福島県立医科大学
FUKUSHIMA MEDICAL UNIVERSITY

Build Back Better, Together

2025 Fukushima Medical University International Symposium
on the Fukushima Health Management Survey

**Fukushima's lessons for the future:
promoting health and responding to disasters**

February 20, 2025

Session I-3

Lessons from 13 years of the Comprehensive Health Check

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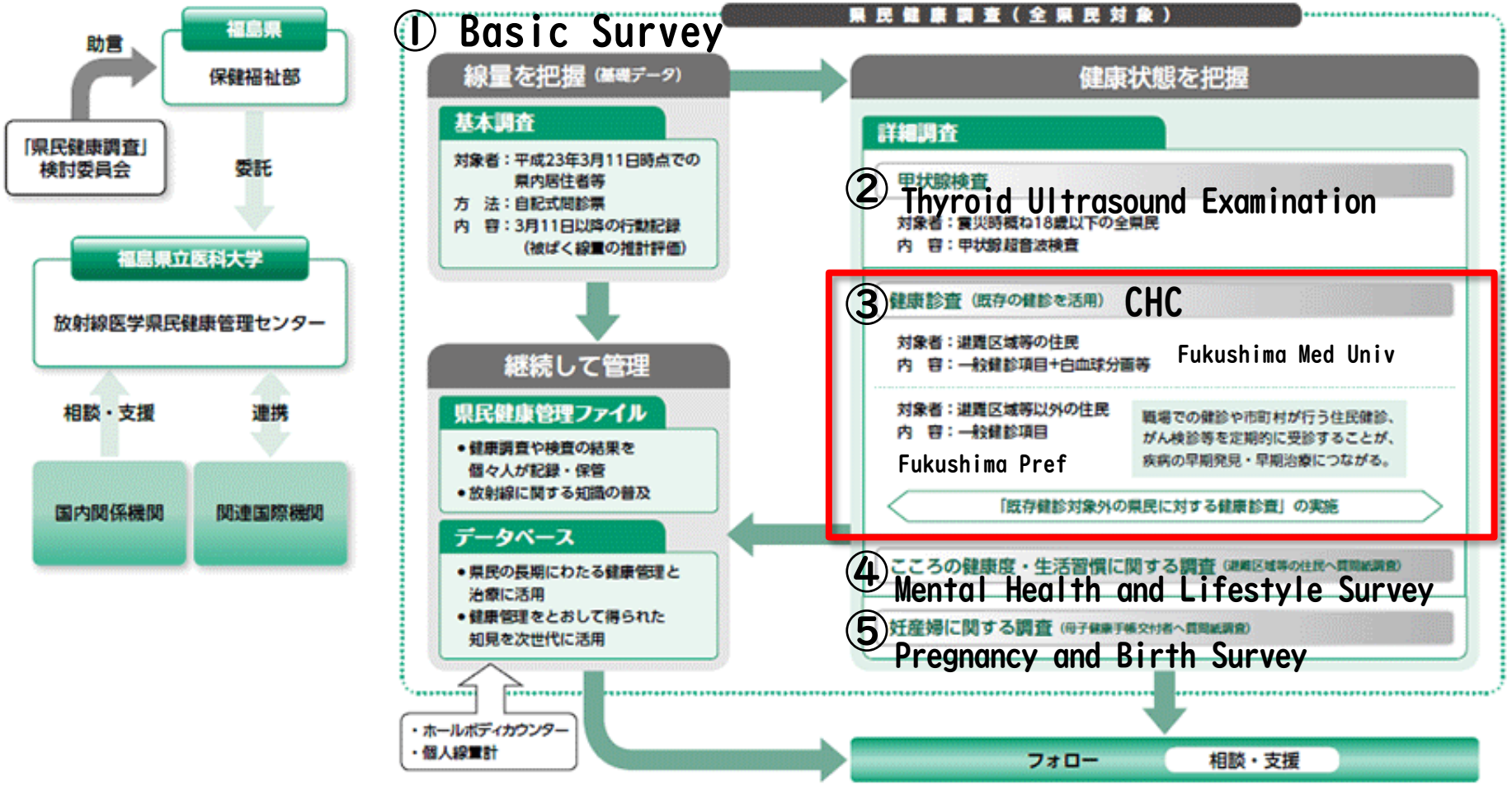
Topics

