



International Journal of Reproductive Medicine & Gynecology

Research Article

Survey-Based Assessment of Changes in Provider Attitude towards Fertility Preservation through Targeted Educational Seminars Regarding Iatrogenic Gonadotoxicity Fertility Preservation Options: A Multidisciplinary Approach -

Monica Pasternak^{1*}, Anjie Li², Katherine Leung MPH³, Julia Johnson⁴
and Lubna Pal⁵

¹Fellow, Department of Reproductive Endocrinology and Infertility, Weill Cornell Medical Center

²Fellow, Center for Special Minimally Invasive and Robotic Surgery, Society of Laparoendoscopic Surgeons

³Statistician, Department of Obstetrics and Gynecology, University of Massachusetts Medical Center

⁴Professor and Chair, Department of Obstetrics and Gynecology, University of Massachusetts Medical Center

⁵Professor, Division of Reproductive Endocrinology and Infertility, Department of Obstetrics, Gynecology and Reproductive Sciences, Yale School of Medicine

***Address for Correspondence:** Monica Pasternak, 405 East 70th St, Apt 3B, New York, NY 10021,
E- mail: Monica.pasternak@gmail.com

Submitted: 19 August 2017; **Approved:** 10 October 2017; **Published:** 13 October 2017

Cite this article: Pasternak M, Li A, Katherine Leung MPH, Johnson J, Pal L. Survey-Based Assessment of Changes in Provider Attitude towards Fertility Preservation through Targeted Educational Seminars Regarding Iatrogenic Gonadotoxicity Fertility Preservation Options: A Multidisciplinary Approach. *Int J Reprod Med Gynecol.* 2017;3(2): 043-050.

Copyright: © 2017 Pasternak M, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



ABSTRACT

Objective: To evaluate the utility of a targeted lecture in improving FP awareness amongst clinicians.

Design: This is a dual institution, prospective survey-based study assessing if an educational lecture can increase the likelihood of FP consideration, discussion, and referral.

Setting: University of Massachusetts and Yale-New Haven Hospital

Patients: N/A a total of 147 pre- and post-lecture surveys were collected and analyzed.

Intervention: A lecture-style educational session providing information regarding Fertility Preservation (FP) options is effective in imparting FP knowledge to clinicians.

Main Outcome Measures: Pre- and post-lecture survey evaluating clinician-perceived practice patterns were addressed with questions regarding consideration of, discussion of and referral for fertility preservation.

Results: 81.2% of clinician respondents reported their patients rarely or never initiate FP discussion. Post-lecture, the likelihood of respondents to consider FP increased from 12.5% to 58.5% ($p < 0.001$), likelihood to initiate discussion increased from 10.0% to 49.0% ($p < 0.001$), and likelihood to refer increased from 61.1% to 82.0% ($p < 0.001$). At baseline, respondents were most familiar with IVF and embryo cryopreservation (84.0%) with only 4.8% of respondents reporting familiarity with radical trachelectomy. Afterwards, familiarity with all methods increased: IVF 96.6%, oocyte cryopreservation 91.8%, tissue cryopreservation 88.4%, GnRH analogs 88.4% and radical trachelectomy 69.4%.

Conclusions: It is important for clinicians to initiate FP discussion, as patients are unlikely to initiate it themselves. A lecture is effective at imparting FP knowledge to clinicians. This simple strategy increased the likelihood that clinicians will consider and discuss FP with appropriate patients, and increased the likelihood they will refer appropriate patients to fertility specialists.

Keywords: Oncofertility; Education; Fertility Preservation

INTRODUCTION

Capsule

A lecture-style educational session providing information regarding Fertility Preservation (FP) options is effective in imparting FP knowledge to clinicians, which may lead to changes in practice patterns.

Many women of reproductive age are affected by cancer and autoimmune disease. Of the approximately 1.7 million people in the United States diagnosed with cancer each year, 15% are younger than 45 years of age [1]. Autoimmune disorders affect 8% of the United States population, 78% of whom are women, with diagnosis and subsequent flares frequently occurring during childbearing age [2]. Due to improvements in therapeutic interventions such as chemotherapy and radiation, the overall survival rates for many malignancies and autoimmune diseases have significantly increased [1]. Discussions surrounding fertility and impact of treatment on fertility are important.

