

**Appendix I** (Continued)

es15 b (If yes) When did it start?

\_\_\_\_ Month \_\_\_\_ Day \_\_\_\_ Year

es16 6 Have you ever in the past avoided social relationships?

\_\_\_\_ Yes<sub>1</sub> \_\_\_\_ No<sub>0</sub>

es17,es18 a (If yes) When did the longest past period start and end?

Start: \_\_\_\_ End: \_\_\_\_  
 Month Day Year Month Day Year

**STOP AND ASSESS:**

**[If 5 is 'NO' and 6 is 'NO' mark 'Ineligible' in Step 6. If 5(a) is less than 6 months ago and period in 6(a) is less than 6 months, mark 'Ineligible' in Step 6]**

es19 7 Considering your most severe period of social isolation, (did/does) it do any of the following:

- interfere significantly with your normal routine;
- interfere significantly with your ability to work or attend school;
- interfere significantly with social activities or relationships; or
- bother you a lot?

\_\_\_\_ Yes<sub>1</sub> \_\_\_\_ No<sub>0</sub>

**[If NO, mark 'Ineligible' in Step 6]**

8 Briefly, what is/was the reason you started being socially isolated?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[If all episodes due to a chronic physical illness or injury, mark 'Ineligible' in Step 6]**

**Step 5: Review of exclusion criteria**

es20 1. Are you comfortable speaking and reading English\*?

\_\_\_\_ Yes<sub>1</sub> \_\_\_\_ No<sub>0</sub> **[If NO, mark 'Ineligible' in Step 6]**

es21 2. Do you live in a group home or institution?

\_\_\_\_ Yes<sub>1</sub> \_\_\_\_ No<sub>0</sub> **[If YES, mark 'Ineligible' in Step 6]**

3. Do you have a history or have you been told you have any of the following conditions:

- es22a \_\_\_\_ Schizophrenia
- es22b \_\_\_\_ Dementia (any type)
- es22c \_\_\_\_ Mental Retardation
- es22d \_\_\_\_ Asperger Syndrome
- es22e \_\_\_\_ Autistic Disorder (Autism)

**[If any of the above conditions checked, mark 'Ineligible' in Step 6]**

**Step 6: Determine eligibility screening outcome**

- es23 { 1. \_\_\_\_<sub>0</sub> Ineligible for study participation.  
 'I'm sorry to say that you are not eligible to participate in this study. Thank you for your interest. Do you have any questions or concerns?'  
 \ 2. \_\_\_\_<sub>1</sub> Eligible for study participation.  
 'I'm pleased to say that you are eligible to participate in this study.'

\*English replaced by the local language for non-English-speaking sites.

## 精神免疫学から観た身体疾患と精神疾患の生物学的共通基盤

早川 宏平\* 加藤 隆弘\*\*\* 神庭 重信\*

抄録：身体疾患は身体的・心理社会的ストレスをもたらすばかりでなく，精神疾患の発症率や自殺のリスクを高めることが知られており，身体疾患と精神疾患の間には共通した生物学的因子の存在が示唆されるが十分には解明されていない。近年，精神疾患の生物学的基盤に関して，脳内の炎症免疫を司るミクログリア細胞を中心とした精神免疫学的観点からのアプローチが注目されている。本稿では脳と身体をつなぐ因子として炎症免疫機構に着目し，アレルギー性疾患・膠原病，感染性疾患などよく知られる身体疾患と精神疾患（精神症状）との併存に関する最新の知見を取り上げ，最後にせん妄・自殺に関しても精神免疫学的観点から考察した。

精神科治療学 29(2) ; 171-178, 2014

Key words : physical illness, autoimmune diseases, infectious diseases, microglia, suicide

## I. はじめに

従来から，種々の精神疾患と身体疾患との併発が知られている。例えば，内分泌疾患（甲状腺機能異常，クッシング症候群など），脳器質性疾患（パーキンソン病，多発性硬化症，脳血管性障害など），癌，全身性エリテマトーデス（SLE），慢性疼痛，心筋梗塞などの身体疾患では抑うつ状態を合併しやすい<sup>27,29)</sup>。慢性疾患では日常生活において様々な制約を課されることによる心理社会的

ストレスが，急性疾患では急激な生活環境の変化等による生活の質（quality of life : QOL）の低下が，精神疾患の誘発要因となりうる。また，精神疾患と身体疾患の両者は自殺のリスクとも深く関連している。精神疾患と身体疾患がしばしば併存する事実から，両者の間に共通した生物学的因子の存在が示唆されるが，未解明な部分が多い。

全身の様々な部位での組織マクロファージ等を介した炎症免疫反応が多く身体疾患の病態機序に関与している。近年では，精神疾患においても脳内炎症免疫系の賦活が指摘されるようになり，筆者らは，精神疾患と身体疾患との生物学的共通基盤として，炎症免疫機構に注目している<sup>24)</sup>。うつ病患者では炎症性サイトカインなどの炎症マーカーが有意に増加していること<sup>17)</sup>，一部の難治性うつ病患者に抗 TNF- $\alpha$  抗体が奏効することなどが報告されている<sup>42)</sup>。長年にわたり精神疾患の病態生理として，「脳科学 = 神経科学」というドグマに基づく「神経伝達系の異常」という定説が信奉されてきたが，脳内にはニューロン以外にグリアと呼ばれる細胞が数多く存在し，それらが精神

Immunological common basis between physical illnesses and psychiatric disorders.

\*九州大学大学院医学研究院精神病態医学分野  
〔〒812-8582 福岡県福岡市東区馬出3-1-1〕

Kohei Hayakawa, M.D., Takahiro A. Kato, M.D., Ph.D., Shigenobu Kanba, M.D., Ph.D. : Department of Neuropsychiatry, Graduate School of Medical Sciences, Kyushu University, 3-1-1, Maidashi, Higashi-ku, Fukuoka-shi, Fukuoka, 812-8582 Japan.

\*\*九州大学先端融合医療レドックスナビ研究拠点  
Takahiro A. Kato, M.D., Ph.D. : Innovation Center for Medical Redox Navigation, Kyushu University.

疾患において果たす役割が近年注目を集めている<sup>25)</sup>。中胚葉由来のグリア細胞である免疫細胞ミクログリアは脳全体に分布して脳全体の5~15%を占め、静止状態では樹状に突起を伸展して脳内の監視役として微細な環境変化をモニタリングしている。

ミクログリアは様々なストレス・脳内環境変化にตอบสนองして活性化すると、遊走能を有するアメーバ状の形態へ変化しマクロファージと類似した性質を呈し、標的部位まで移動し、炎症性サイトカインやフリーラジカルといった神経障害因子および神経栄養因子を産生し、脳内の炎症免疫機構を司っている。ミクログリアの活性化が統合失調症など精神疾患において死後脳研究等により報告されており、筆者らは精神疾患におけるミクログリア仮説を提唱している<sup>26)</sup>。

本稿ではまず、脳(精神疾患)と身体(身体疾患)をつなぐ因子として炎症免疫機構に着目し、アレルギー性疾患、膠原病、感染性疾患などよく知られる身体疾患と精神疾患との併存に関する最新の知見を取り上げた。続いて、せん妄、最後には精神疾患と身体疾患に共通する重大な行動的問題として自殺に関して取り上げ、精神免疫学的観点から考察した。その中で、特にミクログリアとの関連に関して最新の知見を踏まえて概説した。

## II. 各 論

### 1. アレルギー性疾患・膠原病

#### 1) 自己免疫性疾患 (autoimmune diseases : AID)

自己免疫性疾患(AID)と精神疾患の関連性については、関節リウマチ(rheumatoid arthritis : RA)と統合失調症の発症が逆相関していることが古くから知られており、統合失調症患者にRAが合併する相対危険度は一般人口の3分の1未満と報告されている<sup>38)</sup>。統合失調症患者では健常人と比べてinterleukin 1 (IL-1)受容体アンタゴニストであるIL-1 receptor antagonist (IL-1RA)の血中濃度が高く、IL-1RAがRA発症に関して防御的に作用することが報告されている<sup>8)</sup>。精神状態評価尺度の1つSCL-90Rを用いた前向き研

究では、RA患者は非RA患者に比べてSCR-90Rの「妄想様観念」項目の得点が有意に低く、RAと精神病症状との排他的関係性が示唆されている<sup>11)</sup>。他方、RA以外のAIDに関しては、統合失調症との親和性が数多く報告されている。台湾のChenらによる大規模有病率調査では、統合失調症の入院患者で健常者と比較してGraves病、乾癬、悪性貧血、セリアック病、過敏性血管炎の発症率が高く、逆にRAの発症率は低いことが報告されている<sup>4)</sup>。デンマークでは2つの大規模疫学調査があり、EatonらはAIDの既往が統合失調症の発症リスクを45%上昇させること、統合失調症患者は健常人と比べて、9つのAID(リウマチ性多発筋痛症、Sjögren症候群、など)の有病率が高いこと、さらに、その家族についても、統合失調症患者の親で健常人の親に比べて12のAIDの有病率が高いことが報告され<sup>6)</sup>、遺伝的素因における免疫系の重要性が示唆されている。この結果を受けて、同じデンマークのグループによる大規模研究では、統合失調症患者の3.6%がAIDを発症し、その発症リスクは健常人の1.53倍であること、統合失調症の家族歴さえもAIDの発症リスクをわずかに上昇させ、AID患者の3.1%に統合失調症の家族歴があることが報告されたばかりである<sup>2)</sup>。この調査の中で、AIDの発症に感染症が果たす役割に注目すると、AIDの発症リスクは感染症による受診歴のない健常人と比較して、感染症による受診歴のある健常者で1.75倍、感染症による受診歴のない統合失調症患者で1.32倍、感染症による受診歴のある統合失調症患者で2.70倍と報告されており、いずれにおいても感染症は統合失調症とともにAIDの発症リスクを上げていく可能性が示唆された<sup>2)</sup>。実際の統合失調症患者においても免疫応答の関与が指摘されている。例えば統合失調症患者と自己抗体に関する81の研究を対象としたメタアナリシス<sup>8)</sup>では、統合失調症患者で20の自己抗体陽性率が高く、とりわけ、初発エピソード精神病では健常人に比べて抗カルジオリピン抗体と、抗NMDA受容体抗体の陽性率が有意に高く、複数の自己抗体の増加が統合失調症と関連しており、各自己抗体の役割・意義も様々であることが想定されている。他方、統合失

調症と双極性障害の患者322名を対象とした研究では、両患者群におけるIL-1RA、可溶性 tumor necrosis factor receptor 1 (TNF-R1) の各血中濃度とGAFスコア、IL-1RAとPANSS陰性尺度スコア、可溶性TNF-R1とPANSS陽性尺度スコア・入院回数/期間の間に有意な相関があり、免疫系が疾患重症度と精神症状の特徴の両者と関連していることが示唆されている<sup>16)</sup>。

