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Post-disaster Healthcare Needs in the Mothers and Fathers of Survivors - a Registry-Based Study of Healthcare Consumption before and after the Utøya Terrorist Attack

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FULL TITLE

Post-disaster Healthcare Needs in the Mothers and Fathers of Survivors - a Registry-Based Study of Healthcare Consumption before and after the Utøya Terrorist Attack

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ABSTRACT

Objectives: To assess changes in parents' short and long term primary and specialized healthcare consumption following a terrorist attack that threatened the lives of their children.

Design: Registry-based study of parent healthcare service consumption, three years before and three years after a terrorist attack.

Setting: The aftermath of the Utøya terrorist attack. The regular, publicly-funded, universal healthcare system in Norway.

Intervention: Parents learning of terrorist attack on their adolescent children on the Utøya summer camp.

Participants: Mothers (n=226) and fathers (n=141) of a total of 263 survivors of the terrorist attack (54.6% of the n=482 survivors 13-33 years).

Main outcome measures: Rates of primary and specialized somatic and mental healthcare service consumption in the early (0 to 6 months) and delayed (6 to 36 months) aftermath of the attack, predicted from negative binominal hurdle regressions. Pre- and post-disaster rates were compared (rate ratio, RR) and 95% confidence intervals (CI) were generated through bootstrap replications. Analyses were performed separately in mothers and fathers, adjusted for age of participant and offset for the time of non-hospitalization.

Results: Rates of primary healthcare service consumption were found to increase significantly in both mothers and fathers in the early aftermath of the attack (mothers RR=1.97, 95% CI 1.76 to 2.23; fathers RR=1.73, 95% CI 1.36 to 2.29). Both rates remained significantly elevated throughout the delayed aftermath. In specialized mental healthcare, significant increase in service consumption was observed (early and delayed) in mothers only (early RR=7.00, 95% CI 3.86 to 19.02; delayed RR=3.20, 95% CI 1.49 to 9.49). In somatic healthcare, no significant change in was found.

Conclusion: Following disasters, healthcare providers must prepare for increased healthcare needs not only in survivors, but also their close family members, such as parents. Needs may present shortly after the disaster and require long term follow-up.

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"STRENGTH AND LIMITATIONS" BOX

- Objective measure on healthcare consumption pre- and post-disaster in a universal, public, accessible and well-developed healthcare system.
- High numbers of both mother and father participants. Nonetheless, the full size of the parent population remains unknown.
- Only services provided by healthcare professionals were included. Psychosocial support by other professionals was not included.

KEYWORDS

Disaster

Terrorism

Indirect exposure

PTSD, Anxiety and Depression

Parents

Health services

Primary Healthcare

Specialized Healthcare

Mental Healthcare

Hurdle regression analyses

Geolocation information: Utøya (60°01'25.0"N 10°14'50.0"E)

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"WHAT THIS PAPER ADDS" BOX

Evidence before this study

Life threat to a child may severely traumatize its parents. In recent years, a number of terrorist attacks have particularly targeted children, adolescents and young adults when away from their mothers and fathers. Little is known about the long-term health impacts on parents, let alone the long-term healthcare needs that may ensue. We searched PubMed for all indexed publications with the following terms: ("PTSD" OR "traumatization" OR "mental health") AND ("terrorism" OR "disaster") AND ("parents" OR "caregivers"). Final search: May-12-2017, 136 studies identified. A majority of the studies assessed the shared trauma of parent and child or the impact of parental traumas on offspring. Three studies specifically addressed the impact on parents of indirect exposure to a disaster or a terrorist attack affecting offspring, of which two were our previous studies of the Utøya parent population.

Added value of this study

Evidence on post-disaster healthcare needs is essential in preparing appropriate post-disaster healthcare responses. Employing an objective measure, this study makes a detailed assessment of primary and specialized healthcare consumption in parents following a terrorist attack on offspring. The study compares rates of healthcare service consumption and numbers of individuals provided for before and after the attack.

Implications of all the available evidence

Experiencing life threat to offspring may induce high levels of post-disaster distress in parents. Healthcare needs in parents may present immediately following a disaster and require long-term commitment from both primary and specialized healthcare providers. Primary healthcare may play a particularly important role in supporting parents in crisis.

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INTRODUCTION

Life threat to a child may jeopardize long-term health in its parents. DSM-5 (1) currently recognizes that learning of a close family member being threatened with death or serious injury as potentially severely traumatizing. In recent years, numerous terrorist attacks particularly targeting children, adolescents and young adults when away from their parents, at school or during their leisure time (e.g. summer camp, night club, café, concert hall (2-7)). Concerns have been raised about post-disaster health of survivors. Parental reactions, coping and needs post-disaster have received little attention.

Impact of threat to a child on parental health has previously been addressed in studies of seriously ill children. Elevated levels of parents' anxiety, depression and post-traumatic stress reactions have been reported following acute diseases (8, 9) and chronic conditions (10, 11) and traffic accidents of child (12, 13). Similarly, in parents of sexually abused children (14, 15) and in parents of young soldiers deployed to hostile environments (16, 17), high levels of emotional distress may persist for years. Although several population-based studies have previously addressed individuals physically distant from the site of a terrorist attack (18-23), only one study has specifically addressed parents who experienced a terrorist attack on their offspring from afar (2). This small very study (n=20 mothers) reported parental distress at levels comparable to the young survivors themselves.

Post-disaster, healthcare resources may be scarce. Thus, healthcare services need to prepare for meeting the demand: How many individuals will turn to the healthcare services post-disaster, and at what time? What services will be needed, and for how long? Insight into long term healthcare needs in survivors is currently emerging (24-26), but, to date, evidence on parental needs is lacking.

In our previous studies of Utøya, we have reported substantial levels of lasting emotional distress in the parent of the survivors (27, 28). In the present study, we assess parental healthcare consumption in the three years before and three years after the terrorist attack. Norway has

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complete population registries on primary and specialized healthcare service utilization from which data was collected.

The first aim of this study was to map out parental pre- and post-disaster healthcare service consumption. Two questions were posed: did rates of primary and specialized healthcare service consumption increase post-disaster compared to pre-disaster levels? And, did the proportion of parents provided for by each of the services increase post-disaster compared to pre-disaster levels? Assuming time-dependent variation in healthcare consumption, we chose to assess the early aftermath (first six months) and the delayed aftermath (six months to three years) separately. The second aim of this study was to assess the reasons for the parents accessing primary healthcare, the entry-point to the healthcare services in Norway, in the aftermath of the terrorist attack, as recorded by their medical practitioners.

METHOD

Setting

The setting of this study is the aftermath of the Utøya terrorist attack.

Trauma: On July-22-2011, two terrorist attacks shook Norway. A single perpetrator detonated a bomb in the governmental quarter in Oslo, before setting out on a shooting spree at the youth summer camp on Utøya Island less than two hours later. The youth were trapped on the small island with the perpetrator for more than one hour. The attack left 69 dead and 495 alive, of whom 35 had sustained severe physical injuries (29). As the attack unfolded, the parents, all physically distant from the island, watched events unfold via live media reports and some had access to intermittent telecommunication with their offspring on the island. Following the attack, the survivors were reunited with their families throughout the country.

Post-trauma care: Following the terrorist attack, multi-disciplinary crisis teams established in affected municipalities (n=128), providing immediate psycho-social support to those in need. Moreover, dedicated contact persons proactively monitored and supported a majority of the families,

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throughout the first year post-disaster, and facilitated access to the regular healthcare services as required (27, 30). Post-disaster healthcare services were provided by the regular two-leveled healthcare system in Norway (31). Level one is the primary healthcare services of general practitioners (GPs), including emergency primary healthcare. Primary healthcare is the largest provider of both somatic and mental healthcare services and act as the entry-point and gatekeeper to secondary healthcare. Level two, the secondary healthcare services, provide specialized mental and somatic care. Specialized healthcare services are accessed through medical referrals only. Regular healthcare services are available 24/7, accessible throughout the country and publicly funded.

Design

This is a longitudinal, prospective study, assessing registry-based data on parental healthcare consumption in the periods three years before and after the terrorist attack (2008-July-22 to 2014-July-21).

Procedure

Parental recruitment and participation in the earlier waves of the larger Utøya study have previously been accounted for (27, 32). The third wave of the study, on which this paper reports, had a closed cohort design, meaning that only participants who had participated in either of the previous waves were invited (n=532). Invitations were distributed by mail and included information on how to opt out. By mid-July-2014, three years after the attack, 95% of participants had consented to participation in writing. The Regional Committees for Medical and Health Research Ethics in Norway approved the study.

Sample

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Participants in this study were the parents of young survivors of the Utøya terrorist attack (n=482). The full parental cohort, participants of either of the previous two waves, has previously been accounted for (27, 32). Participants in the third wave, on which this paper reports, included a total of 226 mothers and 141 fathers (251 distinct families) of 263 survivors aged 13 to 33 years (54.6%). Mean ages, at the time of the attack, of mothers and fathers were 46.7 (SD 5.8) and 49.7 (SD 5.9) years, respectively. A majority of the parents were of Norwegian origin (n=335, 92.0%, missing n=3), held a university or a university college degree (n=225, 61.3%), had an average or above average financial situation (n=297, 80.9%), and were, at the time of data collection, mostly employed (n=314, 86.3%, missing n=3). Attrition from previous waves (n=165, 31.0%) favored male gender (OR 2.02, χ^2p<0.001). Neither non-Norwegian origin (OR-mothers=1.00, χ^2p=0.996, OR-fathers=1.15, χ^2p=0.805) nor levels of early post-traumatic stress reactions (mean-mothers 1.34 vs 1.34, t-test p=0.967, mean-fathers 0.80 vs 0.88, t-test p=0.358) were associated with non-participation at wave three. Most participants consented to collection of registry-based data (mothers n=222, 98.5% and fathers n=136, 96.5%).

Measures

Primary healthcare consumption was assessed through the Health Economics Administration (HELFO) database by analyzing the reimbursement claims filed by primary healthcare providers, GPs, to the national insurance scheme. All records dating from 2008-July-22 to 2014-July-21 were included, regardless of whether they referred to services provided at a GP clinic, through house calls, by telephone or mail, provided by regular GPs or locum GPs, within regular office hours or when on-call. A total of 13,419 records were identified, of which 42 (0.3%) were duplicates (matching date, time, diagnosis, provider and mode of contact). The non-duplicates (n=13,377) were subdivided according to the type and time of service (Supplementary table 1). Reason for encountering was recorded according to International Classification of Primary Care (ICPC-2) (33) and clustered according to type of health problem (34).

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Specialized healthcare consumption was assessed through the Norwegian Patient Registry (NPR) - activity reported by hospitals and hospital clinics - and the Health Economics Administration Database (HELFO) - reimbursement claims filed to the National Insurance Scheme by private specialized healthcare providers. All services recorded by physicians and psychologists dating from 2008-July-22 to 2014-July-21 were included, irrespective of whether the service was provided in a public hospital, a private clinic, by telephone or mail and within regular office hours or not. A total of 6,024 specialized healthcare services were identified (HELFO database n=1,872, NPR n=4,152 services), of which 193 (3.2%) were duplicates (matching date, diagnosis, healthcare provider and nature of service). The services were subdivided into mental healthcare (n=2,079) and somatic healthcare (n=3,752) and further into type and time of service (Supplementary table 1).

Quality of data. Claims to the national insurance scheme are submitted electronically. All incomplete claims are automatically rejected and returned to healthcare provider for resubmission. Thus, the HELFO database contains no missing data. In contrast, NPR does not reject incomplete information, and consequently contains a small number of incomplete entries (Supplementary table 2).

Statistics

Healthcare service consumption was analyzed through negative binominal hurdle regression models (35). Mothers and fathers were analyzed separately. All regression models were adjusted for age of participant and offset for duration of observational period. As hospital admissions exclude acquisition of further healthcare services, observational periods were defined as days of non-hospitalization. Predictions of frequency of healthcare consumption were made for each period of interest, i.e. pre-disaster, and early- and delayed aftermath. Index parent for the predictions was defined as mother or father of 47 years of age at time of attack. Annualized rates were estimated by dividing predicted frequency of service consumption by duration of the time period assessed (early aftermath=6months, delayed aftermath=30months). Predictions of pre- and post-disaster healthcare

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consumption were then compared by rate ratios (RR). Bias-corrected and accelerated 95% confidence intervals (CI) of RR were generated through bootstraps of 10,000 bootstrap replications.

Secondly, proportion of mothers and fathers acquiring one or more services in each six months period was assessed by averaging observed semiannual values before the attack and in the early and delayed aftermath. Pre- and post-disaster estimates were compared by ratios. Bias-corrected and accelerated 95% confidence intervals for the ratios were generated through bootstraps of 10,000 bootstrap replications.

All analyses were made on the full dataset, which included all services provided by the primary and specialized healthcare service providers. However, as supplementary material, the analyses were repeated on a dataset including only *in person* consultations with the healthcare provider (i.e. excluding telephone consultations, mail correspondence etc.).

Improved quality of the NPR registry during the pre-disaster period was observed. Thus, sensitivity analyses were performed, repeating all analyses that included pre-disaster NPR data with values of the final year pre-disaster only.

Analyses were performed with R-version-3.0.3 (R Foundation for Statistical Computing), with the R-packages *pscl* for hurdle regressions and boot for bootstrap analyses. Violin plots were generated through an adaptation of the *vioplot* package.

RESULTS

The primary aim of this study was to create a detailed description of pre- and post-disaster patterns of parental healthcare consumption. Thus, we began by mapping out the frequency distributions by which each parent accessed healthcare services in the periods three years before and after the attack (Figure 1a-b). In primary healthcare (red violins), nearly all parents had accessed services on one or more occasion both pre- and post-disaster. In the aftermath of the attack, there was an increase in the median number of services used by each patient. In specialized healthcare, the number of

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individuals utilizing mental healthcare (blue violins) increased, while somatic healthcare (green violins) remained largely unchanged.