In the context of disease (malignant or autoimmune) a number of mechanisms such as the increased catabolic state, malnutrition, elevated stress hormone levels, as well as the underlying disease process are recognized for detriment to the oocyte reserve egg quality [3]. Indeed, insult to ovarian reserve and premature ovarian insufficiency are recognized sequelae to many of the chemotherapeutic agents used to treat malignant [4], as well as autoimmune disorders [3,5,6]. Furthermore, given the trend towards delayed childbearing, an increasing proportion of women are diagnosed with cancer and autoimmune disease before their first pregnancy [7]. Therefore, survivors of malignant and serious non-malignant disorders may face significant challenges related to future fertility and procreative ability.

As part of the education and informed consent process prior to cancer treatment, the American Society of Clinical Oncology recommends that oncologists address the possibility of infertility,

be equipped to answer basic questions about Fertility Preservation (FP) options, and offer referral to a reproductive specialist to all interested in seeking further information or pursuing FP options [8]. Despite the clear cut guidelines and recommendations however, the actual dispensation of FP related counseling to eligible patients is far from ideal. In a number of studies that seek patient perception of having received FP related counselling, at least half of oncology patients surveyed did not recall any such discussion [9,10]. Of those who did recall a fertility centered discussion, many were dissatisfied with the information provided. [11] A lack of provider knowledge regarding available FP options is recognized as a barrier that limits patient access to and utilization of FP options. [12] Heartening are findings indicating that many oncologists are receptive to being educated on FP methods so as to better serve their patients. [13] In the field of oncology, there is a paucity of literature on the efficacy of various educational interventions affecting changes in perception, clinical management, and outcomes regarding FP [13]. Similarly, FP perspectives within the field of rheumatology are lagging even further behind in providing this information to patients. [2] The purpose of this study is twofold. It is primarily to assess changes in clinician perspectives regarding iatrogenic gonadotoxicity and the relevance of FP practice and counseling immediately after an educational lecture. Secondly, we aim to develop a preliminary understanding of the opinions and practices of providers in the field of rheumatology with regards to FP.

MATERIALS AND METHODS

This is a prospective, survey based study assessing provider perspectives on fertility preservation before and after an informative session on FP options available to reproductive age women anticipating disease and or treatment related gonadotoxicity. The study was approved by the Institutional Review Board of the University of Massachusetts and Human Investigation Committee of Yale University. A waiver of consent was approved because of the voluntary nature of the survey, as well as the minimal risk to

survey participants. Appropriate departments at the two academic medical centers that provided care to reproductive aged women potentially affected by malignancy or autoimmune disease, were approached and offered the opportunity for their providers and trainees to hear a one-hour talk scheduled as a Grand Round session on the subject of iatrogenic gonadotoxicity and FP options. Between both institutions, investigators contacted the coordinator for the departments of Internal Medicine, Pediatrics, Hematology and Oncology, Rheumatology, Family Medicine, Pediatric Surgery, Pharmacy, Radiation Oncology, and Breast Oncology to arrange a time for presentation and subsequent survey distribution.

Lectures were given at UMMH between February 2014 – March 2014, and at Yale from July 2014 – February 2015. Lectures were given by the two of the investigators (AL and MP), as well as a Dr. Cindy Duke, a specialist in Reproductive Endocrinology and Fertility. Lecture content included a review of the literature surrounding the potential gonadotoxicity of chemotherapy and radiation therapy, as well as a description of the available methods of fertility preservation. Voluntary participation of attendees was requested; participants completed a pre-lecture survey that collected information on demographics, clinical practice pertinent to the research question, level of awareness of available FP options and perspective on potential barriers to utilization of FP services (Supplemental appendix 1). All lecture participants were invited to complete the dispensed surveys. Participants were excluded if they declined to complete the survey packet. Survey responses were included even if respondent elected not to complete all portions of the post-lecture survey.

Demographics were addressed with nine items in the questionnaire including gender, age range, race and ethnicity, level of training and years of practice, specialty, and previous education pertaining to FP, as well as the estimated annual number of eligible patients for FP consideration.