## 2) アトピー性疾患, 特に, アトピー性皮膚炎 (atopic dermatitis : AD)

外部の抗原に対する過剰な免疫反応により生じるアトピー性疾患も、精神疾患との関連が深い。アトピー性皮膚炎 (AD) を発病すると、その他のアトピー性疾患の発症リスクも上昇することが“atopic march”として知られ、ADに始まって食物アレルギー、気管支喘息、アレルギー性鼻炎といったアトピー性疾患が順次、発症していく<sup>45)</sup>。その中に精神・神経疾患も含まれ、日本人に報告の多いアトピー性脊髄炎やアトピー関連末梢神経炎といった神経疾患<sup>19,20)</sup>や、種々の精神疾患 (うつ病, 不安障害, ADHD, 自閉症など) が知られている<sup>45)</sup>。出生から31歳までの期間を追跡したThe Northern Finland 1966 Birth Cohort Studyでは、ADの女性患者でうつ病の発症リスクが3~4.7倍になることや、男性患者においても抑うつ症状が最重症の群ではADとうつ病との相関性が高まること (OR 6.3倍) が報告されている<sup>47)</sup>。また、ADとADHDとの有意な相関を報告した研究として、ADHD児の約9%はADが原因であること<sup>44)</sup>などが報告されている。ADと精神疾患が合併しやすい理由として、炎症免疫仮説が提唱されている<sup>45)</sup>。病像が形成されて慢性ストレス状態下におかれると免疫反応が細胞性免疫から液性免疫にシフトして、IL-4/5などのTh2サイトカインが優勢になるほか、それに伴って急性炎症が抑制されてコルチゾールの基礎値が上昇するなどHPA系 (hypothalamic-pituitary-adrenal axis) の修飾も加わり、さらなるアトピー性疾患の発症が誘発されやすくなると考えられている<sup>30)</sup>。このような内分泌系も巻き込んだ全身の免疫反応の不均衡が、脳内の炎症性サイトカインを介して精神・神経症状に影響している可能性が想

定され<sup>24)</sup>、今後さらなる研究による解明が必要である。

## 2. 感染性疾患

炎症性疾患の代表とも言える感染症では、中枢神経系への直接感染に限らず、様々な全身の感染性疾患において精神疾患の併存が知られている。ここでは精神疾患を併発しやすい代表的な感染性疾患として慢性C型肝炎とHIV感染を取り上げる。

### 1) 慢性C型肝炎

C型肝炎ウイルス (HCV) 感染による慢性C型肝炎は、長い経過のうちに肝硬変へと進行し、いずれ肝細胞癌を高確率で発症するが、精神疾患との関連性も深い。(自身がキャリアであるという自覚がなくとも) 慢性C型肝炎患者では同じウイルス性肝炎である慢性B型肝炎患者に比べて健康関連QOLが有意に低く、健常者に比べて抑うつ症状の有病率が高い<sup>1)</sup>。また、注意障害、実行機能障害、言語学習の障害など認知機能障害を併発しやすく、脳波やMRS (Magnetic Resonance Spectroscopy) の異常所見もしばしば認められる<sup>9,54)</sup>。疲労や認知機能低下を伴うHCV患者では、脳幹部のセロトニン神経系、線条体のドーパミン神経系の変化との関連も示唆されている<sup>55)</sup>。こうした背景に、炎症免疫系の果たす役割も想定されている。HCVは身体局所で炎症を起こしてIL-1 $\beta$ やTNF- $\alpha$ 等の炎症性サイトカインを介して間接的に脳に影響を及ぼすほか、ウイルス自体が脳内にミクログリアを集積させて直接的に影響している可能性がある。単球に感染したHCVは血液脳関門を通過して二次性にミクログリアに感染し、感染ミクログリアがサイトカインを放出することで種々の精神・認知機能に影響していると推測され<sup>1)</sup>、HCV患者の死後脳研究では、前頭葉と皮質下白質においてサイトカイン (IL-1 $\alpha$ , IL-1 $\beta$ , IL-4, TNF- $\alpha$ , IL-12, IL-18) およびケモカイン (IL-8, IL-16, IP-10 (interferon-inducible protein 10)) の有意な高値が報告されている<sup>56)</sup>。また、治療に用いられるインターフェロン (IFN)- $\alpha$ はサイトカインの一種であり、しばしばうつ病を誘発されることが知られている。IFN- $\alpha$ 治

療により、キヌレニン濃度が末梢血と cerebrospinal fluid (CSF) 中で上昇し、CSF 中キヌレニン濃度は CSF 中のキノリン酸とキヌレン酸濃度の上昇とも相関している。さらに、CSF 中のキヌレニンとキノリン酸は CSF 中の IFN- $\alpha$ 、可溶性 TNF- $\alpha$  受容体 2、MCP-1 濃度と相関するだけでなく、精神状態評価尺度の 1 つ MADRS を指標とした抑うつ症状の増悪との相関も報告されている<sup>41</sup>。こうした研究結果は、近年注目されているうつ病におけるキヌレニン仮説<sup>36</sup>を支持するものと考えられる。

## 2) HIV 感染

HIV 感染では、ミクログリアの両価的役割が注目されている。HIV は T リンパ球、単球、マクロファージなど CD4 陽性の免疫細胞に感染し、アポトーシスを引き起こす。特に CD4 陽性 T リンパ球に感染すると、後天性免疫不全症候群 (AIDS) を発症する。全身性の HIV 感染から数週間後には HIV が中枢神経系に侵入し、感染から数年を経て免疫不全状態に陥ると、運動・認知・行動の障害で特徴づけられる HIV 関連認知症 (HIV-associated dementia : HAD) を発症することがある。HAD 患者では CSF および尾状核におけるドパミンとホモバニリン酸の濃度が低下し、画像研究や死後脳研究では海馬や基底核領域におけるドパミン神経を含む細胞死と脳萎縮、大脳皮質の非薄化などが報告されている。病理学的には結節形成、多核巨細胞、アストログリオシス、ミエリン減少、ミクログリア活性化など多彩な像を呈するが、中でもグリア細胞がその病態形成に寄与していると考えられている。HIV は中枢神経系に侵入するとまず神経細胞に対して神経突起の減少等の変異を引き起こし、次いで CCR3 や CCR5 といったケモカイン受容体を介してミクログリアに感染する。HIV の感染はミクログリアを活性化させて炎症反応を引き起こすとともに、細胞の増殖促進と形態変化を惹起する。しかし、ミクログリアは炎症反応によって神経障害をもたらすほかに、神経保護的な側面も併せ持っている。例えば、ミクログリアはアポトーシスした細胞に反応して抗炎症性サイトカインを放出し、死滅した細胞を除去するとともに axonal sprout-

ing を促進し、さらなる脳障害を予防するという作用も有していることが報告されている<sup>34</sup>。このようなミクログリアの炎症・免疫機構を介した神経障害性と神経保護性の両価的作用が、HAD の病態を探索する上で重要な鍵を握っているかもしれない。

## 3. せん妄 (delirium)

身体疾患加療中、特に入院加療中に最も遭遇しやすい精神疾患 (精神症状) の 1 つがせん妄である。様々な全身性の炎症にしばしば付随するせん妄は、意識混濁を背景に多彩な精神・行動症状を引き起こし、癪をはじめとする身体疾患患者においてはきわめて一般的な精神神経学的問題である<sup>29</sup>。せん妄は本人、家族や介護者に強いストレスを与えるだけでなく<sup>3</sup>、その後の長期に及ぶ認知機能低下<sup>10</sup>、入院長期化や死亡率増加<sup>7</sup>、多大な医療費の増大の一因にもなっているため、その適切な診断・治療・予防法の確立が急務であるが<sup>18</sup>、せん妄の病態基盤には不明なところが多いために、根本的な治療・予防法は未だ確立されていない。病態生理仮説として、抗コリン薬によりせん妄が誘発されるという経験的事実からコリン作動性神経の低活動性がせん妄を誘発するという仮説<sup>18</sup>が以前より提唱されてきた。仮説に基づいてコリンエステラーゼ阻害薬 rivastigmine の有効性が検証されたが、せん妄期間が短縮することではなく、むしろ死亡率増加の可能性も示唆され、その仮説に限界も見え始めている<sup>51</sup>。近年では炎症免疫仮説<sup>52</sup>が提唱され、せん妄患者の死後脳研究でミクログリアが活性化していたことから<sup>35</sup>ミクログリアの関与が考えられるようになった。ミクログリア活性化阻害作用を持つ抗生物質 minocycline は、統合失調症やうつ病に対する有効性が報告されており<sup>32, 33</sup>、われわれは最近、終末期癌患者におけるせん妄に対して minocycline が有効であった症例を報告している<sup>14</sup>。複合的な要因を背景に持つ混合型せん妄に対して、向精神薬を一切使うことなく minocycline 単独でせん妄が改善したため、せん妄の炎症免疫仮説を支持するものと考えられた。

#### 4. 自殺

精神疾患と身体疾患を結びつける重要でかつ深刻な行動の1つに自殺があり、ここでは疫学的知見とともに、炎症免疫学的視点から自殺に関する生物学的知見を紹介する。

##### 1) 自殺と身体疾患

身体疾患により自殺念慮や自殺企図のリスクが高まることが一般的に知られ、癌や気管支喘息<sup>51</sup>、関節リウマチ<sup>48</sup>、皮膚疾患（乾癬、アトピー性皮膚炎、痤瘡）<sup>40</sup>などで自殺リスクとの関連が報告されている。特に癌と自殺の関連性は強く、PHQ-9を用いた2,924名の癌患者を対象とした調査では、7.8%もの癌患者が過去2週間のうちに自殺念慮を抱き、精神的苦痛、重度の疼痛、高齢の3要素が自殺念慮と有意に相関していた<sup>53</sup>。小児癌からの成人生存者では自殺念慮を抱くリスクが高く<sup>43</sup>、癌に伴う精神的苦痛が後々にまで強い影響を及ぼす可能性が示唆される。HarrisとBarracoughらによると、多くの身体疾患（HIV/AIDS、ハンチントン病、多発性硬化症など）と自殺との関連性は高齢者よりも若年～中年に強く認められるものの、その例外が癌であった<sup>12</sup>。自殺は喫煙やコレステロール低値などの生活習慣に関連した要素とつながりが深く、一卵性双生児の自殺一致率の高さや、女性において自殺の家族歴が自殺リスクを高めるとい報告は、自殺における遺伝的要因の影響も示唆しており、自殺者の死後脳研究ではセロトニンやノルアドレナリン系の神経伝達異常も指摘されている<sup>13</sup>。

##### 2) 自殺と炎症免疫系

このように身体疾患に多く見られる自殺の背景には生物学的基盤が存在すると考えられている。自殺完遂者を対象とした死後脳研究で、統合失調症や大うつ病の自殺完遂者の脳内ミクログリア活性化<sup>46</sup>や、アルコール依存症のうつ病自殺完遂者のグリア細胞密度増加<sup>15</sup>が報告され、炎症免疫系の関与が注目され始めている。自殺完遂者群は自然死群と比較して、前頭眼窩皮質でIL-4およびIL-13の発現がmRNAレベルで有意に増加しており、さらに、サイトカイン発現には性差があって、女性ではIL-4が、男性ではIL-13がそれぞれ有意に増加しており、内分泌系の影響も示唆され

