Nationwide Survey on the Status of Fertility Preservation Therapy in Japan and Involvement of Embryologists in the Practice of Fertility Preservation Therapy

Hiroyuki Tomari [1], Osamu Okitsu [2], Satoshi Mizuno [3], Akiko Yabuuchi [4], Tadashi Okimura[5], Hiroyuki Kikuchi [6], Sayako Furuyama [7], Ken Taniguchi [8], Isao Tamura [9], Kuniaki Ota [10], Yusuke Fukuda [11], Yuki Horage [7], Nao Suzuki [7]

[1] Center for Reproductive Medicine, IVF Nagata Clinic, Fukuoka, Japan

[2] Kusuhara Women's Clinic, Tokyo, Japan

[3] IVF Osaka Clinic, Osaka, Japan

[4] STEMCELL Technologies,

[5] Kato Ladies Clinic, Tokyo, Japan

[6] Sendai ART Clinic, Miyagi, Japan

[7] Department of Obstetrics and Gynecology, St. Marianna University School of Medicine, Kanagawa, Japan

[8] Taniguchi Eye and Gynecology Clinic, Saga, Japan

[9] Department of Obstetrics and Gynecology, Graduate School of Medicine, Yamaguchi University, Yamaguchi, Japan

[10] Department of Obstetrics and Gynecology, Tokyo Rosai Hospital, Tokyo, Japan

[11] Toho University Omori Medical Center, Tokyo, Japan

Correspondence: Nao Suzuki

Department of Obstetrics and Gynecology, St. Marianna University School of Medicine, 2-16-1 Sugao, Miyamae-ku, Kawasaki, Kanagawa 216-8511, Japan

E-mail: nao@marianna-u.ac.jp

Tel: +81-44-977-8111, Fax: +81-44-977-2944

Abstract

Purpose

To investigate the actual status of fertility preservation techniques in oncofertility in Japan and to clarify the involvement of embryologists in this field.

Methods

This survey was conducted online, targeting embryologists working at 622 facilities registered with the Japan Society of Obstetrics and Gynecology for Assisted Reproductive Technology.

Results

The response rate was 56.6%. In total, 56.8% of facilities used some form of cryopreservation as fertility preservation therapy for patients with cancer; patients' age range was widely defined at each facility. The most common renewal frequency of cryopreserved specimens for patients with cancer was at 1-year intervals. The most common renewal methods were during patient visits to the hospital and contact by letter. Knowledge levels regarding fertility preservation therapy was not high among many embryologists, but respondents recognized the important role of embryologists in oncofertility.

Conclusions

This study is the first to clarify the importance of embryologists in oncofertility. Many embryologists felt that their knowledge of fertility preservation was limited and considered it necessary to improve their education, including public certification. Guidelines for long-term storage systems, including methods for renewal of cryopreservation, need to be established.

Key words: assisted reproductive technology; embryologist; fertility preservation; Japan; oncofertility.

Introduction

In recent years, cancer diagnostic methods and multidisciplinary treatment methods such as chemotherapy, radiotherapy, and bone marrow transplantation have advanced, and with the remarkable improvement in cancer treatment results, rates of complete remission among pediatric, adolescent, and young adult (AYA) patients with cancer have improved substantially. However, the antitumor effect of high-dose chemotherapy and radiation therapy has been reported to significantly reduce fertility.[1-3] In 2004, efforts to preserve fertility to improve quality of life among pediatric and AYA began to be discussed in Japan, and in 2012, the Japan Society for Fertility Preservation was established as the first oncofertility association in Japan.[4]

