

Subtotal hysterectomy in modern gynecology: A decision analysis

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OBJECTIVE: Our purpose was to compare the risks and benefits of subtotal (supracervical) hysterectomy with those of total hysterectomy in women at low risk for cervical cancer.

STUDY DESIGN: A decision analysis was performed. Baseline probabilities for operative and postoperative morbidity, mortality, and long-term quality of life were established for subtotal and total hysterectomy.

RESULTS: Operative complication rates and ranges for total abdominal hysterectomy were infection 3.0% (3.0% to 20.0%), hemorrhage 2.0% (2.0% to 15.4%), and adjacent organ injury 1.0% (0.7% to 2.0%). Those for subtotal hysterectomy were infection 1.4% (1.0% to 5.0%), hemorrhage 2.0% (0.7% to 4.0%), and adjacent organ injury 0.7% (0.6% to 1.0%). Operative mortality, the risk for development of cervicovaginal cancer, and long-term adverse effects on sexual or vesicourethral function were low in both groups.

CONCLUSIONS: Recently proposed benefits from subtotal hysterectomy are not well proven. Total hysterectomy remains the procedure of choice for most women. (*Am J Obstet Gynecol* 1997;176:1186-92.)

Key words: Subtotal hysterectomy, decision analysis

Total hysterectomy with removal of the cervix has been standard practice in the United States since the 1950s, when a 1% to 2% incidence of cervical stump carcinoma was reported. However, the lower risk for cervical cancer with modern screening tests has led to a recent resurgence of interest in subtotal hysterectomy (supracervical uterine amputation). Proponents contend that cervical conservation results in fewer intraoperative complications and fewer postoperative sexual and bladder problems.¹⁻³ To date, there are no adequately controlled trials to examine these issues. Decision analysis is a method used to predict the potential results of different therapeutic options based on uncertain data. The purpose of this study was to use a decision analysis technique to determine the advantages and disadvantages of subtotal hysterectomy compared with total hysterectomy.

Material and methods

Data sources. Probabilities for events were derived from a comprehensive literature review. The MEDLINE database was used to locate relevant articles published in

the English language between 1980 and 1996. Articles reporting results of original research were given priority, although review articles and commentaries were consulted as well. Additional studies were located by reviewing bibliographies of articles located by MEDLINE and consulting experts in the field. Three recent unpublished cohort studies and one unpublished randomized trial were also evaluated. Studies were reviewed and classified with use of a modified U.S. Preventive Services Task Force system as follows⁴: (1) properly designed randomized controlled trial, (2) controlled trial without randomization, cohort, or case-control study, and (3) all other sources, including descriptive studies and opinions of respected authorities based on clinical experience.

The overall strength of the supporting evidence for each outcome variable was then graded as good (A), fair (B), or poor (C) on the basis of the quality and number of studies. These data were used to assess validity and to determine the most reasonable baseline probabilities.

Decision model. We focused on subtotal versus total hysterectomy as treatment for benign uterine disease in women at low risk for cervical carcinoma. Excluded from the analysis were hysterectomies performed (1) as an emergency procedure or with anatomic distortion where surgical judgment dictates the need for subtotal hysterectomy and (2) in women with previous abnormal Papanicolaou smears, cervical intraepithelial neoplasia, human papillomavirus infections, or other characteristics known to place them at higher risk for development of carcinoma.

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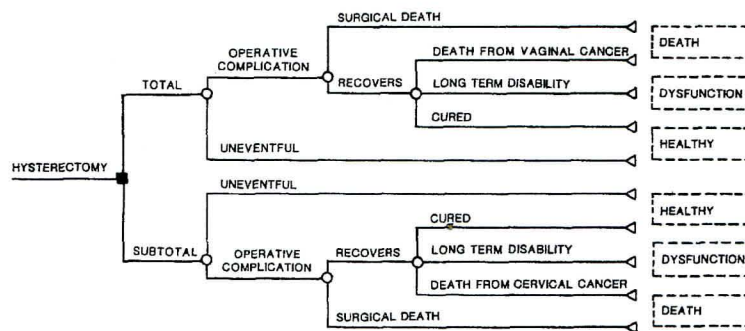


Fig. 1. Decision model. Square at far left, Choice between two treatment options: total hysterectomy or subtotal hysterectomy. Round nodes, Chance outcomes; end branches, final outcome states.