ている<sup>49</sup>。10代の自殺完遂者で炎症性サイトカイン（IL-1 $\beta$ /IL-6/TNF- $\alpha$ ）が前頭前野で増加しているという報告があり、前頭葉における炎症免疫系の異常と自殺との関連が推測されている<sup>39</sup>。自殺企図者の血漿中可溶性IL-2受容体が有意に増加していたという報告を皮切りに<sup>37</sup>、自殺企図者を対象とした血液・CSF中のサイトカイン・ケモカインに着目した研究が相次いでいるが<sup>22</sup>、それらの研究結果に十分な統一性があるとはいいがたい。繰り返し報告されている所見としては、血漿・CSF中のIL-6濃度増加<sup>21,31</sup>と、IL-2濃度低下<sup>21,28</sup>が挙げられる。こうしたサイトカイン値異常の臨床的意義は不明だが、同じ自殺企図でも縊首や入水、ガス中毒、複数回の重篤な自傷行為等の暴力的な方法<sup>50</sup>を用いた場合にCSF中のIL-6濃度が最も高かったという報告<sup>31</sup>は、自殺における炎症免疫系を介した生物学的基盤を考える上で何らかのヒントになるかもしれない。

### III. おわりに

本稿では、身体疾患と精神疾患の併発に関連する生物学的因子について、主に炎症免疫機構の観点から概観した。現在筆者らが考えている、炎症免疫系から鑑みた身体疾患（身体）と精神疾患（脳・こころ）とのクロストークに関する模式図（仮説）を示す（図1）。今回紹介した身体疾患の多くは、各部位の組織マクロファージや血液中の免疫細胞を介して、局所から全身に至る炎症免疫系を賦活している。こうした炎症免疫系の賦活が脳にまで影響を及ぼすようになるとミクログリアが二次的に活性化され、活性化したミクログリアが脳内に炎症性サイトカイン・ケモカイン・フリーラジカルなどを産生・放出し、こうして、神経障害や神経-グリア相関の破綻が引き起こされる可能性がある。さらに、近年、身体的ストレス・心理社会的ストレスと炎症免疫系との相関が示唆されており、こうしたストレスによる修飾も加わり、結果的に精神症状の出現や精神疾患の併発に至るのではないかと、筆者らは考えている（図1）。なお、最近の臨床研究により元々は身体疾患の治療薬として開発されたCOX-2阻害剤やmi-

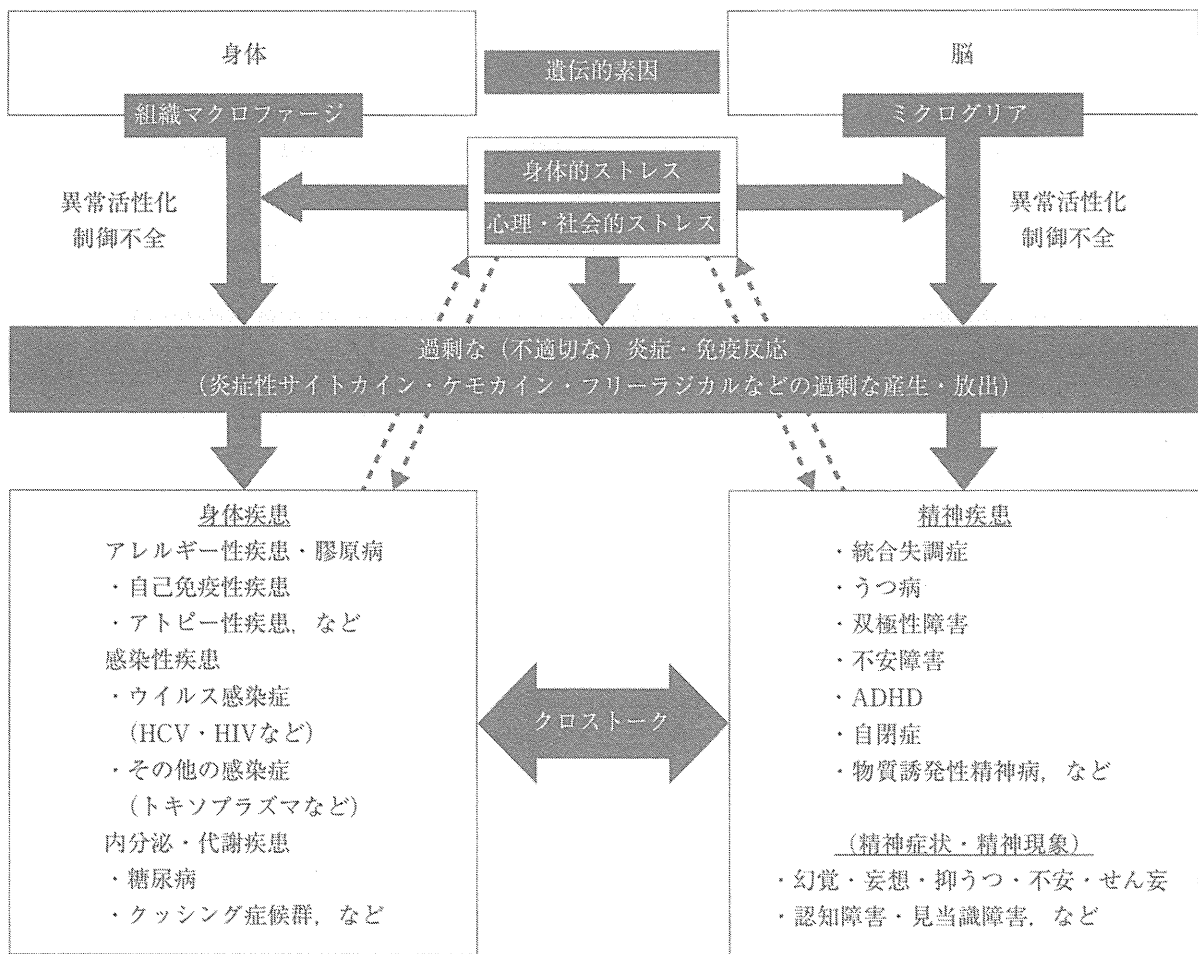


図1 炎症免疫系を介した身体疾患と精神疾患のクロストーク

nocycline などの薬剤が抗精神病作用・抗うつ作用などの向精神作用を有していることが判明しており<sup>26)</sup>、炎症制御は身体機能の回復ばかりではなく精神機能の回復にも寄与しているようで大変興味深い。

本稿では触れなかったが、生体へのストレスは炎症免疫系ばかりではなく内分泌系や自律神経系にも作用しており、このような免疫・内分泌・自律神経の複雑な相互作用が種々の身体症状・精神症状を引き起こしている可能性がある<sup>23,24)</sup>。筆者らは、こうした相関が、近年増加傾向にある糖尿病とそれに併存するうつ病にも当てはまるのではないかと推察している<sup>25)</sup>。精神疾患研究において「神経伝達系の異常」以外の側面、すなわち炎症免疫系や内分泌系からのアプローチは精神医学に新しい知見をもたらしてくれることが大いに期待

され<sup>25,26)</sup>、身体疾患と精神疾患の併存に着目するのはきわめて有用である<sup>23,24)</sup>。こうしたアプローチを推進するためには、精神科医と身体科医が手を携えて臨床的観察を続けていくことが肝心であり、さらには、脳科学や免疫学など基礎科学の専門家による卓越した科学的アプローチ、そして両者の対話から始まるコラボレーションが必要不可欠であろう。今後、身体疾患と精神疾患との生物学的共通基盤が明らかとなり、画期的な治療法の創出につながることを期待したい。

文 献

- 1) Amodio, P., Salari, L., Montagnese, S. et al.: Hepatitis C virus infection and health-related quality of life. World J. Gastroenterol, 18: 2295-2299, 2012.
- 2) Benros, M.E., Pedersen, M.G., Rasmussen, H. et al.: A nationwide study on the risk of autoimmune diseases

- in individuals with a personal or a family history of schizophrenia and related psychosis. *Am. J. Psychiatry*, 2013. (Epub ahead of print)
- 3) Breitbart, W. and Alici, Y. : Agitation and delirium at the end of life : "We couldn't manage him". *JAMA*, 300 ; 2898-2910, E2891, 2008.
  - 4) Chen, S.J., Chao, Y.L., Chen, C.Y. et al. : Prevalence of autoimmune diseases in in-patients with schizophrenia : nationwide population-based study. *Br. J. Psychiatry*, 200 ; 374-380, 2012.
  - 5) Druss, B. and Pincus, H. : Suicidal ideation and suicide attempts in general medical illnesses. *Arch. Intern. Med.*, 160 ; 1522-1526, 2000.
  - 6) Eaton, W.W., Byrne, M., Ewald, H. et al. : Association of schizophrenia and autoimmune diseases : linkage of Danish national registers. *Am. J. Psychiatry*, 163 ; 521-528, 2006.
  - 7) Ely, E.W., Shintani, A., Truman, B. et al. : Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. *JAMA*, 291 ; 1753-1762, 2004.
  - 8) Ezeoke, A., Mellor, A., Buckley, P. et al. : A systematic, quantitative review of blood autoantibodies in schizophrenia. *Schizophr. Res.*, 150 ; 245-251, 2013.
  - 9) Forton, D.M., Allsop, J.M., Main, J. et al. : Evidence for a cerebral effect of the hepatitis C virus. *Lancet*, 358 ; 38-39, 2001.
  - 10) Girard, T.D., Pandharipande, P.P., Carson, S.S. et al. : Feasibility, efficacy, and safety of antipsychotics for intensive care unit delirium : the MIND randomized, placebo-controlled trial. *Crit. Care Med.*, 38 ; 428-437, 2010.
  - 11) Gorwood, P., Pouchot, J., Vinceneux, P. et al. : Rheumatoid arthritis and schizophrenia : a negative association at a dimensional level. *Schizophr. Res.*, 66 ; 21-29, 2004.
  - 12) Harris, E.C. and Barraclough, B.M. : Suicide as an outcome for medical disorders. *Medicine (Baltimore)*, 73 ; 281-296, 1994.
  - 13) Hawton, K. and van Heeringen, K. : Suicide. *Lancet*, 373 ; 1372-1381, 2009.
  - 14) Hayakawa, K., Kato, T.A., Monji, A. et al. : Minocycline, a microglial inhibitor, diminishes terminal patients' delirium? *Am. J. Geriatr. Psychiatry*, 2014. (in press)
  - 15) Hercher, C., Parent, M., Flores, C. et al. : Alcohol dependence-related increase of glial cell density in the anterior cingulate cortex of suicide completers. *J. Psychiatry Neurosci.*, 34 ; 281-288, 2009.
  - 16) Hope, S., Ueland, T., Steen, N.E. et al. : Interleukin 1 receptor antagonist and soluble tumor necrosis factor receptor 1 are associated with general severity and psychotic symptoms in schizophrenia and bipolar disorder. *Schizophr. Res.*, 145 ; 36-42, 2013.
  - 17) Howren, M.B., Lamkin, D.M. and Suls, J. : Associations of depression with C-reactive protein, IL-1, and IL-6 : a meta-analysis. *Psychosom. Med.*, 71 ; 171-186, 2009.
  - 18) Inouye, S.K. : Delirium in older persons. *N. Engl. J. Med.*, 354 ; 1157-1165, 2006.
  - 19) Isaacs, J.D., Bodini, B., Ciccarelli, O. et al. : Atopic myelitis in a European woman residing in Japan. *J. Neurol. Neurosurg. Psychiatry*, 82 ; 1022-1024, 2011.
  - 20) Isobe, N., Kira, J., Kawamura, N. et al. : Neural damage associated with atopic diathesis : a nationwide survey in Japan. *Neurology*, 73 ; 790-797, 2009.
  - 21) Janelidze, S., Mattei, D., Westrin, A. et al. : Cytokine levels in the blood may distinguish suicide attempters from depressed patients. *Brain Behav. Immun.*, 25 ; 335-339, 2011.
  - 22) Janelidze, S., Ventorp, F., Erhardt, S. et al. : Altered chemokine levels in the cerebrospinal fluid and plasma of suicide attempters. *Psychoneuroendocrinology*, 38 ; 853-862, 2013.
  - 23) 加藤隆弘, 園田紀之, 井口登與志ほか : 気分障害と糖尿病のクロストークとその病態基盤. *実験医学*, 30 ; 28-32, 2012.
  - 24) Kato, T.A., Hayakawa, K., Monji, A. et al. : Missing and possible link between neuroendocrine factors, neuropsychiatric disorders, and microglia. *Front Integr. Neurosci.*, 7 ; 53, 2013.
  - 25) Kato, T.A., Watabe, M. and Kanba, S. : Neuron-glia interaction as a possible glue to translate the mind-brain gap : a novel multi-dimensional approach toward psychology and psychiatry. *Front. Psychiatry*, 4 ; 139, 2013.
  - 26) Kato, T.A., Yamauchi, Y., Horikawa, H. et al. : Neurotransmitters, psychotropic drugs and microglia : clinical implications for psychiatry. *Curr. Med. Chem.*, 20 ; 331-344, 2013.
  - 27) Katon, W. and Schulberg, H. : Epidemiology of depression in primary care. *Gen. Hosp. Psychiatry*, 14 ; 237-247, 1992.
  - 28) Kim, Y.K., Lee, S.W., Kim, S.H. et al. : Differences in cytokines between non-suicidal patients and suicidal patients in major depression. *Prog. Neuropsychopharmacol. Biol. Psychiatry*, 32 ; 356-361, 2008.
  - 29) Lawlor, P.G., Gagnon, B., Mancini, I.L. et al. : Occurrence, causes, and outcome of delirium in patients with advanced cancer : a prospective study. *Arch. Intern. Med.*, 160 ; 786-794, 2000.
  - 30) Liezmann, C., Klapp, B. and Peters, E.M. : Stress, atopy and allergy : A re-evaluation from a psychoneuroimmunologic perspective. *Dermatoendocrinol.*, 3 ; 37-40, 2011.
  - 31) Lindqvist, D., Janelidze, S., Hagell, P. et al. : Interleukin-6 is elevated in the cerebrospinal fluid of suicide attempters and related to symptom severity. *Biol. Psychiatry*, 66 ; 287-292, 2009.
  - 32) Miyaoka, T., Yasukawa, R., Yasuda, H. et al. : Minocycline as adjunctive therapy for schizophrenia : an open



