

Is Sperm Banking of Interest to Patients With Nongerm Cell Urological Cancer Before Potentially Fertility Damaging Treatments?

Andrea Salonia,*[†] Andrea Gallina,* Rayan Matloob,* Lorenzo Rocchini,* Antonino Saccà,* Firas Abdollah,* Renzo Colombo,* Nazareno Suardi,* Alberto Briganti,* Giorgio Guazzoni,* Patrizio Rigatti* and Francesco Montorsi[‡]

From the Department of Urology, University Vita-Salute San Raffaele, Milan, Italy

Purpose: We assessed the opinions of patients with nongerm cell urological cancer on sperm banking before undergoing surgical or nonsurgical therapy that could potentially endanger subsequent fertility.

Materials and Methods: Between April 2007 and July 2008, 753 patients visited a urological office and were invited to complete a brief self-administered questionnaire to assess opinions on sperm banking before undergoing any eventual therapy potentially dangerous for male fertility. Logistic regression models tested the association between predictors (age, educational level, relationship status, previous fatherhood and benign disorder vs nongerm cell urological cancer) and patient wishes for sperm banking.

Results: Median patient age was 65 years (mean 61.6, range 18 to 76). Overall 522 patients (69.3%) had nongerm cell urological cancer and only 242 (32.1%) were in favor of pretreatment sperm banking. On univariate analysis age (OR 0.961, $p < 0.001$), a stable relationship (OR 0.486, $p < 0.001$) and previous fatherhood (OR 0.390, $p < 0.001$) were inversely associated with the wish for sperm banking, whereas having cancer and educational status were not significantly correlated. Multivariate analysis indicated that aging (OR 0.966, $p = 0.001$) and previous fatherhood (OR 0.587, $p = 0.029$) maintained inverse associations. Having urological cancer was positively (OR 1.494, $p = 0.045$) associated with the wish for sperm banking.

Conclusions: In urological patients there is a low rate of willingness to bank sperm before any potential fertility damaging therapeutic approach. Having nongerm cell urological cancer is an independent predictor that is positively associated with the wish to bank sperm. It is vitally important to provide comprehensive information about pretreatment sperm banking to young adults with nongerm cell urological cancer.

Key Words: semen preservation, cryopreservation, urogenital neoplasms, infertility

RATES of mild to severe infertility and permanent infertility in men with cancer after any type of treatment vary widely in the scientific literature, and depend on a number of factors.¹ The therapeutic approach in

men with newly diagnosed cancer highlights the importance of potential therapy infertility complaints after therapy. In this context ASCO has stated that because fertility preservation has become possible in men un-

Abbreviations and Acronyms

ASCO = American Society of Clinical Oncology

NGCUC = nongerm cell urological cancer

Submitted for publication December 30, 2008.
Study received ethics committee approval.

* Nothing to disclose.

[†] Correspondence: Department of Urology, University Vita-Salute San Raffaele, Via Olgettina 60, 20132 Milan, Italy (telephone: +39 02 2643 7286; FAX: +39 02 2643 7298; e-mail: salonia.andrea@hsr.it).

[‡] Financial interest and/or other relationship with Pfizer, Bayer, Eli Lilly, Pierre Fabre, AMS and GSK.

Editor's Note: This article is the fifth of 5 published in this issue for which category 1 CME credits can be earned. Instructions for obtaining credits are given with the questions on pages 1238 and 1239.

dergoing treatment for cancer, any fertility preservation approach should be considered as early as possible during treatment planning. Therefore, ASCO emphasized that any oncologist seeing men of reproductive age for consideration of cancer therapy should address potential treatment related infertility with them. However, few data have been published regarding fertility preservation not only in young, commonly defined men of reproductive age, but also in aging men with prostate, bladder or kidney cancer.^{2,3} This aspect is currently of great importance because men are more frequently experiencing fatherhood in late adulthood.^{2,4,5} Moreover widely available screening programs and public awareness about urological cancers (mainly prostate cancer) have resulted in a larger proportion of young men with a newly diagnosed neoplasm looking for an ablative treatment potentially associated with de novo male infertility.⁶