1. Lessons from 13 years of the Comprehensive Health Check
2. Psychological burden and Diabetes
3. Future perspective

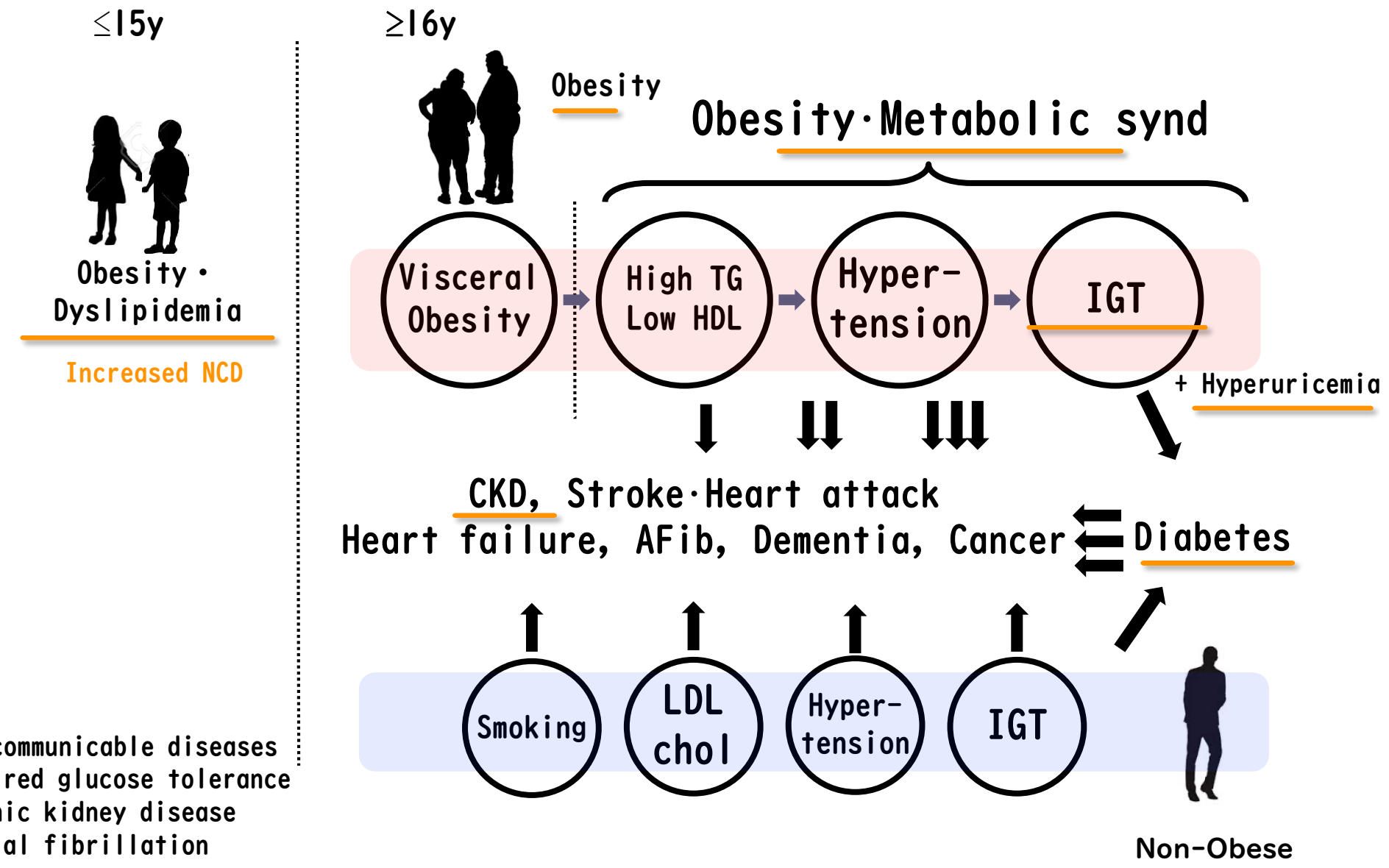
FHMS includes 5 surveys



CHC: Comprehensive Health Check
FHMS: Fukushima Health Management Survey

From website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University

Increased NCD after the diaster



NCD: Non-communicable diseases
IGT: Impaired glucose tolerance
CKD: Chronic kidney disease
Afib: Atrial fibrillation

Tanabe ... Shimabukuro, Diabetes Res Clin Pract 2021

NCD after the nuclear accident: what we know in CHC

≤15y: Children

A certain number of children presented with obesity, dyslipidemia, hyperuricemia, liver dysfunction, hypertension, and IGT. Obesity improved in the follow-up survey, but the improvement of lipid abnormalities in boys was delayed.

≥16y

- Increased: obesity, metabolic synd, IGT & diabetes, chronic kidney disease, hyperuricemia, and polycythemia
- Increased but improved: blood pressure, LDL-cholesterol (residents under treatment increased), liver dysfunction (decreased due to the improvements of daily physical activity and frequency of breakfast intake)
- No changes: WBC counts and fractions within the evacuated areas: no direct effects observed

CHC: The Comprehensive Health Checkup
IGT: Impaired glucose tolerance
WBC: White blood cell count

Based on the report submitted to the 41st Prefectural Oversight Committee Meeting for the Fukushima Health Management Survey

Lifestyle- and disaster-related factors and NCD risk: CHC ≥40y、men 10,120, women 13,961

	obesity		leanness		Hyper-tention		Diabetes mellitus		Dyslipi-demia		Liver dysfunction		CKD	
	M	W	M	W	M	W	M	W	M	W	M	W	M	W
Aging		↑	↑	↓	↑	↑	↑	↑		↑	↓	↑	↑	↑
Obesity	—	—	—	—	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Leanness	—	—	—	—	↓	↓		↓	↓	↓				
Excersise ≥ 2x/w									↓		↑			
Sleep satisfaction								↓						
EtOH < 40g/d			↓		↑			↓	↓	↓				
EtOH ≥ 40g/d					↑	↑			↓		↑	↑	↓	
Current smoking			↑	↑			↑		↑					
Evacuation		↑			↑				↑	↑	↑	↑		
Change of jobs	↑		↓	↓			↑		↑		↑			
Depressive symptoms											↑	↑		
PTSD symptoms														
Radiation concerns	↑													
Participation in recreation	↓		↓								↓			↑