Next, we addressed the development of healthcare consumption over time (Figure 2a-b). Upper halves of figures (line charts) report the annual rates at which healthcare services were provided to the parents before and after the attack. Bottom halves of figures (pie charts) report the numbers and proportion of parents provided for within each six months period. Notably, in the early aftermath of the attack, both primary and specialized mental healthcare services experienced immediate increase in demand. In the delayed aftermath, healthcare acquisition largely appeared to level out. Specifically, no second waves were observed. Model predictions of post- versus pre-disaster healthcare consumption are summarized in Figure 3a-b. Addressing predicted rates of *service*s *utilized* (a), we found a significant increase in primary healthcare in both mothers and fathers, both in the early and in the delayed aftermath. Additionally, significantly elevated consumption rates, both early and delayed, were found in specialized mental healthcare consumption in mothers. In fathers, service consumption could not be reliably bootstrapped, due to insufficient number of occurrences. No significant changes were found in specialized somatic healthcare. Addressing predicted proportions of *individuals utilizing the services* (b), we found a significant increase in proportions of both mothers and fathers utilizing primary healthcare services in the early and the delayed aftermath. In the specialized mental healthcare services, similarly, there were significantly increased levels of both mothers and fathers utilizing services in the early aftermath. In the delayed aftermath, the level of mothers, but not fathers, remained significantly increased. No significant changes were found in specialized somatic healthcare. Sensitivity analyses, substituting average three-year pre-disaster figures with data from the final year pre-disaster only, did not affect any conclusions substantially.

Finally, we assessed the reasons for parents encountering the healthcare services in the aftermath of the attack, as recorded by the primary healthcare providers at the time of the services' provision (Figure 4). Notably, psychological health complaints dominated reasons for encountering in

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both genders. In fact, 78.4% of mothers (n=174) and 47.1% of fathers (n=64) consulted their GP about psychological complaints (ICPC-2, chapter "P") in the aftermath of the attack. More than one third were diagnosed with depression (mothers n=42, 19.0%; fathers n=15, 11.0%), or PTSD (mothers n=14, 6.3%; fathers n=10, 7.4%) or both (mothers n=9, 4.1%; fathers n=4, 2.9%). Individuals with psychological health complaints were largely managed by primary healthcare, without receiving specialized services (mothers n=106, 60.9%; fathers n=47, 73.4%).

DISCUSSION

The aim of this study was to make a detailed description of pre- and post-disaster healthcare consumption in parents of the Utøya terrorist attack survivors. In the previous, we have demonstrated a significant post-disaster increase in both primary and specialized mental healthcare.

Primary healthcare, being the principal provider of healthcare services to parents both pre- and post-disaster, increased promptly following the terrorist attack and peaked within the first six months period. Largely attributable to psychological health complaints, the increase in healthcare consumption echoed elevated levels of early distress previously demonstrated (27). Post-disaster increase in healthcare consumption was most notable in female participants, possibly reflecting gender differences in post-disaster stress reactions (36, 37). Potential barriers to accessing post-disaster healthcare in men need to be addressed in future research.

An increase in proportion of parents acquiring specialized mental healthcare services post-disaster was found. We have previously demonstrated that parental specialized healthcare consumption after the Utøya terrorist attack was associated with post-traumatic stress reactions (27). Thus, is in keeping with a recent registry-based study of the psychiatric diagnoses assigned by Swedish specialized mental healthcare providers to survivors of the 2004 Southeast Asian Tsunami (38), we hold that the increase in specialized mental healthcare consumption post-disaster largely represented severely traumatized individuals in need of long-term mental healthcare. However, lack of capacity or capability of primary healthcare in providing trauma-informed care, e.g. due to lack of

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appropriate experience or expertise, may also have contributed to early referrals in some. Furthermore, it should be noted that, despite the substantial increase in their specialized mental healthcare service consumption, overall, only a majority of parents did in fact utilize specialized mental healthcare services post-disaster. Indeed, a majority of the parents were fully managed by their GP.

Pre-trauma psychiatric history has previously been established as strongly predictive of post-traumatic mental ill-health (39). In fact, a registry-based study of Danish survivors of the 2004 Southeast Asian Tsunami found that post-disaster specialized mental healthcare consumption, in adjusted analyses, was significantly associated with the participants' three year pre-disaster history of services consumption, rather than their post-disaster distress (40). Contrasting to this, in our study post-disaster increase in specialized mental healthcare consumption stemmed largely from influx of new individuals, rather than increased service consumption among those already provided for by the services. Thus, we hold that disasters may not only potently intensify specialized mental healthcare consumption in vulnerable individuals, but also channel high numbers of new individuals into the services.

Strengths and limitations

The context of this study is a universal, public, accessible and well-developed healthcare system. The study employs an objective measure on healthcare consumption, recorded by the healthcare provider at the time of the healthcare service provision. The study allows for reliable comparison of pre- and post-disaster data, with negligible levels of missing data. However, observed healthcare consumption does not objectively reflect healthcare needs. Consumption may represent a combination of perception of needs by a patient deciding to seek medical advice, as well as the clinical judgement of a provider, who e.g. may encourage renewed contacts, make referrals etc. Although being most applicable in similar clinical settings, we hold that our findings reflect underlying post-disaster distress, and thus healthcare needs, arising in parents anywhere in the

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world in the face of terror. Moreover, we believe that similar patterns of healthcare needs may ensue after other traumatic exposure of parents, such as when child is struck by natural disaster, traffic accident and serious illness.

In this study, we included only services provided by healthcare professionals. Thus, parts of the proactive post-disaster outreach program were not included (27). Psychosocial support through the outreach program may both have eased access to healthcare, thus increasing consumption, as well as alleviated healthcare needs, thus decreasing consumption. No adjustment for participation in the post-disaster outreach program was made. Finally, although uncommon due to universal coverage of the national insurance scheme, some participants may have self-financed additional healthcare services or obtained services abroad.

Conclusion

Widespread unmet healthcare needs have been reported among survivors of terrorism (41). In this study, we demonstrated that a surge in healthcare needs may not be limited to survivors of a disaster, but may also include close family members, such as parent. Primary healthcare providers may hold the key to a successful post-disaster intervention, providing timely trauma-informed care, including swift referrals of individuals in need of specialized mental healthcare interventions.

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FIGURES

Figure 1 a-b: Split-violin diagram - distribution of parental healthcare service consumption before (left violin) and after (right violin) the terrorist attack. Vertical axis: number of services. Horizontal axis: modified Kernel estimates, distributions of mothers (a) and fathers (b).

Figure 2 a-b: Healthcare service consumption over time with rates of services (line chart) and proportion of individuals provided for (pie chart) in the three year periods before and after the attack (numeric values available in Supplementary table 3).

Figure 3 a-b: Ratios of pre- and post-disaster hurdle estimates of (a) overall service consumption and (b) proportions of individuals provided for by the services (numeric values available in Supplementary table 4).

[a] Ratio of estimates could not be reliably bootstrapped in our model.

Figure 4: Reasons for accessing the primary healthcare services, according to ICPC-2, in the three year periods before and after the terrorist attack. Categories with incidence of < 0.2 services per person per year are pooled ("other"). Width of bars corresponds to duration of time interval. Total number of services: 13,337. (numeric values available in Supplementary table 5).

DECLARATIONS

Ethics approval and consent to participate

Consents to participation and collection of registry-based data were obtained in writing from all participants. The study was approved by the Regional Committees for Medical and Health Research Ethics in Norway.

Availability of data and material

Data supporting the findings of this study are not publicly available. The patient level, registry-based data may be accessed through the Norwegian Directorate of Health

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(https://helsedirektoratet.no/english). Restrictions apply. Technical appendix and statistical code are available from the corresponding author.

Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: The study was supported by the Norwegian Directorate of Health; JMH and LES have received research grants from the Norwegian Research Council; no other relationships or activities that could appear to have influenced the submitted work. All researchers worked independently from funders.

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Authorship & contributorship

JMH, ST, LES and GD conceived of the study and developed the study design with TW-L. JMH, LES and GD gathered the data. JMH and TW-L conducted the statistical analyses. JMH wrote the first draft of the paper. All authors contributed to further drafts and approved the final submission, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JMH is the guarantor of the manuscript being an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Supplementary table 1 – Nature of the healthcare services provided to the study participants in the three year periods before and after the Utøya attack (total number of services: 19,208).

	Primary healthcare		Specialized mental healthcare		Specialized somatic healthcare	
	before (n=5,675)	after (n=7,702)	before (n=578)	after (n=1,501)	before (n=1,836)	after (n=1,916)
outpatient, consultations	3130 (55.2)	4082 (53.0)	531 (91.9)	1374 (91.5)	1631 (88.8)	1694 (88.4)
outpatient, other services[a]	2545 (44.8)	3620 (47.0)	31 (5.4)	112 (7.5)	67 (3.6)	97 (5.1)
inpatient, admissions[b]	-	-	16 (2.8)	15 (1.0)	138 (7.5)	125 (6.5)

[a] telephone consultations, mail correspondence etc.

[b] mean duration of admissions, pre- and post-disaster - mental healthcare – 10.7 days (SD 9.2) and 15.1 days (SD 17.2) - somatic healthcare - 5.4 days (SD 7.6) and 4.60 days (SD 6.9).

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Supplementary table 2 - Incomplete entries missing patient id in the Norwegian Patient Registry[1]

a) Specialized mental healthcare services (by hospital)

year	missing id (%)
2008	5.80 %
2009	4.79 %
2010	0.78 %
2011	0.49 %
2012	0.53 %
2013	0.30 %
2014	0.25 %

b) Specialized somatic healthcare services (by hospital)

year	missing id (%)
2008	4.89 %
2009	3.31 %
2010	2.19 %
2011	2.18 %
2012	1.66 %
2013	1.32 %
2014	1.22 %

[1] Source: the Norwegian Patient Registry.

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Supplementary table 3 – Rates of healthcare service consumption in the three-year periods before and after the terrorist attack, annualized values (supplement to Figure 2).

	mothers (n=222)			Fathers (n=136)		
	primary	mental	somatic	primary	mental	somatic
Before (all services | consultations only)						
2008-Jul-22 to 2009-Jan-21	5.41 | 3.33	0.34 | 0.34	2.12 | 2.05	3.79 | 2.24	0.24 | 0.22	1.21 | 1.16
2009-Jan-22 to 2009-Jul-21	5.98 | 3.05	0.41 | 0.39	1.49 | 1.46	3.57 | 1.93	0.19 | 0.19	0.87 | 0.72
2009-Jul-22 to 2010-Jan-21	5.60 | 3.13	0.49 | 0.48	1.19 | 1.17	4.25 | 2.35	0.46 | 0.34	1.72 | 1.69
2010-Jan-22 to 2010-Jul-21	6.08 | 3.14	0.47 | 0.44	1.76 | 1.64	4.10 | 2.46	0.87 | 0.87	2.00 | 1.97
2010-Jul-22 to 2011-Jan-21	6.19 | 3.35	0.47 | 0.43	1.46 | 1.38	4.97 | 2.91	1.06 | 1.04	1.72 | 1.66
2011-Jan-22 to 2011-Jul-21	6.13 | 3.17	0.72 | 0.64	1.49 | 1.40	5.00 | 2.85	0.74 | 0.71	1.96 | 1.94
After (all services | consultations only)						
early aftermath						
2011-Jul-22 to 2011-Aug-21	18.65 | 7.62	1.57 | 1.35	0.97 | 0.97	9.26 | 4.59	1.06 | 0.97	0.97 | 0.97
2011-Aug-22 to 2011-Sep-21	14.65 | 7.57	3.46 | 3.03	1.89 | 1.84	7.15 | 3.88	0.79 | 0.79	1.59 | 1.50
2011-Sep-22 to 2011-Oct-21	9.62 | 4.92	3.35 | 3.19	1.68 | 1.62	5.91 | 3.09	0.62 | 0.62	1.85 | 1.85
2011-Oct-22 to 2011-Nov-21	9.57 | 5.19	3.51 | 3.30	1.41 | 1.41	7.15 | 3.88	0.44 | 0.44	2.74 | 2.74
2011-Nov-22 to 2011-Dec-21	9.51 | 5.03	4.00 | 3.78	1.62 | 1.62	6.62 | 3.26	0.62 | 0.62	1.68 | 1.68
2011-Dec-22 to 2012-Jan-21	7.24 | 3.68	3.30 | 2.97	1.03 | 0.86	6.44 | 3.79	0.62 | 0.62	2.03 | 1.85
delayed aftermath						
2012-Jan-22 to 2012-Jul-21	7.89 | 3.86	2.17 | 1.95	1.35 | 1.32	5.21 | 3.00	0.68 | 0.63	1.38 | 1.29
2012-Jul-22 to 2013-Jan-21	7.67 | 4.25	1.53 | 1.43	2.09 | 2.01	5.32 | 3.31	0.68 | 0.63	1.26 | 1.22
2013-Jan-22 to 2013-Jul-21	7.05 | 3.64	1.76 | 1.68	1.82 | 1.71	4.78 | 2.72	0.63 | 0.53	1.62 | 1.51
2013-Jul-22 to 2014-Jan-21	7.52 | 4.10	1.32 | 1.24	1.95 | 1.86	5.26 | 3.04	0.69 | 0.59	1.50 | 1.38
2014-Jan-22 to 2014-Jul-21	7.60 | 3.80	0.88 | 0.83	1.6 | 1.43	5.16 | 2.87	0.76 | 0.71	2.04 | 1.87
Summary (all services | consultations only)						
Average before	5.90 | 3.20	0.48 | 0.45	1.58 | 1.52	4.28 | 2.46	0.59 | 0.56	1.58 | 1.52
Average after	8.21 | 4.22	1.81 | 1.68	1.71 | 1.62	5.47 | 3.12	0.69 | 0.63	1.60 | 1.51

primary: primary healthcare, mental: specialized mental healthcare, somatic: specialized somatic healthcare

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Supplementary table 4: Hurdle predictions of (a) rates of healthcare service consumption and (b) proportion of individuals acquiring one or more services in each half year period (supplement to Figure 3).