Available data suggest that physicians often do not discuss treatment related male infertility or fertility preservation and restoration as consequences of treatment.^{1,4,7} Likewise although intrauterine insemination and intracytoplasmic sperm injection with cryopreserved sperm resulted in deliveries,⁸ patients with prostate cancer, bladder cancer or kidney cancer—formally defined as nongerm cell urological cancers—are rarely advised to bank sperm preoperatively or before any therapeutic approach.^{1,4,7}

To the best of our knowledge no data have been published regarding the wish for preserving future fatherhood capacity in patients with NGCUC undergoing any potentially fertility damaging treatment. We assessed the opinions of men with NGCUC in terms of sperm banking before any surgical or nonsurgical therapy that could endanger fertility.

MATERIALS AND METHODS

Patient Population

The analyses were based on a cohort of 818 consecutive patients who underwent an evaluation at a single urological office in a major tertiary academic center for benign urological disorders or cancer between April 2007 and July 2008. Patients were invited to complete a brief self-administered questionnaire including demographic data (age, educational status, relationship status and previous fatherhood) and urological medical history (including the main reason for the urological consultation). The questions were specifically aimed at assessing the man's opinion of eventual sperm banking before any type of surgical or nonsurgical treatment potentially dangerous for his fertility.

Patients were stratified according to marital status (defined as stable relationship if the patient had had the same partner for at least the previous 12 or more consecutive months, and otherwise as no stable relationship or

widowhood). Similarly patients were segregated according to educational status into a low educational level group which included patients with an elementary or secondary school education, and a high educational level group which consisted of men with a high school or university degree. Patients were also subdivided according to urological medical history (benign vs malignant urological disorders).

According to the specific purpose of the study, 11 patients for whom a detailed history about previous fatherhood was lacking (1.3%), 8 with a nonurological cancer (2, 0.2%), those with germ cell testicular cancer (1.0%) or 44 who did not or refused to answer the specific question about the wish for sperm banking (Are you willing to eventually bank your sperm before any potentially fertility damaging surgical or nonsurgical therapy? 5.4%) were excluded from analysis. Literacy problems as well as other reading and writing problems were determined in all patients. Of the 818 consecutive patients who requested the urological office visit at our institution, the present analyses were based on 753 (92.1%) evaluable patients.

Main Outcome Measures

The primary end point of the present study was to assess the wish of patients with prostate, bladder or kidney cancer for future sperm banking before any surgical or nonsurgical therapy potentially dangerous for male fertility.

Statistical Analyses

Data are presented as medians, and means \pm SD. The statistical significance of differences in means and proportions were tested with the 2-tailed *t* and chi-square tests, respectively. Logistic regression models tested the association among predictors (age [continuously coded], educational status [low level vs high level], relationship status [stable vs not stable], previous fatherhood [yes vs no], and benign vs malignant urological disorder) and patient wish for sperm banking before any surgical or nonsurgical therapy potentially dangerous for male fertility. All statistical tests were performed using S-Plus® Professional, version 1. All tests were 2-sided with a significance level set at 0.05. Data collection was approved by our ethics committee and was conducted according to Health Insurance Portability and Accountability Act guidelines. All patients signed an informed consent agreeing to deliver their own anonymous information for future studies.

RESULTS

Table 1 details patient characteristics and descriptive statistics. Nongerm cell urological cancers were found in 522 patients (69.3%). Table 2 stratifies the characteristics of the whole cohort according to the wish for sperm banking. A positive opinion toward eventual sperm cryopreservation before potentially fertility damaging therapies was found in 32.1% of the men. Patients who would bank sperm were significantly younger than those who did not want to cryopreserve semen. Figure 1 depicts the relationship between age and the probability of wanting to bank sperm. Highly educated patients did not have a significantly greater desire to bank semen com-