↑ increase,
↓ decrease,
Empty, not significant,
—, not analyzed

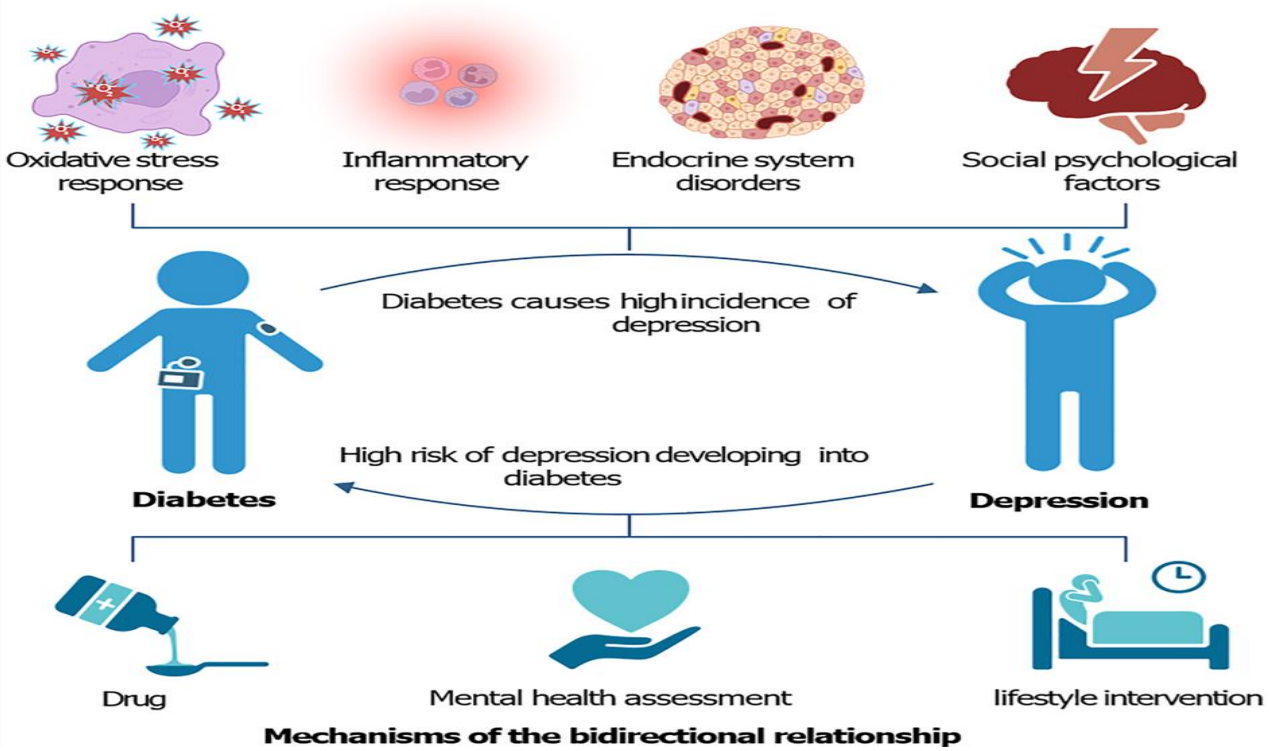
Based on the report submitted to the 41st Prefectural Oversight Committee Meeting for the Fukushima Health Management Survey

Topics

1. Lessons from 13 years of the Comprehensive Health Check
2. Psychological burden and Diabetes
3. Future perspective

【Background】

- Psychological distress and depression have been reported to bidirectional with diabetes[1-4], and psychological distress and post-traumatic stress disorder (PTSD) are risk factors for developing type 2 diabetes[1-5].



Yun Liu et al. World J Psychiatry 2024 Oct 19

1) Mommersteeg PM et al. BMC Public Health (2012) 12:1109.
2) Li C et al. BMJ Open (2017) 7:e014235.
3) Hackett RA et al. Nat Rev Endocrinol (2017) 13:547-60.
4) Yun Liu et al.World J Psychiatry 2024 Oct 19;14(10):1429-1436.
5) Vancampfort D et al. *Psychosom Med* (2016) 78:465-73.

【K6 questionnaire (Kessler-6 Scale) 】

The following questions ask about how you have been feeling during the **past 30 days**. For each question, please circle the number that best describes how often you had this feeling.

Q1. During the past 30 days, about how often did you feel …	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. …nervous?	1	2	3	4	5
b. …hopeless?	1	2	3	4	5
c. …restless or fidgety?	1	2	3	4	5
d. …so depressed that nothing could cheer you up?	1	2	3	4	5
e. …that everything was an effort?	1	2	3	4	5
f. …worthless?	1	2	3	4	5

13 points ≦ positive→ Non-specific mental health distress

https://www.hcp.med.harvard.edu/ncs/k6_scales.php

【PCL questionnaire（PTSD check list）】

PCL-S

The event you experienced was _____ (event) on _____ (date).