- label study. *Clin. Neuropharmacol.*, 31 ; 287-292, 2008.
- 33) Miyaoka, T., Wake, R., Furuya, M. et al. : Minocycline as adjunctive therapy for patients with unipolar psychotic depression : an open-label study. *Prog. Neuropsychopharmacol. Biol. Psychiatry*, 37 ; 222-226, 2012.
- 34) Mocchetti, I., Campbell, L.A., Harry, G.J. et al. : When human immunodeficiency virus meets chemokines and microglia : neuroprotection or neurodegeneration? *J. Neuroimmune Pharmacol.*, 8 ; 118-131, 2013.
- 35) Munster, B.C., Aronica, E., Zwinderman, A.H. et al. : Neuroinflammation in delirium : a postmortem case-control study. *Rejuvenation Res.*, 14 ; 615-622, 2011.
- 36) Myint, A.M., Kim, Y.K., Verkerk, R. et al. : Kynurenine pathway in major depression : evidence of impaired neuroprotection. *J. Affect. Disord.*, 98 ; 143-151, 2007.
- 37) Nassberger, L. and Traskman-Bendz, L. : Increased soluble interleukin-2 receptor concentrations in suicide attempters. *Acta Psychiatr. Scand.*, 88 ; 48-52, 1993.
- 38) Oken, R.J. and Schulzer, M. : At issue : schizophrenia and rheumatoid arthritis : the negative association revisited. *Schizophr. Bull.*, 25 ; 625-638, 1999.
- 39) Pandey, G.N., Rizavi, H.S., Ren, X. et al. : Proinflammatory cytokines in the prefrontal cortex of teenage suicide victims. *J. Psychiatr. Res.*, 46 ; 57-63, 2012.
- 40) Picardi, A., Lega, I. and Tarolla, E. : Suicide risk in skin disorders. *Clin. Dermatol.*, 31 ; 47-56, 2013.
- 41) Raison, C.L., Dantzer, R., Kelley, K.W. et al. : CSF concentrations of brain tryptophan and kynurenines during immune stimulation with IFN- $\alpha$  : relationship to CNS immune responses and depression. *Mol. Psychiatry*, 15 ; 393-403, 2010.
- 42) Raison, C.L., Rutherford, R.E., Woolwine, B.J. et al. : A randomized controlled trial of the tumor necrosis factor antagonist infliximab for treatment-resistant depression : the role of baseline inflammatory biomarkers. *JAMA Psychiatry*, 70 ; 31-41, 2013.
- 43) Recklitis, C.J., Diller, L.R., Li, X. et al. : Suicide ideation in adult survivors of childhood cancer : a report from the Childhood Cancer Survivor Study. *J. Clin. Oncol.*, 28 ; 655-661, 2010.
- 44) Schmitt, J., Buske-Kirschbaum, A. and Roessner, V. : Is atopic disease a risk factor for attention-deficit/hyperactivity disorder? A systematic review. *Allergy*, 65 ; 1506-1524, 2010.
- 45) Simpson, E.L. : Comorbidity in atopic dermatitis. *Curr. Dermatol. Rep.*, 1 ; 29-38, 2012.
- 46) Steiner, J., Bielau, H., Brisch, R. et al. : Immunological aspects in the neurobiology of suicide : elevated microglial density in schizophrenia and depression is associated with suicide. *J. Psychiatr. Res.*, 42 ; 151-157, 2008.
- 47) Timonen, M., Jokelainen, J., Hakko, H. et al. : Atopy and depression : results from the Northern Finland 1966 Birth Cohort Study. *Mol. Psychiatry*, 8 ; 738-744, 2003.
- 48) Timonen, M., Viilo, K., Hakko, H. et al. : Suicides in persons suffering from rheumatoid arthritis. *Rheumatology (Oxford)*, 42 ; 287-291, 2003.
- 49) Tonelli, L.H., Stiller, J., Rujescu, D. et al. : Elevated cytokine expression in the orbitofrontal cortex of victims of suicide. *Acta Psychiatr. Scand.*, 117 ; 198-206, 2008.
- 50) Traskman, L., Asberg, M., Bertilsson, L. et al. : Monoamine metabolites in CSF and suicidal behavior. *Arch. Gen. Psychiatry*, 38 ; 631-636, 1981.
- 51) van Eijk, M.M., Roes, K.C., Honing, M.L. et al. : Effect of rivastigmine as an adjunct to usual care with haloperidol on duration of delirium and mortality in critically ill patients : a multicentre, double-blind, placebo-controlled randomised trial. *Lancet*, 376 ; 1829-1837, 2010.
- 52) van Gool, W.A., van de Beek, D. and Eikelenboom, P. : Systemic infection and delirium : when cytokines and acetylcholine collide. *Lancet*, 375 ; 773-775, 2010.
- 53) Walker, J., Waters, R.A., Murray, G. et al. : Better off dead : suicidal thoughts in cancer patients. *J. Clin. Oncol.*, 26 ; 4725-4730, 2008.
- 54) Weissenborn, K., Krause, J., Bokemeyer, M. et al. : Hepatitis C virus infection affects the brain-evidence from psychometric studies and magnetic resonance spectroscopy. *J. Hepatol.*, 41 ; 845-851, 2004.
- 55) Weissenborn, K., Ennen, J.C., Bokemeyer, M. et al. : Monoaminergic neurotransmission is altered in hepatitis C virus infected patients with chronic fatigue and cognitive impairment. *Gut*, 55 ; 1624-1630, 2006.
- 56) Wilkinson, J., Radkowski, M., Eschbacher, J.M. et al. : Activation of brain macrophages/microglia cells in hepatitis C infection. *Gut*, 59 ; 1394-1400, 2010.
- 57) Wise, M.G. and Rundell, J.R. : *Concise Guide to Consultation Psychiatry*, 2nd ed. The American Psychiatric Press, Washington, D.C., 1994.



# Mental Health Distress and Related Factors Among Prefectural Public Servants Seven Months After the Great East Japan Earthquake

Yuriko Suzuki<sup>1</sup>, Maiko Fukasawa<sup>1</sup>, Akiko Obara<sup>2</sup>, and Yoshiharu Kim<sup>1,3</sup>

<sup>1</sup>Department of Adult Mental Health, National Institute of Mental Health, National Center of Neurology and Psychiatry, Kodaira, Tokyo, Japan

<sup>2</sup>Miyagi Mental Health and Welfare Center, Osaki, Miyagi, Japan

<sup>3</sup>National Information Center of Disaster Mental Health, National Institute of Mental Health, National Center of Neurology and Psychiatry, Kodaira, Tokyo, Japan

Received September 19, 2013; accepted February 16, 2014; released online May 24, 2014

Copyright © 2014 Yuriko Suzuki et al. This is an open access article distributed under the terms of Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## ABSTRACT

**Background:** To develop an empirically informed support measure for workers, we examined mental health distress and its risk factors among prefectural public servants who were affected by the Great East Japan Earthquake and faced a demanding workload in the midterm of the disaster.

**Methods:** We conducted a self-administered health survey of all public servants in the Miyagi prefectural government two and seven months after the Great East Japan Earthquake (3743 workers, 70.6% of all employees). We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for mental distress (defined as K6 score  $\geq 10$ ) in the domain of disaster-work-related stressors, work-related stressors, and disaster-related stressors.

**Results:** Among those with better levels of workplace communication, the only factor that increased the risk of mental distress was not taking a non-work day each week (adjusted OR 2.55, 95% CI 1.27–5.14). Among those with poorer levels of workplace communication, in addition to not taking a non-work day each week (adjusted OR 3.93, 95% CI 3.00–5.15), handling residents' complaints (adjusted OR 1.55, 95% CI 1.00–2.42), having dead or missing family members (adjusted OR 2.87, 95% CI 1.53–5.38), and living in a shelter more than two months after the disaster (adjusted OR 2.80, 95% CI 1.32–5.95) increased the risk of mental distress.

**Conclusions:** All workers should be encouraged to take a non-work day each week. Among workers with poor workplace communication, special attention should be given to those who handle residents' complaints, have lost a family member(s), and are living in a shelter for a prolonged period of time.

**Key words:** mental health; disaster; worker; cross-sectional study; risk factors

## INTRODUCTION

The Great East Japan Earthquake hit northern Japan on March 11, 2011, causing one of Japan's worst natural disasters. This disaster strained the mental health of not only residents<sup>1</sup> but also public servants. Recently, workers have become an important target of post-disaster health monitoring because they are key to the recovery of local governmental entities and, therefore, communities.<sup>2</sup> In the case of the Great East Japan Earthquake, based on first-hand experience, the mental health community warned that public servants in the affected areas faced increased levels of stress in the aftermath of the disaster.<sup>3,4</sup> In response to these clinical observations, the Japanese Society of Neurology and Psychiatry issued an

emergency statement to protect the health of public servants (i.e., people working for prefectures and municipalities).<sup>5</sup> Given their extensive experience responding to natural disasters, mental health professionals were concerned about public servants' mental and physical health. Japan's fairly strong administrative structure, with its central and prefectural governments, has municipalities serving as the service point for local residents.<sup>6</sup> Public servants play a major role in the immediate response and recovery phases of a disaster and, unlike transient rescue workers who are deployed to an affected area for a defined period of time, face multiple stressors as victims of the disaster as they have a high workload in the disaster's aftermath and are local residents living in the disaster-affected community.