Table 1. Patient characteristics and descriptive statistics

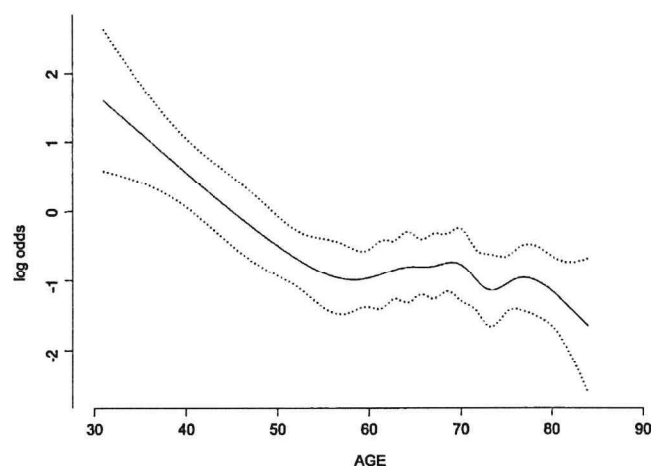
	No. (%)
Educational status:	
Low level	288 (38.2)
High level	465 (61.8)
Relationship status:	
Stable	629 (83.5)
Not stable	124 (16.5)
Previous fatherhood:	
Yes	643 (85.4)
No	110 (14.6)
Malignant urological disorders:	522 (69.3)
Bladder Ca	334 (64)
Kidney Ca	31 (5.9)
Prostate Ca	149 (28.5)
Penis Ca	1 (0.2)
Multiple NGCUCs*	7 (1.3)
Benign urological disorders:	231 (30.7)
Benign prostate hyperplasia	137 (59.3)
Genitourinary tract infections†	31 (13.3)
Bladder outlet obstruction‡	26 (11.3)
Stones	26 (11.3)
Other	11 (4.8)

* Bladder cancer with or without prostate or kidney cancer, vesicoureteral reflux, erectile dysfunction, penile trauma, etc.

† Prostatitis, bacterial cystitis etc.

‡ Urethral stenosis, bladder neck sclerosis and obstructive disorders other than benign prostatic hyperplasia.

pared to those with a lower educational status. Conversely a significantly lower proportion of men with stable marital status or previous fatherhood reported a positive wish for sperm banking. Patients with cancer showed a significantly greater wish for sperm banking compared to those with a benign urological disorder. In this context patients with cancer and those with a benign urological disorder were age comparable (mean [SD] age 64.5 [12] vs 63.0 [13.3] years, respectively, $p = 0.48$). In contrast

**Figure 1.** Relationship between age (x-axis) and probability of wishing to bank sperm (y-axis). Age is coded as cubic splines to allow nonlinear effect.

patients with cancer reported a significantly lower rate of previous fatherhood than those with a benign disorder (376 of 522 vs 197 of 231 patients, respectively, difference 13.3%, $p = 0.0001$, chi-square = 14.843).

Table 3 stratifies the whole cohort of men by decade of age according to the wish for sperm banking. The descriptive analysis for decade of age showed that a significantly higher rate of patients desired to bank sperm if they were younger than 60 years compared to older men (103 of 251 vs 139 of 502, chi-square = 12.97, $p = 0.0003$, 95% CI 6.06, 20.54). In this context figure 2 shows that 59 years old was the most informative cutoff for wishing to bank sperm.

Table 4 shows the results of univariate and multivariate analyses that tested the association be-

Table 2. Descriptive statistics of patients with positive or negative willingness to bank sperm before potentially male fertility damaging therapies

	+Banking	−Banking	p Value
No. pts (%)	242 (32.1)	511 (67.9)	
Age:			
Median	63	67	
Mean (SD)	59.9 (14.6)	66.0 (10.3)	<0.001 (2-tailed Student t test)
95% CI for mean	58.08, 61.67	65.12, 66.90	
No. educational status (%):			0.71 (chi-square test, 0.14)
Low level	95 (39.4)	193 (37.7)	
High level	146 (60.6)	319 (62.3)	
No. relationship status (%):			0.0004 (chi-square test, 12.63)
Stable	184 (76.3)	445 (86.9)	
Not stable	57 (23.7)	67 (13.1)	
No. previous fatherhood (%):			<0.0001 (chi-square test, 20.26)
Yes	185 (76.8)	458 (89.5)	
No	56 (23.2)	54 (10.5)	
No. main urological disorder (%):			<0.0001 (chi-square test, 25.28)
Malignant	198 (81.8)	324 (63.4)	
Benign	44 (18.2)	187 (30.9)	

