SUPPLEMENT 3

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Health and Medical Research Fund
Health and Health Services Research Fund

Research Dissemination Reports

精神健康政策及服務的委託研究
醫療衞生研究基金
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研究成果報告

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Commissioned Research on Mental Health Policy and Services

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Research Dissemination Reports

MENTAL HEALTH

PAEDIATRICS

NEUROLOGY

Editorial

Dissemination reports are concise informative reports of health-related research supported by the Health and Medical Research Fund (and its predecessor funds) administered by the Food and Health Bureau. In this edition, we present 11 dissemination reports of projects related to mental health, paediatrics, and neurology. In particular, three projects are highlighted due to their potentially significant findings, impact on healthcare delivery and practice, and/or contribution to health policy formulation in Hong Kong.

Psychotic disorders including schizophrenia are severe mental illnesses pose a significant burden on healthcare systems around the world. Numerous early intervention programmes for psychosis have been established. In Hong Kong, the Early Assessment Service for Young People with Psychosis (EASY) was launched in 2001, as a publicly funded, territory-wide service comprising community awareness programmes, an open referral system and a 2-year specialised early intervention for young people aged 15 to 25 years with first episode psychosis. Chang et al[1] systematically evaluated the effectiveness of an extended EASY programme for adult first episode psychosis patients. They found that patients who received 3-year extended EASY treatment had significantly shorter treatment delay than those managed in standard psychiatric care and that the extended EASY programme was superior to standard care in functional outcome improvement and alleviating symptom severity, in particular negative and depressive symptoms.

Adolescent drinking is an important public health issue but little is known about the drinking pattern in Hong Kong adolescents. Ho et al[2] investigated the drinking pattern of Hong Kong secondary school students in order to identify risk factors and problems associated with alcohol drinking. They found that in secondary 1-6 students, the overall prevalence of current drinking and binge drinking were 21.5% and 7.5%, respectively. Risk factors for adolescent drinking were parental pro-drinking practices, lack of parental disapproval of adolescent drinking, and adolescent positive expectation of alcohol drinking. These modifiable factors could be targeted in interventions. Adolescent drinking was associated with depressive symptoms, poor academic performance, and sleep problems.

Mirror therapy has been shown to be effective for patients with phantom limb pain after amputation. Mirror therapy involves the superimposition of reflections of unaffected limb movements on the affected limb to make it appear as if the latter is moving. Fong et al[3] conducted a randomised controlled trial comparing the effectiveness of a 6-week (12-session) course of mirror therapy against bimanual arm training in improving motor and functional performance of hemiplegic upper extremity on adults with chronic stroke. Both therapies were useful in enhancing hemiplegic arm functions of stroke patients, with possible benefits to the distal hand functions in mirror therapy.

We hope you will enjoy this selection of research dissemination reports. Electronic copies of these dissemination reports and the corresponding full reports can be downloaded individually from the Research Fund Secretariat website (https://rfs2.fhb.gov.hk/). Researchers interested in the funds administered by the Food and Health Bureau also may visit the website for detailed information about application procedures.

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References

1. Chang WC, Chan SKW, Lee EHM, Hui CLM, Chen EYH. Extended early intervention versus standard psychiatric care for adults with first-episode psychosis. Hong Kong Med J 2019;25(Suppl 3):S4-8.
2. Ho DSY, Huang R, Wang MP, Lo WS, Lam TH. Adolescent alcohol drinking in Hong Kong: a school-based survey. Hong Kong Med J 2019;25(Suppl 3):S13-5.
3. Fong KNK, Ting KH, Chan CCH, Li LSW. Mirror therapy with bilateral arm training for hemiplegic upper extremity motor functions in patients with chronic stroke. Hong Kong Med J 2019;25(Suppl 3):S30-4.

Extended early intervention versus standard psychiatric care for adults with first-episode psychosis

WC Chang *, SKW Chan, EHM Lee, CLM Hui, EYH Chen

KEY MESSAGES

1. Adult patients with first-episode psychosis who received 3-year extended Early Assessment Service for Young People with Psychosis (EASY) had significantly shorter treatment delay than those treated with standard psychiatric care.
2. Extended EASY programme was superior to standard care in improving functional outcome and alleviating symptom severity, in particular negative and depressive symptoms.
3. Lack of positive effect of extended EASY programme on reducing admission and suicide rates may be due to the modest sample size. Further investigation involving greater number of patients is required.

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Introduction

Psychotic disorders including schizophrenia affect 3% of the population and have high disease burden. Numerous early intervention (EI) programmes for psychosis have been established worldwide in the past two decades, based on the premise that shortening of treatment delay and provision of phase-specific treatments in the initial years of psychosis can improve long-term outcome. Prolonged duration of untreated psychosis (DUP) was associated with poorer illness outcomes.[1] A meta-analysis demonstrated that patients with first-episode psychosis (FEP) who receive EI service had better outcomes than those treated with standard psychiatric care in terms of symptom severity, functioning, hospitalisation, and service engagement.[2]

In 2001 in Hong Kong, Early Assessment Service for Young People with Psychosis (EASY) was launched. It comprised community awareness programme, an open referral system, and a 2-year specialised EI for young people aged 15 to 25 years with FEP.[3] Young patients in EI service had better functioning, milder symptom severity, fewer suicides and hospitalisations, and lower disengagement rate than those in standard care.[4] Our randomised controlled trial (SMH-29) further demonstrated superiority of extended 3-year EI over 2-year EI in improving symptom and functional outcomes in young patients with FEP.[5] Since 2011, EASY programme has been expanded to provide 3-year treatment to FEP patients aged 15 to 64 years. This study aimed to evaluate the effectiveness of extended EASY programme for adult patients with FEP.

Methods

This was a multicentre study involving seven clusters including Hong Kong West, Hong Kong East, Kowloon East, Kowloon Central, Kowloon West, New Territories East and New Territories West. The study was approved by the local institutional review boards. All subjects provided written informed consent prior to participation of follow-up interview assessment. This study used a historical-control design to compare adult patients with FEP who received 3-year extended EASY programme with those who were treated with standard psychiatric service in terms of treatment delay, pathway to care, and outcomes in functioning, symptoms, and service utilisation, based on retrospective record review and follow-up interview assessment.

We identified 160 FEP patients who enrolled to extended EASY programme (EI group) between 1 January 2012 and 30 July 2012, and 160 FEP patients who enrolled in standard psychiatric services (SC group) between 1 September 2010 and 31 March 2011 from the Psychiatric Case Register of Hospital Authority via random sampling. Inclusion criteria were Chinese adults aged 26 to 55 years presenting with FEP (ICD-10 diagnosis of schizophrenia, schizoaffective disorder, acute and transient psychotic disorders, delusional disorder or other non-organic psychotic disorders). Exclusion criteria were substance-induced psychosis, psychotic

disorders secondary to general medical condition, affective psychosis, and mental retardation.

Subjects' baseline and 3-year follow-up variables were obtained via systematic record review. Outpatient and inpatient medical records and clinical information were retrieved. Baseline data included socio-demographics, occupational status, and age at service entry. Treatment delay in the form of DUP was estimated. Positive and negative symptom levels were assessed using Clinical Global Impression-Severity of Illness Scale (CGI-S). Depressive symptoms were evaluated using CGI-S for bipolar illness. Functional outcome was evaluated using Social Occupational Functioning Assessment Scale (SOFAS). Engagement of full-time employment was assessed. Data were collected on mortality, suicide, and service utilisation including psychiatric admissions, treatment defaults, service disengagement, and antipsychotic medication dose.

Subjects were contacted for follow-up interview assessment. Diagnosis was made according to ICD10 Diagnostic Criteria for Research,[33] based on structured diagnostic interview, medical records, and informant history. Family history of psychotic disorder and past history of substance abuse were ascertained. Premorbid Adjustment Scale was used to measure premorbid functioning. Age of psychosis onset, first-episode status, and DUP were measured and verified. Help-seeking and referral patterns were examined. Positive and negative symptom severity was evaluated using Positive and Negative Syndrome Scale. Depressive symptoms were measured by Calgary Depression Scale for Schizophrenia. Psychosocial functioning was measured by SOFAS and Role Functioning Scale. The Chinese version of SF-12 was used to measure subjective quality of life. Antipsychotic-induced motor side-effects were examined by Simpson-Angus Scale, Barnes Akathisia Scale, and Abnormal Involuntary Movement Scale.

Psychosocial functioning was the primary outcome measure. Between-group comparisons were made using Chi-squared test and independent t-test as appropriate. Analysis of covariance was used for variables that were significantly different between groups, adjusting for the effect of DUP on outcomes. The level of statistical significance was set at $P<0.05$.

Results

The EI and SC groups were comparable regarding demographics and baseline clinical, functional, and treatment characteristics, as well as non-participation rate for follow-up interview assessment. Of 320 patients, 251 were interviewed 48.3±3.1 months after service entry (Table 1).

