et al. (2016) [4] showed reductions in the PAID score (from 30 to 20 points, −10.4) as well as in the number of subjects with a high diabetes-related burden (from 29.3% to 12.6%) between baseline and follow-up (6–18 months), and the items in the PAID questionnaire scoring the highest were 'worrying about the future and the possibility of serious complications', 'feelings of guilt or anxiety for neglecting therapy' and 'worrying about hypoglycaemia' at both baseline and follow-up. This is exactly in line with our present study results and suggests that it is very important to discuss these topics during a DTTP. However, while hypoglycaemia and diabetes complications are discussed in all currently available DTTPs, none of these programmes can provide precise figures on the risk of developing diabetes-related complications and their prevalence. This may be why the current DTTPs are, in fact, not as effective as they could be in reducing the diabetes-related burden.

In a population-based prospective trial, 506 participants with DM2 were assessed three times over 18 months for different psychological outcomes, including diabetes-related distress, which was measured by the Diabetes Distress Scale [8]. This trial found a 29.2% prevalence of diabetes-related distress at any of the three time points (baseline, 9-month follow-up and 18-month follow-up), but a mean of only 6.4% for all time points combined. Thus, diabetes-related distress is clearly highly variable over time and is probably associated with multiple variables, such as patients' feelings of well-being and their living conditions. Indeed, our present trial has confirmed this result, as only one patient showed high diabetes-related distress twice (T0 and T2), whereas all others at only one visit.

For the DM2 cohort as a whole, the improvement in HbA1c was −0.7%; for those not on insulin therapy, the change was −0.9% after 6 months. In patients with DM2 and taking insulin, HbA1c decreased with no changes in insulin dosage and body weight. In contrast, in those with DM1, HbA1c remained stable overall, although those with initially high HbA1c levels improved markedly, eventually achieving the treatment target of $\leq 7.5\%$ recommended by German guidelines for patients with DM1 [9]. In fact, after 6 months, the mean HbA1c of the whole group was on target at 7.4%.

Conclusion

Participation in a DTTP is associated with a reduction of diabetes-related distress in patients with DM1. However, this immediately achieved improvement after DTTP was not fully maintained after 6 months. Also, while all participants had diabetes-specific problems before the intervention, the mean PAID score was nevertheless below the threshold of 40 points, indicating that the overall prevalence of diabetes-related distress was low, especially in those with DM2. Further future research is necessary to either increase the efficacy of DTTPs by adding to our information on the individual risks for diabetes-related morbidity and/or developing more sensitive instruments to detect diabetes-related distress.

Statement of informed consent

Informed consent was obtained from all patients included in the study.

Statement on human rights

All procedures followed were in accordance with the ethical standards of the responsible committees for human experimentation (institutional and national) and with the Helsinki Declaration of 1975 (as revised in 2008).

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Disclosure of interest

The authors declare that they have no competing interest.

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Evacuation is a risk factor for diabetes development among evacuees of the Great East Japan earthquake: A 4-year follow-up of the Fukushima Health Management Survey

Introduction

The Great East Japan earthquake struck on 11 March 2011. After the earthquake, a massive tsunami hit the Tokyo Electric Power company's Fukushima Daiichi nuclear power plant in Fukushima prefecture, causing the release of radiation. The Fukushima Daiichi nuclear disaster forced the evacuation of several towns, which led to lifestyle changes and anxiety over radiation among the evacuees.

For this reason, immediately after the disaster, the Fukushima Health Management Survey (FHMS) was started to investigate the effects of long-term exposure to low-dose radiation [1].

Based on previous data from a comprehensive health check-up with a 1.6-year follow-up, it had been reported that evacuation was a cause of body weight gain [2], diabetes [3], hypo-high-density lipoprotein (hypo-HDL) cholesterolaemia [4], hypertension [5] and metabolic syndrome [6]. These results suggested that evacuation might be a risk factor for the development of various disorders.

In the previous study [3], after adjusting for age, gender, body mass index (BMI), smoking status, systolic blood pressure, HDL cholesterol (HDL-C), alanine aminotransferase (ALT) and γ-glutamyl transpeptidase (γ-GT) levels using the Cox proportional hazards model, it was demonstrated that evacuation was associated with a significantly higher incidence of diabetes. As it was unclear why this was so, it was assumed that the reason might be the associated change in lifestyle with evacuation. Lifestyle change is a well-known cause of obesity that, in turn, can lead to an increase in incidence of diabetes.