In the field of oncofertility, cryopreservation technology for germ cells such as gametes (oocytes/sperm), embryos (fertilized oocytes), and ovarian tissue is essential. Similar to other health care providers, embryologists have a huge role in this field. Cryopreservation of embryos (fertilized oocytes) has a long history, and it is a desirable method for fertility preservation from the perspective of the long-term prognosis of offspring. The laboratory techniques in this field are nearly the same as those in assisted reproductive technology (ART). Furthermore, more than 130 live births after transplantation of frozen–thawed ovarian tissue have been reported worldwide.[5] In 2019, the American Society for Reproductive Medicine (ASRM) stated that "freezing of ovarian tissue has already passed the research stage,"[6] making this a method with

great potential for the future. Because ovarian tissue freezing requires laparoscopic surgery for patients with an unstable general condition, and because it is often targeted toward pediatric and adolescent patients with cancer, only a few facilities in Japan can currently handle cryopreservation of ovarian tissue. Few embryologists are speculated to have mastered the techniques involved in cryopreservation of ovarian tissue. Regarding the cryopreservation of unfertilized oocytes, guidelines of the ASRM[7] and American Society of Clinical Oncology (ASCO)[8] recognize unfertilized oocyte freezing as a technology that can be applied clinically. In 2014, the Japan Society of Obstetrics and Gynecology (JSOG) approved the clinical application of medically adapted oocyte freezing. Embryologists who have mastered embryo (fertilized oocyte) cryopreservation techniques can easily carry out cryopreservation of unfertilized oocytes.

Presently, no consensus exists on ART laboratory technology in oncofertility, such as when and how to freeze germ cells and tissues or how to thaw and fertilize them. In fact, fertility preservation therapy is performed in accordance with the concept in each ART facility, and technical disparities in fertility preservation therapy are assumed to exist among regions and facilities. To solve this problem, the present situation of ART laboratory technology related to oncofertility in Japan should be understood and these issues need to be clarified. Thus, the purpose of this study was to investigate the actual status of fertility preservation techniques in

oncofertility in Japan and to clarify the role of embryologists in this field.

Materials and methods

This survey was approved on January 7, 2021 (IRB approval no. 5093) by the Bioethics Committee of St. Marianna University School of Medicine. Survey respondents were embryologists working at 622 facilities registered with the JSOG for *in vitro* fertilization and embryo transfer (ART registered facilities). The questionnaire was designed to investigate the implementation of fertility preservation therapy and the involvement of embryologists **(Table 1)**. The questionnaire comprised 13 multiple-choice or open-ended questions. For multiple-choice questions, if the response did not match any of the provided choices for an item, the respondent was permitted to provide their own response. Of the 13 items in the questionnaire, five items were related to respondent information and ART facilities and five items addressed information on the status of fertility preservation therapy. The other three items pertained to embryologists in oncofertility. This survey was conducted in an online format by sending a request letter to the hospital director or clinical department director of each facility and enclosing the QR code for the survey. The system design for the online survey was commissioned to an online research company (Macromill, Inc., Tokyo, Japan). The response period was from February 26 to March 24, 2021. In this survey, consent was obtained at the beginning of the questionnaire for use of the responses in the present research. Then, the questions were made available to respondents who gave their consent to participate in this study. Additionally, it was possible to withdraw consent at any time even after starting the survey. Regarding privacy protection, because responses and tabulation were done in an online format, access restrictions were set and managed by assigning individual IDs and passwords.

Results

Survey response status and respondent/facility background

Table 2 shows the responses obtained from embryologists at 352 out of 622 ART facilities registered with the JSOG (response rate 56.6%). Consent was obtained from all respondents for research use. In total, 65.1% of respondents were women and 34.9% were men. Respondents' ages ranged from 24 to 82 years; 6.8% were under age 30 years, 36.9% were in their 30s, 41.8% were in their 40s, 11.9% were in their 50s, and 2.6% were age 60 years or older. Embryologists had a mean ± standard deviation (SD), min–max) 14.8±6.8 (0–34) years of experience, with 77.0% having more than 10 years' experience. Additionally, the number of embryologists at each respondent's facility varied from 0 to 59, with an average (±SD) of 4.7±4.9. We obtained survey responses from facilities in all 47 prefectures **(Figure 1)**.