EI patients had significantly shorter DUP than SC patients although there was no significant difference with respect to the proportion of patients receiving inpatient treatment upon entry (Table 2). EI patients had significantly lower mean CGI-S positive symptom levels in the first and second year of follow-up than SC patients. EI patients attained significantly higher mean SOFAS scores in the first, second, and third year of follow-up, and had longer cumulative full-time employment than SC patients. There was a trend that EI patients were less likely to disengage from service. After controlling for

TABLE 1. Baseline characteristics of patients with first-episode psychosis

Variables	Early intervention (n=160)*	Standard care (n=160)*	t/χ^2	P value
Male gender	66 (41.3)	61 (38.1)	0.33	0.57
Age at service entry, y	37.6±8.5	39.2±8.0	1.75	0.08
Full-time employed at entry	20 (12.5)	27 (16.9)	1.22	0.27
Age at psychosis onset, y	36.6±8.9	37.3±8.2	-0.72	0.47
Psychiatric diagnosis			2.19	0.14
Schizophrenia-spectrum disorder	130 (81.2)	119 (74.4)		
Other non-affective psychoses	30 (18.8)	41 (25.6)		
Clinical Global Impression – Severity Scale				
Positive symptom score	5.1±1.2	5.4±1.0	-1.67	0.09
Negative symptom score	2.6±1.3	2.7±1.5	-0.68	0.50
Depression score	2.0±1.3	1.9±1.2	0.83	0.41
Social and Occupational Functioning Assessment Scale score	41.8±12.6	40.7±11.5	0.79	0.43
On antipsychotic medication	159 (99.4)	156 (98.1)	1.03	0.37
Chlorpromazine equivalent dose, mg	146.1±102.1	172.2±225.2	-1.32	0.19

* Data are presented as mean±standard deviation or No. (%) of subjects

TABLE 2. Treatment delay and 3-year outcome based on retrospective medical record review

Variables	Early intervention	Standard care	t/χ^2	P value
Inpatient treatment upon service entry	78 (48.8)	91 (56.9)	2.12	0.15
Duration of untreated psychosis, d	353.7±545.9	620.7±1045.8	-	-
Log duration of untreated psychosis	2.0±0.8	2.3±0.8	-2.40	0.017
Clinical Global Impression – Severity Scale				
Year 1	(n=151)	(n=141)		
Positive symptom score	2.2±0.9	2.7±1.2	-4.04	<0.001
Negative symptom score	2.1±1.1	2.3±1.2	-1.42	0.16
Depression score	1.4±0.7	1.5±0.7	-0.85	0.40
Year 2	(n=148)	(n=134)		
Positive symptom score	1.4±0.7	1.7±0.9	-2.46	0.02
Negative symptom score	1.8±1.1	2.0±1.1	-1.65	0.10
Depression score	1.2±0.5	1.2±0.5	-1.48	0.14
Year 3	(n=143)	(n=132)		
Positive symptom score	1.5±0.8	1.6±0.9	-1.07	0.29
Negative symptom score	1.7±1.1	1.9±1.1	-1.64	0.10
Depression score	1.1±0.5	1.2±0.5	-1.20	0.23
Social and Occupational Functioning Assessment Scale				
Year 1	51.2±9.6 (n=151)	48.2±9.6 (n=141)	2.66	0.01
Year 2	56.2±9.9 (n=148)	52.0±9.6 (n=134)	3.72	<0.001
Year 3	57.4±10.3 (n=143)	52.1±9.3 (n=132)	4.53	<0.001
Months in full-time work in 3 years	11.5±14.0 (n=143)	8.0±12.7 (n=132)	2.34	0.02
Relapse of psychotic episodes	55 (36.9)	44 (31.7)	0.88	0.35
All-cause mortality	2 (1.3)	5 (3.1)	1.31	0.45
Suicide	2 (1.3)	2 (1.3)	0.00	1.00
Service utilisation over 3 years				
Psychiatric hospitalisation	94 (60.7)	100 (65.8)	0.88	0.35
Length of hospital stay, d	41.9±72.3	53.0±101.6	-1.11	0.27
Default in outpatient appointment	67 (41.9)	72 (45.0)	0.32	0.57
Service disengagement	17 (10.6)	28 (17.5)	3.13	0.08
Length of service stay, mo	33.8±7.6	31.8±10.1	1.92	0.06
Chlorpromazine equivalent dose, mg				
Year 1	306.5±218.7	299.6±221.1	0.26	0.80
Year 2	338.5±267.3	312.6±216.2	0.85	0.40
Year 3	351.0±327.5)	353.0±293.7	-0.05	0.96

* Data are presented as mean±standard deviation or No. (%) of subjects

the effect of DUP, better outcomes in EI patients remained significant in terms of positive symptoms and SOFAS. No significant differences were noted in rates of relapse, mortality, suicide, admission, and treatment defaults.

EI and SC patients were comparable in terms of patterns of first help-seeking action and referral source (Table 3). EI patients had shorter (not significantly) DUP, help-seeking delay, and referral delay than SC patients. Upon follow-up assessment, EI patients demonstrated significantly less severe positive symptoms, negative symptoms, general psychopathology, and depressive symptoms than SC patients. EI patients displayed significantly higher Role Functioning Scale total score and immediate and extended social network scores, and SF-12 physical domain score than SC patients. Better outcomes in EI patients remained significant after controlling for the effect of DUP, with the exception of positive symptom severity.

TABLE 3. Treatment delay and outcome based on interview assessment

Variables	Early intervention (n=130)*	Standard care (n=121)*	t/χ^2	P value
First help-seeking action			0.97	0.62
Community non-medical sector	49 (38.0)	39 (32.5)		
Community medical sector	34 (26.4)	32 (26.7)		
Non-community medical sector	46 (35.6)	49 (40.8)		
Referral source			4.66	0.10
Community non-medical sector	8 (6.3)	17 (14.1)		
Community medical sector	20 (15.9)	22 (18.2)		
Non-community medical sector	98 (77.8)	82 (67.7)		
Inpatient status upon service entry	70 (53.9)	69 (48.8)	0.26	0.61
Duration of untreated psychosis, d	375.8±565.8	635.2±1136.1	-	-
Log duration of untreated psychosis	2.1±0.8	2.2±0.8	-1.54	0.13
Help-seeking delay, d	330.7±534.4	67.4±1088.3	-	-
Log help-seeking delay	2.0±0.8	2.1±0.9	-1.29	0.20
Treatment delay, d	45.7±118.4	68.5±286.4	-	-
Log treatment delay	0.7±0.9	0.7±0.9	-0.36	0.72
Positive and Negative Syndrome Scale				
Positive symptom score	8.7±3.2	9.6±3.8	-2.13	0.03
Negative symptom score	10.8±5.7	13.4±8.0	-2.91	0.01
General psychopathology	19.4±4.0	24.4±8.9	-5.59	<0.001
Calgary Depression Scale for Schizophrenia score	1.8±3.0	2.8±3.7	-2.28	0.02
Social and Occupational Functioning Assessment Scale score	59.0±11.4	57.3±12.1	1.16	0.25
Role Functioning Scale score	22.4±3.3	21.3±4.0	2.30	0.02
Work productivity	5.1±1.9	4.9±1.9	0.65	0.52
Independent living	6.8±0.5	6.6±1.0	1.94	0.06
Immediate social network	5.7±1.1	5.4±1.2	2.70	0.01
Extended social network	4.7±0.9	4.4±1.2	2.59	0.01
Full-time employed at follow-up	41 (31.5)	42 (34.7)	0.29	0.59
SF-12 physical domain score	49.0±7.1	46.4±8.1	2.47	0.01
SF-12 mental domain score	48.0±9.2	46.5±11.7	1.06	0.29
On antipsychotic medication	122 (93.8)	112 (93.3)	0.03	0.87
Chlorpromazine equivalents at follow-up, mg	416.0±595.3	387.2±307.4	0.46	0.65
Simpson-Angus Scale score	0.2±1.0	0.5±1.6	-1.64	0.10
Barnes Akathisia Rating Scale score	0.1±0.5	0.2±0.7	-1.29	0.20
Abnormal Involuntary Movement Scale score	0.3±1.8	0.3±1.1	0.27	0.79

* Data are presented as mean±standard deviation or No. (%) of subjects

Discussion

Compared with SC patients, EI patients had significantly shorter DUP, lower levels of negative and depressive symptoms, and better functional outcome in follow-up assessment. EI patients demonstrated shorter (not significantly) help-seeking and referral delays than SC patients. Nonetheless, patterns of first formal help-seeking action and referral source were similar between groups. EI patients displayed better functional outcome and attained higher SF-12 physical domain score. EI patients displayed lower negative and depressive symptom levels. This is of critical clinical significance, as negative symptoms are associated with poor functional outcome and limited response to pharmacotherapy. Depressive symptoms frequently occur in people with psychotic disorders and are associated with heightened suicide risk.

Contrary to past studies reported that patients received EI service had fewer admissions than those

in standard care, we found no significant group difference in hospitalisation outcome over 3-year treatment period. This may be due to difference in caseloads between EASY programme and EI services in Western countries. Our EASY programme has a higher patient-to-case manager ratio that may lower the capacity of EI service in reducing readmission. The modest sample size might also contribute to null findings owing to compromised statistical power to detect subtle but significant difference. This also applies to examination of rates of mortality and suicide. Consistent with most prior EI research, our EI patients had lower service disengagement rate than SC patients (at trend-wise significance).