			mothers (n=222)				fathers (n=136)			
			all services		consultations only		all services		consultations only	
			estimate	ratio, after/before (95% CI)	estimate	ratio, after/before (95% CI)	estimate	ratio, after/before (95% CI)	estimate	ratio, after/before (95% CI)
a) services										
primary	*before*		5.92		3.21		0.71		0.66	
	after	- early	11.65	1.97 (1.76 - 2.23)	5.71	1.78 (1.57 - 2.02)	0.54	1.73 (1.36 - 2.29)	0.52	1.57 (1.28 - 1.91)
		- delayed	7.57	1.28 (1.15 - 1.42)	3.97	1.24 (1.11 - 1.43)	0.76	1.20 (0.99 - 1.45)	0.68	1.26 (1.05 - 1.52)
		- overall	8.26	1.40 (1.27 - 1.54)	4.26	1.33 (1.20 - 1.50)	0.73	1.29 (1.07 - 1.55)	0.66	1.31 (1.10 - 1.55)
mental	*before*		0.46		0.43		0.71		0.66	
	after	- early	3.25	7.00 (3.86 - 19.02)	2.98	6.88 (3.84 - 18.95)	0.54	0.77 [a]	0.52	0.78 [a]
		- delayed	1.48	3.20 (1.49 - 9.49)	1.38	3.19 (1.45 - 9.60)	0.76	1.07 [a]	0.68	1.03 [a]
		- overall	1.78	3.84 (1.95 - 11.21)	1.65	3.82 (1.94 - 11.18)	0.73	1.03 [a]	0.66	1.00 [a]
somatic	*before*		1.58		1.52		1.31		1.26	
	after	- early	1.48	0.93 (0.74 - 1.20)	1.43	0.94 (0.75 - 1.21)	1.64	1.25 (0.77 - 2.18)	1.59	1.26 (0.75 - 2.19)
		- delayed	1.77	1.12 (0.86 - 1.44)	1.67	1.10 (0.84 - 1.44)	1.36	1.04 (0.75 - 1.51)	1.30	1.03 (0.73 - 1.48)
		- overall	1.72	1.09 (0.85 - 1.37)	1.63	1.08 (0.84 - 1.37)	1.41	1.07 (0.79 - 1.52)	1.35	1.07 (0.78 - 1.52)
b) individuals										
primary	*before*		0.74		0.63		0.56		0.49	
	after	- early	0.88	1.19 (1.13 - 1.25)	0.79	1.26 (1.17 - 1.34)	0.74	1.31 (1.16 - 1.48)	0.66	1.36 (1.18 - 1.57)
		- delayed	0.79	1.07 (1.03 - 1.11)	0.69	1.10 (1.04 - 1.16)	0.62	1.11 (1.02 - 1.21)	0.53	1.10 (0.99 - 1.21)
		- overall	0.80	1.09 (1.05 - 1.13)	0.70	1.12 (1.07 - 1.18)	0.64	1.14 (1.05 - 1.24)	0.55	1.14 (1.04 - 1.26)
mental	*before*		0.03		0.03		0.03		0.03	
	after	- early	0.22	6.68 (3.86 - 12.00)	0.22	6.55 (3.78 - 11.65)	0.08	3.14 (1.33 - 6.86)	0.08	3.14 (1.35 - 6.86)
		- delayed	0.12	3.49 (2.00 - 6.38)	0.11	3.33 (1.90 - 6.12)	0.05	1.89 (0.84 - 3.96)	0.05	1.77 (0.73 - 3.60)
		- overall	0.13	4.02 (2.34 - 7.22)	0.13	3.86 (2.25 - 6.92)	0.05	2.10 (0.95 - 4.18)	0.05	2.00 (0.86 - 3.75)
somatic	*before*		0.35		0.34		0.28		0.27	
	after	- early	0.34	0.98 (0.82 - 1.15)	0.34	0.99 (0.83 - 1.16)	0.28	1.01 (0.80 - 1.24)	0.27	1.00 (0.78 - 1.23)
		- delayed	0.34	0.99 (0.89 - 1.12)	0.34	0.99 (0.88 - 1.11)	0.30	1.08 (0.90 - 1.29)	0.30	1.08 (0.89 - 1.29)
		- overall	0.34	0.99 (0.89 - 1.11)	0.34	0.99 (0.88 - 1.10)	0.30	1.07 (0.91 - 1.26)	0.29	1.07 (0.90 - 1.26)

primary: primary healthcare, mental: specialized mental healthcare, somatic: specialized somatic healthcare.
[a] Ratio could not be reliably bootstrapped in our model.

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Supplementary table 5: Reasons for accessing primary healthcare services, according to ICPC-2, before and after the terrorist attack. Categories with incidence of < 0.2 services per person per year are pooled (supplement to Figure 4).

	ICPC-2	mothers (n=222)			fathers (n=136)		
		before	early	delayed	before	early	delayed
Overall		5.90	11.54	7.56	4.28	7.09	5.15
General and unspecified	(A)	0.91	0.94	1.06	0.50	0.88	0.67
Digestive	(D)	0.22	0.19	0.31	0.26	0.10	0.29
Cardiovascular	(K)	0.29	0.29	0.51	0.55	0.76	0.65
Musculoskeletal	(L)	1.36	1.21	1.60	1.10	0.84	1.07
Psychological	(P)	0.80	6.47	1.63	0.36	2.50	0.83
Respiratory	(R)	0.62	0.86	0.74	0.45	0.76	0.39
Skin	(S)	0.26	0.14	0.28	0.25	0.28	0.38
Endocrine/Metabolic and Nutritional	(T)	0.32	0.26	0.37	0.34	0.57	0.36
Other		1.13	1.19	1.05	0.47	0.38	0.51

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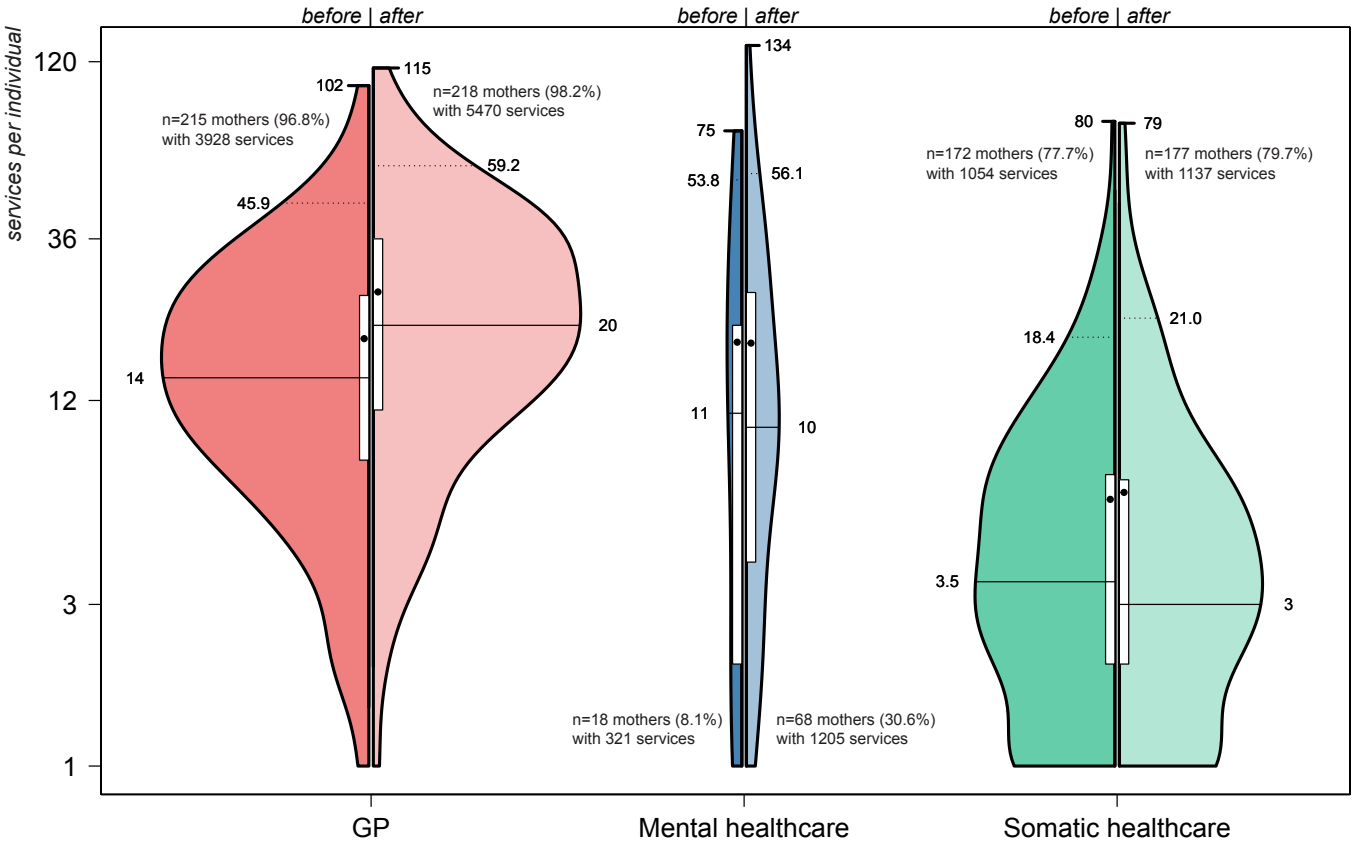
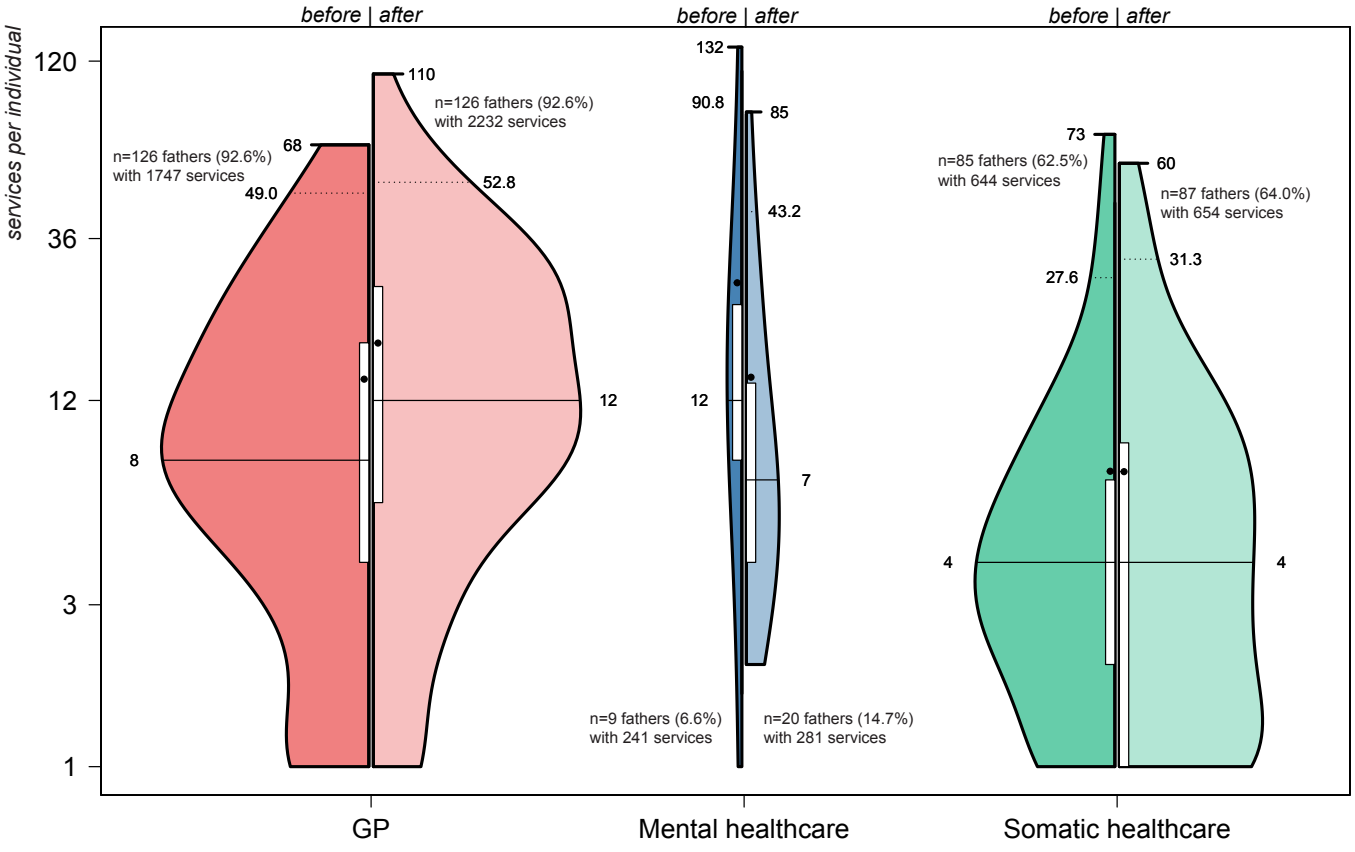
a) mothers (n=222)