Status of fertility preservation therapy

In total, 200 facilities (56.8%) were implementing some form of cryopreservation as fertility-preserving therapy for patients with cancer **(Figure 2)**. Of these, 151 (75.5%) were certified by the JSOG as medically indicated **(Figure 3A)**, 127 (63.5%) were registered for unfertilized oocytes, and 149 (74.5%) for embryos (fertilized oocytes). Fewer facilities (41 facilities, 20.5%) were registered for ovarian tissue **(Figure 3B)**. Regarding age restrictions for patients with cancer who were eligible for cryopreservation, 55.4% (93/168) of facilities had age restrictions for embryo (fertilized oocyte) cryopreservation, 62.8% (86/137) for unfertilized oocyte cryopreservation, 73.3% (33/45) for ovarian tissue cryopreservation, 12.8% (24/187) for sperm cryopreservation, and 13.0% (9/69) of facilities had age restrictions for testicular sperm cryopreservation **(Figure 4A)**. In those facilities with age restrictions, the median age restriction

was 16.0–45.0 years for embryos (fertilized oocytes), 16.0–44.0 years for unfertilized oocytes, 1.5–40.0 years for ovarian tissue, 14.0–57.5 years for sperm, and 8.5–57.5 years for testicular sperm **(Figure 4B)**. The frequency of extended renewal of cryopreserved specimens for fertility preservation in patients with cancer was annual renewal at most facilities **(Figure 5A)**. The most common procedures for renewing the cryopreservation period in cancer reproductive medicine were having the patient come to the facility (56.8%) and contacting the patient via a letter (54.9%); 28.2% of respondents said that they contacted the patient by phone, 14.7% by e-mail, and 4.1% by managing the procedure through an app **(Figure 5B)**.

Involvement of embryologists in the practice of fertility preservation therapy

When embryologists were asked to self-assess their level of knowledge regarding fertility preservation therapy (100% was defined as needing no supplemental knowledge), 128 (36.4%) answered 50%, followed by 119 (33.8%) who answered 70% **(Figure 6)**. In total, 62.8% of embryologists reported a knowledge level of 50% or less.

Open-ended responses were received from 41 facilities regarding difficulties in the ART laboratory when performing cryopreservation of germ cells and tissues for patients with cancer **(Figure 7)**. The most common response was that they could not contact the patient during the cryopreservation renewal procedure (n=43.9%,18/41), followed by concerns about the long-term storage and management of frozen germ cells and tissues (n=39.0%, 16/41). Additionally, respondents had the following opinions: 9.8% (4/41) said they need more close contact with cancer treatment facilities; 7.3% (3/41) reported difficulty in acquiring skills and securing an embryologist; 4.9% (2/41) said they lacked the time to provide information on reproductive medicine to patients with cancer; 4.9% (2/41) said they lacked knowledge about oncofertility; and 4.9% (2/41) said there was insufficient time before oocyte retrieval and

cryopreservation.

When asked an open-ended question about the role of embryologists in oncofertility, many respondents indicated that embryologists have a critical role to play in oncofertility. A keyword search of the content of the free-text descriptions revealed many opinions regarding stress owing to the weight of responsibility, the importance of specialized skills and knowledge, and the need for public qualifications and a continuing education system **(Figure 8)**.

Discussion

Although several studies have reported on the status of fertility preservation therapy in Japan,[9-13] this was the first nationwide survey of Japanese embryologists on the status of fertility preservation therapy and the involvement of embryologists in oncofertility. There is no mention of fertility preservation therapy in Japanese guidelines for reproductive medicine; consequently, there is no discussion regarding the relationship between laboratory work and oncofertility.[14] Additionally, few studies have focused on fertility preservation therapy among embryologists worldwide. In fact, the European Society of Human Reproduction and Embryology (ESHRE) and ASRM guidelines clearly state the importance of being able to provide cryopreservation techniques for fertility preservation therapy, but these guidelines do not specifically mention embryologists' involvement in oncofertility.[6,15,16] In our survey, we obtained responses from

experienced embryologists from 352 facilities in all 47 prefectures of Japan, with ART facilities of varying size. We consider this survey to be of high quality and helpful in understanding the actual state of embryology technology in oncofertility in Japan and clarifying the role of embryologists as technicians in this field.