There are several limitations in the study. Interview assessment could not be conducted at service intake; data at baseline and during 3-year treatment period were based on medical record review, which might be biased by documentation quality. Measurement of treatment delay is retrospective with potential recall bias. Outcomes on hospitalisation and mortality were likely to be underpowered and should be treated with caution. Generalisation of our results to other populations should be cautious because our findings were based on EI service of comparatively low resources and high caseloads, relative to well-established EI services implemented in Western countries.

Conclusion

Extended EASY programme is superior to standard care in reducing treatment delay, improving negative and depressive symptom outcomes, and enhancing functioning in adult patients with FEP. Further investigation with a larger sample size is required to examine the effectiveness of extended EASY programme in reducing rates of admission, mortality, and suicide. Future research clarifying potential differential treatment effects of extended EASY programme on FEP patients at various age groups should be conducted to streamline service delivery and optimise outcomes. Reassessment is warranted to examine whether positive effects achieved by extended EASY programme could be maintained after service withdrawal.

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References

1. Penttilä M, Jääskeläinen E, Hirvonen N, Isohanni M, Miettunen J. Duration of untreated psychosis as predictor of long-term outcome in schizophrenia: systematic review and meta-analysis. Br J Psychiatry 2014;205:88-94.
2. Nordentoft M, Rasmussen JO, Melau M, Hjorthoj CR, Thorup AAE. How successful are first episode programs? A review of the evidence for specialized assertive early intervention. Curr Opin Psychiatry 2014;27:167-72.
3. Tang JYM, Wong GHY, Hui CLM, et al. Early intervention for psychosis in Hong Kong: the EASY programme. Early Interv Psychiatry 2010;3:214-9.
4. Chen EYH, Tang JYM, Hui CLM, et al. Three-year outcome of phase-specific early intervention for first-episode psychosis: a cohort study in Hong Kong. Early Interv Psychiatry 2011;5:315-23.
5. Chang WC, Chan GHK, Jim OTT, et al. Optimal duration of an early intervention for first-episode psychosis: randomised controlled trial. Br J Psychiatry 2015;206:492-500.

Stepped care programme in primary care to prevent anxiety and depression: a randomised clinical trial

SYS Wong *, WK Tang, WWS Mak, FMC Cheung, S Mercer, SM Griffiths, J Woo, DTF Lee, K Kung, AT Lam

KEY MESSAGES

1. Subthreshold depression and anxiety are prevalent in primary care. The probability of patients developing depression or anxiety in 1 year was 13.5%.
2. A stepped care programme was not superior to usual care in terms of preventing onset of depression or anxiety, reducing severity of symptoms, reducing health care utilisation, or improving quality of life in primary care patients with subthreshold depression or anxiety at 12 and 15 months.
3. A watchful waiting period or a less resource-demanding intervention is suggested before initiating further intervention for subthreshold depression or anxiety. Patients considered to be severely depressed or anxious at baseline should be referred to a stepped care programme.

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Introduction

Anxiety and depressive disorders are associated with significant morbidity, disability, and health care utilisation.[1] Subthreshold depressive and anxiety symptoms are prevalent in primary care, and up to 35% of these patients will develop a major depressive or anxiety disorder within a year.[2,3] Therefore, preventing the onset and development of these disorders is of high priority. In Hong Kong, the waiting list for referral to non-urgent psychiatric care is long. A stepped care programme may be more cost-effective.[4,5] This study evaluated the effectiveness of a stepped care programme in the prevention of depression and anxiety among patients in primary care with subthreshold depression and anxiety.

Methods

This prospective, randomised, two-armed (1:1) study was conducted from June 2010 to February 2013. Patients aged ≥18 years who had subthreshold depression or anxiety (a score of ≥16 in the Center for Epidemiologic Studies Depression Scale [CES-D] or a score of ≥6 in the Hospital Anxiety and Depression Scale – anxiety section [HADS-A]) were recruited from the general out-patient clinics of the New Territories East Cluster. Patients were excluded if they had any psychiatric disorders (according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [DSM-IV]), insufficient command of the Chinese language, or were unwilling or unable to give informed consent.

A total of 240 participants were randomised to receive usual care (n=119) or the stepped care programme (n=121) that involved (1) watchful waiting, (2) telephone counselling, (3) problem solving therapy, and (4) family doctor treatment. Patients were assessed at baseline and at 3, 6, 9, 12, and 15 months by telephone interview. Primary outcome measures included incidence of major depression and generalised anxiety disorder according to the Structured Clinical Interview for DSM-IV. Secondary outcome measures included depressive and anxiety symptoms measured by the Chinese version of CES-D, HADS-A, Beck Anxiety Inventory, and Beck Depression Inventory-II. Quality of life was measured using the Chinese version of Short-Form Health Survey. Utilisation of health services and medication to improve mood or mood-related symptoms were also recorded. Satisfaction with delivered care was measured using the Consumer Assessment of Healthcare Providers

and Systems 2.0 Adult Questionnaire. Social support was measured using the Chinese version of Multidimensional Scale of Perceived Social Support.

Results

The stepped care group and usual care group were comparable in terms of demographics and baseline measures. The dropout rate at 15 months was 14.2% (n=34).

Of 121 participants in the stepped care group, 35 were eligible for telephone counselling and 24 accepted it. Of these 24, six were eligible for problem-solving treatment and three accepted it. Of these three, one subsequently received treatment from the family doctor. No adverse effects were reported.

At 15 months, 21 (17.4%) participants from the stepped care group and 18 (15.1%) participants from the usual care group developed DSM depression or anxiety. The cumulative probability of developing depression or anxiety was 13.5% at 12 months, and 21.8% at 15 months. The Cox proportional hazard model showed no significant difference between the two groups in terms of the risk of developing major depression or generalised anxiety at 15 months (hazard ratio=1.62; 95% CI, 0.82-3.18). Baseline comparison of participants with CES-D scores of <16 versus ≥16 revealed a hazard ratio of 3.14 (95% CI, 1.53-6.44; P=0.002).

Using linear mixed models and repeated analysis of variance, the two groups did not differ significantly in terms of reduced depression or anxiety scores, health service utilisation (frequency and cost), or quality of life.

Discussion

The stepped care programme was not superior to usual care. First, a lower baseline level of severity and natural variation resulted in a lower proportion of participants who required further intervention following watchful waiting. Second, not all participants who were eligible for stepped care intervention accepted it. Third, the underestimated sample size had inadequate power to detect differences in the two groups. Fourth, participants in the usual care group might have sought help because they had higher self-motivation and awareness of depression and anxiety. Fifth, data were collected by telephone interview over time. As such, there may have been attention bias, recall bias, and observation bias.

Subthreshold depression or anxiety is prevalent in Hong Kong primary care patients. Approximately 16.4% (464/2827) of recruited patients had subthreshold depression or anxiety. The probability of developing depression or anxiety disorders within a year was 13.5%. Further research on subthreshold depression and anxiety is needed to determine the magnitude of the problem in primary care. Future interventions for subthreshold depression or anxiety should include a watchful waiting period (eg 3 months) or less resource-demanding interventions before further interventions. Patients with high subthreshold depression or anxiety at baseline should be referred for intervention.

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Results of this study have been published in: Zhang de X, Lewis G, Araya R, et al. Prevention of anxiety and depression in Chinese: a randomized clinical trial testing the effectiveness of a stepped care program in primary care. J Affect Disord 2014;169:212-20.

References

1. Simon G, Ormel J, VonKorff M, Barlow W. Health care costs associated with depressive and anxiety disorders in primary care. Am J Psychiatry 1995;152:352-7.
2. Beekman AT, Penninx BW, Deeg DJ, Ormel J, Braam AW, van Tilburg W. Depression and physical health in later life: results from the Longitudinal Aging Study Amsterdam (LASA). J Affect Disord 1997;46:219-31.
3. Beekman AT, Bremmer MA, Deeg DJ, et al. Anxiety disorders in later life: a report from the Longitudinal Aging Study Amsterdam. Int J Geriatr Psychiatry 1998;13:717-26.
4. Hunkeler EM, Katon W, Tang L, et al. Long term outcomes from the IMPACT randomised trial for depressed elderly patients in primary care. BMJ 2006;332:259-63.
5. van't Veer-Tazelaar PJ, van Marwijk HW, van Oppen P, et al. Stepped-care prevention of anxiety and depression in late life: a randomized controlled trial. Arch Gen Psychiatry 2009;66:297-304.

15-year computer-record study of adolescents exposed to peer suicide

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KEY MESSAGES

1. Adolescents exposed to peer suicide and non-exposed controls did not differ significantly after 15 years, except for the percentage of females who attended accident and emergency department three times or more.
2. For schools in which a suicide occurred, a de-briefing or support programme should be implemented to increase student resilience, especially for peers of the suicide victim.