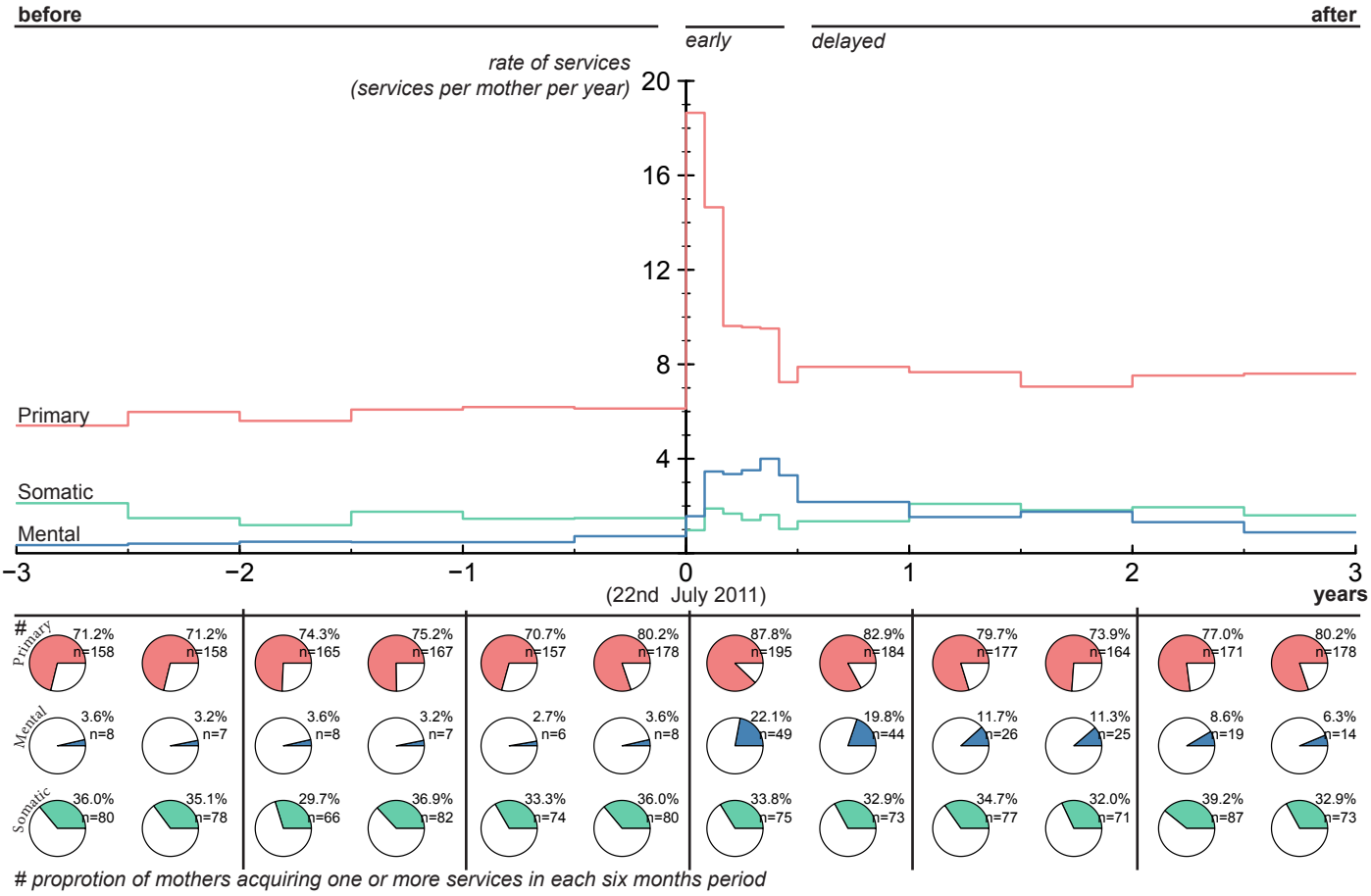


b) fathers (n=136)



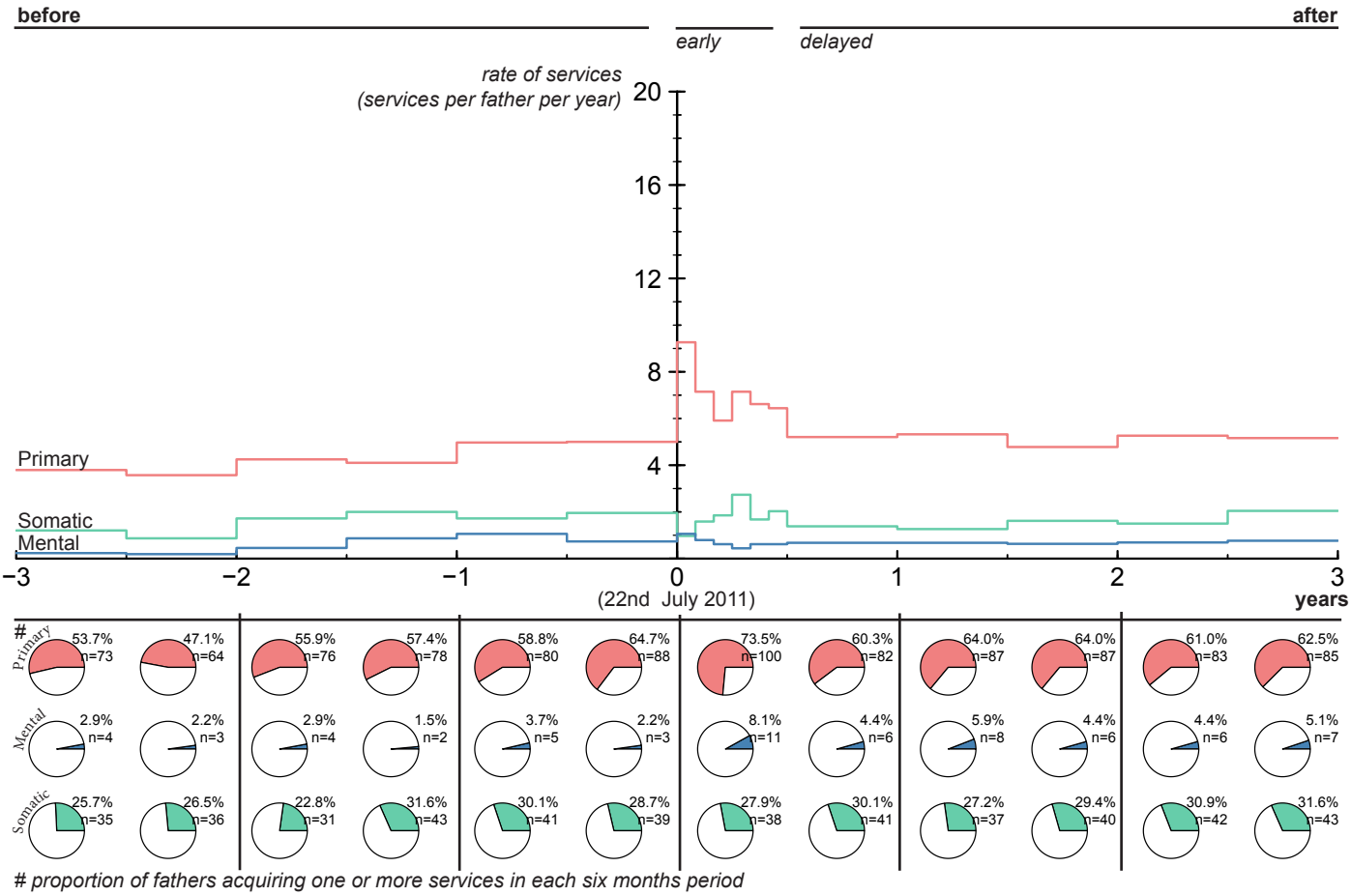
Colored areas/violins: Kernel density estimations, multiplied by proportion of mothers and fathers having utilized services pre- and post-disaster (left and right violin, respectively). White vertical box: inter quartile range (Q1-Q3). Solid horizontal line: median value. Black bullet: mean value. Dotted horizontal line: 95th percentile. Upper edge: maximum value.

a) mothers (n=222)



 # proprotion of mothers acquiring one or more services in each six months period

b) fathers (n=136)



 # proportion of fathers acquiring one or more services in each six months period

primary: primary healthcare - mental: specialized mental healthcare - somatic: specialized somatic healthcare.

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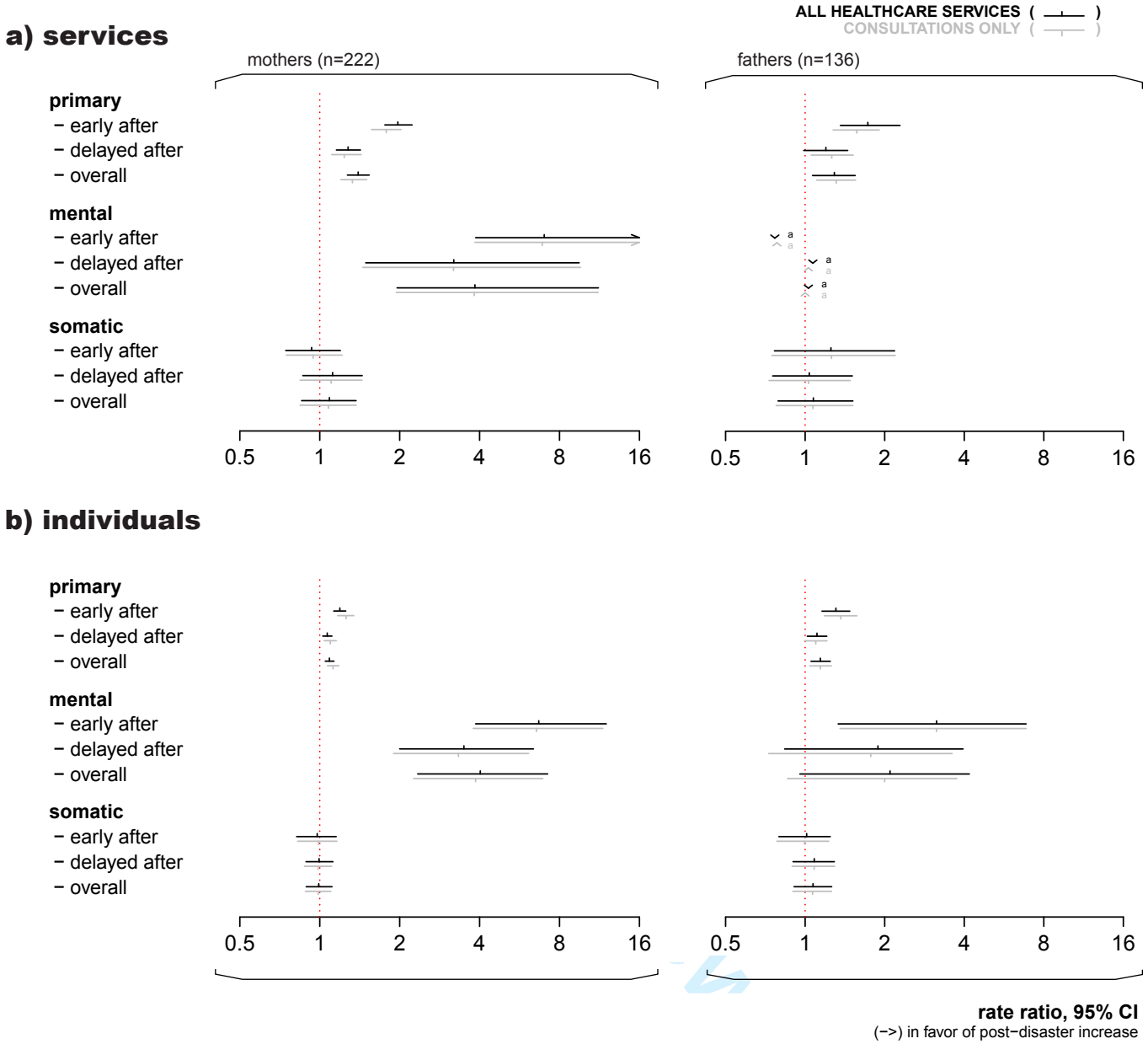

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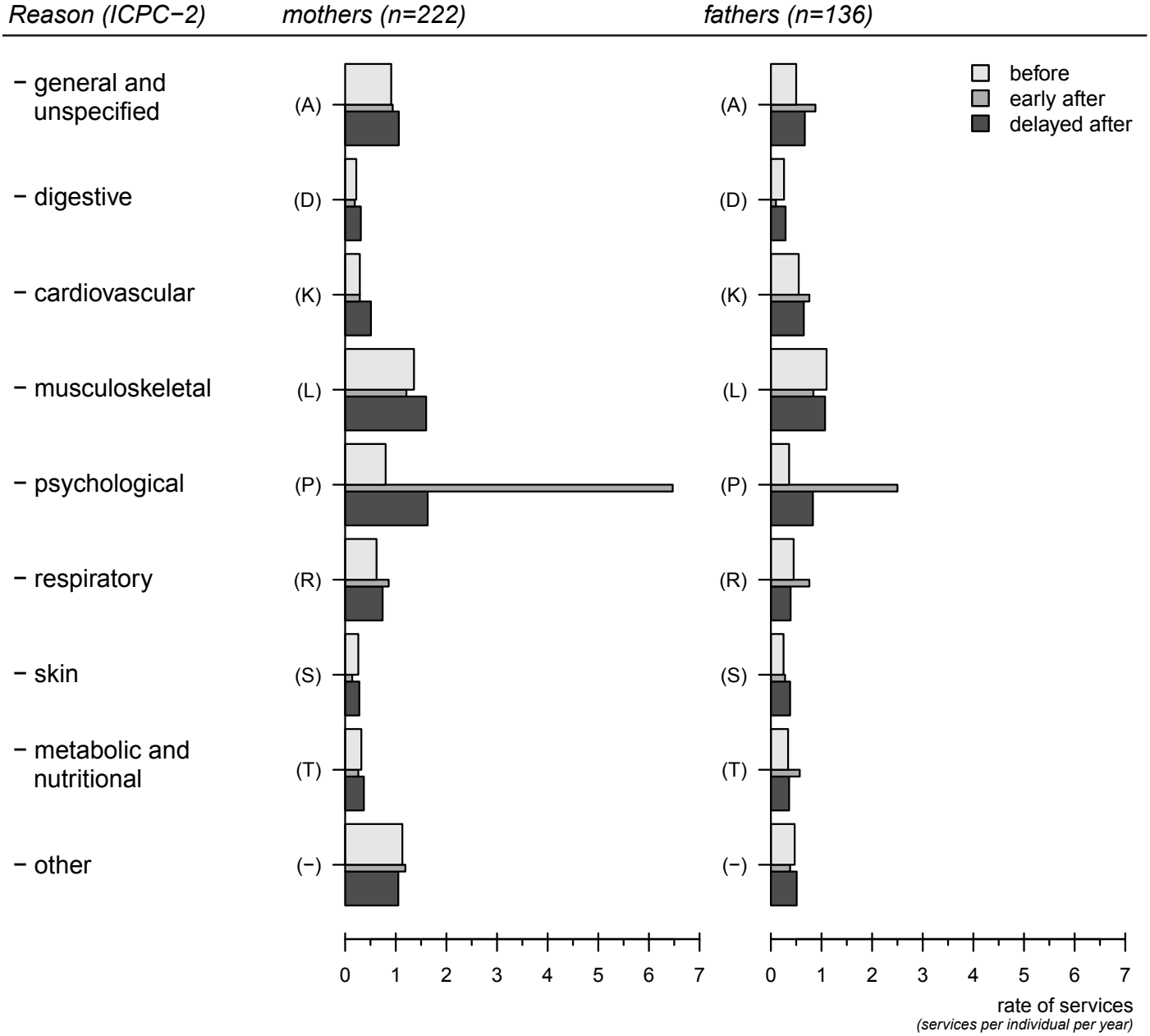
Reason (ICPC−2)
mothers (n=222)
fathers (n=136)
− general and unspecified
− digestive
− cardiovascular
− musculoskeletal
− psychological
− respiratory
− skin
− metabolic and nutritional
− other
(A)
(D)
(K)
(L)
(P)
(R)
(S)
(T)
(−)
before
early after
delayed after
0 1 2 3 4 5 6 7
rate of services
(services per individual per year)

only

STROBE statement?checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract		
	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract OK. Page 1.
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found OK. Page 3.
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported OK. Page 5.
Objectives	3	State specific objectives, including any prespecified hypotheses OK. Page 6.
Methods		
Study design	4	Present key elements of study design early in the paper OK. Page 7.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection OK. Page 6-7.
Participants	6	(*a*) *Cohort study*?Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up*Case-control study*?Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls*Cross sectional study*?Give the eligibility criteria, and