Current practice patterns were addressed with questions regarding discussion of and referral for FP. Four items assessed how often FP discussion was considered or initiated by the health provider, and how often such a discussion was initiated by the patient; response options were: Always, Sometimes, Rarely, Never, I do not have patients with cancer or rheumatologic conditions. Providers were asked regarding their practice of referring eligible patients for FP consultation and counseling by a fertility specialist with response options for referral ranging from < 10% of the time, to 76-100% of the time.

Health provider perspective relating to FP was evaluated in the context of their specialty: 1) how long the provider would be willing to delay definitive gonadotoxic treatment in a patient interested in FP, 2) would the provider be willing to consider a less-effective treatment option for better fertility outcomes, 3) patient age at which provider perceives FP as an option, 4) perception on percentage of patients in provider's practice who would benefit from FP counseling, and 5) how quickly would provider like his/her patient to be seen after a referral for FP consultation by a fertility specialist is made. The providers' knowledge regarding FP options was assessed with the identification of methods with which he/she was familiar. The final question asked was for the participants to list perceived barriers to FP. Please refer to the supplemental document provided for a copy of the distributed questionnaire.

Content and context of the informative material included in the talk and survey questions were developed guided by review of existing medical literature up until September 1, 2013 on PubMed and Ovid

Medline such that adequate time could be given for IRB approval prior to the scheduled lectures in 2014. Search keywords included fertility preservation, infertility, education, and survey. The content and context of the lecture and of the survey was reviewed, refined and finalized with input from all authors including Reproductive Endocrinologists, a Fellow in Reproductive Endocrinology and Infertility, and Residents in Obstetrics & Gynecology.

Following the pre-lecture survey, the topic of FP was immediately reviewed in a 60-minute power point presentation that was prepared for a multidisciplinary audience. Attendees were then requested to complete a post-lecture survey that assessed impact of lecture content and topic review on familiarity of audience with FP options and enquired of providers' future likelihood towards consideration, discussion, and referral for consultation regarding FP for eligible patients except for information on demographics, the post-lecture survey included all questions that were included in the pre-lecture survey. All responses the surveys collected were entered into a database shared between both institutions, with a unique study ID correlated to each participants pre- and post-lecture survey responses. Subsequent statistical analysis comparing both sets of pre and post lecture data.

Statistical Methods:

Study data were collected and managed using REDCap (Research Electronic Data Capture), an electronic data capture tool hosted at University of Massachusetts Medical School [14]. Participant characteristics and response to questions were described with frequency and percent or mean and standard deviation. Differences in participant characteristics and responses to questions between institutions were compared with Students t-test for continuous variables and chi-square test or Fishers exact test (for categorical variables with cell counts less than 5). Survey questions were compared between pre and post-lecture with a chi-square test or Fishers exact test. Analyses were run using Stata/MP 13.1 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP). A two tailed *P* value of < 0.05 was considered to reflect statistical significance.

RESULTS

A total of 147 sets of pre and post lecture surveys were collected, including 66 from the University of Massachusetts and 81 from Yale University. For a copy of survey questions, please refer to the supplemental materials provided at the end of this manuscript. Pre- and post-lecture answers were paired using a unique study ID. There were a number of participants who completed the pre-surgery questionnaire, but did not complete the post-survey questionnaire. Questions unanswered were excluded from analysis. Participant demographics are described in table 1. Some questions were left unanswered by various participants, thus accounting for discrepancy in the sample size of certain responses.

81.2% of clinician respondents reported that their patients rarely or never initiate FP discussion. Post-lecture, the likelihood of respondents to consider FP increased, as did likelihood to initiate discussion regarding FP, and likelihood to refer to a specialist for further FP counseling (Table 2). The survey also demonstrated that although after the informative session providers were more aware of the effect of gonadotoxic agents on fertility, the majority of providers were not willing to sacrifice any level of treatment efficacy in order to reduce the risk for gonadotoxicity (Table 3).



Table 1: Distribution of Demographics by Site.