According to survey responses, in fertility preservation therapy for patients with cancer, 56.8% of responding facilities used some form of cryopreservation. Many facilities performed cryopreservation of oocytes, sperm, and embryos, which is also routinely performed in ART. Of these, 75.5% were certified by the JSOG as medically indicated, but we found that even facilities without such certification were performing cryopreservation for fertility preservation. In this regard, because subsidies for fertility preservation therapy among patients with cancer were expanded in Japan from April 2021, the number of facilities that are medically approved by the JSOG—a condition for receiving subsidies for egg and embryo cryopreservation—is expected to increase in the future. However, we found that fewer facilities were performing ovarian tissue cryopreservation compared with cryopreservation of oocytes, sperm, and embryos as fertility preservation therapy for patients with cancer. This means that patients are referred to higher-level medical institutions such as university hospitals when they are diagnosed with cancer, but few ART facilities in Japan collaborate in the cryopreservation of ovarian tissue. The reasons for this may include the need for specialized equipment and facilities for the collection

199 and transplantation of ovarian tissue under laparoscopic conditions and the need for higher-level
200 techniques for freezing and thawing. The situation in other countries is not well known, but in
201 Japan, the ASRM requires that facilities be able to provide cryopreservation of embryos and
202 oocytes as a condition for fertility preservation therapy. However, because the ASRM does not
203 necessarily require cryopreservation of ovarian tissue,[6] we assume that not many facilities in the
204 United States can provide ovarian tissue cryopreservation for patients with cancer, at least as in
205 Japan.

206 Regarding age restrictions for eligible patients in oncofertility, many facilities had age
207 restrictions for embryo, unfertilized oocyte, and ovarian tissue cryopreservation, but many
208 facilities did not have age restrictions for sperm and testicular sperm cryopreservation. In
209 facilities with age restrictions, we inferred that pediatric patients with cancer were included
210 because the lower limit for testicular sperm and ovarian tissue cryopreservation was low
211 whereas the age limit for embryo, unfertilized oocyte, and sperm cryopreservation was set
212 mainly for AYA. In Japan, there are no national or organizational regulations regarding age
213 restrictions in oncofertility. The present survey revealed that age restrictions are widely set for
214 both germ cell and tissue cryopreservation at each facility. A survey of data collected from 30
215 European countries reported that some countries have age restrictions on the use of
216 cryopreserved specimens: 17 countries have age restrictions for oocyte cryopreservation, 13 for

217 embryo cryopreservation, and seven for ovarian tissue cryopreservation.[16] European data on age
218 restrictions and the upper age limit for oocyte cryopreservation are 42–55 years, 45–55 years for
219 embryos, and 40–50 years for ovarian tissue; these values are higher than those in our survey in
220 Japan. Regarding the age restriction for cryopreservation, the special adoption system may be a
221 good reference for ethical discussions, such as consideration of the developmental environment
222 of the future born child. Many local governments in Japan limit the age difference between
223 parents and children to approximately 40–45 years from the perspective of parents being able to
224 support their children physically and financially until they reach adulthood. For the same reason,
225 further discussion on this point may be needed because few facilities in this survey set an age
226 restriction for sperm and testicular sperm cryopreservation, and even those that did set such
227 restrictions had a high upper age limit of 57.5 years.
228 The most common renewal frequency of extended cryopreservation for various germline cells
229 and tissues in patients with cancer was set at 1-year intervals. The advantage of a longer interval
230 is that patients can save time by not having to visit the hospital for procedures so they can
231 concentrate on treatment of their primary disease. However, if the interval is too long, there is
232 less opportunity to check on the patient's underlying disease status and their willingness to
233 continue germline cryopreservation. Patients with a certain frequency should be contacted not
234 only for cryopreservation renewal but also so that the attending reproductive physician can