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Introduction

Exposure to suicide is associated with an increased risk of suicide because of imitation behaviour.[1] Suicide prevention programmes for young people are based on the assumption that imitation plays a role in self-harm/suicidal behaviour.[2] Adolescents exposed to peer suicidal behaviour are more at risk of developing depression in the short term, harbouring suicidal ideation, and enacting suicide attempts.[3,4] However, a 3-year study of youths exposed to suicide found no evidence of heightened risk for self-harm/suicidal behaviour.[1] Exposed to peer suicide evokes more suicidal thoughts and attempts and heightens depression in immediate term but not after 6 years.[3]

Adolescents exposed to the attempted suicide of a close friend or family member also show a heightened risk for suicidal behaviour.[5] The attention and concern given to the suicide attempters and the less grave outcome (such as death and bereavement) may 'encourage' at-risk adolescents to attempt such behaviour. In Hong Kong, 25% of adolescents exposed to suicide were probable psychiatric cases, and 15 to 21% of them reported suicidal acts.[4] The risk remained evident after controlling for age, sex, and other potential psychosocial risk factors. Adolescents exposed to attempted suicide are at greater risk than exposed to completed suicide: the former were at greater risk of externalising problems, whereas the latter were at greater risk of internalising problems.

In Hong Kong, the percentage of having probable psychiatric illness in adolescents exposed to peer attempted suicide and non-exposed controls was 26.4 and 11.5, respectively, whereas the percentage of having a history of suicidal acts in peers of suicide completers, attempters, and controls was 15.1, 21.0, and 4.8, respectively. Close friends of suicide completers/attempters, respectively, were particularly at risk of internalising/externalising problems, psychiatric disturbances, and suicidal behaviour. It was uncertain whether such risk was transient or persistent.

This study reviewed records of adolescents exposed to peer suicide and non-exposed controls in terms of psychopathology and attendance at accident and emergency department (AED) and/or psychiatric clinics/hospitals of the Hospital Authority.

Methods

This study was conducted from July 2010 to July 2011. Of 2869 subjects studied 15 years earlier with regard to suicidal behaviour and exposure to suicidal behaviour, 2701 subjects' data were retrieved from the Clinical Management System of the Hospital Authority. The system provides over 90% of the accident and emergency service and over 99% of inpatient psychiatric service in Hong Kong. Medical records of the subjects such as AED attendances, psychiatric hospital admissions, psychiatric outpatient attendances, AED diagnoses, and psychiatric inpatient/outpatient diagnoses were reviewed.

Results

In females attended AED three times or more, the percentage was lower in non-exposed controls than those exposed to completed suicide (35.3% vs 44.3%, X^2=8.147, P=0.017) or those exposed to attempted suicide (35.3% vs 42.4%, X^2=6.117, P=0.047) [Table]. Male subjects showed a similar trend, but the effect sizes were smaller: (35.5% vs 40.4%, X^2=2.396, P=0.302) and (35.5% vs 38.6%, X^2=0.809, P=0.667),

TABLE. Accident and emergency department (AED) attendances of those exposed to completed or attempted suicides within 15 years

AED attendance	Female			Male		
	Exposed to completed suicide (n=271)	Exposed to attempted suicide (n=531)	Non-exposed controls (n=604)	Exposed to completed suicide (n=280)	Exposed to attempted suicide (n=254)	Non-exposed controls (n=761)
Low (0)	71 (26.2%)	160 (30.1%)	209 (34.6%)	79 (28.2%)	69 (27.2%)	220 (28.9%)
Medium (1-2)	80 (29.5%)	146 (27.5%)	182 (30.1%)	88 (31.4%)	87 (34.3%)	271 (35.6%)
High (≥3)	120 (44.3%)	225 (42.4%)	213 (35.3%)	113 (40.4%)	98 (38.6%)	270 (35.5%)

respectively.

The exposed and non-exposed groups did not differ significantly in the number of contacts with psychiatric services, self-harm, suicidal behaviour, death, AED diagnoses, drug abuse, aggressive behaviour, or psychiatric diagnoses.

Discussion

Accident and emergency department attendances

Adolescents exposed to peer suicide had significantly more externalising and internalising problems than the non-exposed controls.[4] The exposed groups also exhibited more suicidal behaviour and drug abuse that could cause haphazard behaviour and higher use of the AED. Nonetheless, these subjects were not actually examined; it may just have been a display of help-seeking behaviour that was not as prevalent in the non-exposed controls. This finding has service and cost implications for the AED. It is unknown whether help was also sought from other sources such as the Social Welfare Department, community services in non-government organisations, or religious organisations.

Self-harm and suicidal behaviour

Adolescents exposed to peer suicide were not at higher risk of developing self-harm or suicidal behaviour in the long term. Nonetheless, the negative impact of exposure to suicidal behaviour, in terms of heightened self-harm and suicidal behaviour, may be sustained over a longer period.[4]

Contact with psychiatric services

In a 3-year study[1] and a 6-year study,[3] the risk of developing psychiatric disturbances in those exposed to suicide was only short-lived and subsided in the long term. For schools in which a suicide occurred, a de-briefing or support programme should be implemented to increase student resilience, especially for peers of the suicide victim.

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References

1. Brent DA, Moritz G, Bridge J, Perper J, Canobbio R. Long-term impact of exposure to suicide: a three-year controlled follow-up. J Am Acad Child Adolesc Psychiatry 1996;35,646-53.
2. Mercy JA, Kresnow MJ, O'Carroll PW, et al. Is suicide contagious? A study of the relation between exposure to the suicidal behavior of others and nearly lethal suicide attempts. Am J Epidemiol 2001;154:120-7.
3. Feigelman W, Gorman BS. Assessing the effects of peer suicide on youth suicide. Suicide Life Threat Behav 2008;38:181-94.
4. Ho TP, Leung PW, Hung SF, Lee CC, Tang CP, at al. The mental health of the peers of suicide completers and attempters. J Child Psychol Psychiatry 2000;41:301-8.
5. Guitierrez P, King CA, Ghaziuddin N. Adolescent attitudes about death in relation to suicidality. Suicide Life Threat Behav 1996;26:8-18.

Adolescent alcohol drinking in Hong Kong: a school-based survey

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KEY MESSAGES

1. In Hong Kong secondary 1 to 6 students, the prevalence of current drinking (past 30 days) was 21.5% overall (22.2% in boys and 20.8% in girls).
2. The prevalence of binge drinking in the past 30 days was 7.5% overall (8.3% in boys and 6.7% in girls).
3. Among various risk factors of adolescent drinking, parental pro-drinking practices, lack of parental disapproval of adolescent drinking, and adolescent positive expectation of alcohol drinking seem to be modifiable and can be targeted in interventions.
4. Adolescent drinking was associated with depressive symptoms, poor academic performance, and sleep problems.

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Introduction

Adolescent drinking is an important public health issue,[1] but little is known about the drinking pattern in Hong Kong adolescents. Effective control of underage drinking requires a thorough understanding of its risk factors and effects. We investigated the drinking pattern of Hong Kong secondary school students and identified risk factors associated with alcohol drinking.

Methods

A total of 23 288 students from 45 randomly selected schools, including 43 local and 2 international schools from 5 districts in Hong Kong, participated in this survey from December 2012 to April 2013. An anonymous questionnaire was completed by students in classrooms. Data on sociodemographic characteristics, alcohol drinking, peer and co-residents' drinking, exposure to pro-drinking and anti-drinking messages, and health outcomes were collected. Standardised sampling and administrative procedures were adopted to ensure good data quality. Descriptive data were weighted by sex, age and grade distribution of students in Hong Kong, based on the Education Bureau Department 2012-13 student enrolment statistics. Chi-square test was applied to compare proportions by sex, age, or grade. Risk factors and health outcomes associated with adolescent drinking were investigated using multilevel logistic regression with adjustment of covariates and school clustering.

Results

Prevalence of alcohol drinking

Of the students, 54.1% (95% confidence interval [CI]=53.4%-54.7%) were ever alcohol drinkers, including experimental (tried once or a few times) [37.5%], ex-less-than-weekly (2.6%), ex-weekly (0.3%), and present drinkers (regardless of frequency) [13.6%] (Table 1). Ever drinking prevalence was similar in boys (54.0%) and girls (54.1%). The prevalence of current drinking (past 30 days) was 21.5% (95% CI=21.0%-22.1%) overall and non-significantly higher in boys (22.2%) than girls (20.8%).

Overall 13.6% of students drank monthly, 4.4% drank weekly, and 0.6% drank daily (Table 2). Boys had significantly higher prevalence of alcohol drinking than girls (monthly, 15.4% vs 11.8%; weekly, 5.2% vs 3.5%; daily, 0.7% vs 0.4%).

Prevalence of harmful use of alcohol and alcohol dependence

Based on the Alcohol Use Disorder Identification Test, hazardous drinking was identified in 3.8% of students (boys 4.0%, girls 3.7%), including 1.1% of students who were at risk of alcohol dependence (boys 1.3%, girls 1.0%). Binge drinking (5+ drinks in a row) in the past 30 days was reported by 7.5% of students overall, 8.3% in boys and 6.7% in girls. Among current drinkers, 32.2% reported binge drinking (boys 34.0%, girls 30.3%).