	Total (N = 147)		Site				p-value
			UMass (N = 66)		Yale (N = 81)		
	Mean	SD	Mean	SD	Mean	SD	
Age	39.5	13.5	42.5	13.9	37.4	12.9	0.022
Graduation year	1998	14.1	1994	14.6	2002	12.9	0.001
Gender	N	%	N	%	N	%	
Male	58	41.1%	24	39.3%	34	42.5%	0.706
Female	83	58.9%	37	60.7%	46	57.5%	
Race							
White	106	75.2%	45	73.8%	61	76.3%	0.677
Asian	34	24.1%	15	24.6%	19	23.8%	
Both White & Asian	1	0.7%	1	1.6%	0	0.0%	
Ethnicity							
Hispanic	5	3.6%	1	1.8%	4	4.9%	0.649
Non-Hispanic	133	96.4%	56	98.2%	77	95.1%	
Level of Training							
Attending	51	36.4%	34	56.7%	17	21.3%	< 0.001
Nurse	11	7.9%	0	0.0%	11	13.8%	
Fellow	10	7.1%	5	8.3%	5	6.3%	
Resident	38	27.1%	10	16.7%	28	35.0%	
Medical Student	3	2.1%	1	1.7%	2	2.5%	
Other	27	19.3%	10	16.7%	17	21.3%	
In an average year how many of your female patients have a cancer or rheumatology diagnosis							
< 10	40	29.2%	21	36.2%	19	24.1%	0.378
10 to 50	40	29.2%	13	22.4%	27	34.2%	
51 to 100	14	10.2%	7	12.1%	7	8.9%	
> 100	20	14.6%	9	15.5%	11	13.9%	
I do not have patients with cancer or a rheumatologic diagnosis	23	16.8%	8	13.8%	15	19.0%	

Table 2: Distribution of Lecture Survey Questions Pre- vs Post-Lecture.

	Time Point				P-value
	Pre-Lecture		Post-Lecture		
	N	%	N	%	
How often do you initiate Fertility Preservation discussions with female cancer or rheumatologic patients					
Always	14	10.0%	70	49.0%	< 0.001
Sometimes	26	18.6%	54	37.8%	
Rarely	30	21.4%	5	3.5%	
Never	33	23.6%	0	0.0%	
How often do you consider future fertility in your female cancer patients or rheumatic patients					
Always	17	12.5%	83	58.5%	< 0.001
Sometimes	40	29.4%	48	33.8%	
Rarely	25	18.4%	0	0.0%	
Never	19	14.0%	0	0.0%	
What percent of your female cancer or rheumatologic patients do you currently refer to a specialist for fertility counseling and potential treatment					
< 10%	70	51.1%	6	4.2%	< 0.001
10-50%	12	8.8%	32	22.5%	
51-75%	8	5.8%	32	22.5%	
76-100%	6	4.4%	55	38.7%	
If you had a female cancer or rheumatologic patient interested in pursuing fertility preservation options, what percentage of them do you think would benefit from a referral to a specialist to discuss fertility preservation					
< 10%	13	11.0%	1	0.7%	< 0.001
10-50%	33	28.0%	15	10.8%	
51-75%	18	15.3%	25	18.0%	
76-100%	54	45.8%	89	64.0%	

When asked about willingness to address FP with pre-pubertal patients, post-lecture, the respondents were significantly more likely to initiate FP related discussion. Pre-lecture, 31.3% believed that FP related conversation would be appropriate for a child < 7 years old. Post-lecture, this increased to 52.4% ($p = 0.05$). Similarly, the percentage of participants willing to engage a patient 7-13 years of age in a FP discussion increased from 42.9% pre-lecture, to 74.1% post-lecture ($p < 0.05$).

Specialty related differences in providers' practice and perspectives relating to FP were apparent. Health providers in the discipline of rheumatology were more likely to give consideration to FP and initiate FP discussions compared to providers in other surveyed disciplines. Rheumatologists were also most willing to discuss FP with their patients, as well as more likely to refer their patients to a specialist for FP discussion as compared to other providers in the combined categories (Table 4).

Prior to the lecture, *In Vitro* Fertilization (IVF) and embryo cryopreservation were the two FP methods that providers were most familiar with (84.0%), with only 4.8% of respondents reporting familiarity with radical trachelectomy (Figure 1). Awareness about all

existing methods of FP amongst participants significantly improved post-lecture (Figure 1). In identifying notable barriers to patient referral to infertility specialist for FP discussion, commonly cited concerns included not having access to FP specialists (29.6%), baseline poor disease prognosis (20.4%), and lack of time due to emergent need to start therapy (28.6%). In addition, there was no significant difference in the attitudes of male respondents as compared with their female counterparts (Table 5).