Address for correspondence. Yuriko Suzuki, MD, MPH, PhD, Department of Adult Mental Health, National Institute of Mental Health, National Center of Neurology and Psychiatry, 4-1-1 Ogawa-Higashi, Kodaira, Tokyo 187-8553, Japan (e-mail: yrsuzuki@ncnp.go.jp).

Past research has revealed the importance of critical stress management of rescue workers such as fire fighters, police, ambulance personnel, and unaffiliated volunteers.<sup>7,8</sup> Rescue workers' stress is conventionally categorized as (1) basic stress, which is increased by changes in one's day-to-day environment when workers are faced with, for example, being away from family without adequate communication, working with new people from different cultures, working in uncertain conditions, and having to assimilate new information; (2) cumulative stress, composed of various stress factors such as a heavy workload, poor communication, the frustration of not being able to meet the beneficiaries' needs, having to cope with situations in which one feels powerless, lack of basic comforts, and inability to rest or relax; and (3) traumatic stress or critical incident stress due to life-threatening events such as witnessing the death of a coworker, or seeing a dead body or other dreadful situations.<sup>9</sup> Such risk factors are scrutinized among workers likely to experience critical stress, the primary outcome of which is traumatic stress.<sup>10</sup> However, empirical evidence on disaster work-related stress in public servants has not yet been fully examined. Close examination of these public servants will help determine how to support them in times of disaster because such workers have various known job stressors, such as overwork and quality of communication, during ordinary times.

In the prefectural government of Miyagi, Japan, a comprehensive measure to monitor and support the health status of workers was put in place after the Great East Japan Earthquake. Utilizing this framework, this study was designed to disentangle multiple stressors in the midterm of the disaster by examining the relationship between mental health status and multifaceted stressors, and to empirically guide a strategy to promote the mental health and readiness of workers. Thus, the study aimed to identify the disaster- and work-related stressors and mental health status of prefectural government public servants who experienced the Great East Japan Earthquake and subsequent increase in workload. We hypothesized that disaster-related work stressors, work-related stressors, or disaster-related stressors might affect the mental health of public servants differently, depending on the level of known work-related stress and quality of workplace communication.

## METHODS

### Study design

We conducted two cross-sectional studies within one year of the Great East Japan Earthquake. We collected data two and seven months after the earthquake (May 2011 and October 2011). The study design is a cross-sectional study of mental health outcomes after seven months to investigate possible risk factors derived at two time points depending on the accuracy and availability of such survey information.

### Participants

All public servants in Miyagi Prefecture, Japan, were the target of the surveys ( $n = 5305$ ), conducted as part of a health program run by the Prefectural Labor Welfare Division. Miyagi prefecture is the closest prefecture to the epicenter of the Great East Japan Earthquake. The number of dead and missing due to the disaster exceeded 10 000,<sup>11</sup> the largest death toll among the prefectures affected by the disaster.

### Procedure

We invited all public servants in the Miyagi prefectural government to participate in a web-based survey as part of a health prevention and promotion program run by the Prefectural Labor Welfare Division. Participants were directed to a self-administered questionnaire primarily to self-monitor their health status, with special attention paid to work pressures after the Great East Japan Earthquake. At the end of the survey, information was provided to participants about mental health resources, and they were invited to an appointment with a psychologist, psychiatrist, and occupational physician.

### Variables

We measured non-specific mental health distress seven months after the disaster as a primary outcome using Kessler's K6 scale.<sup>12</sup> In the K6 scale, participants were asked if they had the following symptoms during the past 30 days: feeling so sad that nothing could cheer you up, nervous, hopeless, restless or fidgety, that everything was an effort, or worthless. Each question was rated on a 5-point Likert scale from zero (none of the time) to four (all of the time), with higher scores signifying worse mental health status (range: 0–24). The Japanese version of the K6 has been validated.<sup>13,14</sup>

The health survey questionnaire elicited the following information: (1) basic information, including age, gender in May 2011, working department, and degree of involvement in disaster-related work (not at all to most of the time, 5-point Likert scale) in October 2011; and (2) possible risk factors in the following domains:

1. **Domain of disaster-related work stressors.** Solicited in the May 2011 survey, these stressors are specifically related to disaster work, working at a disaster-area work site (coastal or inland area), working at a morgue, and handling residents' complaints.

2. **Domain of work-related stressors.** These are work-related stressors that are reported even in typical work settings, with the October 2011 survey asking questions including the amount of overtime assessed by the longest hours worked since the disaster and during the previous month (i.e., September 2011), whether or not a non-work day was taken each week, and the May 2011 survey asking questions including the level of workplace communication by rating the quality of communication (poor, reasonable, or good) between bosses, colleagues, and subordinates.

**3. Domain of disaster-related stressors.** These stressors specifically relate to disaster victims, with questions in the May 2011 survey concerning whether they had dead or missing family members and if they lived someplace other than in their own house (e.g., in a shelter as of May 2011), and questions in the October 2011 survey asking about the degree of property damage reported in the official damage report (i.e., total collapse, mostly collapsed, half-collapsed, partial collapse, none).

### Ethical standards

All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The study protocol was approved by the institutional review board of the National Center of Neurology and Psychiatry.

### Statistical analysis

Among all workers, 4334 completed the survey in May 2011, and 4413 completed the survey in October 2011. We analyzed the dataset of those who participated in both surveys (3743 workers, 70.6% of all workers).

First, we grouped those who scored  $\geq 10$  on the K6 scale in October 2011, which comprised the upper 10% of participants, indicating that they had mental distress. The upper 10% was conservatively chosen because approximately 10% of the population is estimated to have a mild level of mental disorder regardless of disaster exposure.<sup>15</sup> Also, the World Mental Health Survey in Japan revealed that 8.8% of community residents at any given time will have had some type of mental disorder during the past 12 months.<sup>16</sup> Next, we used two-tailed chi-square tests to examine associations between mental distress and exposure variables. We used K6 scale outcomes as the dependent variable, and exposure variables in disaster-related work stressors, work-related stressors, or disaster-related stressors as independent variables. We adjusted for age group (18–29, 30–39, 40–49, and 50–65 years), gender, and degree of involvement in disaster-related work at a time in the multivariate analysis, as those variables were associated with mental distress in the bivariate analysis. We chose to control for the degree of involvement in disaster-related work based on the assumption that greater involvement in this type of work leads to greater burden of mental distress. We were also interested in identifying other modifiable risk factors in the workplace after the disaster.

Poor communication with coworkers also reportedly increases the risk of work-related mental health in ordinary times,<sup>17</sup> and the bivariate analysis indicated that level of workplace communication was associated with mental distress (Table 2). Because the level of workplace communication is not necessarily a disaster-related stressor, we specifically chose to include as factors of interest, the disaster-related risk

factors in the multivariate analysis for separate groups based on quality of communication (good, reasonable, or poor) in order to control for the known workplace risk factor of poor workplace communication.

All statistics were generated using Stata 12.0 for Windows (StataCorp LP, College Station, TX, USA). Statistical significance was set at 0.05, and all tests were two-tailed.

## RESULTS

Table 1 shows the basic characteristics of the study participants. Those with a K6 score  $\geq 10$  numbered 358 (9.6%). For reference, using two cutoffs widely used in ordinary times, 1224 (32.7%) workers scored  $\geq 5$  and 164 (4.4%) scored  $\geq 13$ . Regarding gender, age group, and degree of involvement in disaster-related work, those with mental distress (K6 score  $\geq 10$ ) were significantly more likely to be female, in younger age groups, and more involved in disaster-related work.

Table 2 shows the bivariate analysis between mental health status and possible stressors. We found disproportionately more mental distress as measured by the K6 scale at a statistically significant level in those who handled residents' complaints, worked overtime both during the month of the longest hours worked and during the month prior to the second survey, reported lower levels of workplace communication, did not take a non-work day each week, had dead or missing family members, faced more severe property damage (half-collapse or worse), and were living in a shelter two months after the disaster (i.e., as of May 2011).

Based on multivariate analysis, Table 3 shows adjusted ORs and 95% CIs of possible risk factors shown in the aforementioned bivariate analysis. Results revealed that the following risk factors significantly increased risk of mental distress: a lower level of workplace communication (adjusted OR 1.97, 95% CI 1.43–2.71), not taking a non-work day each week (adjusted OR 3.95, 95% CI 3.08–5.07), having dead or missing family members (adjusted OR 2.23, 95% CI 1.23–4.03), and living in a shelter as of May 2011 (adjusted OR 2.55, 95% CI 1.27–5.14).

In the analysis stratified by different levels of communication, among those who had good levels of workplace communication, not taking a non-work day each week (adjusted OR 3.71, 95% CI 1.92–7.18) was the only factor that increased the risk of mental distress. Among those who had poor or reasonable workplace communication, in addition to not taking a non-work day each week (adjusted OR 3.93, 95% CI 3.00–5.15), handling residents' complaints (adjusted OR 1.55, 95% CI 1.00–2.42), having dead or missing family members (adjusted OR 2.87, 95% CI 1.53–5.38), and living in a shelter as of May 2011 (adjusted OR 2.80, 95% CI 1.32–5.95) increased the odds of mental distress among prefectural government workers.

**Table 1. Basic characteristics of the participants in relation to mental health status as measured by the K6 scale (*n* = 3743)**

	All		K6 < 10		K6 ≥ 10		<i>df</i>	$\chi^2/t$	<i>P</i> value
	<i>n</i> 3743	%	<i>n</i> 3385	%	<i>n</i> 358	%			
Gender									
Male	2903	77.6	2644	78.1	259	72.4	1	6.2	0.013
Female	840	22.4	741	21.9	99	27.7			
Age group (years)									
18–29	445	11.9	392	11.6	53	14.8	3	29.3	<0.001
30–39	898	24.0	795	23.5	103	28.8			
40–49	1255	33.5	1118	33.0	137	38.3			
50–65	1145	30.6	1080	31.9	65	18.2			
Mean age (standard deviation)	43.2	(10.4)	43.5	(10.4)	40.7	(9.4)	3741	4.8	<0.001
Department									
General affairs	510	13.6	468	13.8	42	11.7	9	6.7	0.671
Earthquake reconstruction and planning	127	3.4	120	3.6	7	2.0			
Living environment	222	5.9	196	5.8	26	7.3			
Health and welfare	658	17.6	586	17.3	72	20.1			
Economic chamber of commerce and tourism	742	19.8	676	20.0	66	18.4			
Agriculture, forestry and fisheries	575	15.4	519	15.3	56	15.6			
Civil section	657	17.6	594	17.6	63	17.6			
Teller stations	68	1.8	61	1.8	7	2.0			
Public business administration	65	1.7	58	1.7	7	2.0			
Others	119	3.2	107	3.2	12	3.4			
Degree of involvement in disaster-related work									
Disaster-related work as primary work	349	9.3	313	9.3	36	10.1	4	17.7	0.001
Mainly disaster-related work	422	11.3	360	10.7	62	17.4			
About the same as primary work	492	13.2	441	13.1	51	14.3			
Mainly primary work	1103	29.5	1014	30.0	89	25.0			
Not involved	1369	36.7	1251	37.0	118	33.2			

Chi-square tests or *t*-tests were used.