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	Item No	Recommendation
		the sources and methods of selection of participants OK. Page 7.
		(b) *Cohort study*?For matched studies, give matching criteria and number of exposed and unexposed*Case-control study*?For matched studies, give matching criteria and the number of controls per case N/A.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable OK. Page 8-9.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group OK. Page 8-9.
Bias	9	Describe any efforts to address potential sources of bias OK. Page 13.
Study size	10	Explain how the study size was arrived at OK. Page 7-8.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why OK. Page 9-10.
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding OK. Page 9-10.
		(b) Describe any methods used to examine subgroups and

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	Item No	Recommendation
		interactions N/A
		(c) Explain how missing data were addressed OK. Page 9-10.
		(d) *Cohort study*?If applicable, explain how loss to follow-up was addressed*Case-control study*?If applicable, explain how matching of cases and controls was addressed*Cross sectional study*?If applicable, describe analytical methods taking account of sampling strategy N/A
		(e) Describe any sensitivity analyses OK. Page 9-10.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study?eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed OK. Page 7-8.
		(b) Give reasons for non-participation at each stage OK. Page 7-8.
		(c) Consider use of a flow diagram Not used.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders OK. Page 7-8
		(b) Indicate number of

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	Item No	Recommendation
		participants with missing data for each variable of interest OK. Page 7-8
		(*c*) *Cohort study*?Summarise follow-up time (eg average and total amount)
Outcome data	15*	*Cohort study*?Report numbers of outcome events or summary measures over time OK. Page 10-11
		*Case-control study?*Report numbers in each exposure category, or summary measures of exposure
		*Cross sectional study?*Report numbers of outcome events or summary measures
Main results	16	*(a)* Report the numbers of individuals at each stage of the study?eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed OK. Page 10-11
		(*b*) Give reasons for non-participation at each stage
		(*c*) Consider use of a flow diagram
Other analyses	17	Report other analyses done?eg analyses of subgroups and interactions, and sensitivity analyses OK. Page 11
Discussion		
Key results	18	Summarise key results with reference to study objectives OK. Page 12-13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias

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	Item No	Recommendation
		OK. Page 13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence OK. Page 12-13
Generalisability	21	Discuss the generalisability (external validity) of the study results OK. Page 13
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based OK. Page 15

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Healthcare consumption in parents of young terrorism survivors: A registry-based study in Norway

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FULL TITLE

Healthcare consumption in parents of young terrorism survivors: A registry-based study in Norway

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ABSTRACT

Objectives: To assess changes in parents' short- and long-term primary and specialized healthcare consumption following a terrorist attack threatening the lives of their children.

Design: Registry-based study comparing healthcare service consumption, in the three years before and the three years after a terrorist attack.

Setting: The aftermath of the Utøya terrorist attack. The regular, publicly-funded, universal healthcare system in Norway.

Intervention: Parents learning of a terrorist attack on their adolescent and young adult child.

Participants: Mothers (n=226) and fathers (n=141) of a total of 263 survivors of the Utøya terrorist attack (54.6% of all survivors 13-33 years, n=482).

Main outcome measures: We report primary and specialized somatic and mental healthcare service consumption in the early (0 to 6 months) and delayed (>6 to 36 months) aftermath of the attack, both in terms of frequency of services consumed (assessed by age-adjusted negative binomial hurdle regression) and proportions of mothers and fathers provided for (mean semiannual values). The pre- and post-disaster rates were compared by rate ratios (RR) and 95% confidence intervals (CI) were generated through bootstrap replications.

Results: Frequency of primary healthcare service consumption increased significantly in both mothers and fathers in the early aftermath of the attack (mothers RR=1.97, 95% CI 1.76 to 2.23; fathers RR=1.73, 95% CI 1.36 to 2.29), and remained significantly elevated throughout the delayed aftermath. In the specialized mental healthcare services, a significant increase in the frequency of service consumption was observed in mothers only (early RR=7.00, 95% CI 3.86 to 19.02; delayed RR=3.20, 95% CI 1.49 to 9.49). In specialized somatic healthcare, no significant change was found.

Conclusion: Following terrorist attacks, healthcare providers must prepare for increased healthcare needs not only in survivors, but also their close family members, such as parents. Needs may present shortly after the attack and require long-term follow-up.

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"STRENGTH AND LIMITATIONS" BOX

- Objective measure on healthcare consumption pre- and post-disaster in a universal, public, accessible and well-developed healthcare system.
- High number of both mother and father participants. Nonetheless, the full size of the parent population remains unknown.
- Only services provided by healthcare professionals were included. Psychosocial support from other professionals was not included.

KEYWORDS

Disaster

Terrorism

Indirect exposure

PTSD, Anxiety and Depression

Parents

Health services

Primary Healthcare

Specialized Healthcare

Mental Healthcare

Hurdle regression analyses

Geolocation information: Utøya (60°01'25.0"N 10°14'50.0"E)

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INTRODUCTION

Life threat to a child may jeopardize parents' long-term health. DSM-5 (1) currently recognizes learning that a close family member is being threatened with death or serious injury as being a potentially traumatizing event. In recent years, numerous terrorist attacks have targeted children, adolescents and young adults who are not with their parents, either at school or during their leisure time (e.g. summer camp, night club, café, concert hall (2-7)). Despite widespread concern about the post-disaster health of survivors, their parents' post-disaster reactions, coping and needs have received little attention.

The impact of life threat to a child on parental health has previously been addressed in studies of seriously ill children. Elevated levels of parental anxiety, depression and post-traumatic stress reactions have been reported following acute (8, 9) and chronic disease (10, 11), as well as traffic accidents involving children (12, 13). Similarly, in parents of sexually abused children (14, 15) and in parents of young soldiers deployed to hostile environments (16, 17), high levels of emotional distress have been shown to persist for years. Several population-based studies have addressed the impact of trauma on individuals physically distant from the site of a terrorist disaster (18-23). Nonetheless, only one study has specifically addressed the distress of parents who witnessed or learned of a terrorist attack that threatened the lives of their own children (2). This small study (n=20 mothers) reported parental distress at levels comparable to those of the young survivors themselves. Additionally, traumatization may potentially induce somatic health complaints, including respiratory, gastrointestinal and cardiovascular disease (24-26). A registry-based study of parents who learned that their adolescent and young adult children were caught in a pub fire in the Netherlands in 2001, reported that the post-disaster incidence of cardiovascular health problems, as recorded by the primary healthcare provider, was significantly higher in parents of burnt survivors than in unaffected community controls (27). Thus, although limited, current evidence suggests that terrorism may potentially elicit both mental and somatic healthcare needs in parents of survivors.

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Our previous studies of the mothers and fathers of the Utøya survivors demonstrated substantial and lasting levels of emotional distress among the participants (28, 29). The current study uses national registry-based healthcare data to assess the parents' primary and specialized healthcare consumption before and after the terrorist attack. Separately in mothers and fathers, we investigated whether the frequency of parents' primary and specialized healthcare service consumption in the early (0-6 months) and delayed (>6-36 months) aftermath of the terrorist attack was higher than in the three-year period before the terrorist attack. Secondly, we examined whether the semiannual proportions of mothers and fathers consuming one or more healthcare services were increased early and delayed, when compared to pre-disaster levels. Lastly, we assessed the reasons for parents accessing healthcare services in the aftermath of the terrorist attack by mapping out the reasons for encountering the primary healthcare services, the entry point to the healthcare system in Norway, as recorded by their primary healthcare providers.

METHOD

Setting

The setting of this study is the aftermath of the Utøya terrorist attack.

Trauma: On July-22-2011, two terrorist attacks shook Norway. A single perpetrator detonated a bomb in the government quarter in Oslo, before setting out on a shooting spree at the youth summer camp on Utøya Island less than two hours later. The youth were trapped on the small island with the perpetrator for more than one hour. The attack left 69 dead and 495 alive, of whom 35 had sustained severe physical injuries (30). The parents, all physically distant from the island, watched events unfold via live media reports and some had access to intermittent telecommunication with their offspring on the island. Following the attack, the survivors were reunited with their families throughout the country.

Post-trauma care: Soon after the terrorist attack, an early proactive outreach program was established, in line with the current trauma-informed consensus of expert opinions (31). Multi-

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disciplinary crisis teams, established in affected municipalities (n=128), were to provide the immediate psychosocial support to those in need; dedicated contact persons were to proactively monitor and support the affected families throughout the first year post-disaster, and to facilitate access to regular healthcare services as required (28, 32). Post-disaster healthcare services were provided by the regular two-level healthcare system in Norway (33). Level one, including the primary healthcare services of general practitioners (GPs) and emergency primary healthcare, provides services for both somatic and mental health complaints and acts as the entry point and gatekeeper to secondary healthcare services. Level two, the secondary healthcare services, provides specialized mental and specialized somatic healthcare services and is accessed through medical referrals only. Regular healthcare services in Norway are publicly funded and accessible throughout the country.

Design

This is a longitudinal, prospective study, assessing registry-based data on parental healthcare consumption in the periods three years before and after the terrorist attack (July-22-2008 to July-21-2014).

Procedure

Parental recruitment and participation in the earlier waves of the larger Utøya study have been explained in detail previously (28, 34). In summary, the earlier waves had open cohort designs, extending invitations to all eligible participants (parents of survivors 13-33 years, n=482). The third wave of the study, on which this paper reports, had a closed cohort design, meaning that only parents who had participated in either of the previous waves (n=532) were invited. Invitations were distributed by mail and included information on how to opt out. By mid-July of 2014, three years after the attack, 95% of participants had consented to participation in writing. The Regional Committees for Medical and Health Research Ethics in Norway approved the study.

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Sample

In the overall study, 299 mothers and 233 fathers (n=532 parents) participated in at least one of the three waves; 75.5% of the mothers (n=226) and 60.5% of the fathers (n=141) took part in Wave 3, on which this paper reports. The participants represented 251 distinct families and cared for a total of 263 survivors (54.6% of all Utøya survivors aged 13 to 33 years). Mean ages of mothers and fathers at the time of the attack were 46.7 (SD 5.8) and 49.7 (SD 5.9) years, respectively. A majority of the parents were of Norwegian origin (n=335, 92.0%, missing n=3), held a university or a university college degree (n=225, 61.3%), had an average or above average financial situation (n=297, 80.9%), and were, at the time of data collection, mostly employed (n=314, 86.3%, missing n=3). Attrition from previous waves (n=165, 31.0%) favored male gender (OR 2.02, χ^2p<0.001). Neither non-Norwegian origin (OR-mothers=1.00, χ^2p=0.996, OR-fathers=1.15, χ^2p=0.805) nor levels of early post-traumatic stress reactions (mean-mothers 1.34 vs 1.34, t-test p=0.967, mean-fathers 0.80 vs 0.88, t-test p=0.358) were associated with non-participation at Wave 3. Most participants consented to collection of registry-based data (mothers n=222, 98.5% and fathers n=136, 96.5%).

Measures

Primary healthcare consumption was assessed through the Health Economics Administration (HELFO) database by analyzing reimbursement claims filed by primary healthcare providers, GPs, to the national insurance scheme. All records dating from July-22-2008 to July-21-2014 were included, regardless of whether they referred to services provided at a GP clinic, during house calls, by telephone or mail, provided by regular GPs or locum GPs, within regular office hours or when on-call. A total of 13,419 records were identified, of which 42 (0.3%) were duplicates (matching date, time, diagnosis, provider and mode of contact). The non-duplicates (n=13,377) were subdivided according to the type and time of service (Supplementary table 1). Reason for encountering was recorded according to International Classification of Primary Care (ICPC-2) (35) and clustered according to type of health problem (36).

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Specialized healthcare consumption was assessed using the Norwegian Patient Registry (NPR) – activity reported by hospitals and hospital clinics – and the Health Economics Administration Database (HELFO) – reimbursement claims filed to the National Insurance Scheme by private specialized healthcare providers. All services recorded by physicians and psychologists dating from July-22-2008 to July-21-2014 were included, irrespective of whether the service was provided in a public hospital, a private clinic, by telephone or mail and within regular office hours or not. A total of 6,024 specialized healthcare services were identified (HELFO database n=1,872, NPR n=4,152 services), of which 193 (3.2%) were duplicates (matching date, diagnosis, healthcare provider and mode of contact). The services were subdivided into specialized mental healthcare services (n=2,079) and specialized somatic healthcare services (n=3,752) and, further, according to type and time of service (Supplementary table 1).