DISCUSSION

This prospective survey based study was undertaken to assess status of and changes in clinician perspectives regarding iatrogenic gonadotoxicity and FP practice and counseling immediately after an informative lecture. We have demonstrated that the familiarity with FP options and likelihood for providers to refer eligible patients to FP specialists increased following a lecture detailing the effect of treatment on fertility and possible methods to preserve reproductive function. This was observed regardless of level of training, and regardless of gender. Although there are existing studies on the efficacy of educational interventions for medical providers, there is a paucity of data on this subject pertaining to changes in perception, clinical management, and outcomes following education on FP.

Table 3: Informative Session Did Not Significantly Change Opinion of Treatment Planning.

	Time Point				P-value
	Pre-Lecture		Post-Lecture		
	N	%	N	%	
If you had a female cancer or rheumatic patient interested in pursuing Fertility Preservation options, how long would you be willing to delay fertility-affecting treatment initiation					
< 1 day	11	9.9%	3	2.4%	0.213
1-2 days	23	20.7%	25	20.2%	
3-7 days	20	18.0%	28	22.6%	
1-2 weeks	37	33.3%	47	37.9%	
> 2 weeks	20	18.0%	21	16.9%	
If you are willing to consider a less effective cancer or rheumatologic treatment regimen in an attempt to preserve fertility, what level of treatment efficacy would you be willing to sacrifice for better fertility outcomes					
Not willing to sacrifice any efficacy	54	46.6%	31	25.6%	0.003
< 1% efficacy	16	13.8%	26	21.5%	
1-5% efficacy	34	29.3%	55	45.5%	
> 5% efficacy	12	10.3%	9	7.4%	

Table 4: Rheumatologists Most Likely to Discuss and Consider FP – Likelihood Increased Further Post-Lecture.

	Pre-Lecture				Post-Lecture			
	Not Rheumatology (N = 127)		Rheumatology (N = 11)		Not Rheumatology (N = 127)		Rheumatology (N = 11)	
	N	%	N	%	N	%	N	%
How often do you initiate Fertility Preservation discussions with these female cancer or rheumatologic patients								
Always	12	9.5%	2	18.2%	60	47.6%	7	63.6%
Sometimes	21	16.7%	5	45.5%	49	38.9%	4	36.4%
Rarely	26	20.6%	4	36.4%	4	3.2%	0	0.0%
Never	32	25.4%	0	0.0%	0	0.0%	0	0.0%
How often do you consider future fertility in your female cancer patients or rheumatic patients								
Always	16	12.9%	1	11.1%	72	57.6%	7	63.6%
Sometimes	35	28.2%	5	55.6%	43	34.4%	4	36.4%
Rarely	22	17.7%	3	33.3%	0	0.0%	0	0.0%
Never	18	14.5%	0	0.0%	0	0.0%	0	0.0%
What percent of your female cancer or rheumatologic patients do you currently refer to a specialist for fertility counseling and potential treatment								
< 10%	64	51.2%	5	55.6%	4	3.2%	1	9.1%
10-50%	10	8.0%	2	22.2%	29	23.2%	2	18.2%
51-75%	6	4.8%	2	22.2%	31	24.8%	1	9.1%
76-100%	6	4.8%	0	0.0%	45	36.0%	7	63.6%



Strengths of our study include the dual site approach and standardization of interventions (lecture and surveys) between the two academic sites improved the power and inclusion of health care providers across multiple disciplines. In addition, there is limited data on the importance of educating the general clinician population regarding FP. This project was intended to fill this gap and be a study to evaluate the need for FP education across multiple sub-specialties. As our study was limited two academic centers in the Northeast region of the United States, and results may not be generalizable to all practice settings in various other regions. In addition, this study was survey-based. Although the survey was designed based on a literature review with influence from previously published FP-related surveys, it was not validated. In addition, the relatively low sample size may introduce a source of bias in the results.

