |
| ANOVA 1: Single Factor, patient pain by physician experience level | 7.25  (SD=2.96) | 5.82  (SD=2.80) | 4.98  (SD=2.46) | 2.42 | 0.094 | 3.099 |
| ANOVA 2: Single Factor, gap (patient - physician) by physician experience level | 0.25  (SD=1.60) | -0.11  (SD=2.25) | 1.49  (SD=2.24) | 5.72 | 0.0046 | 3.099 |
| ANOVA 3: Single Factor, Physician Pain Estimate by Physician Experience Level | 7  (SD=2.00) | 5.93  (SD=1.84) | 3.49  (SD=1.68) | 24.86 | 2.64E-09 | 3.099 |

As can be seen in Table 1, there were only 2 ANOVAs performed that showed significant differences between experience level groups: gap and physician pain estimate. We used Tukey’s HSD and found the following groups to have honestly significant differences: for physician pain estimate by experience level, the differences between groups 1 & 3 and the differences between groups 2 & 3 were significant; for gap by experience level, the difference between groups 2 & 3 were significant. Meaning, there were significant differences in physician pain estimate for those physicians with past procedural experience of fewer than 50 past procedures compared to physicians with past procedural experience of more than 200 past procedures and for physicians with 50-200 past procedures compared to those with more than 200 past procedures. There was also a significant difference in gap between physicians with 50-200 past procedures and those physicians with more than 200 past procedures.

The effect sizes for the differences in physician pain estimate and gap which were found to be significant are reported in Table 2. The effect size of each of the experience level differences on physician pain estimate and gap are moderate to large effects.

Table 2 Significant effect sizes of experience on gap and physician pain estimate

|  |  |  |
| --- | --- | --- |
| ANOVA | Experience level groupings | Cohen’s d |
| Physician pain estimate | <50 past procedures & >200 past procedures | 1.98 |
| Physician pain estimate | 50 – 200 past procedures & >200 past procedures | 1.38 |
| Gap | 50 – 200 past procedures & >200 past procedures | 0.72 |

Next, we examined the role of the physician’s sex (male vs. female) in predicting pain estimates. Male physician experience was positively correlated with gap (patient – physician), r = 0.32, n = 56, p = 0.015. Female physician experience with the procedure had a weak negative and statistically insignificant correlation with gap (r = -.12, n = 36, p = 0.49). The procedures that were performed by female physicians (n = 36) had a mean pain gap (patient – physician) of -.014. The procedures that were performed by male physicians (n=56), on the other hand, had a mean pain gap (patient – physician) of 1.06. An independent samples t-test comparing male and female physicians’ pain gaps was associated with a statistically significant effect, t(81) = 2.27, p < 0.05, indicating that the male physicians underestimate their patients’ pain significantly more than female physicians do. Further, Cohen’s effect size value (*d* = 2.48) indicated a very large effect size. While there is a statistically significant difference between male and female physician gaps, the difference we found was not great enough to show the desired power level, 80%. Using WinPepi to find the appropriate sample size to test the difference we found, we saw that we needed a sample size of 173 (68 female physician procedures and 105 male physician procedures) to detect the difference we found with a power of 80% and a significance level of 5%.

1. **Discussion and Conclusion**

**4.1 Discussion**

Millions of women across the globe undergo amniocentesis, hysterosalpingography, and external cephalic version. There is a large body of research discussing the potential benefits and risks associated with each of these procedures. In contrast, there is almost no information about how women and their attending health care provider evaluate how painful these procedures are. As pain plays a crucial role in women’s pregnancy-related treatment and care decisions [18,19], understanding how they and their attending health care providers perceive and judge procedural pain is crucial. Our novel results clearly demonstrate that physicians underestimate the pain they cause during routine procedures compared to their patients’ reports. Our data, as one would expect, did show that patients’ pain reports and their physicians’ pain estimates were positively correlated, though there was a systematic underestimation of pain by the physicians in our sample.

Previous investigation has found that experience plays a crucial role in physicians’ pain estimation [6,7,15]. In accordance with these findings, our data revealed that the pain gap (patient – physician) was negatively correlated with past procedural experience such that the greater the physician’s past procedural experience was, the greater the gap between patients’ pain and physicians’ pain reports. Interestingly, greater physician experience did not translate into a lower patient pain report. It is, therefore, important to alert physicians, and especially experienced ones, of this tendency to ensure their pain estimation is better aligned with their patients’ experience.