Table 3. Age stratification of patients with positive or negative willingness to bank sperm before potentially male fertility damaging therapies

Age	No. Pts (%)	No. (%)	
		+Banking	−Banking
30 or Younger	25 (3.3)	14 (56.0)	11 (44.0)
31–40	35 (4.6)	25 (71.4)	10 (28.6)
41–50	56 (7.4)	25 (44.6)	31 (55.4)
51–60	135 (18.0)	39 (28.9)	96 (71.1)
61–70	310 (41.2)	89 (28.7)	221 (71.3)
71 or Older	195 (25.9)	50 (25.6)	145 (74.4)

tween predictors and the wish for sperm banking. According to univariate analyses being in a stable relationship and previous fatherhood status were inversely correlated with the wish for cryopreservation (all $p < 0.001$). In contrast having cancer vs a benign urological disorder and educational status were not significantly correlated with a positive attitude toward sperm banking. The multivariate analyses showed that age and previous fatherhood maintained an inverse association with the wish for sperm banking after accounting for educational and relationship status, previous fatherhood and malignancy of the urological disorder. After adjusting for all covariates having cancer was independently correlated with the wish for cryopreservation.

DISCUSSION

We tested whether having prostate cancer, bladder cancer or kidney cancer could be an independent predictor of the wish for sperm banking before any surgical or nonsurgical therapy potentially dangerous for male fertility. Current findings show that having NGCUC is independently associated with the wish for cryopreservation after adjusting for a number of covariates such as age, educational status, relationship status and previous fatherhood.

The need to assess whether men with NGCUC would actually wish to bank sperm first stemmed from recent observations suggesting that although the biological effects of cancer treatments on the reproductive system are relatively well described,^{9,10} the evidence available on the factors involved in impaired spermatogenesis and the subsequent effects on fertility mostly emphasized only testicular cancer.¹¹ Conversely few data are available on the relative incidence of infertility and fertility preservation in men of reproductive age who survive NGCUC.^{2,3,7}

In this context at least in Western countries a trend has been observed toward delayed fatherhood.^{12,13} Although cancer is a disease associated with aging, widely available screening programs and public awareness about urological cancers (mainly

prostate cancer) have resulted in a larger proportion of relatively young men with a newly diagnosed neoplasm looking for an ablative treatment and eventually fatherhood after the cancer treatment.^{14,15} Epidemiological evidence suggests that prostate cancer alone will account for approximately 25% of cancer diagnosed in 2008 in the United States. Interestingly case estimation supports the idea that 91% of these new cases of prostate cancer are expected to be diagnosed at local or regional stages, for which 5-year relative survival approaches 100%.¹⁶ However, data are not univocal for all the NGCUCs because recent findings show that adequately treated prostate cancer, urinary bladder cancer and kidney cancer each contributed singularly to a decrease in the total yearly cancer death rate with independent contributions of 24.1%, 0.7% and 0.6% for the 3 malignant disorders, respectively.^{16–18} Therefore, as the population age increases worldwide the number of young adult cancer survivors will dramatically increase along with their wish for fatherhood. According to ASCO recommendations fertility preservation approaches should be considered as early as possible during cancer treatment planning even in patients with NGCUC.¹

Sperm banking is a simple and practical approach that is widely available to all patients with cancer who wish to preserve their fertility potential before cancer therapy. However, epidemiological reviews suggest that sperm cryostorage for fertility preservation in men with cancer is overall underused.¹⁹ To the best of our knowledge no study has previously highlighted the importance of suggesting sperm banking to potentially preserve posttreatment fertility in men with solely urological cancer other than in adolescents or young adults with testicular cancer.²⁰