Therefore, the present study concentrated more on lifestyle factors at baseline to determine whether they could confound the relationship between incident diabetes and evacuation, and also followed people over a longer time span of 4 years. Data from the aftermath of the disaster were used as baseline.

Methods

Study population and design

The FHMS was carried out by Fukushima Medical University. The participants were Japanese adults living near the Fukushima Daiichi nuclear power plant in Fukushima Prefecture who were residents of Tamura city, Minamisoma city, Kawamata town, Hirono town, Naraha town, Tomioka town, Kawauchi village, Okuma town, Futaba town, Namie town, Katsurao village, Iitate village and Date city. According to census data from 2010, the combined population of these communities was 278,286 individuals. In 2008, the Japanese government had started an annual health-check programme, The Specific Health Check and Guidance System, which focused on detecting metabolic syndromes in adults aged 40–74 years and was run by national healthcare insurers. The dates of annual health check-ups from 2011 as a part of the comprehensive health checks in the FHMS were followed. A previous report details the methodology of these health checks and the FHMS [1]. Based on national census data, the target population of adults aged 40–74 years living in the above-mentioned 13 municipalities was 125,987 in 2010, a year before the disaster. Also obtained were data for 21,354 adults who had undergone annual health check-ups in 2011 after the disaster (baseline) as well as at least one check-up between 2012 and 2014; they represented around 17% of the population according to the 2010 census. To conduct a longitudinal analysis, 3001 participants who had not received an annual check-up between 2012 and 2014 were excluded. Also excluded were 1989 participants who had been diagnosed with diabetes in 2011 check-ups, and 2877 participants who were missing data on, for example, physical activity (2798 participants), weight changes from age 20 years (46 participants), weight changes within one year (24 participants) and hours of restorative sleep (nine participants) as baseline. Finally, 13,487 participants who had undergone follow-up examinations were included in the analysis (Fig. S1; see supplementary data associated with this article online). For those who underwent check-ups more than once during the survey period, the date on which diabetes was identified, or the latest date in subjects without diabetes, was recorded.

Ethics and consent

Informed consent was obtained from all subjects and community representatives as required to conduct an epidemiological study as per the guidelines of the Council for International Organizations of Medical Science [7]. Also, the study protocol was reviewed and approved by the Ethics Committee of Fukushima Medical University (#1916), and conducted in accordance with the approved guidelines.

Measurements

All measurements used in this analysis are described in detail in the Appendix (see supplementary data associated with this article online).

Statistical analysis

Participants were divided into two groups, based on their residence status after the Great East Japan Earthquake, as evacuees ($n = 4235$) and non-evacuees ($n = 9252$). Baseline characteristics of the evacuees and non-evacuees who underwent follow-up health examinations were compared using chi-square or Wilcoxon rank-sum tests. To evaluate the impact of evacuation on incidence of diabetes, hazard ratios (HRs) of new-onset diabetes and 95% confidence intervals (CIs) for evacuation were calculated using multivariable-adjusted HRs after adjusting for other potential confounding factors [age, gender, BMI scores, current smoker, excess alcohol consumption, weight change (≥ 10 kg) from age 20 years, weight change (≥ 3 kg) within 1 year, sleep quality and physical activity]. SAS version 9.3 software (SAS Institute, Cary, NC, USA) was used for all analyses. All probability values for statistical tests were two-tailed, and P values < 0.05 were considered statistically significant.

Results

Baseline characteristics of participants who had follow-up health checks after the disaster

Among all 18,353 participants (including 1989 patients with diabetes), the prevalence of diabetes at baseline was estimated to be 10.8% (Supplementary data, Fig. S1). The study followed 13,487 participants (43.5% male) without diabetes using data from annual check-ups in 2010–2011 and those who had undergone at least one other annual check-up in 2012–2014 (Supplementary data, Fig. S1). Table 1 presents the clinical characteristics of the two groups (evacuees and non-evacuees) at baseline. First, when risk factors for the development of diabetes were compared, the evacuees were significantly younger and more often female than non-evacuees. The evacuees also had a significantly greater prevalence of obesity, dyslipidaemia, weight change (≥ 10 kg) from age 20, weight change (≥ 3 kg) within one year, adequate sleep and smoking habit than non-evacuees. However, no significant differences were observed in HbA1c levels, hypertension or physical activity between the two groups.