While, there were clearly statistically significant differences between patient and physician pain ratings for the same procedure, it is hard to know whether the differences we found are clinically significant. In fact, the topic of minimally clinical important differences (MCID) has been gaining attention in recent years. The research on the topic is quite varied. One review of 37 studies found MCID reports which ranged from 8 to 40 mm (on a 100 mm pain scale) and 13% to 85% on a relative scale [20]. For our sample, we used a 10-point NRS and we found, for example in the highest experience group, that the mean gap was 1.49 (SD = 2.24), whereas in the median experience group there was a mean gap of -.11 (SD = 2.25). Though we cannot say with absolute certainty that it is clinically significant since we could not apply the methods used for finding MCID, the difference between these findings falls within the range of study findings in the review. This is evidence that the gap between patients’ and physicians’ pain estimates for procedures performed by physicians in the highest procedural experience level can be of meaning for the patient.

Physicians’ sex seemed to influence pain gap such that male physicians underestimated their patients’ pain to a greater degree than their female counterparts. We found a difference of approximately 1.07 between the mean gap for male and female physicians. While this was a statistically significant finding, our sample was underpowered for this specific aspect at a power of 80%, (we would have needed a sample size of 173). As such, we recommend that future research obtains data from a larger sample of both male and female physicians in order to investigate this finding further.

Previous research has identified several factors that could help explain sex differences in pain estimation. Sheiner, et al. [15], for instance, argued that the wider the cultural gap between physician and patient, the less accurate the interpretation of the patient’s pain. This is also a plausible explanation here, since only female obstetrician/gynecologists may have similar experiences to their patients.

A second possible explanation of sex difference in pain rating could be based on usage of non-verbal cues. Ruben, Blanch-Hartigan & Hall [21] found that while high levels of physician non-verbal support – such as a nod, a smile, or a light touch to the arm - resulted in higher patient pain tolerance overall, there were differences between how men and women rated pain. For men, high physician non-verbal support resulted in decreased pain ratings, whereas for women high physician non-verbal support interestingly resulted in increased pain ratings. The reasoning behind this finding is unknown, though it could be that women perceive non-verbal support as legitimacy to express pain. Thus, this finding can inform one explanation for why male physicians in our sample underestimated pain to a greater degree. If male physicians were indeed showing higher levels of non-verbal support (an aspect of physician behavior we did not measure in the current study), it could be that male physicians anticipated that this would result in lower pain ratings, when in fact higher physician non-verbal support tends to result in higher pain ratings for women. Both of these explanations, however, are beyond the scope of investigation of this study. Future research can investigate the origin of sex differences in pain estimation by testing these two theories.

**4.2 Limitations**

The present study has several limitations. First, the sample size of patients and their physicians was relatively small. The small sample also meant that it was only the median procedural-experience level in which there were a substantial number of physicians from both sexes. That said, we did have close to 100 patients, and with them, 20 physicians.

Furthermore, in order to see whether the underestimation of female patient pain by male physicians is present in a field in which there are exclusively female patients, we gathered and analyzed data on obstetric and gynecological procedures performed by OB/GYNs. However, this limited our study in that we did not have similar data on male patients. It is possible that our findings on gender differences may be explained by the common assumption that women experience less pain than men and that they exaggerate their pain more so than men [8]. This notion might bias physicians when estimating their patients’ pain and could represent an example of medical prejudice. For example, a review by Samulowitz, et al. [14] showed that gender bias influences physicians’ perception and treatment of their patients’ pain, and that women’s experience of pain is taken less seriously than that of males. However, our study could not investigate this possibility as our data was limited to female patients. Therefore, we recommend future research investigates the origins of this difference.

In addition, so as to not interfere with the day-to-day functioning of the clinic in which these procedures were performed, we did not randomly assign physicians to perform the different procedures. Instead, physicians were assigned to perform different procedures based on their seniority level (years of practicing medicine). This resulted in the newest physicians generally performing the hysterosalpingographies and the most senior physicians performing amniocentesis. As a result, we primarily looked at physician’s procedural experience with the procedure they were performing. A more balanced view of the effect of physicians’ experience on their pain estimation would include an equal number of physicians at each seniority level performing each of the procedures.

Similarly, around the world and in Israel in particular, there has been a growing number of female physicians specializing in obstetrics and gynecology [22,23]. However, this is a relatively new phenomenon, thus there were few senior (experienced) female physicians in our sample. As such, sex confounded for experience. There is, therefore, room for future studies to investigate the effect of both physician sex and experience on physician pain estimate in a more thorough manner as the population of experienced female obstetrician/gynecologists increases.

In addition, unlike in some previous work in which midwives overestimated contraction pain for women whom they deemed as anxious [9], we did not have any similar information on the personality characteristics or anxiety levels of the patients in our study. This precluded us from associating patient characteristics with a gap in pain estimations, leaving room for future studies. We also chose procedures where pain estimations have little to no effect on how the patient is treated. Indeed, future studies could extend this work to other procedures in obstetrics, gynecology and beyond, where different pain estimations lead to different care.