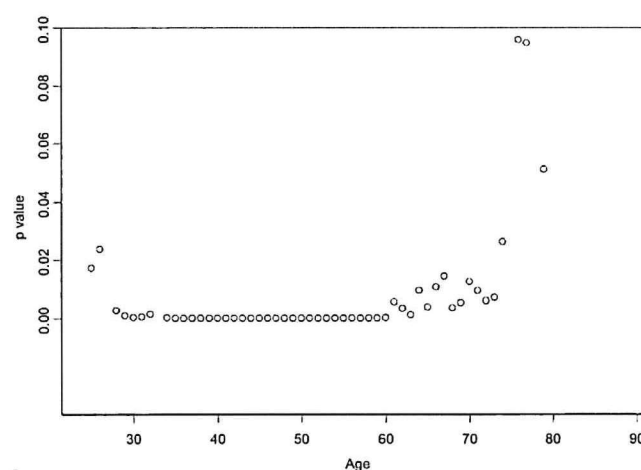


Figure 2. Relationship between age (x-axis) and probability of wishing to bank sperm (y-axis), showing most informative age cutoff (detail).

Table 4. Logistic regression analyses predicting the wish for sperm banking

	Univariate Analysis OR	p Value (95% CI)	Multivariate Analysis OR	p Value (95% CI)
Age	0.961	<0.001 (0.95–0.97)	0.966	0.001 (0.95–0.98)
Educational status	0.930	0.650 (0.68–1.27)	1.37	0.50 (0.56–1.09)
Relationship status	0.486	<0.001 (0.33–0.72)	0.777	0.135 (0.45–1.11)
Previous fatherhood	0.390	<0.001 (0.26–0.59)	0.587	0.029 (0.36–0.95)
Ca vs benign disorders	1.027	0.875 (0.74–1.43)	1.494	0.045 (1.01–2.21)

Approximately 32% of the whole cohort of patients self-expressed a written positive feeling toward eventual sperm cryopreservation before potentially fertility damaging therapies. Present findings confirm previously reported data about different types of cancers.²¹ Although sperm cryopreservation before therapy is now available for patients with cancer, only a few men spontaneously bank their sperm.^{20,21}

In addition, minimal use of cryopreserved specimens for reproductive purposes has been described.^{19,20} Because our analysis mirrors the opinion of a sufficiently large cohort of patients (92.1% of the self-compilers provided complete data) compared with previous studies in this field, the present findings provide numerous points with interesting links to different aspects of the issue.²² The apparently low rate of positive responders might actually represent the common response of the whole urological population toward the possibility of actually having late fatherhood after cancer. However, our data also show that among the patients with cancer 37.9% reported a positive opinion compared with only 19% of those with a benign urological disorder ($p < 0.0001$, chi-square = 25.38). This confirms previous data in patients with testicular cancers. Magelssen et al reported that when offered approximately 50% of the young and middle-aged patients newly diagnosed with testicular cancer were interested in pretreatment sperm banking.²⁰ In addition, the literature indicates that lack of adequate knowledge about sperm banking, the perceived high cost and lack of convenient facilities may create negative attitudes toward sperm cryostorage.²³ This is certainly true for patients but, surprisingly, it is even more real for oncologists who tend to overestimate the costs of sperm banking and the number of samples needed to make cryopreservation worthwhile.

Current data show that patients who desired to bank sperm were significantly younger than those who did not want to cryopreserve semen. This finding was expected and easily understandable since the younger the patient, the greater the possibility of a longer disease-free posttreatment survival and of a delayed desire to father children after cancer therapy. In their survey of cancer survivors who were diagnosed before age 35 years, Schover et al showed that the youngest survivors have generally not yet attempted to father children but were actu-

ally concerned about their future fertility, anticipating that problems may occur.²⁴ Moreover these authors also reported that the majority of younger cancer survivors see their cancer experience as potentially making them even better parents. Similarly Saito et al reported that sperm cryopreservation encouraged young patients with cancer during and after cancer treatment.²¹ Of these patients 80% replied that sperm cryopreservation eventually helped them in the battle against cancer, although sperm banking did not eliminate the real fear of infertility.^{21,24} In this context Pacey reported that simply knowing that a patient's own sperm is somewhere safe, regardless of what decisions he could or could not make about fathering, acts as a psychological benefit to the man with cancer.²⁵ However, many men have still been left with significant anxieties and insufficient information about reproductive issues.²⁴ As debated our results are of major interest because urological cancers, at least prostate cancer, have an impact on a prospectively larger proportion of relatively young men looking for an ablative treatment, a sufficiently long disease-free lifetime and, eventually, fatherhood.^{16–18}