A decision model was used to estimate sequelae from the two surgical procedures (Fig. 1). The basic choices were to perform subtotal hysterectomy or total hysterectomy. With either operation, the following possible outcomes were evaluated on the basis of the available literature: (1) a technically successful uncomplicated operation with no short- or long-term sequelae or (2) intraoperative or postoperative morbidity or mortality, including the development of invasive carcinoma of the cervix (subtotal) or vaginal cuff (total).

Baseline complication rates were those most commonly reported from the most well-designed studies, and the ranges included all reported rates. Infection was defined as any serious operative site or wound infection needing treatment. Hemorrhage was intraoperative or postoperative blood loss >1000 ml or that required blood transfusion. Adjacent organ injury referred to inadvertent bladder, ureteral, or bowel damage. Sexual dysfunction included dyspareunia and reduced coital frequency, libido, orgasmic frequency, and overall satisfaction. Persistent vesicourethral symptoms were frequency, nocturia, urgency, and incontinence. Other complications judged to have similar rates for both operations were not considered. These included thromboembolic disease, fascial dehiscence, paralytic ileus, and small bowel obstruction.

The decision analysis was utility based. Quality of life after each of the two operative procedures was determined by estimating the level of disability avoided. Disability was defined as 100% with death and 0% in a healthy woman with no morbidity. The length of disability assigned to each complication was an average agreed on by the authors from our experience with gynecologic surgical patients, and the percent disability was based on our estimate of patient perceptions. Life expectancy rates were obtained from the National Center for Health Statistics (Vital Statistics of the United States, 1992, Vol. II, Sec 6, Life Tables).⁵

The expected outcome from each of the two surgical procedures was estimated in terms of days of full func-

tionality (good days) lost as a result of the procedure and its complications. For example, the number of good days lost after total hysterectomy as a result of infection (dl.i) was estimated by multiplying the probability or likelihood of infection (p.i.) by the fraction of full functionality lost by the patient because of the postoperative infection (f.i) and by the duration of the infection in days (d.i):

$$dl.i = p.i \times f.i \times d.i.$$

The expected number of days lost because of surgical death (dl.s) was the product of the surgical mortality rate (smr) and the life expectancy (le) of the patient minus the patient's age (a):

$$dl.s = smr \times (le - a) \times 365$$

Similar equations were used to represent the cost of each potential adverse effect of surgery, and the costs were then summed for each surgical procedure to provide a basis for comparison.

Results

Table I lists the perioperative and long-term complications considered, the probability that each complication would occur with either surgical procedure, and the quality and strength of evidence. The rates of infection, hemorrhage, and intraoperative injury were somewhat less with subtotal hysterectomy, but the risk of death from cervicovaginal cancer was essentially eliminated with total hysterectomy. The effect of the two procedures on sexual function was particularly difficult to interpret because of conflicting data and the potential for bias in most studies. There were no differences in other complications or mortality between the two groups.

Because the importance of a specific complication varies with patients, scenarios can be constructed by changing the percent disability as perceived by an individual patient. In the following two examples, it was assumed that the hysterectomy was necessary on the basis of accepted indications and that yearly cervical cytologic examinations were normal preoperatively.

Table I. Probability of outcomes and quality of evidence used in decision model

Complication	Probability		Evidence		References
	Baseline	Range	Quality	Strength	
Total hysterectomy					
Surgical death	0.001	0.0005-0.006	II	Good	6-9
Infection	0.03	0.03-0.20	I	Good	10-12
Hemorrhage	0.02	0.02-0.15	II	Fair	10, 12
Adjacent organ injury	0.01	0.007-0.02	II	Fair	6, 12, 13
Impaired sexual response	0.01	0.00-0.25	III	Poor	3, 8, 14-18
Vesicourethral symptoms	0.01	0.00-0.26	III	Poor	7, 19-24
Vaginal cancer death	0.00	0.00-<0.0001	III	Good	7, 25-27
Subtotal hysterectomy					
Surgical death	0.001	0.0005-0.004	II	Fair	6-9
Infection	0.014	0.01-0.05	II	Fair	10, 11
Hemorrhage	0.02	0.007-0.04	II	Fair	10-12
Adjacent organ injury	0.007	0.006-0.01	II	Fair	6, 12, 13
Impaired sexual function	0.005	0.00-0.01	III	Poor	3, 11, 14, 16, 17
Vesicourethral symptoms	0.001	0.00-0.001	III	Poor	7, 19-21
Cervical cancer death*	0.001	0.0003-0.03	III	Good	7, 28, 29