INSTRUCTIONS: Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

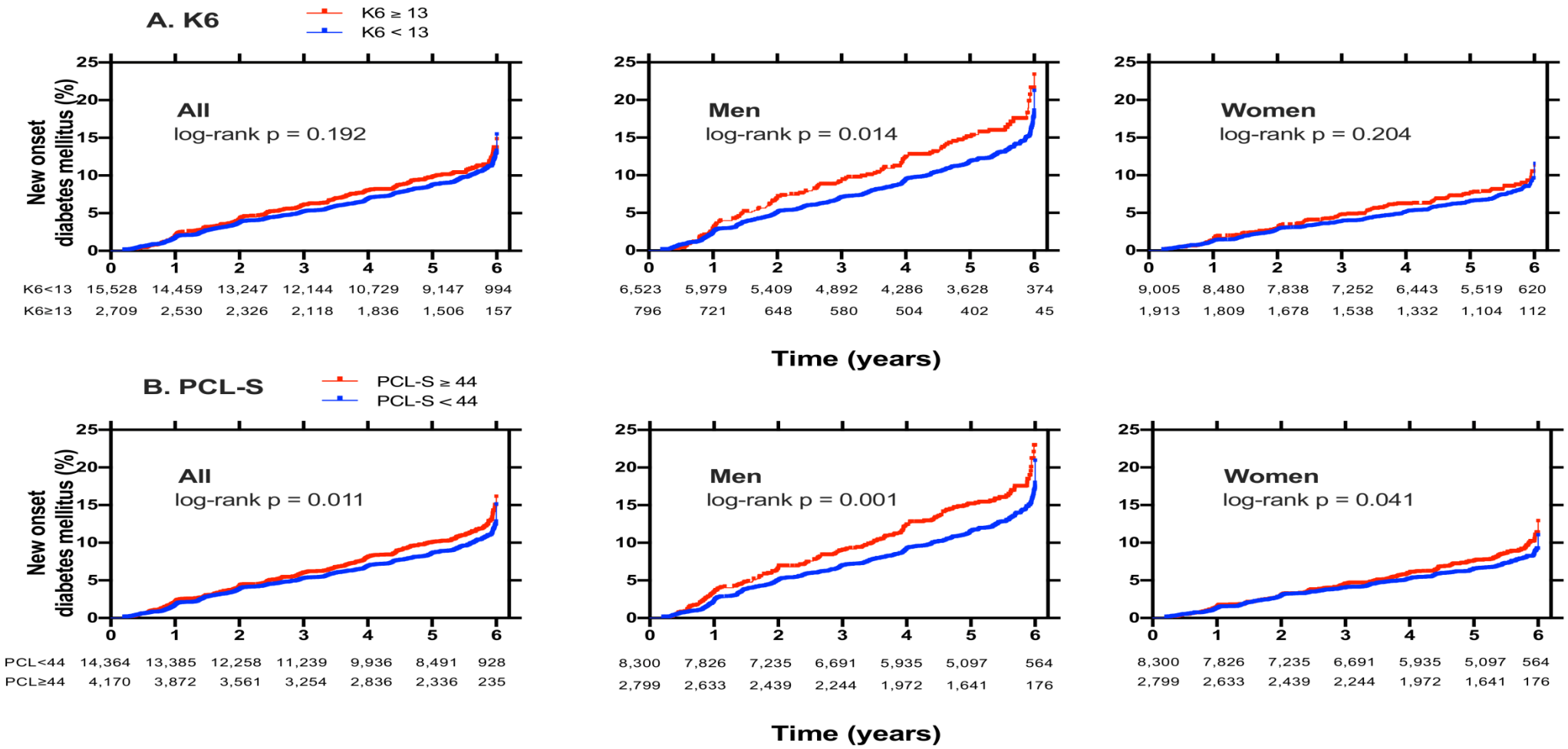
		Not at all	A little bit	Moderately	Quite a bit	Extremely
1.	Repeated, disturbing *memories, thoughts,* or *images* of the stressful experience?	1	2	3	4	5
2.	Repeated, disturbing *dreams* of the stressful experience?	1	2	3	4	5
3.	Suddenly *acting* or *feeling* as if the stressful experience *were happening again* (as if you were reliving it)?	1	2	3	4	5
4.	Feeling *very upset* when *something reminded you* of the stressful experience?	1	2	3	4	5
5.	Having *physical reactions* (e.g., heart pounding, trouble breathing, sweating) when *something reminded you* of the stressful experience?	1	2	3	4	5
6.	Avoiding *thinking about* or *talking about* the stressful experience or avoiding *having feelings* related to it?	1	2	3	4	5
7.	Avoiding *activities* or *situations* because *they reminded you* of the stressful experience?	1	2	3	4	5
8.	Trouble *remembering important parts* of the stressful experience?	1	2	3	4	5
9.	*Loss of interest* in activities that you used to enjoy?	1	2	3	4	5
10.	Feeling *distant* or *cut off* from other people?	1	2	3	4	5
11.	Feeling *emotionally numb* or being unable to have loving feelings for those close to you?	1	2	3	4	5
12.	Feeling as if your *future* will somehow be *cut short*?	1	2	3	4	5
13.	Trouble *falling* or *staying asleep*?	1	2	3	4	5
14.	Feeling *irritable* or having *angry outbursts*?	1	2	3	4	5
15.	Having *difficulty concentrating*?	1	2	3	4	5
16.	Being "*super-alert*" or watchful or on guard?	1	2	3	4	5
17.	Feeling *jumpy* or easily startled?	1	2	3	4	5

PCL-S for DSM-IV (11/1/94) Weathers, Litz, Huska, & Keane National Center for PTSD - Behavioral Science Division

44 points ≦ positive→ probable PTSD

https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist

Psychological burden increased new onset Diabetes



Hirai H, Shimabukuro M et al. Front. Endocrinol. 13:1008109.

Men：psychological distress and PTSD are risk factors for developing diabetes

Cox proportional Hazard model

Factors		K6 ≥ 13						PCL-S ≥ 44					
		Men (n=7,319)			Women (n=10,918)			Men (n=7,435)			Women (n=11,099)		
		HR	95%CI		HR	95%CI		HR	95%CI		HR	95%CI	
Model 1:	Unadjusted	1.28	1.05	1.56	1.13	0.94	1.36	1.30	1.11	1.53	1.18	1.01	1.39
Model 2:	+ Age sex and body mass index	1.27	1.04	1.55	1.11	0.92	1.34	1.24	1.06	1.46	1.06	0.90	1.25
Model 3:	+ Hypertension and dyslipidemia	1.28	1.05	1.56	1.10	0.91	1.32	1.24	1.05	1.45	1.05	0.89	1.23
Model 4:	+ Smoking habit, drinking habit, and physical activity	1.27	1.04	1.55	1.10	0.91	1.32	1.23	1.05	1.44	1.05	0.89	1.23
Model 5:	+ Evacuation	1.23	1.01	1.50	1.08	0.90	1.30	1.20	1.02	1.41	1.03	0.88	1.21
Model 6:	+ Sleep satisfied	1.26	1.02	1.55	0.99	0.81	1.20	1.22	1.03	1.45	0.95	0.80	1.13
Model 7:	+ Education ≥ 13 year	1.26	1.02	1.55	0.98	0.81	1.20	1.22	1.03	1.45	0.94	0.80	1.12
Model 8:	+ Change in work situation	1.23	1.00	1.52	0.99	0.81	1.21	1.20	1.01	1.43	0.95	0.80	1.13