Providers responses identify that discussion on FP concepts is best introduced by the health provider as patients are unlikely to be the first to initiate discussions regarding FP despite future fertility being of interest and of relevance, as has been noted in prior studies [10,15]. Retrospectively, an abundance of these patients do not even remember discussing FP with their clinicians [9,16] and many of those who do remember such a discussion are dissatisfied with the quality and amount of information provided [11]. Our study underscores a need for and importance of clinicians leading discussion on the subject of FP when interacting with reproductive age patients suffering from conditions that are detrimental to reproductive biology, or those

anticipating gonadotoxic treatment, as patients are perceived as unlikely to bring up this topic themselves.

Existing data support that future fertility is a significant concern for reproductive age survivors and their families. Among adolescents with hematologic cancers, 81% of patients and 93% of parents were interested in family planning even if it was experimental [17]. Our data suggests that clinicians may not be aware of the importance FP to their patients. Our intervention was simple and straightforward – a one-hour lecture. Following this intervention, likelihood of clinicians to consider FP and likelihood to discuss FP was higher, underscoring the importance of continued education to better align physician awareness with patient interests.

The American Society of Clinical Oncologists (ASCO) cites that a significant barrier to FP discussion includes lack of knowledge regarding FP methods [8]. Our study supports that an educational lecture is effective at increasing awareness of FP options. This educational method also conveys the complexity in FP methods and the value of referral to a reproductive specialist. ASCO recommends that oncologists address the possibility of infertility and to be equipped to answer basic question about FP options. Given that the oncologist has many clinical issues to address, the general medical community including the patient’s primary care physician should be able to address basic FP options as well. Of concern were the lacking awareness of FP resources available to the community within the tertiary care institutions where the surveys were undertaken. This lack of knowledge regarding FP options is a recognized barrier in the literature [12] and our data corroborates with this. Forman et al found that oncologists specifically are receptive to being educated on FP methods [13]. Similarly, we found that this interest in expanding knowledge about FP was not limited to oncologists, but generalizable to primary care providers and specialists alike. Since the interest is there, there should be an increase of educational material intended not only for oncologists and specialists, but generalists as well.

Lack of patient access to FP access was cited as a reason for not engaging eligible patients in FP related discussion. Given that a number of fertility clinics offer FP options currently, the provider discernment of “lacking access” is a misperception that needs to be corrected through awareness enhancing campaigns. As these services are widely available at fertility clinics, this is largely a financial and logistics issue that needs to be addressed on institutional and regional

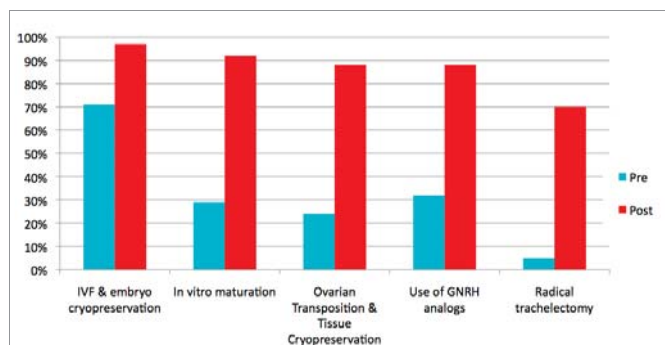


Figure 1: Awareness of fertility preservation methods available to reproductive age women.

Table 5: No Significant Difference of Perspective between Male and Female Respondents.

	Pre-Lecture				Post-Lecture			
	Male		Female		Male		Female	
	N	%	N	%	N	%	N	%
How often do you initiate Fertility Preservation discussions with these female cancer or rheumatologic patients								
Always	8	14.0%	6	7.3%	29	50.9%	39	47.6%
Sometimes	8	14.0%	18	22.0%	20	35.1%	33	40.2%
Rarely	18	31.6%	12	14.6%	2	3.5%	2	2.4%
Never	8	14.0%	24	29.3%	0	0.0%	0	0.0%
How often do you consider future fertility in your female cancer patients or rheumatic patients								
Always	9	15.8%	8	10.3%	33	58.9%	47	57.3%
Sometimes	17	29.8%	23	29.5%	18	32.1%	29	35.4%
Rarely	12	21.1%	13	16.7%	0	0.0%	0	0.0%
Never	3	5.3%	15	19.2%	0	0.0%	0	0.0%
What percent of your female cancer or rheumatologic patients do you currently refer to a specialist for fertility counseling and potential treatment								
< 10%	26	45.6%	43	54.4%	4	7.0%	1	1.2%
10-50%	6	10.5%	6	7.6%	16	28.1%	16	19.8%
51-75%	5	8.8%	3	3.8%	11	19.3%	20	24.7%
76-100%	4	7.0%	2	2.5%	20	35.1%	33	40.7%