ascertain the treatment status of the primary disease; most facilities set this interval to 1 year. As for the method of renewal, 56.8% of facilities chose to have the patient visit the clinic in person. However, some facilities have patients renew without a visit, such as by letter, phone call, or e-mail. Although not included in the survey, many facilities in routine clinical practice likely choose methods that do not require in-person visits for cryopreservation renewal of embryos (fertilized oocytes) or gametes (oocytes and sperm) for general ART patients. In fertility preservation among patients with cancer, establishing a system that allows patients to confirm their survival, treatment status of the underlying disease, and whether they wish to continue cryopreservation of their germ cells and tissues without having to visit the clinic in person would reduce the burden on patients.

Our survey revealed that many embryologists have low levels of knowledge about fertility preservation therapy. This may be owing to the fact that cryopreservation of embryos, unfertilized oocytes, sperm, and testicular sperm is commonly performed in ART, and the method is not very different for patients with cancer, as well as the fact that few facilities can perform ovarian tissue cryopreservation, a technique that is unique to oncofertility. In other words, embryologists are able to provide cryopreservation techniques in oncofertility without having knowledge of fertility preservation therapy, which may explain the lack of interest in fertility preservation therapy.

253 The survey revealed two main concerns among embryologists regarding oncofertility. One
254 was that it is sometimes impossible to contact patients with cancer during the cryopreservation
255 renewal process. The reasons for this are that, unlike patients undergoing infertility treatment,
256 patients with cancer concentrate on treatment of their primary disease and do not have a high
257 level of awareness about the cryopreservation procedures that they have undergone. Moreover,
258 embryologists do not know what level of care is needed for patients with cancer, making it
259 difficult to contact them for renewal procedures. The second concern was about the long-term
260 storage and management of cryopreserved specimens from patients with cancer. The reason for
261 this is thought to be that patients with cancer require a longer cryopreservation period than
262 infertile patients, and there are concerns about the ability of laboratories to store and manage
263 cryopreserved specimens until the date when they can be used by patients with cancer. This
264 includes concerns about whether staff fluctuations during that time would affect the
265 management of cryopreserved specimens and their related information. The Japanese Society
266 for Reproductive Medicine has established some institutional requirements for the management
267 of cryopreserved specimens in ART in Japan, but other detailed requirements have not been
268 established. Recently, Japanese guidelines for reproductive medicine have been published,
269 providing broad recommendations for the safe long-term management of cryopreserved
270 specimens by referring to the guidelines of overseas organizations.[14] Even now, however,

271 detailed information such as the ASRM guidelines[17] is not available in Japan, and this is
272 considered to be an issue for the future.

273 In this survey, many embryologists recognized that the role of embryologists in oncofertility
274 is very important, and many commented on the importance of specialized skills and knowledge.
275 The survey also clarified the need to establish a public qualification for embryologists and a
276 continuing education system to ensure the quality of embryologists' professional skills and
277 knowledge.

278 In conclusion, we clarified the implementation status of embryologists' techniques in
279 oncofertility. Although most respondents were experienced embryologists, many had a low level
280 of knowledge about fertility preservation therapy. To create a medical environment in which
281 reproductive medical technology can be uniformly provided as fertility preservation therapy to
282 patients with cancer in all 47 prefectures of Japan, education for embryologists regarding
283 fertility preservation therapy should be improved. We also revealed difficulty among
284 respondents in contacting patients with cancer during the renewal period of cryopreservation
285 and concerns about the long-term storage and management of cryopreserved specimens,
286 suggesting the need to develop guidelines and crisis management strategies to address these
287 issues. The results of this survey suggest that embryologists play an important role in
288 reproductive medicine in general, including oncofertility, and that an educational system should

289 be established in consideration of public certification of embryologists.