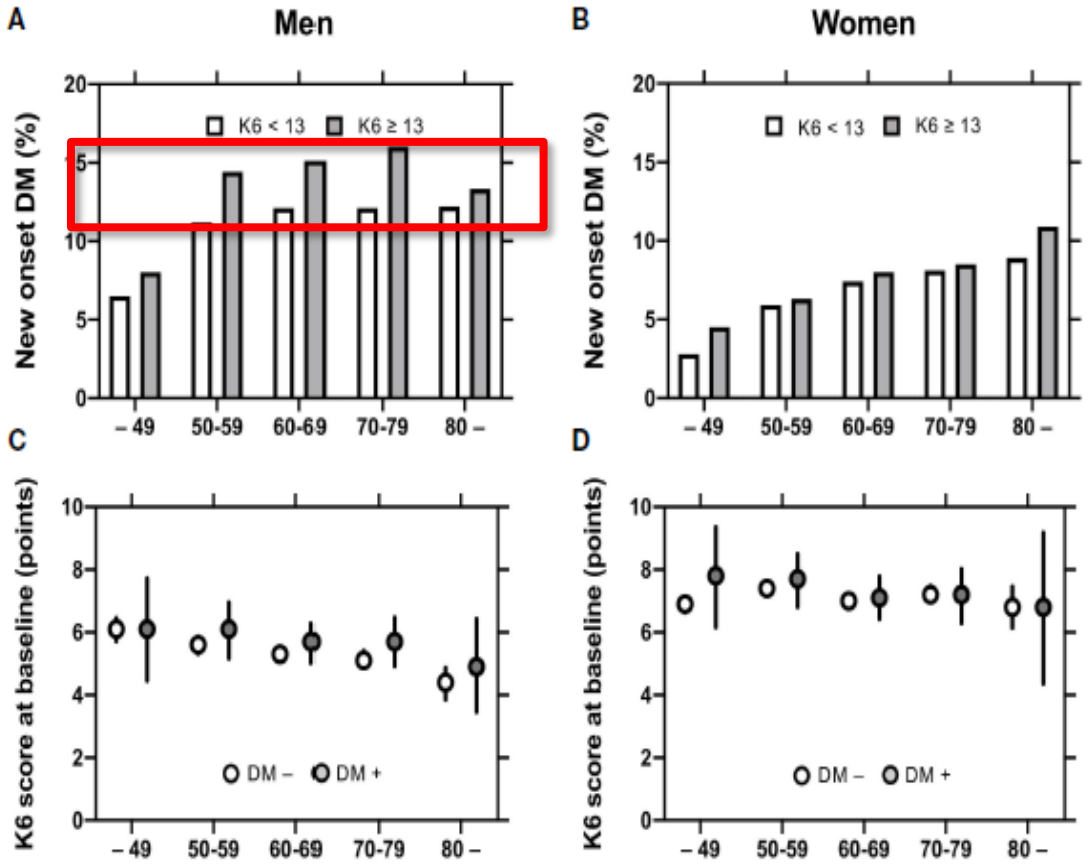
HR: hazard ratio , CI: confidential intervals

In men, both K6 ≥13 and PCL-S ≥ 44 showed significant HRs after correction for the above variables.

【Discussion】

1) The difference of self-reported symptom

The proportion of women among K6 ≥13 and PCL ≥ 44 groups was 70.6% and 67.1%, respectively; thus 2.40 and 2.04 times higher than that of men. This is consistent with previous reports showing that the incidence of PTSD is approximately twice as high in women as in men[1)]. K6 and PCL-S are self-reported questionnaires and could be subjective. 1) Fonkoue IT et al. Clin Auton Res (2020) 30:409-21.

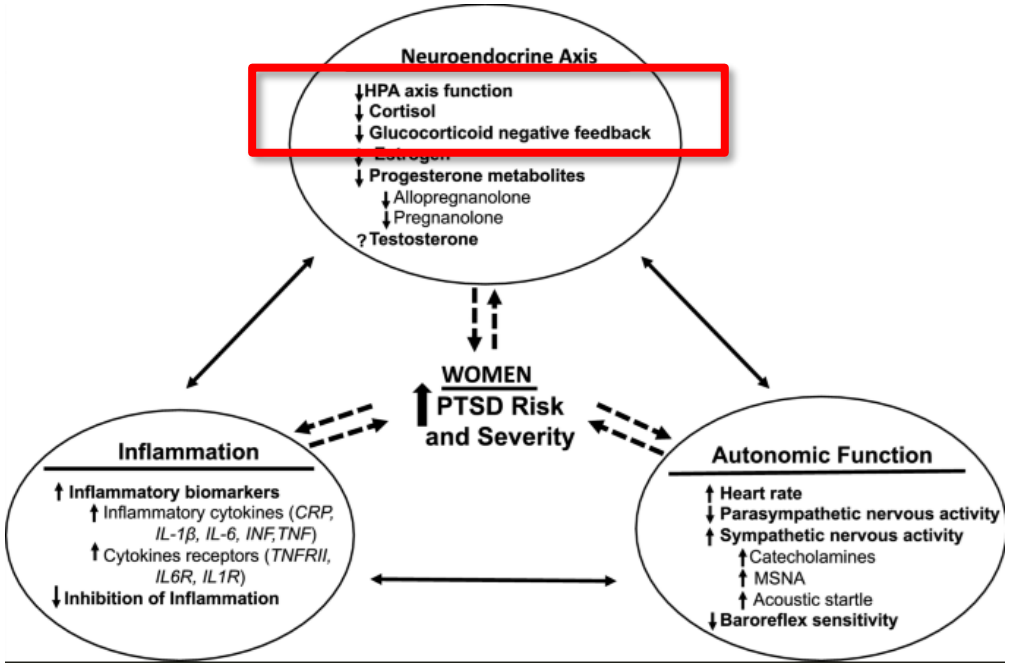


Hirai H, Shimabukuro M et al. Front. Endocrinol. 13:1008109.