Another limitation is that while we measured the pain patients reported to us, we do not have a direct measure of how much pain they conveyed to their physicians. Along these lines, while we had reports of pain, we did not observe the situation, so we do not know how the patients or physicians acted during the procedure (e.g., how much support, non-verbal or other, was given). Literature suggests that female OB/GYN’s behavior might be different than their male counterparts [24].

Similarly, we did not know or ask the physicians the exact number of times that they performed the procedure and instead relied on their estimate of past procedural experience as categorized by the different levels of experience. Lastly, a literature review suggested a curvilinear relationship between accuracy and experience level [4]. Our study design did not allow us to investigate this phenomenon. Nevertheless, our analysis revealed that physicians typically estimated that their execution of the procedure was less painful than their patients reported, and that this effect was also seen among male physicians.

**4.3 Conclusion**

Limitations notwithstanding, the procedures investigated in our study did provide important insights into situations in which the pain is inflicted upon the patient by her doctor in the course of treatment. This study shows that while physicians may be able to distinguish between high and low levels of pain, they systematically underestimate the pain they cause patients in procedures they perform.  This effect is seen significantly more among experienced physicians.  This study has also found that male physicians systematically underestimate their female patients’ procedural pain, even when those physicians exclusively see female patients.

**4.4 Practice Implications**

Pain estimation by the physician may influence clinical practice, as well as bedside manner, which is often as important in the patients’ minds [25] and is of growing importance in physician training [26]. Thus, our findings can help to guide and illuminate potential gaps and pain estimation practices. As patients increasingly expect to be involved in their care, and to express their opinions and preferences, doctors should be attuned to patient pain. Our findings point to the existence of discrepancies, which might need to be addressed through physician training.  The most important example of this is that experienced male physicians in the field of OB/GYN also need to be made aware of these discrepancies.