## DISCUSSION

In this study, mental distress was identified in 358 workers (9.6%) in the Miyagi prefectural government who were in the upper 10% on the K6 scale (score ≥10). In 2009, 11.5% of Miyagi residents scored ≥10, and in 2006, 12.1% of them did so.<sup>18</sup> A previous report on municipal public servants showed that the proportion of workers with mental distress (K6 score ≥9) was 8.2% in ordinary times.<sup>19</sup> The percentage in the present study fell in between the percentages reported in these previous studies. One explanation is the different population composition, as our participants were predominantly male, middle-aged, working people compared to the community studies' participants, who were predominantly non-working elderly people. Moreover, although government workers were affected by the disaster, their jobs were somewhat secure even after the disaster compared to those of community residents who faced less job security as a consequence of the disaster. Socioeconomic factors, including job security, are known associated factors for mental distress during times of disaster as well as in ordinary times.<sup>20,21</sup> Under these circumstances, timing the survey seven months after the disaster might have allowed for recovery to levels of mental distress seen in ordinary times among the workers.

Comparing the results of bivariate and multivariate analyses in regards to handling residents' complaints, working

overtime during the previous month, and working overtime in the month with the longest hours worked, no statistical significance was observed in the multivariate analysis for all participants. The strong associations between degree of involvement in disaster-related work and these variables were observed in bivariate analyses (results available upon request), and no significance was seen after controlling for the degree of involvement in disaster-related work. Similarly, because property damage and living someplace other than in their own house (eg, a shelter) were associated in the bivariate analysis, statistical significance was not observed after controlling for the variables in the multivariate analysis.

### Risk factors

In examining the association between possible risk factors and mental distress, the work-related stressors of having poor or reasonable levels of workplace communication and not taking a non-work day each week, as well as the disaster-related stressors of having dead or missing family members and living in a shelter as of May 2011, increased the risk of mental distress in the analysis of all workers. Disaster-related stressors that are often reported as risk factors, such as working at a morgue and handling residents' complaints, were not associated with mental distress in the overall analysis.

Work-related stressors (eg, poor workplace communication or insufficient rest) had a significant impact on mental distress,

**Table 2. Relationship between potential stressors on participants' mental health status as measured by the K6 scale**

	All		K6 < 10		K6 ≥ 10		df	$\chi^2$	P value
	n	%	n	%	n	%			
Disaster-work-related stressors									
Working at a disaster-area work site (n = 3743)									
Inland area	3164	84.5	2867	84.7	297	83.0	1	0.7	0.388
Coastal area	579	15.5	518	15.3	61	17.0			
Working at a morgue (n = 3739)									
No	3488	93.3	3152	93.2	336	93.9	1	0.2	0.652
Yes	251	6.7	229	6.8	22	6.2			
Handling residents' complaints (n = 3739)									
No	3492	93.4	3167	93.7	325	90.8	1	4.4	0.036
Yes	247	6.6	214	6.3	33	9.2			
Work-related stressors									
Working overtime during the previous month (n = 3682)									
Less than 20 hours	2771	75.3	2538	76.2	233	66.0	2	32.5	<0.001
20 to 40 hours	614	16.7	549	16.5	65	18.4			
More than 40 hours	297	8.1	242	7.3	55	15.6			
Working overtime in the month with the longest hours worked (n = 3673)									
Less than 40 hours	2113	57.5	1941	58.5	172	48.9	2	12.3	0.002
40 to 80 hours	942	25.7	830	25.0	112	31.8			
More than 80 hours	618	16.8	550	16.6	68	19.3			
Workplace communication (n = 3742)									
Poor	102	2.7	63	1.9	39	10.9	2	116.5	<0.001
Reasonable	2693	72.0	2425	71.7	268	74.9			
Good	947	25.3	896	26.5	51	14.3			
Workplace communication (n = 3742) (summarized)									
Good	947	25.3	896	26.5	51	14.3	1	25.6	<0.001
Poor and reasonable	2795	74.7	2488	73.5	307	85.8			
Took a non-work day each week (n = 3739)									
Yes	2768	74.0	2611	77.2	157	44.0	1	185.4	<0.001
No	971	26.0	771	22.8	200	56.0			
Disaster-related stressors									
Dead or missing family members (n = 3742)									
No	3648	97.5	3308	97.7	340	95.2	1	8.2	0.004
Yes	94	2.5	77	2.3	17	4.8			
Property damage (n = 3741)									
Less than half-collapse	3199	85.5	2912	86.1	287	80.2	1	18.9	0.005
Half-collapse or worse	542	14.5	471	13.9	71	19.8			
Living someplace other than in their own house (eg, shelter) (n = 3740)									
No	2894	77.4	2647	78.2	247	69.4	2	18.9	<0.001
Previously, yes	776	20.8	681	20.1	95	26.7			
Currently, yes (as of May, 2011)	70	1.9	56	1.7	14	3.9			

Chi-square tests were used.

especially in times of disaster. Even in ordinary times, work-related stress among workers in local governments is an area of concern, along with stringent budgets and pressing human resource needs.<sup>6</sup> In prefectures and municipalities within the affected area, temporary officers were employed to fill the gap between decreased human resources and a demanding workload in the affected area. These measures are empirically supported in view of maintaining the mental health of workers. The importance of workplace communication is supported by a study on industrial mental health in ordinary times,<sup>17</sup> and workplace communication remains important in times of disaster. We added a separate analysis stratified by level of communication and found that the disaster-related stressors of having dead or missing family members and living in a shelter as of May 2011 (signifying prolonged unstable residence two months after the disaster) increased the risk of

mental distress. This supports the findings of a previous study, where the loss of loved ones and the day-to-day stresses related to evacuation were shown to be associated with worsened mental health status.<sup>22</sup>

In the analysis stratified by level of communication, not taking a non-work day each week was the only significant risk factor among those who reported having good workplace communication. On the other hand, handling residents' complaints, having dead or missing family members, and living in a shelter as of May 2011 increased the risk of mental distress among those who reported poor or reasonable levels of workplace communication. Unlike the results for those with a poor or reasonable level of workplace communication, we could not obtain results on the association between family loss and mental distress for participants with good workplace communication because no one in this category had

**Table 3. Adjusted odds ratios and 95% confidence intervals of disaster-work-related, work-related, and disaster-related stressors on participants' mental health distress (K6 score  $\geq 10$ )<sup>a</sup> by quality of workplace communication<sup>b</sup>**

	All ( <i>n</i> = 3666)			Workplace communication					
				Good ( <i>n</i> = 908)			Poor and reasonable ( <i>n</i> = 2732)		
	OR	95% CI	<i>P</i> value	OR	95% CI	<i>P</i> value	OR	95% CI	<i>P</i> value
Gender (reference: Male)									
Female	1.44	1.08–1.91	0.012	1.42	0.65–3.10	0.374	1.42	1.93–1.04	0.025
Age group (reference: 18–29 year old)									
30–39 year old	0.89	0.61–1.29	0.526	0.77	0.31–1.94	0.584	0.90	1.37–0.60	0.630
40–49 year old	0.75	0.52–1.08	0.116	0.48	0.18–1.24	0.128	0.80	1.20–0.54	0.282
50–65 year old	0.48	0.32–0.73	0.001	0.71	0.27–1.85	0.487	0.45	0.72–0.28	0.001
Degree of involvement in disaster related work (reference: Not involved)									
Mainly primary work	1.02	0.75–1.38	0.898	1.04	0.41–2.63	0.939	1.02	1.41–0.74	0.906
About the same as primary work	1.07	0.73–1.57	0.712	2.14	0.80–5.71	0.130	0.95	1.45–0.63	0.823
Mainly disaster related work	1.48	1.01–2.18	0.045	3.17	1.22–8.22	0.018	1.27	1.94–0.82	0.284
Disaster related work as primary work	1.15	0.74–1.77	0.533	2.61	0.93–7.38	0.069	0.99	1.61–0.61	0.966
Disaster-related work stressor									
Work site (reference: Inland area)									
Coastal area	0.93	0.67–1.28	0.657	0.54	0.20–1.46	0.223	1.01	0.72–1.43	0.954
Work at a morgue (reference: No)									
Yes	1.08	0.67–1.74	0.757	0.76	0.17–3.34	0.718	1.11	0.67–1.84	0.692
Complaint handling by residents (reference: No)									
Yes	1.48	0.98–2.22	0.061	0.98	0.32–2.97	0.968	1.55	1.00–2.42	0.050
Work related stressor									
Working overtime during the previous month (reference: Less than 20 hours)									
20 to 40 hours	0.74	0.53–1.04	0.081	0.71	0.29–1.73	0.456	0.75	0.53–1.08	0.127
More than 40 hours	1.04	0.69–1.57	0.834	0.94	0.34–2.62	0.911	1.08	0.69–1.69	0.740
Working overtime in the month longest hour worked (reference: Less than 40 hours)									
40 to 80 hours	1.23	0.92–1.65	0.158	1.15	0.53–2.48	0.720	1.25	0.91–1.71	0.170
More than 80 hours	1.07	0.75–1.54	0.707	0.92	0.37–2.27	0.857	1.11	0.75–1.64	0.614
Communication at work (reference: Good)									
Poor and reasonable	1.97	1.43–2.71	<0.001	—	—	—	—	—	—
A holiday a week (reference: Yes)									
No	3.95	3.08–5.07	<0.001	3.71	1.92–7.18	<0.001	3.93	3.00–5.15	<0.001
Disaster related stressor									
Death or missing of family members (reference: No)									
Yes	2.23	1.23–4.03	0.008	—	—	—	2.87	1.53–5.38	0.001
House damage (reference: Less than half-collapse)									
Half-collapse or severer	1.27	0.93–1.75	0.134	0.87	0.33–2.26	0.769	1.32	0.94–1.86	0.106
Living in other than their house (eg, shelter) (reference: No)									
Previously yes	1.25	0.95–1.64	0.115	0.94	0.43–2.07	0.885	1.32	0.99–1.78	0.062
Currently yes (as of May, 2011)	2.55	1.27–5.14	0.009	1.97	0.20–18.92	0.559	2.80	1.32–5.95	0.007

OR = odds ratio, CI = confidence interval.

<sup>a</sup>Adjusted by gender, age group, and degree of involvement in disaster-related work.

<sup>b</sup>Answers regarding communication level were missing for 26 participants, and no imputation was done. Thus, the total number of participants in the good communication and poor and reasonable groups (*n* = 908, *n* = 2732, respectively) was not equal to the number of all participants (*n* = 3666).

experienced family loss. By design, we were not able to examine the causal relationship between family loss and mental health, and further investigation is needed. Results of the analysis stratified by level of workplace communication should be interpreted with caution because the measure of communication level is a subjective single-item question that is not validated. Bearing this limitation in mind, these findings suggest that for all workers, regardless of their quality of workplace communication, having at least a non-work day each week is strongly recommended. In a disaster setting, although this is easier said than done, supervisors must understand the importance of having at least one non-work day per week and make organizational efforts to secure

holidays for staff. For workers with a poor or reasonable level of workplace communication, offering them an opportunity to share their concerns with coworkers might help lessen the psychological burden of handling residents' complaints and dealing with grief, loss, and the inconvenience of evacuation. Also, these workers might benefit from organizational measures that accommodate the work environment, such as work rotations and buddy systems. Social support is known to be one of the strongest protective factors of mental health after a disaster.<sup>23</sup> Among workers, coworkers are the most accessible source of social support, and thus fostering quality workplace communication is key to maintaining mental health at work.