levels. Other barriers cited post-lecture included poor disease prognosis, emergent need to start therapy, and patient refusal. This is not unexpected as they are sound reasons for not pursuing FP. As knowledge increases, the ability to screen for FP-inappropriate patients should improve as well, and our data supports this. Indeed, a need for timeliness of intervention, and concerns regarding consequences of delaying definitive therapy were apparent in survey responses. Provider's awareness of time constraints relating to the various FP options, and time needed to collaborate with a fertility specialist, can be particularly meaningful in allowing an individual patient autonomy in the decision-making process that can impact the quality of her living years.

Approximately half of the respondents were attending-levels, while the other half were largely trainees (medical students, residents, fellows). Regardless of level of training, there was interest in the topic of FP. In a sub-analysis done at the University of Massachusetts, knowledge regarding FP, consideration of FP, and likelihood to discuss FP with appropriate patients increased post-lecture regardless of level of training. However, trainees were more likely to refer patients to FP specialists. This may be a reflection of attending-level referrals being limited to those patients that are more appropriate, while trainees may refer all-comers. Regardless, the entire medical spectrum from student to professor benefited from the contents of the lecture. This implies that there needs to be investment in educating not only the trainees, but the entire medical field as regardless of level of training, learning does not stop.

It is well known that cyclophosphamide given in dosages commonly prescribed to patients with autoimmune disease impacts female fertility [18]. It has also been shown that women with autoimmune disease care deeply about their future reproductive potential [19]. The American College of Rheumatology Task Force Panel affirms that many of their patients are interested in their reproductive health, to the point where they included in their guidelines specific management options for women with lupus nephritis who desire to preserve their fertility [20]. Our data reflects this improved level of awareness regarding FP amongst providers in the field of rheumatology as compared to other disciplines. These respondents were more likely to consider FP, discuss it with their patients, and also more likely to refer appropriate patients to FP specialists. The observed differences can be hypothesized to be attributable to a chronic nature of rheumatologic illnesses, allowing providers to focus on long-term implications of disease of treatment. This is in contrast with the relatively more acute presentation and deemed urgency for intervention for malignant disorders. The perception of autoimmune disease as a chronic disease may create a ripe platform for discussion of long-term consequences of treatment, of which fertility is a cornerstone.

CONCLUSIONS

Successes in improving survival and longevity through advancements in health care access and improvements in therapeutics need not come at the expense of compromise in life quality. It is incumbent upon the healthcare providers to consider and discuss future procreative ability and ovarian function for reproductive age patients afflicted with chronic diseases and malignant disorders, when formulating individualized treatment plans for each patient. Our study suggests that an informative lecture is an effective means of imparting

FP knowledge to providers across healthcare disciplines. Providers across disciplines should not only be familiar with the available FP options, but also familiarize themselves with FP resources available to their patients, both locally and regionally and refer interested patients to appropriate fertility preservation specialists as a priority.

ACKNOWLEDGEMENTS

The authors thank Dr. Cindy Duke for her assistance in preparing and presenting lecture material at grand rounds.