Eriksson et al reported that women were more likely to experience distress symptoms and overreport them, while men were more likely to tolerate distress symptoms and underreport them[2)]. If this is the case, men with distress symptoms may have larger neuroendocrine changes when the distress symptoms are self-reported[2)].

2) Eriksson AK et al. Diabetes Med (2008) 25:834-42.

2) The different response of hypothalamic-pituitary-adrenal axis (HPA)



Fonkoue IT et al. Clin Auton Res (2020) 30:409–21.

The hypothalamic-pituitary-adrenal axis (HPA)during mental stress, can be modified, influenced, or both differentially in men and women [1]. Fonkoue et al. hypothesized that stress reactivity observed in men leads to a higher risk for new-onset diabetes via high levels of cortisol, while the lower cortisol response to stress observed in women stems from a hypo-reactivity of the HPA, which is associated with an increased risk for psychological distress and PTSD[1]. 1) Fonkoue IT et al. Clin Auton Res (2020) 30:409-21.

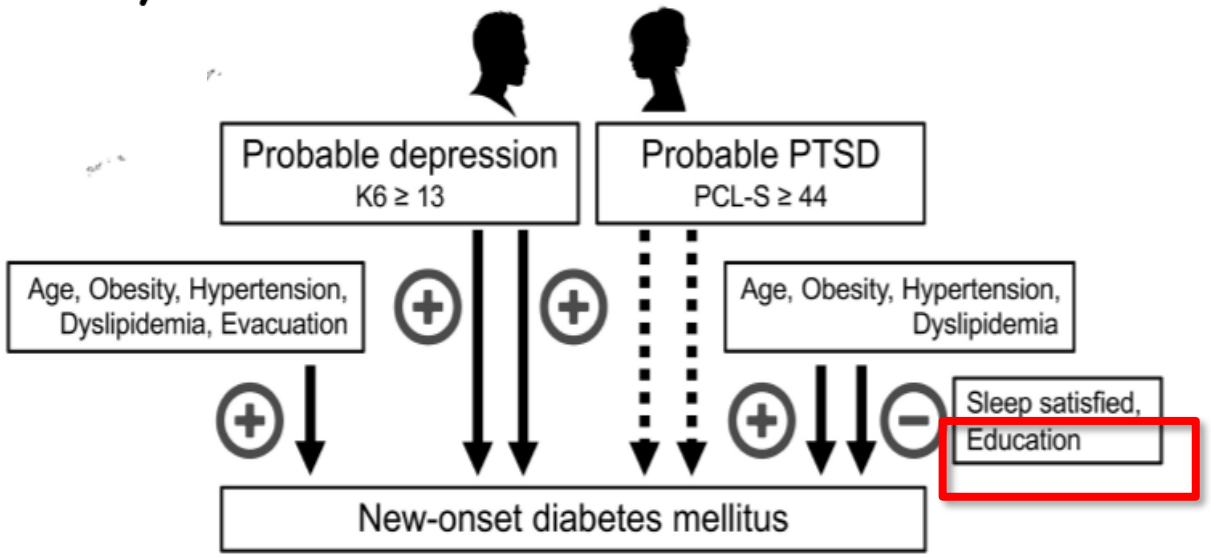
3) The difference of social factors

The association of psychological stress with employment rate, socioeconomic status, and education levels, which may differ between men and women, could be linked to gender difference in new-onset diabetes. It has been reported that unemployment impairs mental health largely in men among evacuees of the Great East Japan Earthquake[3].

In this study, education ≥ 13 years in women could be associated with lower risk of diabetes. Previous studies reported that higher education level was associated with lower diabetes risk [4] in agreement with our finding in women.

3) Ishiguro A et al. Disaster Med Public Health Prep. (2019) 13:487-96.
4) Kivimäki M et al. Lancet Public Health (2020) 5:e140-e9.