## Limitations

The survey response rate was fairly high because it was conducted in an occupational health program setting. Workers were identifiable under the prefectural governments' internet-communication system. Although we informed workers that the survey results would be concealed and independent of any performance evaluation, they might have felt pressured to respond to the questionnaires. Thus, the possibility of under-reporting of mental distress remains. Further, approximately 5% of the workers did not respond to either of the surveys even in the abovementioned context. Thus, it is possible that those who were too busy to respond might also have been those with the highest needs, although we could not confirm this speculation without data on nonresponders' characteristics.

Second, previous studies investigating workers' post-disaster mental health mainly focused on traumatic reactions and critical stress.<sup>24</sup> In this study, however, given the nature and extent of stressors among public servants, we chose general mental health status as measured by the K6 scale as a main outcome. Thus, the presentation of reactions and their associated risk factors might have differed from that of traumatic reactions. Future research is needed on outcomes of traumatic stress among public servants in times of disaster.

Third, we did not examine other known mental health risk factors such as smoking, alcohol consumption, or chronic health conditions because they fell outside the focus of this analysis. In addition, preexisting mental disorders consistently increase the risk of mental distress in times of disaster; however, we did not consider this factor because this information could not be obtained. Although available, we did not include mental distress as of May 2011 because mental health in the early phase of a disaster does not necessarily reflect a person's baseline level of mental health.<sup>25</sup>

Finally, this survey included all public servants in the Miyagi prefectural government; therefore, it included workers who were not involved in disaster-related work based on their assigned jobs and work locations. We found that 20.6% of all participants were involved in disaster-related work as primary work and mainly handled disaster-related work; thus, not all participants should be assumed to have been directly affected by the disaster. Bearing this assumption in mind, those with a lesser degree of disaster involvement can serve as comparisons by controlling for level of involvement in disaster-related work. Further, under the Japanese administrative structure, municipal officers are more directly involved in disaster-related work, and they have first-hand disaster experience as survivors, especially those based in coastal areas. The results of this study might not be generalizable to such workers in local municipalities. However, these results are an important reference of mental health status and its risk factors among prefectural public servants in the area affected by the Great East Japan Earthquake.

In conclusion, public servants in the affected area were both victims and workers who had to respond to extraordinary

disaster-related demands. To evaluate their needs and develop empirically based measures to support them, we conducted surveys to reveal the association between mental distress and its risk factors in the domains of disaster-related-work stressors, work-related stressors, and disaster-related stressors. Overall, disaster-work-related stressors or critical stressors that are specific to a traumatic event, such as working at a morgue or handling residents' complaints, were not associated with increased mental distress in this study population. More general approaches appropriate to an occupational health program, such as facilitating workers to take a non-work day, are needed to support workers regardless of their quality of workplace communication. Also, special attention should be paid to those who handled residents' complaints, lost a family member(s), and lived in a shelter for a prolonged period of time, especially for workers with poor workplace communication.

## ACKNOWLEDGEMENTS

This study was funded by the Health and Labor Science Research Grants for Research on Psychiatric and Neurological Diseases and Mental Health (Grant No. 23201501) from the Ministry of Health, Labour and Welfare of Japan.

We would like to express our deepest thanks to Ms. Rumiko Sasaki, Mr. Toshinori Ushibukuro, and Mr. Mitsunori Sato from the Division of Human Resources and Welfare of Miyagi prefectural government, and Dr. Yuiko Kimura and Ms. Yumiko Moriya from Miyagi Prefectural Government Health Clinic. Also, we would like to acknowledge the dedicated coordination efforts of Ms. Akemi Toubai from the Miyagi Mental Health and Welfare Center.

Conflicts of interest: None declared.

## REFERENCES

1. Suzuki Y, Kim Y. The Great East Japan Earthquake in 2011; toward sustainable mental health care system. *Epidemiol Psychiatr Sci.* 2012;21:7–11.
2. Inter-Agency Standing Committee (IASC) [Internet]. Geneva: IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings [updated 2007; cited 2013 Sep 9]. Available from: [http://www.who.int/mental\\_health/emergencies/guidelines\\_iasc\\_mental\\_health\\_psychosocial\\_june\\_2007.pdf/](http://www.who.int/mental_health/emergencies/guidelines_iasc_mental_health_psychosocial_june_2007.pdf/).
3. Kato H, Suzuki Y, Kim Y. Mental health response after a natural disaster. *Traumatic Stress.* 2011;9:152–7 (in Japanese).
4. Nakajima S. Administrative support for mental health activities by local governments at wide-scale disasters. *J Ment Health.* 2011;58:27–34 (in Japanese).
5. Japanese Society of Neurology and Psychiatry [Internet]. Tokyo: Emergency statement to protect public servants' health (prefectures and municipalities) [updated 2011; cited 2013 Sep 9]. Available from: [https://www.jspn.or.jp/activity/eastjapanquake/info/geje\\_emergency\\_appeal2011\\_07\\_21.html](https://www.jspn.or.jp/activity/eastjapanquake/info/geje_emergency_appeal2011_07_21.html).
6. Council of Local Authorities for International Relations



- [Internet]. Tokyo: Local Government in Japan [updated 2010 March 26; cited 2013 Sep 9]. Available from: <http://www.jlgc.org.uk/en/pdfs/LocalGovernmentInJapan2010.pdf>.
7. Perrin MA, DiGrande L, Wheeler K, Thorpe L, Farfel M, Brackbill R. Differences in PTSD prevalence and associated risk factors among World Trade Center disaster rescue and recovery workers. *Am J Psychiatry*. 2007;164:1385–94.
  8. Stellman JM, Smith RP, Katz CL, Sharma V, Charney DS, Herbert R, et al. Enduring mental health morbidity and social function impairment in World Trade Center rescue, recovery, and cleanup workers: The psychological dimension of an environmental health disaster. *Environ Health Perspect*. 2008;116:1248–53.
  9. International Federation of Red Cross and Red Crescent Societies (IFRC) [Internet]. Geneva: Managing stress in the field [updated 2009; cited 2013 Sep 9]. Available from: <http://www.ifrc.org/Global/Publications/Health/managing-stress-en.pdf>.
  10. Neria Y, DiGrande L, Adams BG. Posttraumatic stress disorder following the September 11, 2001, terrorist attacks: A review of the literature among highly exposed populations. *Am Psychol*. 2011;66:429–46.
  11. National Police Agency [Internet]. Tokyo: Damage and police action after the Great East Japan Earthquake, 2011 as of August 9, 2013 [updated 2013 Aug 9; cited 2013 Sep 5]. Available from: <http://www.npa.go.jp/archive/keibi/biki/higaijokyo.pdf>.
  12. Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, et al. Screening for serious mental illness in the general population. *Arch Gen Psychiatry*. 2003;60:184–9.
  13. Furukawa TA, Kawakami N, Saitoh M, Ono Y, Nakane Y, Nakamura Y, et al. The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. *Int J Methods Psychiatr Res*. 2008;17:152–8.
  14. Sakurai K, Nishi A, Kondo K, Yanagida K, Kawakami N. Screening performance of K6/K10 and other screening instruments for mood and anxiety disorders in Japan. *Psychiatry Clin Neurosci*. 2011;65:434–41.
  15. van Ommeren M, Saxena S, Saraceno B. Aid after disasters: Needs a long term public mental health perspective. *BMJ*. 2005;330:1160–1.
  16. Kawakami N, Takeshima T, Ono Y, Uda H, Hata Y, Nakane Y, et al. Twelve-month prevalence, severity, and treatment of common mental disorders in communities in Japan: Preliminary finding from the World Mental Health Japan Survey 2002–2003. *Psychiatry Clin Neurosci*. 2005;59:441–52.
  17. Eguchi H, Tsuda Y, Tsukahara T, Washizuka S, Kawakami N, Nomiyama T. The effects of workplace occupational mental health and related activities on psychological distress among workers: A multilevel cross-sectional analysis. *J Occup Environ Med*. 2012;54:939–47.
  18. National Information Center of Disaster Mental Health. National Institute of Mental Health, National Center of Neurology and Psychiatry [Internet]. Special summary report of the Comprehensive Survey of Living Conditions, 2010 and 2007 [updated 2013 Feb 26; cited 2013 Sep 9]. Available from: <http://saigai-kokoro.ncnp.go.jp/document/medical.html>.
  19. Suzuki K, Sasaki H, Motohashi Y. Relationships among mood/anxiety disorder, occupational stress and the life situation: Results of survey of a local government staff. *Bulletin of Akita University Graduate School of Medicine Doctoral Course in Health Sciences* [Internet]. 2010 [cited 2013 Sep 6];18:120–129. Available from: <http://air.lib.akita-u.ac.jp/dspace/bitstream/10295/1701/1/hoken18-2%28120%29.pdf>.
  20. Norris FH, Elrod CL. Psychosocial consequences of disaster: A review of past research. In: Norris FH, Galea S, Friedman MJ, Watson PJ, editors. *Methods for Disaster Mental Health Research*. New York: The Guilford Press; 2006. p. 20–42.
  21. Marchand A, Blanc MÈ. Occupation, work organisation conditions and the development of chronic psychological distress. *Work*. 2011;40:425–35.
  22. Lock S, Rubin GJ, Murray V, Rogers MB, Amlôt R, Williams R. Secondary stressors and extreme events and disasters: A systematic review of primary research from 2010–2011. *PLOS Currents Disasters* [Internet]. 2012 Oct [cited 2013 Sep 5]. Available from: <http://currents.plos.org/disasters/article/dis-12-0013-secondary-stressors-and-extreme-events-and-disasters-a-systematic-review-of-primary-research-from-2010-2011/>.
  23. Arnberg FK, Hultman CM, Michel PO, Lundin T. Social support moderates posttraumatic stress and general distress after disaster. *J Trauma Stress*. 2012;25:721–7.
  24. Bills CB, Levy NA, Sharma V, Charney DS, Herbert R, Moline J, et al. Mental health of workers and volunteers responding to events of 9/11: Review of the literature. *Mt Sinai J Med*. 2008;75:115–27.
  25. Norris FH, Tracy M, Galea S. Looking for resilience: understanding the longitudinal trajectories of responses to stress. *Soc Sci Med*. 2009;68:2190–8.

# Effectiveness of brief suicide management training programme for medical residents in Japan: a cluster randomized controlled trial

Y. Suzuki<sup>1\*</sup>, T. A. Kato<sup>2</sup>, R. Sato<sup>3</sup>, D. Fujisawa<sup>4</sup>, K. Aoyama-Uehara<sup>3</sup>, N. Hashimoto<sup>5</sup>, N. Yonemoto<sup>6</sup>, M. Fukasawa<sup>1</sup> and K. Otsuka<sup>7</sup>

<sup>1</sup> Department of Adult Mental Health, National Institute of Mental Health, National Center of Neurology and Psychiatry, Tokyo, Japan

<sup>2</sup> Department of Neuropsychiatry, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

<sup>3</sup> Department of Psychiatry, Yokohama City University School of Medicine, Yokohama, Japan

<sup>4</sup> Psycho-oncology Division, National Cancer Center East, and Department of Neuropsychiatry, Keio University School of Medicine, Tokyo, Japan

<sup>5</sup> Department of Psychiatry, Hokkaido University Graduate School of Medicine, Sapporo, Hokkaido, Japan

<sup>6</sup> Department of Epidemiology and Biostatistics, Translational Medical Center, National Center of Neurology and Psychiatry, Tokyo, Japan

<sup>7</sup> Department of Disaster Psychiatry and Community Psychiatry, Iwate Medical University, Iwate, Japan

**Aims.** To evaluate the effectiveness of a brief suicide management training programme for Japanese medical residents compared with the usual lecture on suicidality.