*A 67% cure rate was the percentage used to calculate potential lives saved by total hysterectomy compared with subtotal hysterectomy.³⁰

Table II. Hysterectomy decision

Complications	Disability (%)	Probability	Disability (days)	Good days lost
Total hysterectomy				
Surgical death	100	0.001	12,775	12.78
Infection	20	0.03	5	0.03
Hemorrhage	25	0.02	10	0.05
Adjacent organ injury	50	0.01	120	0.60
Impaired sexual response	5	0.01	12,775	5.39
Vesicourethral symptoms	5	0.01	12,775	6.39
Vaginal cancer death	100	0.00	9,175	0.00
Cost in days lost of total hysterectomy				13.46
Subtotal hysterectomy				
Surgical death	100	0.001	12,775	12.76
Infection	20	0.01	5	0.01
Hemorrhage	25	0.02	10	0.05
Adjacent organ injury	50	0.007	120	0.42
Impaired sexual response	5	0.005	12,775	9.19
Vesicourethral symptoms	5	0.001	12,775	0.64
Cervical cancer death	100	0.01	9,175	91.75
Cost in days lost of subtotal hysterectomy				96.06
Conclusion				
Advantage: Total hysterectomy				83 (years 0.23)

This patient, a 45-year-old woman whose life expectancy of 80 years gives her 12,775 potential good days, has no preference between total or subtotal hysterectomy, but she wants to minimize the chance of cervical cancer. In this circumstance 83 quality days of life would be gained by advising total hysterectomy.

Table II represents the usual clinical situation favoring total hysterectomy derived from baseline probabilities and the estimated percent disability for each potential complication.

Table III illustrates how the decision process can be used to individualize treatment. In this case subtotal hysterectomy may be justified.

Comment

Evidence-based medicine is becoming prevalent in contemporary patient care. Treatment recommenda-

tions derived from experience, intuition, and traditional literature reviews have been criticized because they can be biased and misleading. Metaanalyses may provide more reliable information on the basis of systematic, replicable, and more objective methods. However, randomized trials and properly controlled cohort studies, which are necessary for high-quality metaanalyses, are not available for most therapeutic decisions physicians must make. Decision analysis has long been used in business to predict outcomes on the basis of uncertain data. This systematic quantitative approach to assess the

Table III. Hysterectomy decision

<i>Complications</i>	<i>Disability (%)</i>	<i>Probability</i>	<i>Disability (days)</i>	<i>Good days lost</i>
Total hysterectomy				
Surgical death	100	0.001	12,775	12.78
Infection	20	0.03	5	0.03
Hemorrhage	25	0.02	10	0.05
Adjacent organ injury	50	0.01	120	0.60
Impaired sexual response	20	0.01	12,775	25.55
Vesicourethral symptoms	5	0.01	12,775	6.39
Vaginal cancer death	100	0.00	9,175	0.00
Cost in days lost of total hysterectomy				45.40
Subtotal hysterectomy				
Surgical death	100	0.001	12,775	12.78
Infection	20	0.01	5	0.01
Hemorrhage	25	0.02	10	0.05
Adjacent organ injury	50	0.007	120	0.42
Impaired sexual response	20	0.005	12,775	12.78
Vesicourethral symptoms	5	0.001	12,775	0.64
Cervical cancer death	100	0.001	9,175	9.18
Cost in days lost of subtotal hysterectomy				23.07
Conclusion				
Advantage: Subtotal hysterectomy				22 (0.06 year)

This patient, a 45-year-old woman, has read about and is particularly apprehensive about the possibility of future sexual dysfunction with total hysterectomy. Although most evidence indicates that postoperative sexual problems are uncommon, no amount of explanation or reassurance convinces her that removal of cervix would not be detrimental. A 1% probability of decreased sexual satisfaction was assigned for total hysterectomy, and the patient's own estimate of 20% disability for that complication was used in the formula. Subtotal hysterectomy would potentially give her 22 extra quality days of life. In this case subtotal hysterectomy would be emotionally reassuring to the patient, and her long-term chance of cervical neoplasia is acceptably low.