Usual alcohol type consumed by adolescent drinkers

Beer was most commonly consumed by current drinkers (43.0%), followed by fruit wine (21.1%), wine (19.6), and others (6.7%) [Table 3].

Environmental exposure to pro- and anti-alcohol messages

Half (48.1%) the students were exposed to pro-drinking messages in the past 30 days, and 6.2% had frequent exposures of 15-30 days. Frequently reported sources of exposure included television (40.3%), supermarket/convenient store (24.1%), advertising board/poster board (19.1%), printed materials (18.5%), and movies (11.6%). Exposure to anti-drinking messages in the past 30 days was reported by 46.1% of students, including 28.3% who were exposed for 1-4 days, 8.3% for 5-9 days, and 9.6% for ≥10 days.

Risk factors of current drinking

Socio-demographic risk factors

Current drinking was associated with older age (adjusted odds ratio [AOR]=1.24 per year), medium (AOR=1.14) or high (AOR=1.61) perceived family affluence (vs low), private housing (AOR=1.11), (vs public rental housing), separated/divorced (AOR=1.32) or one or both parents died (AOR=1.37) (vs intact family). Students who were born in Mainland China were less likely (AOR=0.87) to be current drinkers (vs born in Hong Kong).

Environmental risk factors

Current drinking was associated with co-residing drinkers (AOR=1.19 per drinker increase), parental pro-drinking practices (AOR=1.23 per practice increase), seeing alcohol displays in shops (AOR=1.06 per day increase), drinking among good

TABLE 1. Prevalence of alcohol drinking in secondary 1 to 6 students by sex

Alcohol drinking	All		Boys		Girls	
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
Never	9718	45.9 (45.3-46.6)	5104	46.0 (45.0-46.9)	4614	45.8 (44.9-46.9)
Ever	11 890	54.1 (53.4-54.7)	6055	54.0 (53.1-55.0)	5835	54.2 (53.1-55.1)
Experimental	8227	37.5 (36.9-38.2)	3966	35.6 (34.7-36.5)	4262	39.5 (38.6-40.5)
Ex-less-than-weekly	582	2.6 (2.4-2.8)	352	3.1 (2.8-3.4)	230	2.0 (1.8-2.3)
Ex-weekly	73	0.33 (0.25-0.41)	47	0.37 (0.27-0.51)	26	0.24 (0.17-0.38)
Drink presently	3008	13.6 (13.1-14.1)	1691	14.9 (14.3-15.6)	1317	12.4 (11.6-12.9)
Current	4570	21.5 (21.0-22.1)	2441	22.2 (21.4-23.0)	2129	21.1 (20.0-21.6)

TABLE 2. Frequency of alcohol drinking in secondary 1 to 6 students by sex

Alcohol drinking	All		Boys		Girls	
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
I do not drink	13 070	61.3 (60.7-62.0)	6756	60.8 (59.9-61.7)	6314	61.9 (60.9-62.8)
Less than monthly	5671	25.0 (24.5-25.6)	2748	23.8 (23.0-24.6)	2923	26.3 (25.5-27.2)
Monthly	2855	13.6 (13.2-14.1)	1645	15.4 (14.7-16.1)	1210	11.8 (11.2-12.4)
1-3 days/month	1988	9.2 (8.8-9.6)	1092	10.1 (9.6-10.7)	896	8.3 (7.7-8.8)
Weekly	867	4.4 (4.1-4.7)	553	5.2 (4.8-5.7)	314	3.5 (3.2-4.9)
1-6 days/week	743	3.8 (3.6-4.1)	470	4.5 (4.1-4.9)	273	3.1 (2.8-4.5)
Daily	124	0.6 (0.5-0.7)	83	0.7 (0.6-0.9)	41	0.4 (0.3-0.6)

TABLE 3. Alcohol type usually consumed by current drinkers in secondary 1 to 6 students

	Alcohol type (No. [%] of participants)*						
	Fruit wine	Beer	Wine	Spirits	Chinese wine	Cocktail	Others
Total	921 (21.1)	1878 (43.0)	767 (19.6)	222 (4.5)	77 (1.5)	107 (3.5)	188 (6.7)
Boys	399 (18.3)	1085 (49.7)	390 (18.3)	129 (4.5)	43 (1.6)	42 (1.9)	110 (5.7)
Girls	522 (24.2)	793 (35.7)	377 (20.9)	93 (4.6)	34 (1.4)	65 (5.3)	78 (7.9)

* Multiple answers were allowed

friends (AOR=10.58 for most/all vs none), and perceiving half/most/all of secondary students were drinkers (AOR=1.98 vs none/some).

Personal risk factors

Current drinking was associated with positive expectations of alcohol drinking (AOR=1.08 per score increase), smoking (AOR=6.45), intention to drink when alcohol was offered by good friends (AOR=5.94), and perceiving alcohol displays in shops attractive (AOR=2.00). However, negative expectations of alcohol drinking (AOR=0.86 per score increase), and disapproval of adolescent drinking by father (AOR=0.59) and mother (AOR=0.66) (vs neutral attitudes) were protective against current drinking.

Problems associated with drinking

A small proportion of adolescents (2.1%) reported behavioural problems caused by alcohol drinking in the past 12 months, including being punished by parents/guardians (1.0%), having sex without condom (0.8%), and having sex with condom (0.5%). Current drinking was associated with depressive symptoms (AOR=1.37), poor academic performance (AOR=1.16), and sleep problems (AOR=1.11).

Discussion

The prevalence of current alcohol drinking and binge drinking was lower in our adolescents than their Western counterparts, for example, 32.3% of our secondary 6 adolescents were current drinkers compared with 50.7% in the US.1 Both current and binge drinking were more prevalent in boys than girls, but the difference was significant only for binge drinking. Binge drinking is particularly harmful to health,[2] yet around 7% had binged in the past 30 days. Binge drinking during adolescence is likely to persist into adulthood. Future alcohol intervention programmes may pay more attention to binge drinking.

Various sociodemographic, environmental, and personal risk factors of adolescent alcohol drinking were identified. Parental influence was evident through a higher socioeconomic status, drinking among family members, parental pro-drinking practices, and lack of disapproval of adolescent drinking. These suggest that parents should be targeted in adolescent alcohol prevention programmes to avoid pro-drinking practices and set clear rules against underage drinking. These programmes can also aim to modify adolescents' expectations of alcohol drinking by emphasising the potential harms such as depressive symptoms, poor academic performance, and sleep problems. The government can also educate the public about the harms of alcohol drinking through mass media campaigns and restrict the display of alcohol in retail stores.

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References

1. Masten AS, Faden VB, Zucker RA, Spear LP. Underage drinking: a developmental framework. Pediatrics 2008;121(Suppl 4):S235-S51.
2. Miller JW, Naimi TS, Brewer RD, Jones SE. Binge drinking and associated health risk behaviors among high school students. Pediatrics 2007;119:76-85.

Underage drinking motivation and contexts in Hong Kong: a qualitative analysis

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KEY MESSAGES

1. This study explores the contextual conundrum of alcohol drinking among Chinese adolescents in Hong Kong.
2. The first encounter with alcohol mostly occurs in the context of family and social networks.
3. Promoting conviviality and sociability is the main motivation for drinking.
4. Peer socialisation does not compel conformity in drinking behaviour.
5. There is a growing acceptance of underage alcohol use by adolescents.

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Introduction

Alcohol consumption in Hong Kong is gaining popularity, in particular among the younger age groups.[1] High risk-taking behaviours among adolescents suggest that alcohol consumption is a potential risk factor in development of other risky behaviours.[2] Nonetheless, this emphasis is due to a lack of understanding of the actual circumstances of the initiation of alcohol use and the meaning of alcohol drinking in adolescence. Moreover, previous analyses primarily relied on quantitative evidence, often of a largely aggregate and summative nature. Qualitative analyses have shown that youth alcohol consumption does not occur uniformly and that wide variations exist with respect to the societal and sub-cultural contexts within which alcohol is consumed.[3] Assessing such situational aspect of drinking is fundamental to the understanding of the contextual factors that encourage drinking under some circumstances and discourage it in others. This study aimed to examine in-depth contextual characteristics of alcohol drinking among adolescents in Hong Kong, with special attention to the social interactions and relationships.

Methods

Adolescents aged 14 to 17 years were recruited from secondary schools in Hong Kong. A letter informing the study purpose was sent to principals of the randomly selected schools in three geographical areas. One week later, the schools were contacted by telephone. Of 44 schools contacted, 13 agreed to participate. A one-page screening questionnaire on drinking behaviour was distributed to classes. Students were asked to leave their contact details if they were willing to talk about their views on alcohol confidentially in informal group discussion. Of 2744 questionnaires distributed, 2271 returned; 538 students provided their contact details.

We purposively selected participants of different age, sex, and drinking status to garner diverse views and perspectives. A total of 131 students were contacted and 81 students participated in focus group discussions. Consent form was obtained from each participant and parents/guardians. The sample size was determined by data saturation. Reasons for refusal included being too busy or unavailable, feeling uncomfortable, and losing interest in taking part. Focus groups were categorised in terms of participants' similar characteristics and circumstances (ie, sex, school, and year at school). An interview guideline with open-ended questions was directed to solicit the adolescents' perspectives and experience relating to alcohol consumption. Confidentiality of all personal information was emphasised. All interviews were audio-recorded and transcribed verbatim. A thematic analysis based upon grounded theory was conducted using NVivo 10.