We found that highly educated patients did not have a significantly greater wish for sperm banking compared to those with a lower educational status. Although it is difficult to interpret the combination of educational status and patient attitudes toward medical problems and overall quality of life, we believe that such a result might partially explain the low rate of the whole positive willingness toward sperm banking. Indeed despite the fact that sperm cryopreservation is actually widely available before any cancer treatment, public and physician awareness of such a procedure is overall still insufficient. This lack of awareness becomes even more important for patients with NGCUC who are not traditionally considered for potential delayed fatherhood and, thus, pretreatment sperm banking. Of course, the present findings and current debate cannot be easily generalized across cultures or countries. For a more complete picture of factors related to educational status the current analysis also could have included patient monthly income, socioeconomic well-being and standard of living. Because educational status is not necessarily related to monthly income, it would be interesting to examine the potential

correlation between the 2 to address the wish to father children after cancer therapy by pretreatment sperm banking. However, we decided not to request income information due to the low response rate to income questions that we usually obtain in real-life clinical practice during standard office visits.

Finally as expected a low rate of men with a stable marital status or previous fatherhood reported a negative wish for sperm banking. This finding is coupled with previous data that showed that pretreatment fatherhood and marital status were statistically significant independent predictors for posttreatment fatherhood.^{11,22} In this context Schover et al reported the results of a postal survey about cancer related infertility and sperm banking in men diagnosed with cancer in the previous 2 years.²² Although the return rate was only 27%, overall 51% of men wanted children in the future including 77% of men who were childless at the cancer diagnosis.²²

Our current analysis is not devoid of limitations. A potential limitation of our study may be the lack of a tool dedicated to the assessment of psychological distress, because this psychological parameter is potentially directly causal in the overall low positive response rate toward sperm banking. Indeed despite significant increases in treatment effectiveness the diagnosis and treatment of any cancer remain one of the most emotionally distressing events in medical care. Zabora et al reported that in the United States patients with breast cancer had the highest levels of distress, depression and anxiety followed by patients with colorectal and prostate cancer, respectively.²⁶ Schover et al reported some anxieties about their own survival and risks for their children's health in their cohort of men newly diagnosed with cancer.²² Similarly in a previous study Schover et al found that 19% of subjects have significant anxiety

that their cancer treatment could have a negative impact on their children's future health.²⁴

Another potential limitation is the complete lack of any ethical and legal questions. Interestingly Robertson highlighted that although sperm is easily stored, when gametic material is stored for later use, written directives for posthumous use may be given and subsequently born children may be recognized as legal offspring of the deceased.²⁷ The author also concluded that concerns about the welfare of offspring resulting from an expected shortened life span of the parent are not sufficient reason to deny cancer survivors assistance in reproducing. These factors are important and prompt us to develop a program to help patients with NGCUC in approaching fertility preserving programs more extensively as well as enable physicians to more easily assist their patients with urological cancer.

CONCLUSIONS

Approximately 32% of interviewed urological patients are willing to bank sperm before any therapy potentially dangerous for future fertility. Having cancer is an independent predictor positively associated with the wish for sperm cryopreservation. Because the number of newly diagnosed patients with prostate, bladder or kidney cancer is dramatically increasing, coupled with the possible wish for eventual fatherhood, the current findings should prompt physicians to make their patients with NGCUC aware of the potential damage to fertility related to most surgical or nonsurgical procedures, and provide comprehensive information about fertility preservation approaches as early as possible during cancer treatment planning for patients with NGCUC before delivering a potential fertility endangering therapy.