relative value of different decision options has been proposed as a method to help clinicians manage individual patients.³¹

Increased consumer and physician interest in subtotal hysterectomy reflects the recent trend toward more conservative pelvic surgical procedures such as myomectomy and endometrial ablation. The popularity of laparoscopic hysterectomy may also be a contributing factor because it is technically easier to leave the cervix. However, it is the responsibility of those who promote any new surgical procedure to prove that it is better than the one it is to replace.³²

We started with the premise that total hysterectomy remains the appropriate procedure for all women at risk for the later development of cervical neoplasia. There are substantial numbers of women in this category. Subtotal hysterectomy could only be considered for those with negative preoperative cervical cytologic results because invasive cervical carcinoma usually occurs in unscreened women or those with abnormal Papanicolaou smears. The contemporary lifetime risk of cervical cancer in a monogamous woman with at least three normal Papanicolaou smears is 0.05%, and the 5-year risk for development of cervical carcinoma is lowered by 69% with two to four previous negative smears.³³ Among 1104 women with unreported preoperative cytologic results who underwent subtotal hysterectomy for benign conditions, two (0.2%) had cervical cancer during 10 years of observation.²⁸ The risk of cervical carcinoma after subto-

tal hysterectomy might be further lowered by removing the endocervix or squamocolumnar junction.^{3, 29}

The primary reason advanced for subtotal hysterectomy is to retain normal sexual function, but there are few convincing data to show that total hysterectomy is related to long-term sexual dysfunction. In the classic studies in the 1950s, Kolodny, Masters, and Johnson³⁴ documented that women may have uterine contractions associated with orgasm but that the cervix played no role in sexual function. In most recent studies claiming an advantage for subtotal hysterectomy, criteria used to evaluate sexual satisfaction are inconsistent, outcome values are not well defined, and one component sometimes worsens while another improves.^{3, 7, 11, 14-17} The preponderance of evidence suggests that detrimental effects on sexual function are rare with either operation and preoperative sexual activity appears to be the most important factor in predicting postoperative sexual satisfaction.^{16, 17} Overall, there are few differences in the rate of postoperative dyspareunia, coital frequency, or libido in patients with either operation. Whether reduced orgasmic function occurs in a small percentage of women when the cervix is removed, as claimed by some, remains to be proved by adequately controlled studies. The data are equally uncertain regarding postoperative bladder symptoms, and they are inadequate to evaluate all other proposed advantages of subtotal hysterectomy.

There are few published data on adverse effects of subtotal hysterectomy, but subsequent trachelectomy has

been necessary in some patients because of continued bleeding, intraepithelial neoplasia, or prolapse of the cervical stump. An abdominal hysterectomy by laparoscopy or laparotomy is usually necessary to leave the cervix, but total vaginal hysterectomy is less expensive and is associated with fewer complications.³⁵ Less frequent Papanicolaou smears are needed after total hysterectomies for benign disorders,^{26, 27} but women who have undergone subtotal hysterectomy require regular screening conforming to established guidelines for cervical cancer prevention. This would mean additional expenses for abnormal Papanicolaou smears including repeat cytologic studies, colposcopy, and treatment such as cryotherapy or conization.

It is apparent that the use of decision analyses in clinical medicine has limitations. Potential bias in observational studies make judgments about probabilities of clinical events imprecise and subjective. Moreover, satisfaction with a specific outcome may be viewed differently by physicians and patients. Physicians often focus on treatment success or surgical complication rates, whereas convenience, expense, pain, and emotional concerns may be key issues for patients. Quality-of-life assessment includes changes in physical, functional, mental, and social health after surgery, but translating these components into a quantitative value is a very complex task.³⁶

In summary, the alleged sexual and genitourinary benefits of subtotal hysterectomy over total hysterectomy are not proved, and well-designed prospective trials are needed to address these issues. The risk of cervical cancer is low in patients properly selected for subtotal hysterectomy, but total hysterectomy is better studied with longer follow-up, is less costly in the long term, and therefore remains the procedure of choice for most women.