Results

A total of 16 focus groups ranging in size from three to seven were undertaken (Table 1). About half of the participants were female and 75% of the participants had tried more than a sip of alcohol on one occasion. The average age for first alcohol use was 12.9 years (12.8 years for male students and 13.0 years for female students). More than half of the participants had experience of alcohol use in the past 1 year, whereas 32% of them drank alcohol in the past 1 month (Table 2).

TABLE 1. Focus group composition

Focus group (n=16)	No. of participants (n=81)	Age range, y	Sex
1	6	15-17	Girls only
2	6	16-17	Girls only
3	5	15-17	Girls only
4	6	15-17	Girls only
5	3	15-17	Girls only
6	5	14-16	Girls only
7	3	15-16	Boys only
8	5	15-17	Boys only
9	6	15-18	Boys only
10	7	14-17	Boys only
11	4	15-16	Boys only
12	5	16-17	Boys only
13	5	16-17	Mixed
14	6	15-18	Mixed
15	6	15-16	Mixed
16	3	15	Mixed

TABLE 2. Demographic and drinking characteristics of participants (n=81)

	Value*
Sex	
Male	41 (50.6)
Female	40 (49.4)
Age, y	
≤14	3 (3.7)
15	34 (42)
16	20 (24.7)
≥17	24 (29.6)
Grade	
≤S3	15 (18.5)
S4	42 (51.8)
S5	22 (27.2)
S6	2 (2.5)
Drinking status	
Lifetime	60 (75.3)
During the last 12 months	43 (53.1)
During the last 30 days	26 (32.1)
Past-30 day-binge drinking	
Yes	15 (18.5)
No	66 (81.5)
Age of first use of alcohol, y	12.94±1.80

* Data are presented as No. (%) of participants or mean±standard deviation

First experience with alcohol

Many participants reported that their first experience with alcohol occurred in family celebration where extended family and relatives were present and where drinking was the norm. *"When having family reunion dinner at home, my dad suggested that maybe I should start learning how to drink alcohol. So he gave me a glass of beer and asked me to drink." (male, 17 years old)*

One of the key motivations for experimenting with drinking was curiosity, particularly when they regarded the alcohol drinking opportunity as part of celebratory experience. Overall, the first exposure to alcoholic beverages was commonly characterised as a negative experience describing the taste of alcohol as "bitter", "weird", and "stinky".

Perceived parental attitudes towards alcohol

Different styles in the ways parents set the boundaries were reported. The prevailing style was the harm minimisation approach: although parents do not actively support underage drinking or provide them alcoholic beverages, they considered underage alcohol use acceptable as long as it is handled "responsibly". *"My parents think that it's okay to drink as long as I stay out of trouble and I don't get too drunk." (male, 16 years old)*

By contrast, a clear and strong anti-drinking parental message was noted by a considerable minority of participants. The prohibitive attitude towards underage drinking by parents was a more significant theme for non-drinking participants compared to drinking participants. *"My parents think that only bad kids drink alcohol. Underage drinking is like committing a crime." (female, 15 years old, non-drinker)*

Drinking occasions and locations

Alcohol was seen to be "appropriate" at special occasions such as friends' birthdays, school breaks, marking educational achievements (examinations), Lunar New Year Festivals, and Christmas. Although drinking did not occur regularly for most participants, the most-cited reason for drinking was "increased enjoyment and happiness" that could not be possibly achieved when sober. *"We [friendship group] exchange greetings for Lunar New Year. When we have dinner together, there must be a bottle of red wine or beer around." (female, 17 years old)*

Apart from the celebratory function, collective consumption of alcohol was viewed as an essential step in bonding with their peers. *"It [alcohol] represents the friendship we all share, that is, the kind of feeling that we are friends." (male, 15 years old)*

The places in which adolescents drink include parks, playgrounds, local food stalls, karaoke, and friends' homes when parents were out or away. Most

notably, all-you-can-eat Chinese hot pot restaurant was consistently cited as a popular hangout venue where adolescents could help themselves with alcoholic drinks with no restriction.

Notably, there was little indication that adolescents use alcohol to pursue intoxication. Although the immediate effects of intoxication (such as making a fool of themselves, not being able to walk straight) were described as "fun" by some, "remaining in control after drinking" was most important for the majority of participants.

Influences on drinking behaviour

Participants recognised willingness to serve alcohol to underage drinkers in establishments that have liquor licences. It was felt that legal restrictions had minimal impact, and that off-licence purchase was relatively easy among those who drink. Participants described numerous strategies to work around the rule. Most of the time, identity card was not even asked for. *"It is pretty easy if you are not wearing a school uniform. You can walk into a supermarket and buy the whole pack. They wouldn't even ask a thing." (male, 15 years old)*

Participants recognised pro-drinking influences of industry marketing. Most participants believed that such marketing efforts did not affect their decision to drink but, at the same time, viewed that pervasiveness of advertising and promotions could influence 'other' young people. *"These things [marketing activities] do not affect me, but they would encourage some teenagers to drink alcohol." (female, 17 years old)*

The relatively low cost of alcohol in Hong Kong means that many young drinkers select flavour and taste over and above price simply because they could afford. Indeed, the prime importance was palatability of alcoholic beverages. *"Price doesn't really matter to me. Brand and taste are more important than price. A few bottles only cost twenty something dollars." (male, 17 years old)*

However, adolescents tended to have limited finances for spending on alcohol and there were occasions where supply of alcohol needed to last longer and could be shared between group members. Under such circumstances, price played a part to a certain extent in the purchases that adolescents choose to make. *"Because you have limited money, you don't want to spend all on buying alcohol right? If there is a large group of friends, we need to consider price." (male, 16 years old)*

Perceptions of drinking or non-drinking among adolescents

Drinking does not necessarily represent an emblem of group membership and hence non-drinking peers are often blended in the group of drinking friends. *"They are my friends. They don't care [whether I drink or not]. They drink theirs and I drink mine [soft drink]." (female, 16 years old)*

Hence, friendship groups do not seem to be defined by common behaviours. However, some abstainers noted that being sober within drinking situations was sometimes intolerable, commonly portraying as "odd," "awkward", and "less sociable".

Irrespective of alcohol use, most participants saw underage drinking as a normal behaviour provided that one drinks in moderation and knows one's limit. The idea of "reaching the limit" is widely understood to mean "doing oneself no physical or social harm" and "not losing control" no matter how much a person drinks. *"It must be bad if people [adolescents] drink too much. But if they can stop drinking once they reach their limit, I think it is acceptable." (male, 15 years old, non-drinker)*

The perceived normality and acceptance of underage drinking was a key theme running through both drinkers and non-drinkers.

Discussion

The traditional Chinese drinking culture, characterised by joining together for celebrations, signifies the adolescents' first alcohol experiment.[4] The first taste of drinks was experimental, yet such experience seems to signal, albeit inadvertently, that underage drinking is a socially acceptable behaviour. We observed a generally relaxed and lenient parental attitude towards children's alcohol use, namely a 'harm reduction approach.' The adolescents' motivations for drinking were essentially reflective of the value that alcohol symbolises within the Chinese culture.[4] Additionally, the idea of 'drinking to belong'[3] was a central theme. However, the much-discussed concepts of 'peer influence' and 'peer selection' did not seem to cogently explain the adolescents' drinking behaviours. Our study did not observe what other researchers saw a 'culture of intoxication.' Rather, sporadic patterns and lower consumption are typical of adolescent drinkers. Contrary to the 'third-person effect' being apparent in discussions, the images and representations presented in alcohol seemed to have contributed to the choice of alcohol and overall normalisation of alcohol drinking. The city's lack of legislation banning the sale of alcohol to minors––off-premise alcohol sales to minors are exclusively subject to industry voluntary codes of conduct––is further inflating youth's perceptions of alcohol access. Regardless of one's drinking status, our participants see underage drinking as a normal and accepted part of social lives provided that it is kept under control.

Conclusion

The present study reveals the cultural backdrop of adolescent drinking to underscore the importance

of understanding the connection between alcohol and collective social activities in Chinese culture at large. Interventions to curtail underage drinking need to reflect social and cultural contexts within which alcohol comes into play and give greater consideration to changing wider social environments conducive to underage alcohol use.[5]

Acknowledgements

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References

1. Hong Kong Department of Health. Action Plan to Reduce Alcohol-related Harm in Hong Kong. Hong Kong SAR Government, 2011.
2. Lau JT, Kim JH, Tsui HY, Cheung A, Lau M, Yu A. The relationship between physical maltreatment and substance use among adolescents: A survey of 95,788 adolescents in Hong Kong. J Adolesc Health 2005;37:110-19.
3. Strunin L. Assessing alcohol consumption: development from qualitative research methods. Soc Sci Med 2001;53:215-26.
4. Hao W, Chen H, Su Z. China: alcohol today. Addiction 2005;100:737-41.
5. Chung V, Yip VC, Griffiths SM, et al. The impact of cutting alcohol duties on drinking patterns in Hong Kong, Alcohol Alcohol 2013;48:720-8.