**References**

1. M. Gendreau, M.R. Hufford, A.A. Stone, Measuring clinical pain in chronic widespread pain: Selected methodological issues. Best Pract. Res. Clin. Rheumatol. 17 (2003) 575-92. <https://doi.org/10.1016/S1521-6942(03)00031-7>
2. A.B. Krueger, A.A. Stone, Assessment of pain: A community-based diary survey in the USA. Lancet.371 (2008) 1519-25. https://doi.org/10.1016/S0140-6736(08)60656-X
3. L. Marquié, E. Raufaste, D. Lauque, C. Mariné, M. Ecoiffier, P. Sorum, Pain rating by patients and physicians: Evidence of systematic pain miscalibration. Pain. 102 (2003) 289-96. <https://doi.org/10.1016/S0304-3959(02)00402-5>
4. M.A. Ruben, D. Blanch-Hartigan, J.C. Shipherd, To Know Another’s Pain: A Meta-analysis of Caregivers’ and Healthcare Providers’ Pain Assessment Accuracy. Ann. Behav. Med*.* 52 (2018) 662-85. <https://doi.org/10.1093/abm/kax036>
5. C. Brudvik, S. Moutte, V. Baste, T. Morken, A comparison of pain assessment by physicians, parents and children in an outpatient setting. Emerg. Med. J. 34 *(*2016) 138-44. <https://doi.org/10.1136/emermed-2016-205825>
6. M. Choinière, R. Melzack, N. Girard, J. Rondeau, M. Paquin, Comparisons between patientsʼ and nursesʼ assessment of pain and medication efficacy in severe burn injuries. Pain. 40 (1990) 143-52. <http://dx.doi.org/10.1097/00004630-198207000-00010>
7. K.M Prkachin, P.E. Solomon, J. Ross, Underestimation of pain by health-care providers: towards a model of the process of inferring pain in others. Can. J. Nurs. Res. 39 (2007) 88-106.
8. G. Schäfer, K.M. Prkachin, K.A. Kaseweter, A.C. Williams, Health care providersʼ judgments in chronic pain. Pain. 157 (2016) 1618-25. <https://doi.org/10.1097/j.pain.0000000000000536>
9. A.C. Williams, J. Morris, K. Stevens, S. Gessler, M. Cella, J. Baxter, What influences midwives in estimating labour pain? Eur. J. Pain. 17 (2013) 86-93. <https://doi.org/10.1002/j.1532-2149.2012.00154.x>
10. L.A. Williams, C. Bohac, S. Hunter, D. Cella, Patient and health care provider perceptions of cancer-related fatigue and pain. Support. Care Cancer. 24 (2016) 4357-63. <https://doi.org/10.1007/s00520-016-3275-2>
11. M.A. Ruben, M. van Osch, D. Blanch-Hartigan, Healthcare providers’ accuracy in assessing patients’ pain: A systematic review. Patient Educ. Couns. 98 (2015) 1197-1206. <https://doi.org/10.1016/j.pec.2015.07.009>
12. K. Maguire, K. Morrell, C. Westhoff, A. Davis, Accuracy of providers assessment of pain during intrauterine device insertion. Contraception. 89 (2014) 22-4. <https://doi.org/10.1016/j.contraception.2013.09.008>
13. A.J. Singer, P.B. Richman, A. Kowalska, H.C. Thode Jr., Comparison of Patient and Practitioner Assessments of Pain From Commonly Performed Emergency Department Procedures. Ann. Emerg. Med. 33 (1999) 652-8. <https://doi.org/10.1016/S0196-0644(99)80003-1>
14. A. Samulowitz, I. Gremyr, E. Eriksson, G. Hensing, “Brave Men” and “Emotional Women”: A Theory-Guided Literature Review on Gender Bias in Health Care and Gendered Norms towards Patients with Chronic Pain. Pain Res. Manag. 2018 (2018) 1-14. <https://doi.org/10.1155/2018/6358624>
15. E. Sheiner, E.K. Sheiner, R. Hershkovitz, M. Mazor, M. Katz, I. Shoham-Vardi, Overestimation and underestimation of labor pain. Eur. J. Obstet. Gynecol. Reprod. Biol. 91 (2000) 37-40. <http://dx.doi.org/10.1016/S0301-2115(99)00247-X>
16. K. Klages, S. Kundu, J. Erlenwein, M. Elsaesser, P. Hillemanns, A. Scharf, I. Staboulidou, Maternal anxiety and its correlation with pain experience during chorion villus sampling and amniocentesis. J. Pain Res. 10 (2017) 591-600. <https://doi.org/10.2147/JPR.S128300>
17. N. Mudgalkar, S.D. Bele, S. Valsangkar, T.N. Bodhare, M. Gorre, Utility of numerical and visual analog scales for evaluating the post-operative pain in rural patients. Indian J. Anaesth. 56 (2012) 553-7. <https://doi.org/10.4103/0019-5049.104573>
18. G. Ahmad, S. Attarbashi, H. O’Flynn, A.J. Watson, Pain relief in office gynaecology: A systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol. 155 (2011) 3-13. <https://doi.org/10.1016/j.ejogrb.2010.11.018>
19. S.E. Truijens, M. van der Zalm, V.J. Pop, S.M. Kuppens, Determinants of pain perception after external cephalic version in pregnant women. Midwifery. 30 (2014) e102-7. <https://doi.org/10.1016/j.midw.2013.11.005>
20. M.F. Olsen, E. Bjerre, M.D. Hansen, J. Hilden, N.E. Landler, B. Tendal, et al. Pain relief that matters to patients: systematic review of empirical studies assessing the minimum clinically important difference in acute pain. BMC Med. 15 (2017) 15-35. <https://doi.org/10.1186/s12916-016-0775-3>
21. M.A. Ruben, D. Blanch-Hartigan, J.A. Hall. Nonverbal Communication as a Pain Reliever: The Impact of Physician Supportive Nonverbal Behavior on Experimentally Induced Pain. Health Commun. 32 (2017) 970-6. <https://doi.org/10.1080/10410236.2016.1196418>
22. The Obstetrician-Gynecologist Workforce in the United States: Facts, Figures and Implications*.* <https://www.acog.org/~/media/BB3A7629943642ADA47058D0BDCD1521.pdf>, 2017 (Accessed April 14, 2019)
23. Z. Haklai, Y. Applbaum, O. Tal, M. Aburbeh, N.F. Goldberger, Female physicians: Trends and likely impacts on healthcare in Israel. Isr. J. Health Policy Res. 2 (2013) 37. <https://doi.org/10.1186/2045-4015-2-37>
24. M. Hojat, J.S. Gonnella, T.J. Nasca, S. Mangione, M. Vergare, M. Magee, Physician empathy: definition, components, measurement, and relationship to gender and specialty. Am. J. Psychiatry. 159 (2002) 1563-9. <https://doi.org/10.1176/appi.ajp.159.9.1563>
25. T. Miron-Shatz, S. Becker, F. Zaromb, A. Mertens, A. Tsafrir, “A Phenomenal Person and Doctor”: Thank You Letters to Medical Care Providers. Interact. J. Med. Res. 6 (2017) e22. <https://doi.org/10.2196/ijmr.7107>
26. K.E. Smith, G.J. Norman, J. Decety, The complexity of empathy during medical school training: evidence for positive changes. Med. Educ. 51 (2017) 1146-59. <https://doi.org/10.1111/medu.13398>