Quality of data. Claims to the national insurance scheme (HELFO) are submitted electronically. All claims with missing patient IDs are automatically rejected and returned to the healthcare provider for resubmission. Thus, the HELFO database contains no data with missing patient ID. In contrast, NPR does not reject incomplete information, and consequently contains a small number of entries with missing patient ID (Supplementary table 2).

Statistics

The data analyzed in this paper is count data (i.e. frequencies of occurrences within a predefined time period) that were recorded in the three years before and after a terrorist attack. Mothers and fathers were assessed separately throughout the paper.

Descriptive statistics are presented graphically. The distribution of overall frequencies by which healthcare services were accessed before and after the terrorist attack are presented as split violin diagrams (37). Rates of healthcare service consumption across the study period and the proportions of individuals accessing healthcare services semiannually are presented in a second figure, by line and pie charts. As is often found in data on healthcare consumption (38), our data was

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overdispersed (variance greater than the mean value) and exhibited excess zeros (individuals with no occurrences). The corresponding numerical values are tabulated in the supplementary material that mirrors the graphics included in the paper.

The statistical analyses included in this paper compare post-disaster by pre-disaster healthcare consumption. As the parents' age was hypothesized to influence healthcare needs independently of the terrorist attack being investigated, rates of pre- and post-disaster healthcare consumption were predicted from age-adjusted regression models, rather than assessing the observed pre- and post-disaster values directly. Negative binomial hurdle regressions were chosen for rate predictions, as this method is suitable for overdispersed count data exhibiting excess zeros (39). In order for results to be interpreted in terms of rates, the regressions need to be offset for the observational period, also known as the persontime at risk. In our material, hospital admissions were considered to make an individual unavailable for healthcare services by other healthcare providers. Thus, in our study observational periods were defined as days of non-hospitalization within each time period being investigated. Negative binominal hurdle regression is a two-component regression model (39). Thus, model predictions need to be calculated for a predefined index individual. In our study, the index parent was defined as a mother or a father of 47 years of age at the time of the attack, reflecting the median age of the full parent sample. In order to increase comparability, we chose to make predictions for the same age in both mothers and fathers, despite the fathers being slightly older than the mothers.

The detailed statistical procedure was as follows. First, predictions of frequency of healthcare service consumption were made for each period of interest, i.e. pre-disaster and the early and delayed aftermath. Second, annualized rates of healthcare service consumption were obtained by dividing the predicted frequency by the duration of the time period investigated (i.e. before=36 months, early aftermath=6 months, delayed aftermath=30 months). Third, the proportion of mothers and fathers acquiring services within a six-month period was calculated by averaging observed semiannual proportions (by design, the frequency of non-zero predictions equals the observed value

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in negative binomial hurdle regressions). Finally, post- versus pre-disaster rate ratios (RR) were computed by dividing the rates of healthcare consumption (both the frequency of services consumption and the proportion of individuals accessing services) in the early and delayed aftermath by the corresponding pre-disaster rates. Bias-corrected and accelerated 95% confidence intervals (CI) of RR were generated through bootstraps of 10,000 replications.

All analyses were made using the full dataset, which included *all services* provided by primary and specialized healthcare service providers. As supplementary material, the analyses were repeated on a dataset including only *in person* consultations with the healthcare provider (i.e. excluding the telephone consultations, mail correspondence etc.).

Across the time period investigated, improved quality of reporting practices to NPR was observed (fewer entries were recorded with missing patient IDs, Supplementary table 2). The improved quality of reporting practices was most evident between 2009 and 2010. In the final year pre-disaster, levels of missing patient IDs were not substantially different to post-disaster levels. As incomplete entries in NPR may lead to underestimation of healthcare consumption, sensitivity analyses were performed by repeating all analyses that included the three-year pre-disaster NPR data, with NPR data from the final year pre-disaster only.

Analyses were performed with R-version-3.0.3 (R Foundation for Statistical Computing), with the R-packages *pscl* (1.4.9) for hurdle regressions and *boot* (1.3-13) for bootstrap analyses. Violin plots were generated through an adaptation of the *vioplot* (0.2) package.

RESULTS

The overall aim of this study was to create a detailed description of pre- and post-disaster patterns of parental healthcare consumption. Thus, we began by mapping out the frequency distributions by which each parent accessed healthcare services in the periods three years before and after the attack (Figure 1a-b). In primary healthcare, nearly all parents were found to have accessed healthcare services on one or more occasion both pre- and post-disaster. In the specialized mental healthcare

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services only a minority of the parents had received services. Notably, high variability in frequency of acquisition was found for all services.

Figure 2a-b descriptively outlines the trajectories of healthcare consumption over time. Upper halves of figures (line charts) report the annual rates at which healthcare services were provided to the parents before and after the attack. Bottom halves of figures (pie charts) report the numbers and proportion of parents provided for within each six-month period. Notably, in the early aftermath of the attack we observed a sharp increase in frequency of both primary and specialized mental healthcare services acquired. In the delayed aftermath, the observed frequency of healthcare service acquisition largely leveled out.

Figure 3a-b presents the output of the statistical analyses comparing pre- and post-disaster healthcare consumption. The horizontal axes indicate the RR of post- versus pre-disaster healthcare consumption. The dotted vertical line indicates no difference (RR=1). A statistically significant difference is indicated when the 95% CI do not overlap this line. First, rates of healthcare *service*s *utilized* (a) before and after the attack were addressed. We found that age-adjusted predictions of primary healthcare service consumption rates in mothers and fathers were significantly elevated both in the early and delayed aftermath, when compared to the three-year period before the terrorist attack. Similarly, in mothers, but not in fathers, a significant increase in rates of post-disaster specialized mental healthcare service consumption was demonstrated, both in the early and delayed aftermath. In fathers, specialized mental healthcare service consumption could not be reliably bootstrapped, due to an insufficient number of occurrences. No significant increase in rates was found in the specialized somatic healthcare services. Second, we compared the proportion of *individuals utilizing the services* (b) before and after the attack. We found that, compared to pre-disaster values, significantly more mothers and fathers utilized primary healthcare services, both in the early and delayed aftermath. Furthermore, significantly more mothers and fathers utilized specialized mental healthcare services in the early aftermath, when compared to pre-disaster levels. In the delayed aftermath, the numbers of mothers, but not fathers, utilizing the specialized mental

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healthcare services remained significantly elevated. Sensitivity analyses addressing the improved reporting practices to NPR across the study period consistently returned conclusions that were not appreciably different to the findings presented in this paper, and are not shown.

Finally, we assessed the reasons for parents encountering the healthcare services in the aftermath of the attack, as recorded by the primary healthcare providers at the time of the services' provision (Figure 4). Notably, psychological health complaints dominated reasons for encountering in both genders. In fact, 78.4% of mothers (n=174) and 47.1% of fathers (n=64) consulted their GP about psychological complaints (ICPC-2, chapter "P") in the aftermath of the attack. More than one third were diagnosed with depression (mothers n=42, 19.0%; fathers n=15, 11.0%), or PTSD (mothers n=14, 6.3%; fathers n=10, 7.4%) or both (mothers n=9, 4.1%; fathers n=4, 2.9%). Individuals with psychological health complaints were largely managed by primary healthcare services without receiving specialized mental healthcare services (mothers n=106, 60.9%; fathers n=47, 73.4%).

DISCUSSION

The overall aim of this study was to make a detailed description of pre- and post-disaster healthcare consumption in parents of the Utøya terrorist attack survivors. We found that primary healthcare was the larger provider of healthcare services both before and after the terrorist attack. The number of services provided to both mothers and fathers increased soon after the terrorist attack and peaked within the first six-month period. The increase in primary healthcare services both in the early and delayed aftermath was largely attributable to psychological health complaints, as recorded by their primary healthcare provider. In Norway, primary healthcare is the entry point to specialized healthcare, as well as to social benefits and public welfare services. Our figures suggest an important role for GPs in managing parents' post-disaster distress. GPs need to be aware that high numbers of parents may turn to primary healthcare with psychological health complaint in the wake of a terrorist attack, enabling appropriate preparations.

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Increase in post-disaster primary healthcare consumption was most notable in female participants. Previous research has identified female survivors of trauma as more susceptible to developing post-traumatic stress disorder than men (40, 41). Thus, our data may in part reflect gender differences in post-disaster stress reactions. However, an alternative explanation is that distressed fathers may have been more reluctant than mothers to seek help for mental health complaints, as has been suggested by previous research (42, 43). Potential barriers to accessing post-disaster healthcare in men and women should be further addressed in future research.

A significant increase in numbers of both mothers and fathers accessing specialized mental healthcare services was found in the current study. This finding is in line with our previous work, demonstrating significant associations between the parents' post-traumatic stress reactions and their self-reported specialized healthcare consumption in the early aftermath of the terrorist attack (28). Lack of capacity or capability of the primary healthcare services in providing for traumatized patients, including lack of appropriate experience or expertise, may have contributed to early referrals to the specialized healthcare services in some patients. However, in keeping with a registry-based study of the psychiatric diagnoses assigned by Swedish specialized mental healthcare providers to survivors of the 2004 Southeast Asian Tsunami (44), the increase in specialized mental healthcare consumption is likely also to include the most severely traumatized parents – those in need of specialized mental healthcare interventions.

In the aftermath of disaster, an increase in healthcare consumption may result from both new patients entering the healthcare system, as well as an increase in frequency of service consumption among those already in the services (45). In our study, most participants were found to utilize primary healthcare services both before and after the terrorist attack. Thus, the increased primary healthcare service consumption stemmed largely from an increase in frequency of healthcare consumption in individuals that were known to the services. In contrast, the specialized mental healthcare services faced an influx of patients that were largely new to the services. Potential differences in parents' post-disaster healthcare consumption according to disaster characteristics, e.g.

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magnitude, duration and potential for damage, whether it is a shared or a non-shared trauma of parent and child, whether it is a natural or a man-made disaster, as well as the levels of post-disaster psychosocial support services are still largely to be investigated.

Strengths and limitations

The context of this study is a universal, public, accessible and well-developed healthcare system. The study employs an objective measure on healthcare consumption, recorded by the healthcare provider at the time of the healthcare service provision. The study allows for reliable comparison of pre- and post-disaster data, with negligible levels of missing data. However, observed healthcare consumption does not objectively reflect healthcare needs. Consumption may represent a combination of the perception of needs of a patient deciding to seek medical advice, and the clinical judgement of a provider, who for example may encourage renewed contacts, make referrals etc. Although most applicable in similar clinical settings, we hold that our findings may reflect underlying post-disaster distress, and thereby healthcare needs that may arise in parents anywhere in the world, in the face of terror. Whether similar patterns of healthcare needs arise in parents after other types of shared or non-shared traumatic exposures, such as when a child is struck by a natural disaster, traffic accident or serious illness, remains to be investigated.

In the current study, we only included healthcare services provided by healthcare professionals. Thus, parts of the proactive post-disaster outreach program were not included (28). In the aftermath of a terrorist attack, many countries are likely to adopt some kind of crisis response, as was reported following the major terrorist attacks in France (46) and the UK (47). The organization and contents of such programs vary across different country settings (48). Psychosocial support through post-disaster outreach programs may facilitate access to healthcare services and thus potentially increase overall healthcare consumption. On the other hand, it may alleviate health complaints, and thus reduce consumption. Following the Utøya terrorist attack, a majority of the mothers and fathers were contacted by the outreach services in their municipality (28). The contents

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of the services provided are not known in detail. No adjustment for engagement with the outreach program was made. Finally, although uncommon due to universal coverage of the national insurance scheme, some participants may have self-financed access to additional healthcare services or obtained services abroad.

Conclusion

Widespread unmet healthcare needs have been reported among survivors of terrorist attacks (49). Our study emphasizes the importance of thinking about survivors in a broader, more systemic way. Post-disaster increase in healthcare needs may not be limited to individuals rescued from the site of a terrorist attack, but may also include close family members, such as parents.

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DECLARATIONS

Ethics approval and consent to participate

Consents to participation and collection of registry-based data were obtained in writing from all participants. The study was approved by the Regional Committees for Medical and Health Research Ethics in Norway.

Availability of data and material

Data supporting the findings of this study are not publicly available. The patient level, registry-based data may be accessed through the Norwegian Directorate of Health (https://helsedirektoratet.no/english). Restrictions apply. Technical appendix and statistical code are available from the corresponding author.

Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: The study was supported by the Norwegian Directorate of Health; JMH and LES have received research grants from the Norwegian Research Council; no other relationships or activities that could appear to have influenced the submitted work. All researchers worked independently from funders.

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Authorship & contributorship

JMH, ST, LES and GD conceived of the study and developed the study design with TW-L. JMH, LES and GD gathered the data. JMH and TW-L conducted the statistical analyses. JMH wrote the first draft of

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the paper. All authors contributed to further drafts and approved the final submission, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JMH is the guarantor of the manuscript being an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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FIGURE LEGENDS

Figure 1 a-b: Split-violin diagrams presenting frequency distributions of parents' overall healthcare service consumption before (left violins) and after (right violins) the terrorist attack. The vertical axes indicate the frequency by which the healthcare services were utilized. Each curve represents a Kernel density estimation, in which the area under curves reflect the proportion of mothers and fathers accessing the services.

Figure 2 a-b: Healthcare service consumption across time, presented as rates of services utilized (line chart) and proportions of mothers and fathers provided for within each six-month period (pie chart). Corresponding numeric values and values for *in person* consultations only are available in Supplementary table 3.

Figure 3 a-b: Rate ratios of parents' post- versus pre-disaster healthcare consumption, in terms of (a) predictions of frequency of healthcare service consumption (age-adjusted negative binomial hurdle regressions) and (b) observed proportions of individuals provided for (mean semiannual values). Confidence intervals (95%) of the ratios were generated through bootstrap replications. Corresponding numerical values are available in Supplementary table 4.

[a)] Ratio of estimates could not be reliably bootstrapped in our model.