290

291 **Acknowledgments**

292 The authors thank the ART-registered facilities of the Japanese Society of Obstetrics and

293 Gynecology for their cooperation in this survey. We thank Analisa Avila, MPH, ELS, of Edanz

294 (https://jp.edanz.com/ac) for editing a draft of this manuscript.

295

296 **Disclosures**

297 This work was funded by a Health Labour Sciences Research Grant from the Ministry of Health,

298 Labour and Welfare of Japan [grant number 20EA1004 to N.S.]. Authors declare no conflict of

299 interests. Human rights statements and informed consent: All procedures followed were in

300 accordance with the ethical standards of the responsible committee on human experimentation

301 (institutional and national) and with the Helsinki Declaration of 1964 and its later amendments.

302 Informed consent was obtained from all participants included in the study. The Institutional

303 Review Board of St. Marianna University School of Medicine approved this study (Number:

304 5093). Animal rights: This report does not contain any studies performed by any of the authors

305 that included animal participants.

306 **References**

1. Lutchman Sigh L, Davies M, Chatterjee R. Fertility in female cancer survivors: pathophysiology, preservation and the role of ovarian reserve testing. Human Reprod Update. 2005;11(1):69–89.

2. Bines J, Oleske DM, Cobleigh MA. Ovarian function in premenopausal women treated with adjuvant chemotherapy for breast cancer. J Clin Oncol. 1996;14(5):1718–29.

3. Wallace WH, Anderson RA, Irvine DA. Fertility preservation for young patients with cancer: who is at risk and what can be offered? Lancet Oncol. 2005;6(4):209–18.

4. Suzuki N. Oncofertility in Japan: advances in research and the roles of oncofertility consortia. Future Oncol. 2016;12(20):2307–11.

5. Dolmans MM, Falcone T, Patrizio P. Importance of patient selection to analyze in vitro fertilization outcome with transplanted cryopreserved ovarian tissue. Fertil Steril. 2020;114(2):279–80.

6. Practice Committee of the American Society for Reproductive Medicine. Fertility preservation in patients undergoing gonadotoxic therapy or gonadectomy: a committee opinion. Fertil Steril. 2019;112(6):1022–33.

7. Practice Committees of the American Society for Reproductive Medicine and the Society for Assisted Reproductive Technology. Mature oocyte cryopreservation: a guideline. Fertil Steril. 2013;99(1):37–43.

8. Loren AW, Mangu PB, Beck LN, Brennan L, Magdalinski AJ, Partridge AH, et al. Fertility preservation for patients with cancer: American Society of Clinical Oncology clinical practice guideline update. J Clin Oncol. 2013;31(19):2500–10.

9. Okamoto S, Fujii N, Yoshioka N, Harada M, Tanimoto M, Maeda Y, et al. Nationwide survey of fertility preservation in patients with hematological malignancies in Japan. Int J Clin Oncol. 2021;26(2):438–42.

10. Takae S, Kato K, Watanabe C, Nara K, Koizumi T, Kawai K, et al. A practical survey of fertility-preservation treatments in the startup phase in Japan. J Obstet Gynaecol Res. 2022;48(5):1061–75.

11. Maezawa T, Suzuki N, Takeuchi H, Kiyotani C, Amano K, Keino D, et al. Identifying issues in fertility preservation for childhood and adolescent patients with cancer at pediatric oncology hospitals in Japan. J Adolesc Young Adult Oncol. 2022;11(2):156–62.

12. Kunitomi C, Harada M, Sanada Y, Kusamoto A, Takai Y, Furui T, et al. The possible effects of the Japan Society of Clinical Oncology Clinical Practice Guidelines 2017 on the practice of fertility preservation in female cancer patients in Japan. Reprod Med Biol. 2022;21(1):e12453. Available from: https://doi.org/10.1002/rmb2.12453.