Associations of wheeze during the first 18 months of life with indoor nitrogen dioxide, formaldehyde, and family history of asthma: a prospective cohort study

AM Li *, CKC Fung, ITS Yu, WB Goggins, GYS Chan, CK Chan, APS Lau, JOS Leung

KEY MESSAGES

1. Wheeze is common among infants and toddlers; recurrent wheeze may indicate underlying asthma.
2. A family history of asthma increases the risk of new onset wheeze.
3. Indoor exposure to formaldehyde is associated with the risk of new onset wheeze, with a 2% increase for each 10-unit increase in formaldehyde.
4. Prevention measures to reduce formaldehyde exposure may reduce wheezy attacks and related disease burden in youngsters.

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Introduction

Wheezing is common in infants and children. It is defined as a whistling sound that signifies small airway narrowing. Infants with recurrent wheezy attacks may be at risk for developing asthma.[1] Early childhood exposure to various environmental triggers may be an important risk factor for sensitisation and asthma exacerbation.[2] However, discrepancy in association between studies can be explained by different study designs and methods used to document environmental pollutant exposure. A systematic review identified seven studies on the association between formaldehyde exposure and asthma in children, but given the heterogeneity in the definition of asthma and cross-sectional design of the studies, further well-designed prospective epidemiological studies are needed.[2] Of 11 population-based studies that examined indoor NO_2 exposure and asthma onset in children, two reported a positive association and the remaining failed to document any association.[3]

In our previous study to examine simultaneous effects of indoor formaldehyde and NO_2 on wheezing in 528 subjects, indoor exposure to formaldehyde was associated with an increased risk of new onset wheeze. In the present study, we increased the sample size and thus statistical power in examining the association between exposure to formaldehyde and NO_2, onset of wheeze in young children during their first 18 months of life and family history of asthma or non-asthma allergy, after adjusting for confounding factors. Exposure to indoor gaseous pollutants is a modifiable environmental factor. Preventive measures can reduce disease burden of wheezing and possibly asthma in the population.

This study aimed: (1) to examine in infants whether exposure to formaldehyde ≥60 μg/m^3 would increase their risk of wheezing; (2) to examine whether infants exposed to NO_2 had an increased risk of wheezing; and (3) to evaluate if the above associations were modified by a family history of asthma and non-asthma allergy.

Methods

This was a prospective longitudinal study of a cohort of infants from around age 4 months to 18 months recruited from 14 maternal and child health centres between 1 September 2013 and 30 April 2014. Baseline information was collected using the validated International Study of Asthma and Allergies in Childhood questionnaire. Formaldehyde and NO_2 exposure was assessed at age 6 months. Monthly telephone health survey and weekly respiratory health diary by parents were conducted until age 18 months. New onset wheeze between age 6 and 18 months was the primary outcome measure.

Inclusion criteria were: (1) locally born ethnic Chinese, (2) age ≤4 months, (3) birth weight ≥2.5 kg, (4) gestation ≥36 weeks, (5) being taken care of at home by parents or grandparents, (6) telephone number(s) available for follow-up, (7) mother aged ≥18 years, and (8) Cantonese speaking. Exclusion

criteria were: (1) any congenital disease, (2) placement of child in day care centre for >20 hours per week, and (3) moving homes after recruitment.

The International Study of Asthma and Allergies in Childhood questionnaire included 14 family and 18 environmental exposure characteristics and was modified for use in infants. A total of 29 potential confounders were examined, including sex, breastfeeding, neo-natal respiratory illness (excluding wheezing and persistent cough), having sibling(s) in family, sibling with asthma, sibling with allergy, maternal asthma, maternal allergy, and father asthma, father allergy, family history of health status, monthly family income, maternal education, living area, cooking fuel, provision of artificial ventilation during cooking, air conditioning, heater, heating fuel, cockroach infestation, keeping dogs and cats, renovation and/or new furniture within the past 12 months, smoking during pregnancy, maternal or female guardian smoking, father or male guardian smoking, home smokers, proximity to traffic, burning of incense, and burning of mosquito coils.

NO_2 exposure was assessed using the standard diffusion method according to British Standard BS EB 13528-2003. The optimal exposure period of 10 to 14 days allowed detection of NO_2 at domestic level with <5% deviation. The diffusion tube had 71-mm diffusion path length and 10-mm diameter of exposure area, and it was the most commonly used measurement tube.

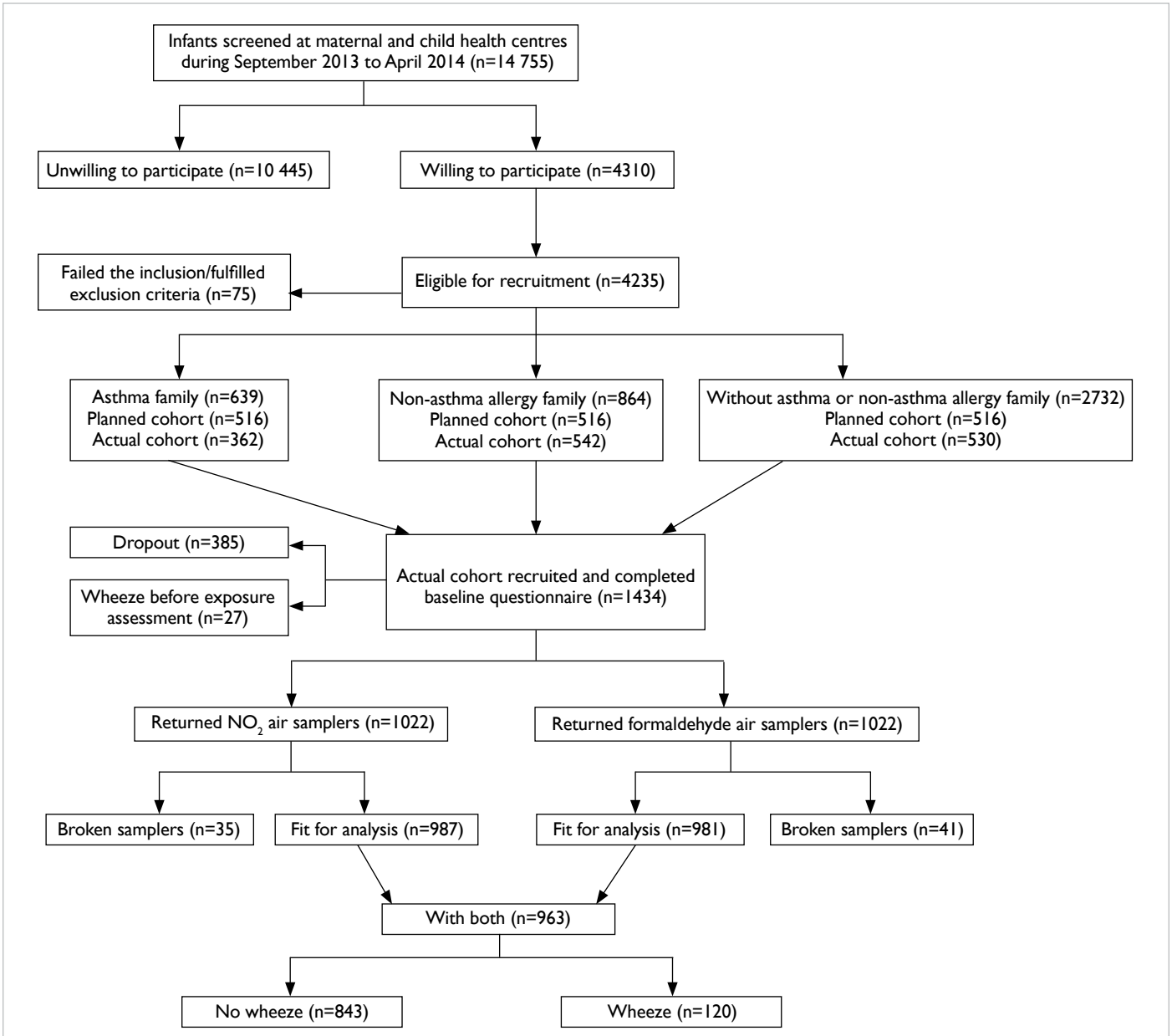

FIG. Flowchart illustrating recruitment and follow-up of subjects

TABLE. Exposure-response relationship between formaldehyde, NO_2 and new onset of wheeze

Factors	Adjusted hazard ratio (95% confidence interval)	P value
Formaldehyde (μg/m³)	1.002 (1.001-1.003)	<0.001
NO_2 (μg/m³)	1.001 (0.995-1.001)	0.692
Sex		
Female	1.000	
Male	1.247 (0.867-1.793)	0.230
Neo-natal respiratory illness		
No	1.000	
Yes	2.281 (0.710-0.732)	0.166
Sibling		
No	1.000	
Yes	1.604 (1.108-2.321)	0.012
Keeping pets		
No	1.000	
Yes	1.371 (0.885-2.125)	0.158
Cooking fuel		
No	1.000	
Yes	0.697 (0.440-2.125)	0.158
Family history		0.021
Healthy	1.000	
Non-asthma allergy	1.059 (0.671-1.673)	0.805
Asthma	1.717 (1.077-2.737)	0.023

Formaldehyde exposure was assessed using the standard diffusion method according to International Standard ISO 16000-4: indoor air–part 4 with an optimum exposure period of 72 hours to detect the domestic level. A standardised self-constructed diffusive sampler in the form of a circular case was used, with a 10-mm diffusion path length and 37-mm diameter of exposure area.