Figure 4: Reasons for accessing the primary healthcare services, according to ICPC-2, in the three year periods before and after the terrorist attack. Categories with incidence of < 0.2 services per person per year are pooled ("other"). Widths of bars correspond to duration of time interval. Total number of services: 13,337. Corresponding numeric values are available in Supplementary table 5.

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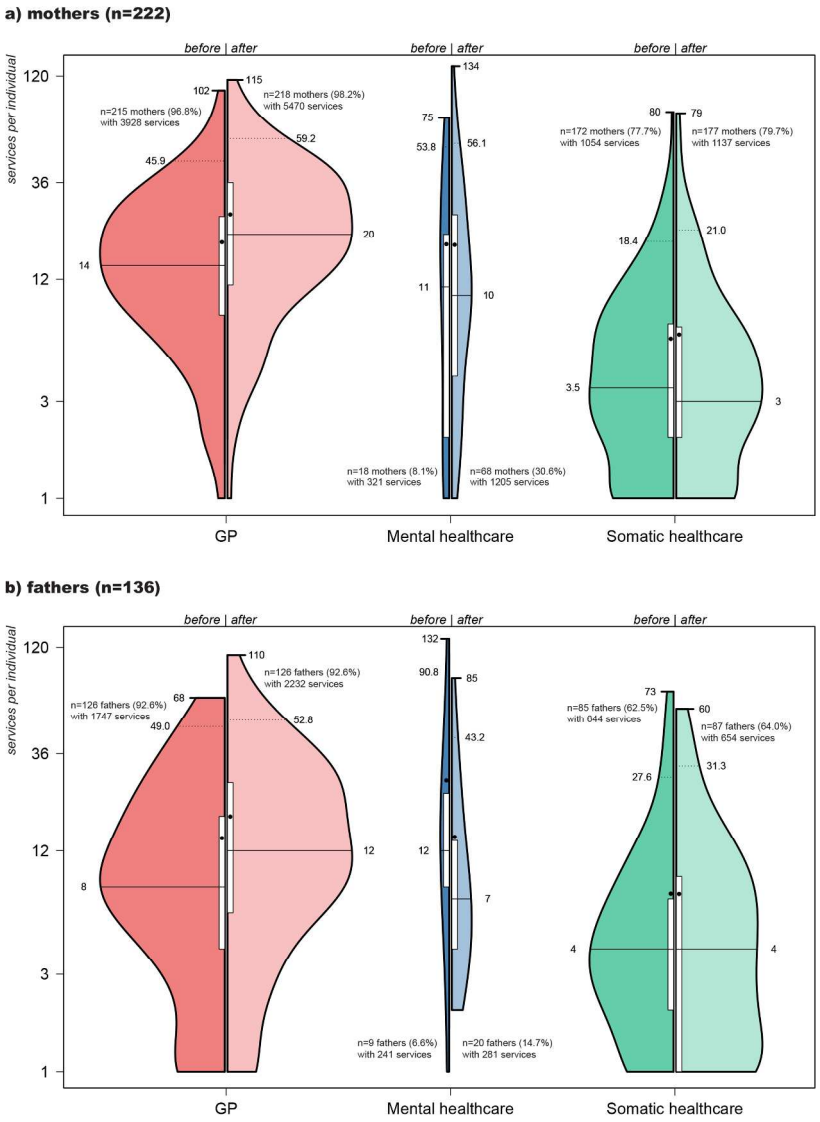

Colored areas/violins: Kernel density estimations, multiplied by proportion of mothers and fathers having utilized services pre- and post-disaster (left and right violin, respectively). White vertical box: inter quartile range (Q1-Q3). Solid horizontal line: median value. Black bullet: mean value. Dotted horizontal line: 95th percentile. Upper edge: maximum value.

Figure 1 a-b: Split-violin diagrams presenting frequency distributions of parents' overall healthcare service consumption before (left violins) and after (right violins) the terrorist attack. The vertical axes indicate the frequency by which the healthcare services were utilized. Each curve represents a Kernel density estimation, in which the area under curves reflect the proportion of mothers and fathers accessing the services.

186x264mm (300 x 300 DPI)

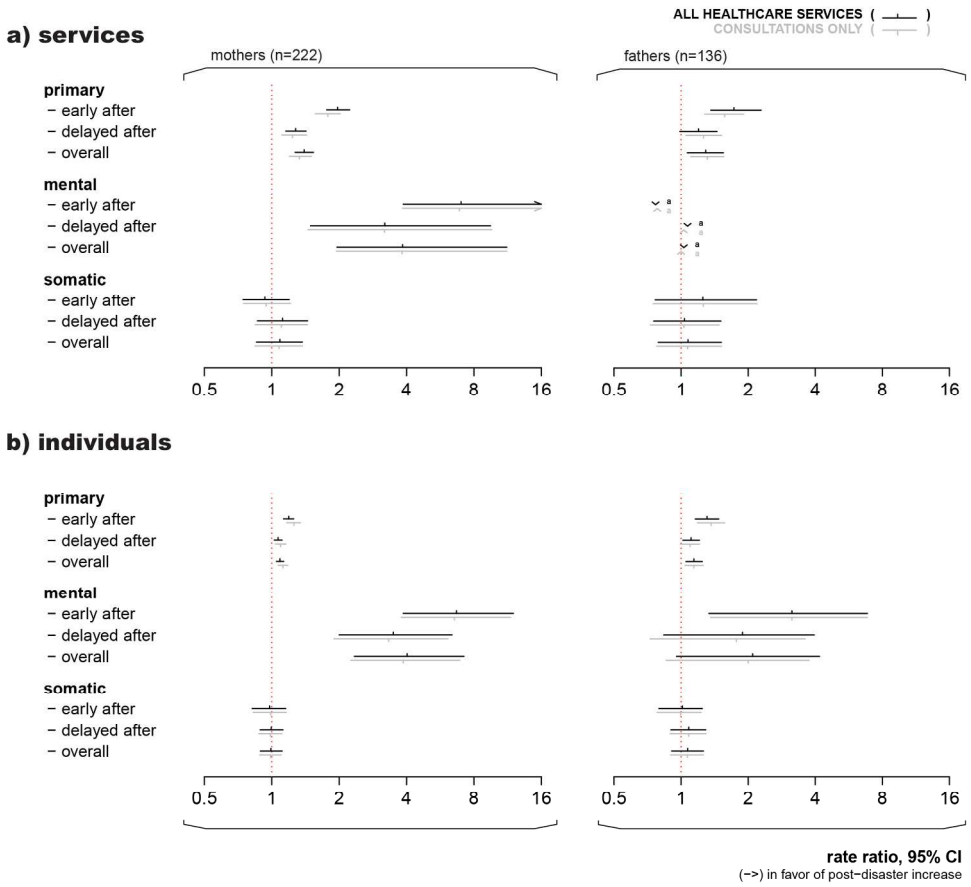

Figure 3 a-b: Rate ratios of parents' post- versus pre-disaster healthcare consumption, in terms of (a) predictions of frequency of healthcare service consumption (age-adjusted negative binomial hurdle regressions) and (b) observed proportions of individuals provided for (mean semiannual values). Confidence intervals (95%) of the ratios were generated through bootstrap replications. Corresponding numerical values are available in Supplementary table 4. ┬ a) Ratio of estimates could not be reliably bootstrapped in our model.

186x166mm (300 x 300 DPI)

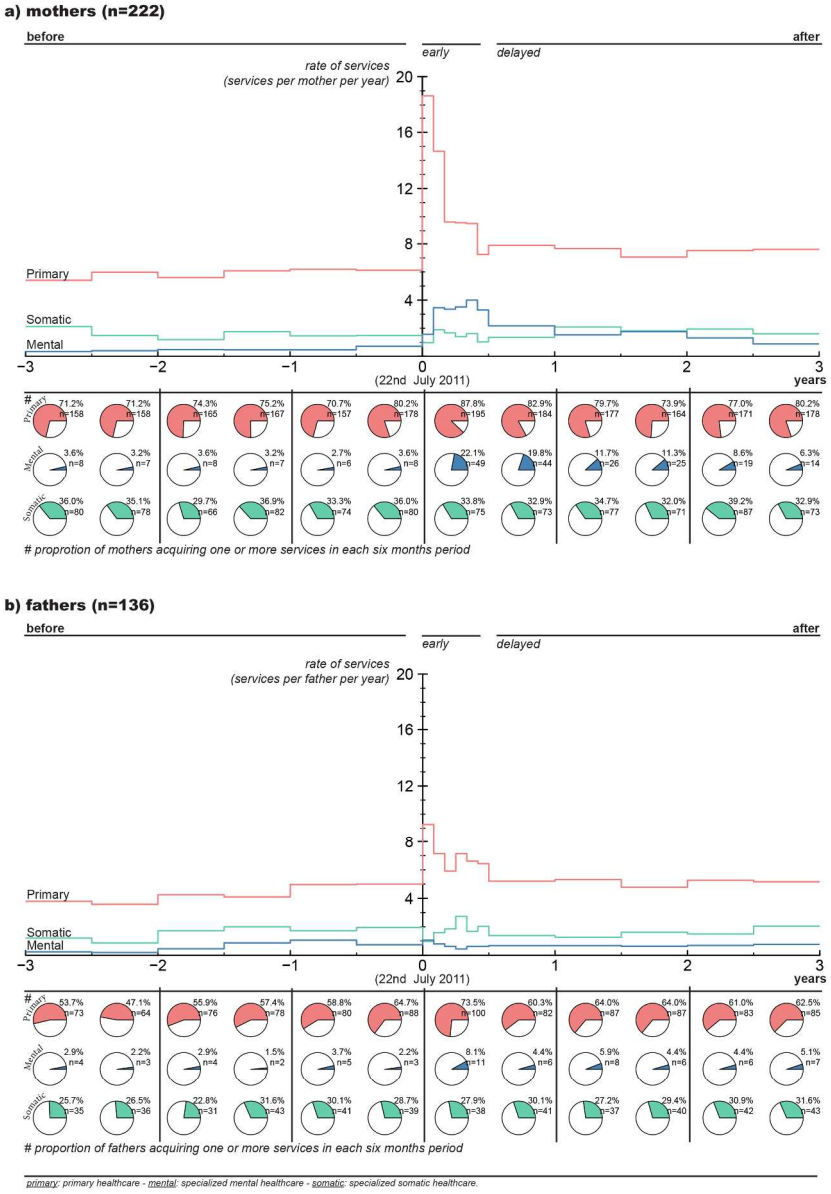

Figure 2 a-b: Healthcare service consumption across time, presented as rates of services utilized (line chart) and proportions of mothers and fathers provided for within each six-month period (pie chart). Corresponding numeric values and values for in person consultations only are available in Supplementary table 3.

194x273mm (300 x 300 DPI)

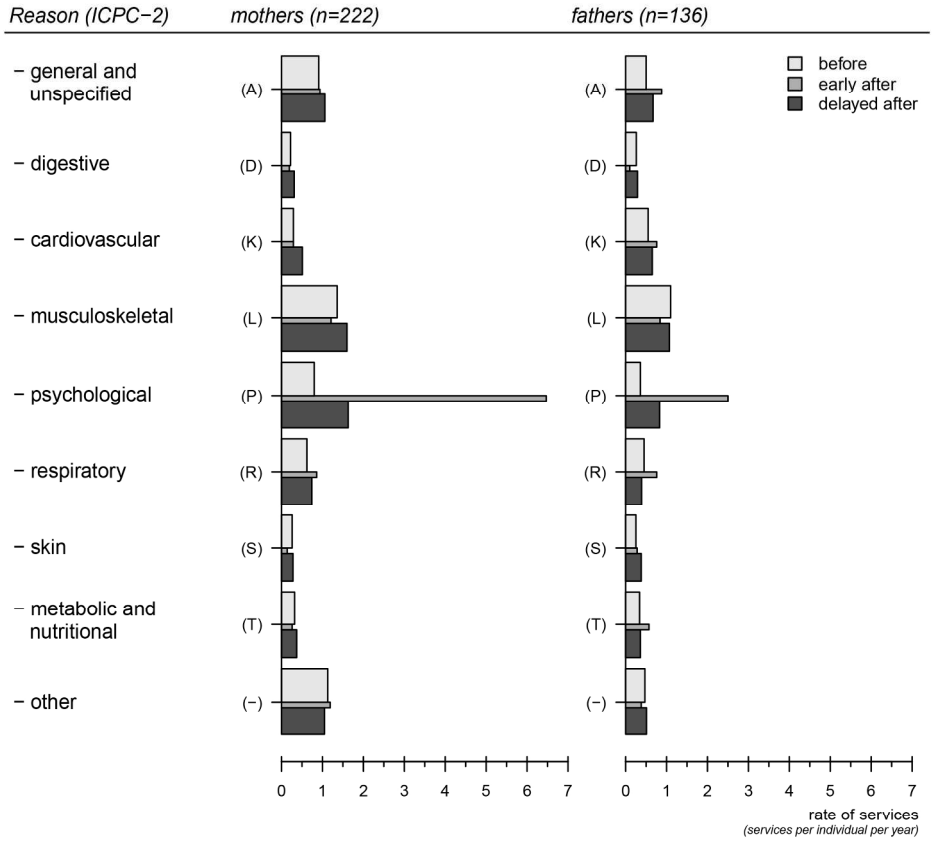

Figure 4: Reasons for accessing the primary healthcare services, according to ICPC-2, in the three year periods before and after the terrorist attack. Categories with incidence of < 0.2 services per person per year are pooled ("other"). Widths of bars correspond to duration of time interval. Total number of services: 13,337. Corresponding numeric values are available in Supplementary table 5.

199x185mm (300 x 300 DPI)

Supplementary table 1 – Nature of the different healthcare services provided to the study participants in the three year periods before and after the Utøya attack (total number of services: 19,208).