REFERENCES

1. Cancer Treatment and Survivorship Facts & Figures 2012-2013. American Cancer Society. 2012. <https://goo.gl/EvJJvi>
2. Lee SJ1, Schover LR, Partridge AH, Patrizio P, Katsifis GE, Tzioufas AG. Ovarian failure in systemic lupus erythematosus patients treated with pulsed intravenous cyclophosphamide. *Lupus*. 2004; 13: 673-678. <https://goo.gl/5DPCps>
3. Meirou D, Biederman H, Anderson RA, Wallace WH. Toxicity of chemotherapy and radiation on female reproduction. *Clin Obstet Gynecol*. 2010; 53: 727-739. <https://goo.gl/xkrkKL>
4. Chemaitilly W, Mertens AC, Mitby P, Whitton J, Stovall M, Yasui Y, et al. Acute ovarian failure in the childhood cancer survivor study. *J Clin Endocrinol Metab*. 2006; 91: 1723-1728. <https://goo.gl/MxgsG2>
5. Ioannidis JP, Katsifis GE, Tzioufas AG, Moutsopoulos HM. Predictors of sustained amenorrhea from pulsed intravenous cyclophosphamide in premenopausal women with systemic lupus erythematosus. *J Rheumatol*. 2002; 29: 2129-2135. <https://goo.gl/c5d42r>
6. Boumpas DT, Austin HA, Vaughan EM, Yarboro CH, Klippel JH, Balow JE. Risk for sustained amenorrhea in patients with systemic lupus erythematosus receiving intermittent pulse cyclophosphamide therapy. *Ann Intern Med*. 1993; 119: 366-369. <https://goo.gl/QvRB0j>
7. Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Kirmeyer S. Births: final data for 2004. *Natl Vital Stat Rep*. 2006; 55: 1-101. <https://goo.gl/saEfc5>
8. Wallace WH, Hagerty K, et al. American Society of Clinical Oncology recommendations on fertility preservation in cancer patients. *J Clin Oncol*. 2006; 24: 2917-2931. <https://goo.gl/yWNq4B>
9. Schover LR, Brey K, Lichtin A, Lipshultz LI, Jeha S. Knowledge and experience regarding cancer, infertility, and sperm banking in younger male survivors. *J Clin Oncol*. 2002; 20: 1880-1889. <https://goo.gl/KmYzUR>
10. Schover LR, Rybicki LA, Martin BA, Bringelsen KA. Having children after cancer. A pilot survey of survivors' attitudes and experiences. *Cancer*. 1999; 86: 697-709. <https://goo.gl/PUJR8K>
11. Partridge AH, Gelber S, Peppercorn J, Sampson E, Knudsen K, Laufer M, et al. Web-based survey of fertility issues in young women with breast cancer. *J Clin Oncol*. 2004; 22: 4174-4183. <https://goo.gl/zF65FL>
12. Quinn GP, Vadaparampil ST, Gwede CK, Miree C, King LM, Clayton HB, et al. Discussion of fertility preservation with newly diagnosed patients: oncologists' views. *J Cancer Surviv*. 2007; 1: 146-155. <https://goo.gl/DCjMfY>
13. Forman EJ, Anders CK, Behera MA. A nationwide survey of oncologists regarding treatment-related infertility and fertility preservation in female cancer patients. *Fertil Steril*. 2010; 94: 1652-1656. <https://goo.gl/oa9r4L>
14. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009; 42: 377-381. <https://goo.gl/4EV5v3>
15. Zebrack BJ, Casillas J, Nohr L, Adams H, Zeltzer LK. Fertility issues for young adult survivors of childhood cancer. *Psychooncology*. 2004; 13: 689-699. <https://goo.gl/6XRBM2>
16. Duffy CM, Allen SM, Clark MA. Discussions regarding reproductive health for young women with breast cancer undergoing chemotherapy. *J Clin Oncol*. 2005; 23: 766-773. <https://goo.gl/e6W2tx>

17. Burns KC, Boudreau C, Panepinto JA. Attitudes regarding fertility preservation in female adolescent cancer patients. *J Pediatr Hematol Oncol*. 2006; 28: 350-354. <https://goo.gl/rnYGxv>
18. Elizur SE, Chian RC, Pineau CA, Son WY, Holzer HE, Huang JY, et al. Fertility preservation treatment for young women with autoimmune diseases facing treatment with gonadotoxic agents. *Rheumatology (Oxford)*. 2008; 47: 1506-1509. <https://goo.gl/iAkZTh>
19. Clowse ME, Chakravarty E, Costenbader KH, Chambers C, Michaud K. Effects of infertility, pregnancy loss, and patient concerns on family size of women with rheumatoid arthritis and systemic lupus erythematosus. *Arthritis Care Res (Hoboken)*. 2012; 64: 668-674. <https://goo.gl/bY4NDt>
20. Hahn BH, McMahon MA, Wilkinson A, Wallace WD, Daikh DI, Fitzgerald JD, et al. American College of Rheumatology guidelines for screening, treatment, and management of lupus nephritis. *Arthritis Care Res (Hoboken)*. 2012; 64: 797-808. <https://goo.gl/zrkbA6>