more sensitive to identify an association of PTSS with family functioning.

Preliminary analyses found the moderate correlation of PTSS between mother and father. While speculative, this indicates that mothers and fathers share a similar perception about their child's state of disease. Interestingly, these findings contradict those reported in another paper by Kazak et al. [14] in which they report very low levels of concordance of PTSD within a family. Cultural difference might contribute to these contradictions. Our finding of a correlation between mothers and survivors indicates that survivors' PTSS are resonant with mothers but not fathers. It is not clear why a correlation was not found between survivors and fathers. One possible speculation is that most of the adolescent survivors spend much time attending school, participating in extracurricular activities, or in peer relationships. They may not spend much time with their fathers, who, in Japan, come home late in the evening because of work. These situations decrease communication with fathers more than with mothers.

The time elapsed after the first diagnosis of cancer was found to be a significant factor for mothers' PTSS. It is commonly reported that trauma-induced psychological symptoms decrease with time. Kessler et al. [15] reported in a general population study that about two-thirds of people with an episode of PTSD recovered over time, even without treatment. The results of our study are consistent with the finding of Phipps et al. [22] that parents of recently diagnosed patients showed higher levels of PTSS than parents of long-term survivors. Kazak et al. [13] reported similar findings that a mother's posttraumatic stress was indirectly related to the interval since the final treatment, as determined by the mother's appraisal of the degree of threat to the life of the child.

As regards the fathers of survivors, Kazak et al. [12] reported that the number of months off treatment was negatively related to variables of posttraumatic stress. However, it is not necessarily the case that a time lapse reduces PTSS. The present study did not establish the associations of time lapse with severe PTSS in survivors and their fathers. One possible reason for this discrepancy is that because our sample was families of long-term survivors with a mean follow up period 10.8 years (range 5–19), they might be affected by medical sequelae or other concurrent stressors rather than the past intensive cancer treatment. This pattern may be more appropriate for a diagnosis of adjustment disorder than PTSD, although several participants showed a clinical level of PTSD.

Our study also revealed that trait anxiety was an associated factor for PTSS for survivors and parents. It must be noted that caution is warranted in interpreting anxiety as a predictor for PTSS, as trait anxiety is well-known to coexist with PTSD-like symptoms. Moreover, it is important to distinguish symptoms of anxiety from PTSS because they are conceptually overlapping but not identical. PTSS is attributed to reexperiencing and avoidant behavior based on the traumatic memories and is closely related to the general level of anxiety. Thus, clinicians should carefully rule out a primary anxiety disorder from the anxiety related to PTSS.

The existence of medical sequelae was a significant factor related to severe PTSS in survivors. Some of these survivors may have experienced physical symptoms at the time of the study and continued limitations of activities in daily life. Thus, it would not be surprising if they reported experiencing increased anxiety or if they perceived their life as currently threatened. This pattern is consistent with the findings from Langeveld et al. [16] that severe sequelae or health problems were associated with posttraumatic stress. However, these findings are not in accord with reports by Hobbie et al. [9], who did not find any association between medical sequelae and PTSS. Specifically, Hobbie et al. [9] reported that subjective factors related to cancer and its treatment (e.g., beliefs regarding a life threat and/or perceived treatment intensity) are more important than the objective medical data about cancer. While speculative, the reason for this discrepancy may be that the study of Hobbie et al. [9] contains a relatively larger proportion of survivors (about 65%) who had moderate to severe medical sequelae, while only 36% of the survivors in our study had medical sequelae, so it was more difficult to identify the relationship between PTSD and medical sequelae.

## Limitations

The current study has several limitations. First, only 62% (89 of 144 families) of the subjects could be included in the analysis, and the prevalence of severe PTSS in survivors was relatively lower than that of parents, so the current study may not have had optimal statistical power. As the present results suggest that only 10.9% of survivors showed severe PTSS, researchers would have to investigate twice as many families to get more valid results.

Second, the result relies on self-reported questionnaires only, which do not allow a proper diagnosis of clinically relevant disorder. Further study is needed to determine the true prevalence of current PTSD compared to "severe PTSS".

Third, the design of the study was cross-sectional, and this investigation lacked a matched control group, so no conclusions regarding causality can be drawn. It needs further consideration that family functioning from the mother's viewpoint is affected by the phase of adolescence, with ensuring conflicts, role changes, and developmental tasks. Comparison to families with healthy adolescents probably would yield further information.

Fourth, as this study was conducted at three sites, and the disease distribution differed among these sites, an institutional bias may have influenced the results.

Finally, the assessments of the treatment intensity and medical sequelae were conducted by an ad hoc method, and the validity and reliability of these measures was not well established, and they may have resulted in classification errors. Replication of the present study with a large, longitudinally followed sample and more optimal assessment tools is needed to provide a better description of factors related to PTSS in childhood cancer survivors and their families.

## Clinical implications

The present data give rise to several important clinical implications for families with childhood cancer survivors. Even when the treatment was successful, some survivors cannot avoid suffering from medical sequelae, so long-term follow up of physical and psychological functioning after treatment is clearly desirable. The Children's Oncology Group website [5] provides detailed guidelines and information about specific later-onset effects for long-term survivors. Moreover, as the risk factors for severe PTSS vary for each family member, health care professionals in pediatric oncology units should assess each member of families and provide suitable treatment. The regular use of "family conferencing" would enable clinicians to bring the dynamics of the family system into relief and focus on the specific individual issues as well. It is important to specify the family functions, to ascertain whether the family has allocated the responsibilities for these functions appropriately, and whether there are suitable mechanisms built in for accountability.

Parents also may benefit from education about their child's and their own symptoms and how to manage them effectively. At the same time, clinicians should assess and treat the general level of anxiety of each family member. Cognitive-behavioral approach and educational information may provide structure and support when anxiety and avoidance discourage exploration. If the situation becomes complicated, referral to a social worker, psychologist, or consultation-liaison psychiatrist would be a good option. Further research is needed to develop intervention programs that are effective in improving family functioning, and that may reduce PTSS in families with childhood cancer survivors.

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