	Primary healthcare		Specialized mental healthcare		Specialized somatic healthcare	
	before (n=5,675)	after (n=7,702)	before (n=578)	after (n=1,501)	before (n=1,836)	after (n=1,916)
outpatient, consultations	3130 (55.2)	4082 (53.0)	531 (91.9)	1374 (91.5)	1631 (88.8)	1694 (88.4)
outpatient, other services[a]	2545 (44.8)	3620 (47.0)	31 (5.4)	112 (7.5)	67 (3.6)	97 (5.1)
inpatient, admissions[b]	-	-	16 (2.8)	15 (1.0)	138 (7.5)	125 (6.5)

[a] telephone consultations, mail correspondence etc.
[b] mean duration of admissions, pre- and post-disaster - specialized mental healthcare – 10.7 days (SD 9.2) and 15.1 days (SD 17.2) - specialized somatic healthcare - 5.4 days (SD 7.6) and 4.60 days (SD 6.9).

Supplementary table 2 – Incomplete entries (missing patient ID) in the Norwegian Patient Registry[1]

a) Specialized mental healthcare services

year	missing ID (%)
2008	5.80 %
2009	4.79 %
2010	0.78 %
2011	0.49 %
2012	0.53 %
2013	0.30 %
2014	0.25 %

b) Specialized somatic healthcare services

year	missing ID (%)
2008	4.89 %
2009	3.31 %
2010	2.19 %
2011	2.18 %
2012	1.66 %
2013	1.32 %
2014	1.22 %

[1] Source: the Norwegian Patient Registry.

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Supplementary table 3 – Observed rates of healthcare service consumption in the three-year periods before and after the terrorist attack, annualized values. Supplement to Figure 2.

	mothers (n=222)			Fathers (n=136)		
	primary	mental	somatic	primary	mental	somatic
Before (all services | consultations only)						
2008-Jul-22 to 2009-Jan-21	5.41 | 3.33	0.34 | 0.34	2.12 | 2.05	3.79 | 2.24	0.24 | 0.22	1.21 | 1.16
2009-Jan-22 to 2009-Jul-21	5.98 | 3.05	0.41 | 0.39	1.49 | 1.46	3.57 | 1.93	0.19 | 0.19	0.87 | 0.72
2009-Jul-22 to 2010-Jan-21	5.60 | 3.13	0.49 | 0.48	1.19 | 1.17	4.25 | 2.35	0.46 | 0.34	1.72 | 1.69
2010-Jan-22 to 2010-Jul-21	6.08 | 3.14	0.47 | 0.44	1.76 | 1.64	4.10 | 2.46	0.87 | 0.87	2.00 | 1.97
2010-Jul-22 to 2011-Jan-21	6.19 | 3.35	0.47 | 0.43	1.46 | 1.38	4.97 | 2.91	1.06 | 1.04	1.72 | 1.66
2011-Jan-22 to 2011-Jul-21	6.13 | 3.17	0.72 | 0.64	1.49 | 1.40	5.00 | 2.85	0.74 | 0.71	1.96 | 1.94
After (all services | consultations only)						
early aftermath						
2011-Jul-22 to 2011-Aug-21	18.65 | 7.62	1.57 | 1.35	0.97 | 0.97	9.26 | 4.59	1.06 | 0.97	0.97 | 0.97
2011-Aug-22 to 2011-Sep-21	14.65 | 7.57	3.46 | 3.03	1.89 | 1.84	7.15 | 3.88	0.79 | 0.79	1.59 | 1.50
2011-Sep-22 to 2011-Oct-21	9.62 | 4.92	3.35 | 3.19	1.68 | 1.62	5.91 | 3.09	0.62 | 0.62	1.85 | 1.85
2011-Oct-22 to 2011-Nov-21	9.57 | 5.19	3.51 | 3.30	1.41 | 1.41	7.15 | 3.88	0.44 | 0.44	2.74 | 2.74
2011-Nov-22 to 2011-Dec-21	9.51 | 5.03	4.00 | 3.78	1.62 | 1.62	6.62 | 3.26	0.62 | 0.62	1.68 | 1.68
2011-Dec-22 to 2012-Jan-21	7.24 | 3.68	3.30 | 2.97	1.03 | 0.86	6.44 | 3.79	0.62 | 0.62	2.03 | 1.85
delayed aftermath						
2012-Jan-22 to 2012-Jul-21	7.89 | 3.86	2.17 | 1.95	1.35 | 1.32	5.21 | 3.00	0.68 | 0.63	1.38 | 1.29
2012-Jul-22 to 2013-Jan-21	7.67 | 4.25	1.53 | 1.43	2.09 | 2.01	5.32 | 3.31	0.68 | 0.63	1.26 | 1.22
2013-Jan-22 to 2013-Jul-21	7.05 | 3.64	1.76 | 1.68	1.82 | 1.71	4.78 | 2.72	0.63 | 0.53	1.62 | 1.51
2013-Jul-22 to 2014-Jan-21	7.52 | 4.10	1.32 | 1.24	1.95 | 1.86	5.26 | 3.04	0.69 | 0.59	1.50 | 1.38
2014-Jan-22 to 2014-Jul-21	7.60 | 3.80	0.88 | 0.83	1.6 | 1.43	5.16 | 2.87	0.76 | 0.71	2.04 | 1.87
Summary (all services | consultations only)						
Average before	5.90 | 3.20	0.48 | 0.45	1.58 | 1.52	4.28 | 2.46	0.59 | 0.56	1.58 | 1.52
Average after	8.21 | 4.22	1.81 | 1.68	1.71 | 1.62	5.47 | 3.12	0.69 | 0.63	1.60 | 1.51

primary: primary healthcare, mental: specialized mental healthcare, somatic: specialized somatic healthcare

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Supplementary table 4 – Rate ratios of parents' post- versus pre-disaster healthcare consumption, in terms of (a) predictions of frequency of healthcare service consumption (age-adjusted negative binomial hurdle regression) and (b) proportions of individuals provided for (mean semiannual values). Confidence intervals (95%) of the rate ratios were generated through bootstrap replications. Supplement to Figure 3.

			mothers (n=222)				fathers (n=136)			
			all services		consultations only		all services		consultations only	
			estimate	ratio, after/before (95% CI)	estimate	ratio, after/before (95% CI)	estimate	ratio, after/before (95% CI)	estimate	ratio, after/before (95% CI)
a) services										
primary	*before*		5.92		3.21		0.71		0.66	
	after	- early	11.65	1.97 (1.76 - 2.23)	5.71	1.78 (1.57 - 2.02)	0.54	1.73 (1.36 - 2.29)	0.52	1.57 (1.28 - 1.91)
		- delayed	7.57	1.28 (1.15 - 1.42)	3.97	1.24 (1.11 - 1.43)	0.76	1.20 (0.99 - 1.45)	0.68	1.26 (1.05 - 1.52)
		- overall	8.26	1.40 (1.27 - 1.54)	4.26	1.33 (1.20 - 1.50)	0.73	1.29 (1.07 - 1.55)	0.66	1.31 (1.10 - 1.55)
mental	*before*		0.46		0.43		0.71		0.66	
	after	- early	3.25	7.00 (3.86 - 19.02)	2.98	6.88 (3.84 - 18.95)	0.54	0.77 [a]	0.52	0.78 [a]
		- delayed	1.48	3.20 (1.49 - 9.49)	1.38	3.19 (1.45 - 9.60)	0.76	1.07 [a]	0.68	1.03 [a]
		- overall	1.78	3.84 (1.95 - 11.21)	1.65	3.82 (1.94 - 11.18)	0.73	1.03 [a]	0.66	1.00 [a]
somatic	*before*		1.58		1.52		1.31		1.26	
	after	- early	1.48	0.93 (0.74 - 1.20)	1.43	0.94 (0.75 - 1.21)	1.64	1.25 (0.77 - 2.18)	1.59	1.26 (0.75 - 2.19)
		- delayed	1.77	1.12 (0.86 - 1.44)	1.67	1.10 (0.84 - 1.44)	1.36	1.04 (0.75 - 1.51)	1.30	1.03 (0.73 - 1.48)
		- overall	1.72	1.09 (0.85 - 1.37)	1.63	1.08 (0.84 - 1.37)	1.41	1.07 (0.79 - 1.52)	1.35	1.07 (0.78 - 1.52)
b) individuals										
primary	*before*		0.74		0.63		0.56		0.49	
	after	- early	0.88	1.19 (1.13 - 1.25)	0.79	1.26 (1.17 - 1.34)	0.74	1.31 (1.16 - 1.48)	0.66	1.36 (1.18 - 1.57)
		- delayed	0.79	1.07 (1.03 - 1.11)	0.69	1.10 (1.04 - 1.16)	0.62	1.11 (1.02 - 1.21)	0.53	1.10 (0.99 - 1.21)
		- overall	0.80	1.09 (1.05 - 1.13)	0.70	1.12 (1.07 - 1.18)	0.64	1.14 (1.05 - 1.24)	0.55	1.14 (1.04 - 1.26)
mental	*before*		0.03		0.03		0.03		0.03	
	after	- early	0.22	6.68 (3.86 - 12.00)	0.22	6.55 (3.78 - 11.65)	0.08	3.14 (1.33 - 6.86)	0.08	3.14 (1.35 - 6.86)
		- delayed	0.12	3.49 (2.00 - 6.38)	0.11	3.33 (1.90 - 6.12)	0.05	1.89 (0.84 - 3.96)	0.05	1.77 (0.73 - 3.60)
		- overall	0.13	4.02 (2.34 - 7.22)	0.13	3.86 (2.25 - 6.92)	0.05	2.10 (0.95 - 4.18)	0.05	2.00 (0.86 - 3.75)
somatic	*before*		0.35		0.34		0.28		0.27	
	after	- early	0.34	0.98 (0.82 - 1.15)	0.34	0.99 (0.83 - 1.16)	0.28	1.01 (0.80 - 1.24)	0.27	1.00 (0.78 - 1.23)
		- delayed	0.34	0.99 (0.89 - 1.12)	0.34	0.99 (0.88 - 1.11)	0.30	1.08 (0.90 - 1.29)	0.30	1.08 (0.89 - 1.29)
		- overall	0.34	0.99 (0.89 - 1.11)	0.34	0.99 (0.88 - 1.10)	0.30	1.07 (0.91 - 1.26)	0.29	1.07 (0.90 - 1.26)

primary: primary healthcare, mental: specialized mental healthcare, somatic: specialized somatic healthcare.

[a)] Ratio could not be reliably bootstrapped in our model.

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Supplementary table 5 – Reasons for accessing primary healthcare services, according to ICPC-2, before and after the terrorist attack. Categories with incidence of < 0.2 services per person per year are pooled. Supplement to Figure 4.

	ICPC-2	mothers (n=222)			fathers (n=136)		
		before	early	delayed	before	early	delayed
Overall		5.90	11.54	7.56	4.28	7.09	5.15
General and unspecified	(A)	0.91	0.94	1.06	0.50	0.88	0.67
Digestive	(D)	0.22	0.19	0.31	0.26	0.10	0.29
Cardiovascular	(K)	0.29	0.29	0.51	0.55	0.76	0.65
Musculoskeletal	(L)	1.36	1.21	1.60	1.10	0.84	1.07
Psychological	(P)	0.80	6.47	1.63	0.36	2.50	0.83
Respiratory	(R)	0.62	0.86	0.74	0.45	0.76	0.39
Skin	(S)	0.26	0.14	0.28	0.25	0.28	0.38
Endocrine/Metabolic and Nutritional	(T)	0.32	0.26	0.37	0.34	0.57	0.36
Other		1.13	1.19	1.05	0.47	0.38	0.51

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STROBE statement?checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract		
	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract OK. Page 1.
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found OK. Page 3.
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported OK. Page 5.
Objectives	3	State specific objectives, including any prespecified hypotheses OK. Page 6.
Methods		
Study design	4	Present key elements of study design early in the paper OK. Page 7.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection OK. Page 6-7.
Participants	6	(*a*) *Cohort study*?Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up*Case-control study*?Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls*Cross sectional study*?Give the eligibility criteria, and

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	Item No	Recommendation
		the sources and methods of selection of participants OK. Page 7.
		(b) *Cohort study*?For matched studies, give matching criteria and number of exposed and unexposed*Case-control study*?For matched studies, give matching criteria and the number of controls per case N/A.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable OK. Page 8-9.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group OK. Page 8-9.
Bias	9	Describe any efforts to address potential sources of bias OK. Page 13.
Study size	10	Explain how the study size was arrived at OK. Page 7-8.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why OK. Page 9-10.
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding OK. Page 9-10.
		(b) Describe any methods used to examine subgroups and

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	Item No	Recommendation
		interactions N/A
		(c) Explain how missing data were addressed OK. Page 9-10.
		(d) *Cohort study*?If applicable, explain how loss to follow-up was addressed*Case-control study*?If applicable, explain how matching of cases and controls was addressed*Cross sectional study*?If applicable, describe analytical methods taking account of sampling strategy N/A
		(e) Describe any sensitivity analyses OK. Page 9-10.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study?eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed OK. Page 7-8.
		(b) Give reasons for non-participation at each stage OK. Page 7-8.
		(c) Consider use of a flow diagram Not used.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders OK. Page 7-8
		(b) Indicate number of

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	Item No	Recommendation
		participants with missing data for each variable of interest OK. Page 7-8
		(*c*) *Cohort study*?Summarise follow-up time (eg average and total amount)
Outcome data	15*	*Cohort study*?Report numbers of outcome events or summary measures over time OK. Page 10-11
		*Case-control study?*Report numbers in each exposure category, or summary measures of exposure
		*Cross sectional study?*Report numbers of outcome events or summary measures
Main results	16	*(a)* Report the numbers of individuals at each stage of the study?eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed OK. Page 10-11
		(*b*) Give reasons for non-participation at each stage
		(*c*) Consider use of a flow diagram
Other analyses	17	Report other analyses done?eg analyses of subgroups and interactions, and sensitivity analyses OK. Page 11
Discussion		
Key results	18	Summarise key results with reference to study objectives OK. Page 12-13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias

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	Item No	Recommendation
		OK. Page 13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence OK. Page 12-13
Generalisability	21	Discuss the generalisability (external validity) of the study results OK. Page 13
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based OK. Page 15

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