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Discussion

DR. HARVEY T. HUDDLESTON, Shreveport, Louisiana. Decision analysis was reported in a direct application to medicine by Lindley in 1975.¹ It has been applied to the management of 13 disorders in medicine (e.g., appendicitis, elective cesarean section, bowel cancer, and ovarian cancer), but this study may be significant in that it seems to be the first application to benign gynecologic surgery.

For many years total hysterectomy has been the procedure of choice for women requiring removal of the uterus. Certainly a total hysterectomy should be used in any patients who are at risk for the development of cervical cancer, and the authors were quick to point this out. A subtotal hysterectomy may be a reasonable option in those monogamous women who have repeatedly had negative Papanicolaou smears. However, the alleged advantages of subtotal hysterectomy are based on "soft data" in most instances, which the authors of this study have been able to illustrate by their review of the literature and the use of a statistical technique called "decision analysis."

The assumptions that were made by the authors as to the quality of the controlled trials and the results of scientific papers that were studied rest predominantly on subjective perceptions by both the authors and the patients, rather than objective facts. As was pointed out at the outset by the authors, decision analysis has been used by business to predict outcomes on the basis of uncertain data. I believe that the operative words here are "uncertain data." As such, the use of decision analysis in medicine essentially relies on "soft data", rather than "hard data" to arrive at specific recommendations for the clinician in his or her management of a patient. As illustrated in this study, this approach did not seem to be of value in resolving the question as to whether a total or subtotal hysterectomy had the advantage. Is there really no difference in the outcomes of total and subtotal hysterectomy? The answer may be that decision analysis is a good tool to be used to augment clinical decisions, but when applied to retrospective studies of too poor evidence quality and strength it cannot discriminate between the two.

It should always be borne in mind that the conclusions that are derived from a study are the reflection of the data from which they are derived. Decision analysis may not be the best statistical method by which to evaluate the relationship between surgery for total hysterectomy versus subtotal hysterectomy because (1) decision analysis cannot overcome the flaws in individual studies, (2) it is weak when results from contradictory observational studies are combined, and (3) some epidemiologists argue that the technique should be reserved for data from randomized controlled studies.

In summary, I congratulate the authors for having the courage to try decision analysis in an effort to better

tailor proposed surgery to the needs of the patient (make the surgery fit the patient, not the patient fit the surgery). It seems that from this study that it was not effective in differentiating one procedure to have an advantage over the other. The final comments are perhaps more appropriate and I believe correct: "It is apparent that the use of decision analysis in clinical studies has several limitations. Potential bias in observational studies makes judgments subjective. Moreover, satisfaction with a specific surgical outcome may be viewed differently by physicians and patients."

I have several questions. (1) In Table I "probabilities" are derived from fair to poor, evidence quality, which may or may not be applicable to your particular patient. Would you comment? (2) Also in Table I the "probabilities" derived were from poor to fair evidence quality in six of seven parameters studied. Does this not seem to be relying too heavily on inferior evidence quality data to assist in a major clinical decision? (3) In Table II the "probability" for a vaginal cancer death is indicated as 0. The incidence of primary squamous cell cancer of the vagina is 1% to 2%. Several authors, Rutledge,² Schiffer et al.,³ Gallup and Morley,⁴ Jimerson and Merrill,⁵ Stuart et al.,⁶ and Bell et al.,⁷ have reported series of squamous cell cancer of the vagina after hysterectomy for benign disease. If the probability of a vaginal cancer death is 0, can it be a complication of this surgery? If it is, and you didn't find any cases in your sample, then could it not mean that your sample is not sufficiently large?

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DR. MARGUERITE K. SHEPARD, Indianapolis, Indiana. The concept of evidence-based medicine was first introduced in 1992.¹ Although representatives of several U.S. medical schools were included in the original working group, the predominant membership was Canadian, presumably an outgrowth of the Canadian program of national health care. Impetus toward this approach to medical decision making in the United States clearly is given by the trend toward managed care and the more cost-effective allocation of finite medical resources. In 1993 Grimes² proposed the use of evidence-based medicine in obstetrics and gynecology. The examples he used in support of the evidence-based approach, including the routine use of episiotomy, repeat cesarean section, and

Table I. Comparison of preliminary and final versions

Complication	Preliminary	Final
Total		
Infection	0.09 (0.05-0.20)	0.03 (0.03-0.20)
Impaired sex	0.00 (0.00-0.20)	0.01 (0.00-0.25)
Vesicourethro.	0.00 (0.00-0.26)	0.01 (0.00-0.26)
Subtotal		
Surgical death	0.004 (0.0005-0.004)	0.001 (0.0005-0.004)
Impaired sex	0.00 (0.00)	0.005 (0.00-0.01)

electronic fetal monitoring, were all supported by a significant body of literature.