summary



Topics

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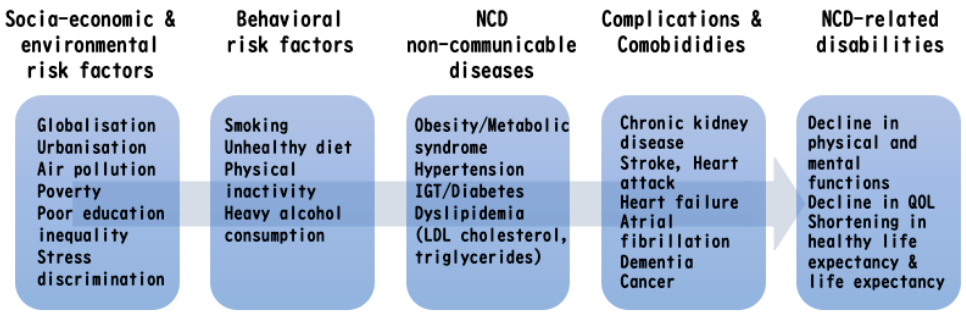
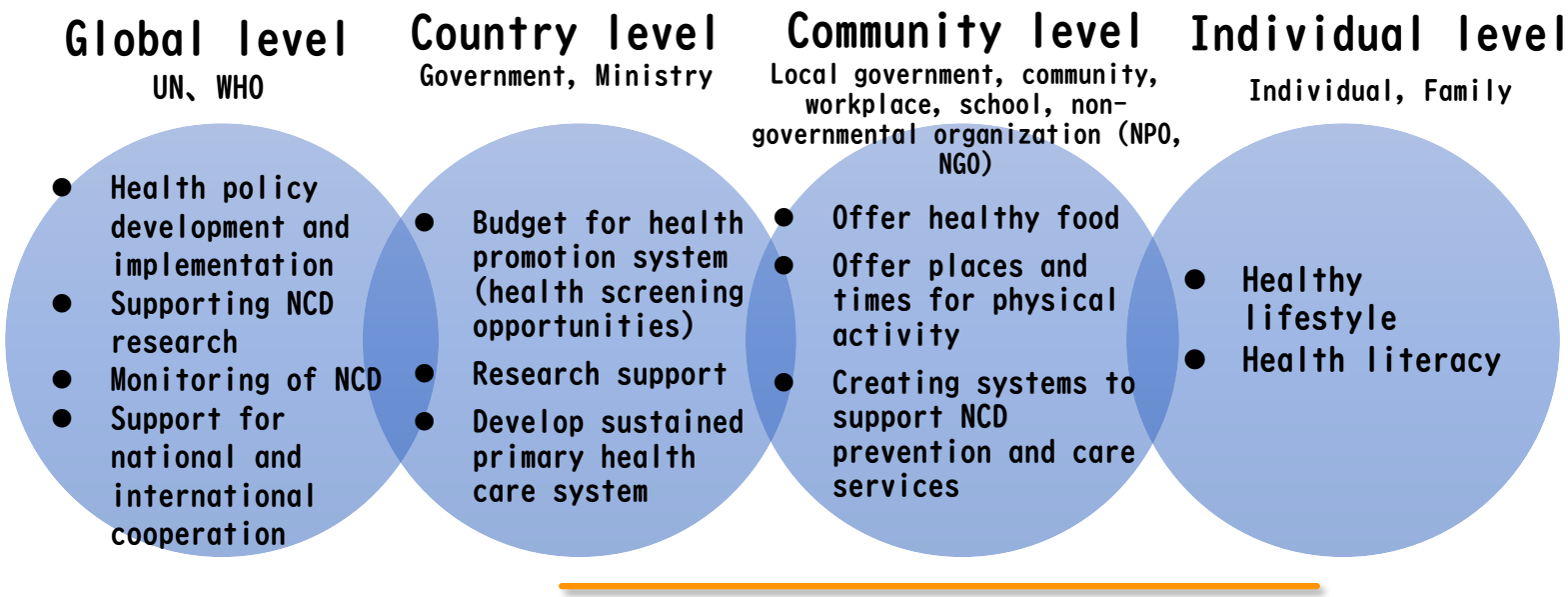
NCD：Who and how to prevent it

How NCD Occurs

NCD: Non-communicable diseases



Dans et al, Lancet 2021:377;680
Park et al, https://bit.ly/3HYhWHC
Modified by Shimabukuro