REFERENCES

1. Lee SJ, Schover LR, Partridge AH et al: American Society of Clinical Oncology recommendations on fertility preservation in cancer patients. *J Clin Oncol* 2006; **24**: 2917.
2. Schover LR: Sexuality and fertility in urologic cancer patients. *Cancer* 1987; **60**: 553.
3. Knoester PA, Leonard M, Wood DP et al: Fertility issues for men with newly diagnosed prostate cancer. *Urology* 2007; **69**: 123.
4. Boyd BG, McCallum SW, Lewis RW et al: Assessment of patient concern and adequacy of informed consent regarding infertility resulting from prostate cancer treatment. *Urology* 2006; **68**: 840.
5. Leridon H and Slama R: The impact of a decline in fecundity and of pregnancy postponement on final number of children and demand for assisted reproduction technology. *Hum Reprod* 2008; **23**: 1312.
6. Coleman MP, Quaresma M, Berrino F et al: Cancer survival in five continents: a worldwide population-based study (CONCORD). *Lancet Oncol* 2008; **9**: 730.
7. Steinsvik EA, Fosså SD, Lilleby W et al: Fertility issues in patients with prostate cancer. *BJU Int* 2008; **102**: 793.
8. Crha I, Ventruba P, Zakova J et al: Survival and infertility treatment in male cancer patients after sperm banking. *Fertil Steril* 2009; **91**: 2344.
9. Agarwal A and Allamaneni SS: Disruption of spermatogenesis by the cancer disease process. *J Natl Cancer Inst Monogr* 2005; **34**: 9.
10. Brydøy M, Fosså SD, Dahl O et al: Gonadal dysfunction and fertility problems in cancer survivors. *Acta Oncol* 2007; **46**: 480.
11. Brydøy M, Fosså SD, Klepp O et al: Paternity following treatment for testicular cancer. *J Natl Cancer Inst* 2005; **97**: 1580.
12. Tarín JJ, Brines J and Cano A: Long-term effects of delayed parenthood. *Hum Reprod* 1998; **13**: 2371.
13. Schover LR: Motivation for parenthood after cancer: a review. *J Natl Cancer Inst Monogr* 2005; **34**: 2.

14. Galper SL, Chen MH, Catalona WJ et al: Evidence to support a continued stage migration and decrease in prostate cancer specific mortality. *J Urol* 2006; **175**: 907.
15. Adolfsson J, Garmo H, Varenhorst E et al: Clinical characteristics and primary treatment of prostate cancer in Sweden between 1996 and 2005. *Scand J Urol Nephrol* 2007; **41**: 456.
16. Jemal A, Siegel R, Ward E et al: Cancer statistics, 2008. *CA Cancer J Clin* 2008; **58**: 71.
17. Araki M, Nieder AM, Manoharan M et al: Lack of progress in early diagnosis of bladder cancer. *Urology* 2007; **69**: 270.
18. Russo P, Jang TL, Pettus JA et al: Survival rates after resection for localized kidney cancer: 1989 to 2004. *Cancer* 2008; **113**: 84.
19. Chung K, Irani J, Knee G et al: Sperm cryopreservation for male patients with cancer: an epidemiological analysis at the University of Pennsylvania. *Eur J Obstet Gynecol Reprod Biol* 2004; **113**: S7.
20. Magelssen H, Haugen TB, von Düring V et al: Twenty years experience with semen cryopreservation in testicular cancer patients: who needs it? *Eur Urol* 2005; **48**: 779.
21. Saito K, Suzuki K, Iwasaki A et al: Sperm cryopreservation before cancer chemotherapy helps in the emotional battle against cancer. *Cancer* 2005; **104**: 521.
22. Schover LR, Brey K, Lichtin A et al: Knowledge and experience regarding cancer, infertility, and sperm banking in younger male survivors. *J Clin Oncol* 2002; **20**: 1880.
23. Schover LR, Brey K, Lichtin A et al: Oncologists' attitudes and practices regarding banking sperm before cancer treatment. *J Clin Oncol* 2002; **20**: 1890.
24. Schover LR, Rybicki LA, Martin BA et al: Having children after cancer. A pilot survey of survivors' attitudes and experiences. *Cancer* 1999; **86**: 697.
25. Pacey A: Personal views: sperm you can bank on. *BMJ* 2003; **327**: 1354.
26. Zabora J, BrintzenhofeSzoc K, Curbow B et al: The prevalence of psychological distress by cancer site. *Psychooncology* 2001; **10**: 19.
27. Robertson JA: Cancer and fertility: ethical and legal challenges. *J Natl Cancer Inst Monogr* 2005; **34**: 104.