13. Maezawa T, Takae S, Takeuchi H, Takenaka M, Ota K, Horie A, et al. A nationwide survey aimed at establishing an appropriate long-term storage and management system for fertility

preserving specimens in Japan. J Adolesc Young Adult Oncol. 2022. Available from: https://doi.org/10.1089/jayao.2021.0209.

14. Yamada M, Ishikawa T, Iwasa T, Oishi H, Osuka S, Oka K, et al. Guidelines for reproductive medicine in Japan. Reprod Med Biol. 2022;21(1):e12483. Available from: https://doi.org/10.1002/rmb2.12483.

15. ESHRE Guideline Group on Good Practice in IVF Labs; De los Santos MJ, Apter S, Coticchio G, Debrock S, Lundin K, Plancha CE, et al. Revised guidelines for good practice in IVF laboratories (2015). Hum Reprod. 2016;31(4):685–6.

16. ESHRE Guideline Group on Female Fertility Preservation; Anderson RA, Amant F, Braat D, D'Angelo A, Chuva de Sousa Lopes SM, Demeestere I, et al. ESHRE guideline: female fertility preservation. Hum Reprod Open. 2020;2020(4):hoaa052. Available from: https://doi.org/10.1093/hropen/hoaa052.

17. Practice Committees of the American Society for Reproductive Medicine, Society for Reproductive Biologists and Technologists, and Society for Assisted Reproductive Technology. Cryostorage of reproductive tissues in the in vitro fertilization laboratory: a committee opinion. Fertil Steril. 2020;114(3):486–91.

Figure legends

Figure 1 Location of participating facilities.

The distribution of facilities is displayed as prefecture-level information.

Figure 2 Does your institution offer fertility preservation therapy for patients with cancer using cryopreservation of germ cells and tissues?

Figure 3 Registration status of facilities registered as medically indicated by the Japanese Society of Obstetrics and Gynecology that perform cryopreservation for fertility preservation.

(A) Percentage of facilities registered as medically indicated by the Japanese Society of Obstetrics and Gynecology. (B) Registration details of facilities registered as medically indicated.

Figure 4 Age restrictions for patients with cancer undergoing cryopreservation as fertility preservation therapy.

(A) Presence of age restrictions for patients with cancer eligible for cryopreservation at the responding facility. (B) Range of age restriction in facilities with age restrictions.

379 Figure 5 Extended renewal of cryopreserved specimens for fertility preservation in patients with
380 cancer.
381 (A) Frequency of extended renewal of cryopreserved specimens for fertility preservation in
382 patients with cancer. (B) Procedure for renewal of cryopreservation period.
383
384 Figure 6 Embryologists' level of knowledge about fertility preservation therapy.
385 Embryologists were asked to self-rate their level of knowledge about fertility preservation
386 therapy, with 100% indicating no supplemental knowledge was needed.
387
388 Figure 7 Difficulties in the laboratory when cryopreserving germ cells and tissues of patients
389 with cancer.
390
391 Figure 8 Main keywords in open-ended responses regarding the role of embryologists in
392 oncofertility.
393

National Survey on the Status of Embryo Freezing for Fertility Preservation in Japan

(Ministry of Health, Labour and Welfare Science Research Grants (Cancer Policy Research Project) Research Group (20EA1004))

Tadashi Okimura [1], Hiroyuki Tomari [2], Osamu Okitsu [3], Satoshi Mizuno [4], Hiroyuki Kikuchi [5], Akiko Yabuuchi [6], Sayako Koyama [7], Ken Taniguchi [8], Isao Tamura [9], Kuniaki Ota [10], Yusuke Fukuda [11], Yuki Horage [7], Nao Suzuki [7]

[1]Kato Ladies Clinic,

[2]IVF Nagata Clinic,

[3]Kusuhara Women's Clinic,

[4]IVF Osaka Clinic,

[5]Sendai ART Clinic,

[6]STEMCELL Technologies,

[7]St. Marianna Medical University,