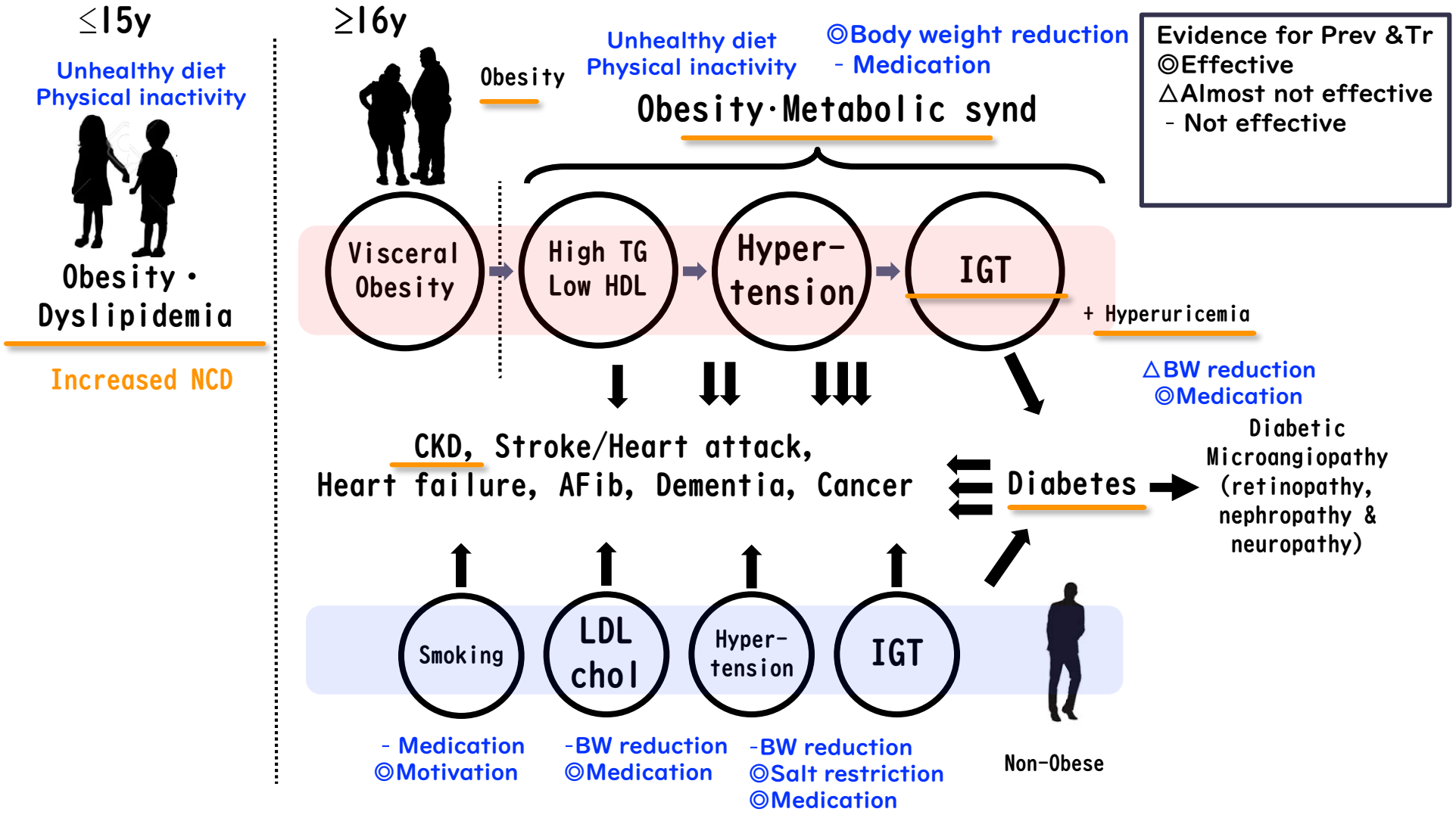


Budreviciute et al. Front Public Health 2020:574111 Modified by Shimabukuro (Private opinion)

CHC: Comprehensive Health Check

Increased NCD after the diaster : Evidence for Prevention and Treatment

Scientifically proven facts



Tanabe ... Shimabukuro, Diabetes Res Clin Pract 2021

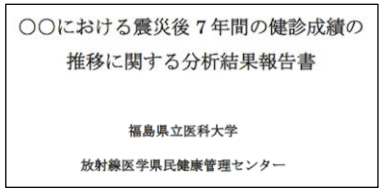
IGT: impaired glucose tolerance
CKD: chronic kidney disease
Afib: atrial fibrillation

Role of CHC in 10 years summary

Reports of the 41st Prefectural Monitoring Committee Meeting for FHMS 2011-2019

1. Provide opportunities for health checkups
   - Secure the physical and mental health of residents who experienced major changes in their living environment after the earthquake.
   - Opportunities to receive checkups for people between 16-39y, who have few opportunities by current health policy.
2. Close cooperation with municipalities
   - Sharing of residents health information via planning of health events and reports conference
3. Analysis of factors associated with physical and mental health after the earthquake
   - Clarification and sharing of factors associated with physical and mental health
   - Academic papers: 51 accepted, 27 in progress (as of Dec. 11, 2024)
4. Impacts of feedback from CHC
   - An improvement in some risks (blood pressure and LDL cholesterol levels) due to increased health awareness, corrected lifestyle, and higher treatment rates
   - The results of health checkups were used for municipal health policy
5. Proposal from CHC
   - Proposal made to municipalities and local residents on the importance of (1) physical activity and healthy diet, (2) mental health care, and (3) promotion of social participation.

Notification of individual results



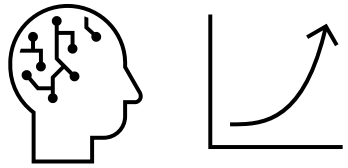
Preparation and sharing of analysis reports

Health seminar

Fisccal Year	Numbers	Visitors
2016	3M 11 times	495
2017	6M 42 times	2,379
2018	6M 26 times	2,324
2019	6M 38 times	3,334
2020	3M 17 times	1,432
2021	3M 18 times	1,642
2022	4M 25 times	2,028
2023	7M 67 times	2,462
2024 (Untill the end of Dec)	7M 117 times	5,927

Summary

take home message



1. Lessons from 13 years of the Comprehensive Health Check

- Increased in adult, partially in children: obesity, metabolic synd, IGT & diabetes, chronic kidney disease, hyperuricemia, and polycythemia.
- Estimated doses were associated with increased NCD→ Presumably, evacuation and lifestyle changes may have affected the development of NCD among residents with higher estimated radiation doses.

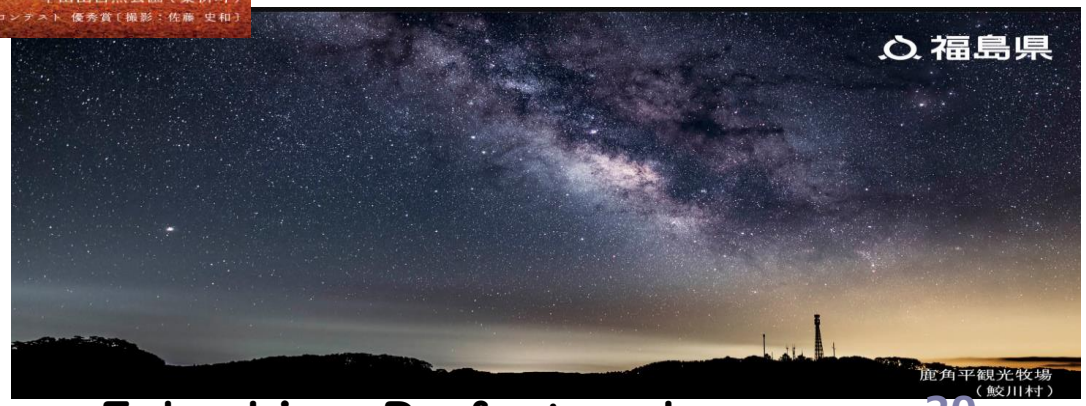
2. Psychological burden and Diabetes

- psychological distress and post-traumatic stress disorder (PTSD) are risk factors for developing diabetes in men.
- The difference of self-reported symptom, the different response of hypothalamic-pituitary-adrenal axis (HPA), and the difference of social factors?

3. Future perspective

- Individuals and communities to learn true health literacy (=evidence) and commit evidence-based prevention and treatment of NCD.
- Sharing information among individuals, communities, municipalities, prefectures, countries, and global

Thank you for your attention



Fukushima Prefecture homepage