Dr. Scott and colleagues have used the evidence-based approach to compare the advantages of subtotal hysterectomy with those of total hysterectomy in appropriately selected patients. They have done an excellent job of culling the recent literature for appropriate supporting data. They have reviewed >30 reports to compare both procedures for five objective and two subjective potential sequelae. All reports have been evaluated for the quality and strength of the evidence. It becomes immediately obvious from the initial comparison seen in Table I that both the quality and strength of data are better for total hysterectomy and the objective sequelae, including surgical death, infection, hemorrhage, adjacent organ injury, and genital tract cancer death, than they are for subtotal hysterectomy and those sequelae that seem to mean the most to the patients requesting this procedure, that is, impaired sexual response and vesicourethral symptoms. This finding underscores one of the biggest problems with the evidence-based approach to many clinical problems with which we have to deal every day: the evidence available is inadequate in strength, quality, or amount to make a rational decision. Once again we must fall back on our clinical judgment. One obvious solution to this problem is to make a concerted effort to collect some data in these areas of controversy. The concern over impaired sexual response is one of the main reasons that women are requesting subtotal hysterectomy. Many women, when asked, state that the topic was never discussed with them at all. Although still somewhat subjective, it would not be difficult to ask the patient and her partner a few targeted questions such as, "How important are uterine contractions and tension on the uterosacral ligaments to your enjoyment of intercourse?" and "Are vaginal barrel tone and length significant components of your response and enjoyment?" and "Is it important to have the sensation that the penis is hitting something?"

It would be even easier to collect more objective data in the area of vesicourethral symptoms. It would only take committing the time and the money to performing targeted preoperative and postoperative urodynamic studies.

The difficulties with applying the evidence-based approach with inadequate supporting data are illustrated by the difficulties that the current authors have encountered. These are subtle but significant differences between the preliminary and final versions. In the first

version the condensation states "Elective subtotal hysterectomy may be an acceptable alternative to total hysterectomy in properly selected women," whereas in the second version the statement "Advantages and disadvantages of subtotal versus total hysterectomy are presented" takes a pointedly neutral stance. The conclusion presented in the program states "... the contemporary risk of developing cervical cancer in women with normal cytology is minimal. Both subtotal and total hysterectomy appear to be acceptable options for this group of women." However, the conclusion in the final version, "Total hysterectomy remains the procedure of choice for most women," is definitely in favor of total hysterectomy. Finally, a comparison of the tables between the preliminary and final versions is seen in Table I. As far as I could tell from comparing the two studies, essentially the same references were used to construct the two tables but the interpretation of the data differed. When the evidence-based model is applied, the first version sets up three scenarios whereas the second version only uses one.

I have three questions. (1) How and why were the revised estimates of the probabilities of adverse occurrences made? (2) Why were the comparisons changed from three cases to one? (3) In the authors' opinion, how do subtle changes in interpretation of the data affect the process of decision analysis?

REFERENCES

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DR. SHARP (Closing). Let me start with the question about whether we were relying on poor evidence for subtotal hysterectomy data, as both Dr. Huddleston and Dr. Shepard asked. The answer is yes. We really are left with whatever is available in the literature; unfortunately, the quality of literature is much better for total hysterectomy. That is perhaps one weakness of the study, and we fully recognize that.

One reason we did the decision analysis is that there are no good data for a metaanalysis.

Dr. Huddleston also asked whether vaginal vault cancer really 0%; this is difficult because the probability of this is very low, there really were limited data available, and, in fact, in many cases all we had was a numerator and not a denominator. So it was difficult, but it probably is very close to 0%.

Dr. Shepard also asked about the preliminary versus the final article and how did we come up with our final percentages, etc. We had all the authors review the literature independently, and we our estimation as to the probability baseline. We didn't always agree, and we wrestled back and forth. We did eventually end up changing it to the final version after the consensus.