Incidence of diabetes

On investigating the incidence of diabetes, the cumulative incidence was 4.54% (612 participants) over a mean follow-up period of 2.67 years. The total incidence of diabetes was 17.0/1000 person-years, while that of the evacuees was 1.61-fold higher (23.2/1000 person-years) compared with non-evacuees (14.4/1000 person-years). Significant differences were also observed in

Table 1
Baseline characteristics of evacuees and non-evacuees who underwent follow-up health examinations after the Great East Japan Earthquake.

	Non-evacuees	Evacuees	P[a]
n	9252	4235	
Gender (% male)	44.2%	41.9%	< 0.001
Age (years)	64.3 ± 7.8	63.1 ± 8.9	< 0.001
HbA1c (%)	5.3 ± 0.3	5.3 ± 0.3	0.071
HbA1c (mmol L^{-1})	34.4 ± 3.3	34.4 ± 3.3	0.071
Obesity (%)[b]	26.7	36.0	< 0.001
Hypertension (%)[c]	52.7	51.9	0.374
Dyslipidaemia (%)[d]	50.0	56.0	< 0.001
Weight change (≥ 10 kg) from age 20 (%)	31.3	39.6	< 0.001
Weight change (≥ 3 kg) within 1 year (%)	19.2	40.1	< 0.001
Regular exercise (%)	34.5	34.3	0.847
Adequate sleep (%)	75.1	64.0	< 0.001
Current smoker (%)	12.2	15.1	< 0.001
Alcohol consumption (%)			
Non-drinker	29.5	33.8	< 0.001
Light drinker	51.9	48.2	
Moderate/heavy drinker[e]	18.6	18.0	

Data are presented as means ± standard deviation (SD) and as percentages for categorical variables.
[a] Evacuees vs non-evacuees after earthquake by chi-square or Wilcoxon rank-sum test.
[b] Body mass index ≥ 25 kg/m^2.
[c] Systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg or self-reported use of blood-pressure-lowering drugs.
[d] LDL-C ≥ 140 mg dL^{-1}, triglycerides ≥ 150 mg·dL^{-1}, HDL-C < 40 mg·dL^{-1}, or self-reported use of cholesterol-lowering drugs.
[e] Ethanol intake ≥ 44 g day^{-1}.

baseline characteristics between the two groups, prompting the construction of Cox proportional hazards models, which found that evacuation was indeed a significant risk factor for the development of diabetes compared with non-evacuation, with a crude HR of 1.73 (95% CI: 1.47–2.04). The age- and gender-adjusted HR for evacuation was 1.78 (95% CI: 1.51–2.09) whereas, after full adjustment, the multivariate HR for evacuation was 1.51 (95% CI: 1.28–1.79).

Discussion

Our team had previously demonstrated that, after adjusting for age, gender, BMI, smoking status, and systolic blood pressure, HDL-C, ALT and γ-GT levels [3], evacuation was significantly associated with an increased incidence of diabetes. However, there were several limitations in that previous analysis. First, the results had been obtained from a short-term follow-up of only 1.6 years. Second, that analysis was not adjusted for lifestyle factors, such as weight change, physical activity and sleep quality. Therefore, the present study investigated the effects of prolonged evacuation on the incidence of diabetes after adjusting for these and other lifestyle factors. The results have revealed that evacuation after the disaster was an independent risk factor for the development of diabetes, even after adjusting for various lifestyle factors.

The present data have also shown that metabolic factors, including obesity and dyslipidaemia, adversely affected evacuees. In addition, ratios of weight change from age 20, sleep deprivation and current smoking were significantly higher in evacuees than in non-evacuees. Thus, the disaster was more likely to have negative effects on metabolic laboratory test results in evacuees compared with non-evacuees. These findings suggest that chronic metabolic health problems such as obesity, type 2 diabetes, hypertension and dyslipidaemia should be carefully monitored and treated following a disaster, especially among evacuees. Living as an evacuee under unfavourable conditions increases stress in terms of privacy, availability of food, duty assignments, income, jobs and health [8]. Particularly in diabetes patients, mental stress can aggravate diabetes control [8,9].