**Methods.** In this multi-center, clustered randomized controlled trial, the intervention group attended a structured suicide management programme and the control group, the usual lecture on depression and suicidality. The primary outcome was the difference in residents' cumulative competency score to manage suicidal persons from baseline (T0) to 1 month after the intervention (T2), determined using the Suicide Intervention Response Inventory (SIRI-1) score, at individual level.

**Results.** Analysis of 114 residents (intervention group  $n=65$ , control group  $n=49$ ) assigned to two clusters in each group revealed no change in SIRI-1 score from T0 to T2 or immediately after the intervention (T1) between the two groups. As a secondary analysis, discrepancy in judgement between the participants and Japanese suicidologists was examined immediately after the intervention in the adjusted model, with a mean difference in score of 9.98 (95% confidence interval: 4.39–15.56;  $p=0.001$ ).

**Conclusions.** The structured programme was not proven to improve competency in suicide management when measured by the SIRI-1 score. Further elaboration of the programme and valid measurement of its outcome would be needed to show the program's effectiveness.

Received 8 January 2013; Revised 15 May 2013; Accepted 15 May 2013; First published online 18 July 2013

**Key words:** Education, evaluation, intervention studies, medical residents, suicide.

## Introduction

Suicide has been a national concern for Japan ever since numbers first exceeded 30 000 per year in 1998 (Shiho *et al.* 2005). However, psychiatric services have not been readily accessible to those with depression in Japan, and more than half of individuals with new onset depression consult their general medical practitioners first, often delaying their receipt of psychiatric care (Fujisawa *et al.* 2008). Health

professionals across a range of fields are therefore in a position to have important first contacts to detect and intervene with patients with mental health problems, but they require appropriate knowledge and skills to do this (Sato *et al.* 2006).

In Japan, sufficiently detailed training for health professionals such as physicians on suicide management of individuals in mental crisis has been lacking. Yet such training would seem vital for them in their role as gatekeepers for persons with health problems, particularly as they are expected to assume important roles in suicide prevention (Mann *et al.* 2005). We hypothesized, therefore, that suicide management training for medical residents could help them increase their competency in managing persons with mental health problems, and ultimately contribute to suicide prevention.

\* Address for correspondence: Dr Yuriko Suzuki, Department of Adult Mental Health, National Institute of Mental Health, National Center of Neurology and Psychiatry, 4-1-1 Ogawa-Fligashi, Kodaira, Tokyo 187-8553, Japan.

(Email: yrsuzuki@ncnp.go.jp)

This intervention study aimed to improve the competency of medical residents, at individual level, in managing suicidal persons they encounter in medical settings through their attendance at a brief structured training programme for suicide management. Its effectiveness was compared with the conventional training that medical residents receive on suicidality.

## Method

### Study design

This study employed a cluster randomized controlled trial design to avoid contamination of the programme among individual medical residents and to facilitate group-level participatory intervention. The trial involved five institutions in Japan (Hokkaido University, Iwate Medical University, Keio University, Yokohama City University and Kyushu University). Each institution offers a training programme for medical residents on suicide prevention and the programmes were provided during their psychiatric rotation (July 2009–March 2010). This study was registered in the national clinical trial registry, the UMIN-CTR (registration number: UMIN000002245), on 24 July, 2009.

### Participants

Participants were second-year medical residents on their psychiatry rotation. In the Japanese medical education system, newly certified physicians must go through 2 years of postgraduate training as general medical residents before they chose a clinical specialty (Morris *et al.* 2005). During these 2 years, psychiatry was one of the required areas for training for at least 1 month in the second year, the time when this research was conducted (Kozu, 2006; Teo, 2007).

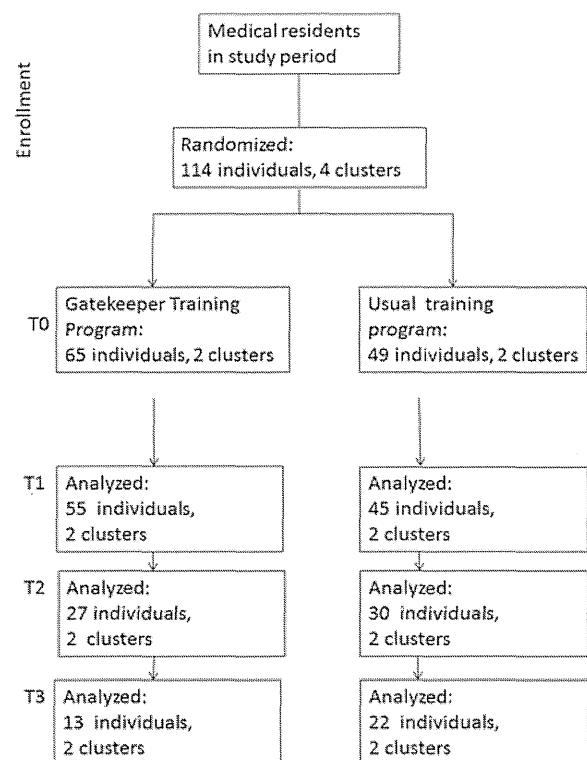
### Randomization

Lists of medical residents in each institution in 2009 were obtained. The unit of randomization was the group of medical residents on their psychiatric rotation during the study period. A cluster constituted a mix of groups completing a psychiatry rotation in the participating institutions. The rotation groups comprised 1–9 medical residents and the groups were equivalent in terms of content of training and individual factors such as preference for future speciality. Since there was variation in the size of the groups, we operationally created a cluster containing several rotation groups in order to make a cluster with 9–18 members. After randomization to clusters, a training session was assigned to each cluster and all medical residents in the rotation group were then invited to participate in the study.

In each institution, two clusters (first half and second half groups) were created and a random number of medical students were assigned to the first group of each institution, yielding two intervention groups and control groups. Consequently, alternate intervention/control conditions were assigned to the second group in each institution to avoid an institutional effect as a whole. Registration of the clusters was conducted by YS, and the randomization procedure was carried out by MF, an independent researcher who was not involved in the intervention. Random numbers were produced by a computer program and four clusters were randomly assigned to the intervention or control group (two clusters each group) (Fig. 1). The nature of the intervention meant that allocation was not concealed.

### Interventions

The training programme for suicide prevention implemented in this study for Japanese medical residents (hereafter, Gatekeeper Training Program) was developed by the research team based on the Mental Health First Aid (MHFA) programme implemented in Australia, which was originally developed for the general public. The MHFA programme is a training



**Fig. 1.** Flow of the participants in the trial. T0: baseline response before intervention; T1: response immediately after the intervention; T2: response 1 month after the intervention; T3: response 3 month after the intervention.

programme designed to help non-health professionals handle contacts with persons in mental health crisis and this programme has been well researched (Kitchener & Jorm, 2006) and its effectiveness demonstrated in Australia (Jorm *et al.* 2004, 2005).

This programme was a 2-hour structured educational programme on managing people with depression and suicidal thoughts. Since the participants in this study were medical residents, the programme was condensed by minimizing the knowledge-based content of the lecture and including more experiential learning, an essential feature of the MHFA programme. To fit the Gatekeeper Training Program into the tightly arranged residency curriculum for medical residents, the only topic taught in the programme was depression and suicide, including current needs to respond to suicide prevention. With reference to the existing mental health first aid guidelines for Japan (Colucci *et al.* 2011), the training covered the approaches which are universally endorsed, rather than taking a specific approach relevant only to Japanese culture. The first part of the programme presented, in lecture format, factual information on depression and suicide in Japan. Action plans for management of people with depression and suicidal thoughts were provided. In the second part, a clinical scenario was shown in a demonstration DVD in which a hospitalized patient with a physical problem and suicidal thoughts was referred to a physician at the bedside. The facilitator then prompted the participants to role-play the scene by taking on different roles of the patient, family member and medical staff. An interactive discussion that followed was facilitated by certified facilitators to address the questions and comments the participants raised. The details of the programme and results of a pilot study are described elsewhere (Kato *et al.* 2010).

For comparative purposes, one of the researchers presented the usual training session, a didactic lecture on depression and suicidality, the contents of which were based on a standard psychiatric textbook (Nishijima, 2008).

### Measures

A self-administered questionnaire comprised of the following inventories and items were distributed to the study participants.

#### *The Suicide Intervention Response Inventory (SIRI)*

To assess the participants' competency in managing suicide intervention, we used the SIRI, a 25-item self-rated questionnaire comprised of forced-choice responses to brief clinical interview excerpts with

suicidal persons. The SIRI is a well-validated and reliable instrument that is sensitive to change in suicide interview skills as a result of training (Neimeyer & Bonnelle, 1997). On the SIRI, respondents are asked to rate the appropriateness of each response alternative on a 7-point Likert scale ranging from -3 (very inappropriate) to 3 (very appropriate).

The SIRI was chosen to evaluate competency in suicide management skills quantitatively because, to the best of the authors' knowledge, this is the only assessment tool validated to measure the competency level in suicide intervention in Japan (Kawashima *et al.* 2010). Also, when physicians encounter a suicidal patient in a general medical setting, they are expected to show an empathetic, non-judgemental attitude, and this is one of the issues that the SIRI aims to measure.

Originally, the SIRI score was calculated by summing the number of appropriate responses made, with a score ranging from 0 to 25 (SIRI-1 score). However, since this method of scoring demonstrated a ceiling effect, the use of a revised scoring system (hereafter, SIRI-2 score) was recommended (Neimeyer & Pfeiffer, 1994). The SIRI-2 score is calculated by summing the discrepancy between participants' ratings of the appropriateness of the responses made and a set of criterion ratings by a panel of American suicidology experts (hereafter, SIRI-2 Original score). The SIRI-2 Original score ranges from 12.90 to 247.28, with lower scores indicating better management of suicidal persons. The SIRI has been translated into Japanese and validated among Japanese suicidologists (Kawashima *et al.* 2010), and thus the discrepancy between the participants' ratings and Japanese experts' ratings can also be calculated (hereafter, the SIRI-2 Japanese score). The primary outcome was chosen as the SIRI-1 score in this study, and the SIRI-2 Original and SIRI-2 Japanese scores were calculated as secondary measures.

The SIRI was administered before the intervention (T0), immediately after the intervention (T1), 1 month after the intervention (T2) and 3 months after the intervention (T3).

#### *Item for assessing confidence in managing suicidal persons*

The participants were asked to indicate their confidence in managing suicidal persons on a 5-point Likert scale, which was originally developed for this study, ranging from 1 (not confident at all) to 5 (very confident).

#### *Medical Outcome Study (MOS) Quality of Life (QOL) Questionnaire-Short Form*

The MOS QOL Questionnaire-Short Form (SF-8) was used to assess the participants' health status