Although worsening of glycaemic control after a disaster may be affected by a number of factors, such as changes in diet, reduction in exercise and more psychological stress, the association between evacuation and increased diabetes incidence remains unclear. In a previous report of mental health care, the FHMS revealed that evacuees who believed that radiation exposure causes negative health effects were significantly more likely to be psychologically distressed [10]. In fact, psychological distress was significantly more prevalent among residents of evacuation zones even after adjusting for other significant risk factors, such as age, gender, living arrangements, experiencing the nuclear-power-plant accident, loss of a family member, becoming unemployed and a history of mental illness. Moreover, psychological distress in each evacuation zone was positively associated with radiation levels in the evacuees' environment [11].

These reports suggest that fear of radiation risk as well as socioeconomic factors contribute to psychological distress among evacuees. Although not conducted under natural-disaster conditions, a prospective population-based study in Finland showed that high levels of psychological distress at baseline predict the development of metabolic syndrome, independent of age, gender, marital status, educational attainment, and baseline health behaviours such as smoking, alcohol intake and leisure-time physical activity [12]. Likewise, the FHMS found that evacuation was significantly associated with an increased incidence of metabolic syndrome [6]. Moreover, the survey also revealed that evacuation is a significant risk factor for overweight [2] and hypertension [5]. Thus, evacuees tend to be more psychologically distressed and are at greater risk of developing metabolic disorders than non-evacuees.

In conclusion, the findings of the present study suggest that prolonged evacuation is a risk factor for the development of diabetes following a disaster. Therefore, it is important to follow-up evacuees and to recommend lifestyle changes where necessary.

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

Supplementary data (Fig. S1 and Appendix) associated with this article can be found, in the online version, at http://www.sciencedirect.com at http://dx.doi.org/10.1016/j.diabet.2017.09.005.

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Intravenous insulin therapy as a therapeutic option for severe hypertriglyceridaemia in a non-diabetes patient

Severe hypertriglyceridaemia (SH) refers to a group of endocrine diseases characterized by blood triglycerides (TGs) permanently raised to > 4 g/L after 12 h of fasting [1,2]. In patients with SH, the risks of acute pancreatitis (AP) and premature atherosclerosis are also greater.

The overall prevalence of SH is not precisely known. The main causes of hypertriglyceridaemia (HTG) are either familial ones (hyperchylomicronaemia) or secondary HTG (excessive alcohol consumption, uncontrolled diabetes, kidney disease, endocrine disease, medications).

There are no clinical guidelines for SH, but treatment with insulin is predominantly used in diabetes patients, whereas heparin, plasmapheresis or a combination of the two has been successfully tested in non-diabetes patients. In the medical literature, however, the use of insulin infusions to treat SH in non-diabetes patients has not been particularly highlighted.

Case report

Our report is of a 38-year-old patient, with a history of alcohol abuse (8 cans of beer/day) and no other medical history, who presented the day before admission to our establishment with epigastric pain and asthenia, which had prompted a consultation with his general practitioner. The requested laboratory tests showed major HTG at 71 g/L, resulting in the patient's admission to the emergency department. He was later admitted to our department of endocrinology.

Clinical examination showed that the patient weighed 74 kg (body mass index: 24 kg/m^2). He was afebrile; his blood pressure was 120/65 mmHg and his pulse was 78 beats/min. Examination of the abdomen revealed mild epigastric tenderness with no rigidity. Cutaneous xanthomas and lipaemia retinalis were absent. After 12 h of fasting, the patient's serum TG was 81 g/L with lipaemic plasma. In 2014, his TGs were 1.4 g/L. Screening for blood alcohol was positive. All of his laboratory results are summarized in Table 1.

Abdominal ultrasound revealed a fatty liver, but computed tomography (CT) of the abdomen was normal, with no signs of pancreatitis. Nevertheless, given the high risk of acute pancreatitis, emergency therapeutic options [plasmapheresis, intravenous (IV) infusion of heparin or insulin] were considered, and insulin infusions were chosen because of our experience in the field.

An IV analogue insulin infusion was started and continued at 1 IU/h, while the patient was kept fasting for the first 24 h. After this time, a low-fat diet was started. To prevent hypoglycaemia, 10% dextrose was titrated to an average flow rate of 30 mL/h to maintain blood glucose within the normal range. Blood glucose