The primary outcome was new onset wheeze. A weekly respiratory health diary was completed by parents to record wheeze as confirmed by a physician. Trained student helpers blinded to the exposure measurements contacted the family on a monthly basis to record any new onset of wheeze and respiratory symptoms in the preceding month. Special attention was paid to note the date of first onset of wheezing.

All data was analysed using the SPSS (Windows version 21; IBM Corp, Armonk [NY], US). To shortlist the possible confounders for new onset of wheezing, the P value of 29 sociodemographic factors and the frequency of event of new onset wheezing were evaluated using the log-rank test, which aimed to provide a notion for pre-selection of possible confounders and the significant level was set at P≤0.25. To evaluate the association of risk factors and new onset of wheezing, the Cox PH model with a backward stepwise method was used. The best combination of possible confounders as identified by log-rank test was achieved by first entering NO_2 and formaldehyde as continuous variables in block 1, and then by uploading all pre-selected possible confounders in categorical variables in block 2. The adjusted hazard ratios (HRs) with 95% confidence interval (CI) for NO_2 and formaldehyde associated with new onset of wheezing were then obtained. With regard to the effect modification and exposure-response relationship, the Cox PH model was used to compute the hazard ratios and 95% CIs of new onset of wheezing for the possible confounders with the risk factors of NO_2 and formaldehyde transformed into categorical variables after sensitivity test.

Results

Of 14755 infants aged ≤4 months screened, only 4235 whose parents consented (participation rate, 28.7%). The final cohort included 228 subjects with a family history of asthma, 384 with a family history of non-asthma allergy, and 351 without family history of any allergies (Fig). During the observation period, 120 (12.5%) subjects had new onset wheezing at a mean age of 13.2 months.

After controlling for possible confounders with a stepwise approach, indoor exposure to formaldehyde increased the risk of new onset wheeze by 2.0% (95% CI=1.0%-3.0%, P<0.001) per 10 units (μg/m³). A family history of asthma also increased the risk of new onset wheeze (adjusted HR=1.72, 95% CI=1.08-2.74, P=0.023). Having sibling(s) also increased the risk of new onset of wheezing (adjusted HR=1.60, 95% CI=1.11-2.32, P=0.01). Indoor exposure to NO_2, sex, cooking fuel, and keeping pets did not have any significant effect on the risk (Table).

Discussion

Indoor exposure to formaldehyde significantly increased the risk of new onset wheeze by 2.0% to 3.0% per 10 units (μg/m³) increase. However, indoor exposure to NO_2 did not pose any significant risk of new onset wheezing. Although furniture made of particle boards or pressed wood products are regarded as the most common source of indoor formaldehyde, our study suggested emission of formaldehyde from other unknown sources. Infants expose to such unknown sources of formaldehyde for a long period may be at increased risk of developing new onset wheezing and subsequent asthma. Opening window to enhance ventilation is effective to get rid of formaldehyde in indoor areas and should be encouraged.

A family history of asthma has been reported as a risk factor for the development of asthma or

wheeze. There was a suggestion that the effects of formaldehyde exposure were strongest in infants without a family history of any allergies. Further studies are required to delineate this complex relationship.

In this study, we excluded two maternal and child health centres located on outlying islands (with different exposure pattern and home environment) and 15 centres located in the city but with heavy workload. The 14 selected centres were scattered throughout Hong Kong to include subjects from different parts of the territory. The participation rate was only 28.7% (n=4235) of all subjects (n=14 755) screened for eligibility, and hence self-selection bias could be an issue. Although the final number of subjects fell short of our target, we could still demonstrate a significant effect of formaldehyde on new onset wheeze. Transient wheezing following viral infection is common in this age group. Longer term follow-up assessment is needed to establish the casual relationship between formaldehyde exposure and asthma development.

Conclusions

Indoor exposure to formaldehyde increased the risk of new onset wheeze in infants aged 6 to 18 months by 2.0% per 10 units ($\mu g/m^3$) of exposure. Indoor exposure to NO_2 did not have any significant effects on the risk. Prevention measures to reduce formaldehyde exposure at home should be implemented. Strategies to reduce indoor concentration of formaldehyde should be promoted. There were suggestions that the association between indoor air pollutants and wheeze/asthma could be modified by a family history of asthma or non-asthma allergies.

Acknowledgements

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References

1. Csonka P, Kaila M, Laippala P, et al. Wheezing in early life and asthma at school age: predictors of symptom persistence. Pediatr Allergy Immunol 2000;11:225-9.
2. McGwin G Jr, Lienert J, Kennedy J Jr. Formaldehyde exposure and asthma in children: a systematic review. Environmental Health Perspectives 2010;118:313-7.
3. Heinrich J. Influence of indoor factors in dwellings on the development of childhood asthma. Int J Hyg Environ Health 2011;214:1-25.

Respiratory health effects of household cleaning products on Hong Kong school children

XQ Lao *, KF Ho, CCY Wong, LW Tian

KEY MESSAGES

1. Frequent use of household cleaning products is associated with slower growth in the lung function parameter of maximum mid-expiratory flow.
2. Frequent use of household cleaning products is associated with an increased risk of rhinitis.

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Introduction

Indoor air pollution is an important public health issue and has a significant effect on health. Various types of cleaning products are used in households, but concerns have been raised about their effects to indoor air pollution.[1] In particular, products that contain active chemical ingredients.

Few studies have investigated the respiratory health effects related to cleaning products in home environments, and most of which targeted adult populations.[2] Frequent use of cleaning products and hypochlorite bleach may be associated with asthma and respiratory symptoms. Frequent use of chemical-based cleaning products in the prenatal period is associated with persistent wheezing in young children.[3] Exposure during childhood may also affect respiratory health, but another study reported that children aged 10 to 13 years who lived in houses that were regularly cleaned with bleach appeared to have a lower risk of developing asthma.[4]

Methods

This was a prospective cohort study involving 25 primary schools in Hong Kong. All primary three and four students from each school were invited to participate. Of 3100 students invited, 2620 agreed to participate in a baseline survey that included a health examination and self-administered questionnaire. Of the 2620 students, 2330 participated in a follow-up survey after approximately 12 months.

Information about the use of 14 chemical cleaning products was collected. Parents of students were asked: "Have you used the following household cleaning products at home in the past 12 months?". If the response was "yes", additional information about the weekly usage frequency (<1, 1-3, 4-6, and ≥7 times) and the average duration of each use (<15, 15-30, 31-45, 46-60, and >60 minutes) was collected. Information about the use of plain water alone for home cleaning was also collected.

A total chemical burden score was generated to indicate each participant's total exposure level to the 14 types of chemical cleaning agents. Because the frequency and duration of use data were categorical, the midpoint value of each category was used to calculate the total chemical burden score (frequency: 0.5, 2.0, 5.0, and 8.5 corresponded to <1, 1-3, 4-6, and >7 times, respectively; duration: 7.5, 23.0, 38.0, 52.5, and 75 corresponded to <15, 15-30, 31-45, 46-60, and >60 minutes, respectively). The total chemical burden score was defined as the cumulative time of exposure using the following formula:

$$Total\ chemical\ burden = \sum_{i=1}^{14} = (Fre_i \times Dur_i),$$

where *Fre* refers to the weekly frequency of use of a certain chemical product, *Dur* refers to the average duration of each use, and *i* represents the specific chemical cleaning product.

The pulmonary function parameters evaluated included the forced vital capacity (FVC), forced expiratory volume in the first second (FEV_1), and maximum mid-expiratory flow (MMEF). Spirometric tests were performed according to the protocol of the American Thoracic Society. Spirometry assessments were performed with the student in a standing position. All students were required to blow at least three times to yield at least two measurements that were reproducible within 5% for both FVC and FEV_1. The highest FVC and FEV_1 scores were used for analysis. Lung function growths were calculated using the following formula:

$$\frac{\text{Lung function at follow-up - Lung function at baseline}}{\text{Follow-up duration (months) / 12}}$$

Rhinitis, in particular non-infectious rhinitis, was defined as those children who have "ever had nasal symptoms such as nasal blockage, sneezing,

and a runny nose as well as itching eyes or lachrymation in the absence of a common cold in the previous 12 months". Those parents who responded "yes" were further asked: "please indicate the months when your child suffered from rhinitis." Only those children whose responses to two questions were consistent were deemed to have rhinitis during the 12-month follow-up.

The baseline and follow-up questionnaires collected rhinitis information of a period of 24 months, which was divided into eight mutually exclusive seasons. Each student was categorised into one of the four rhinitis patterns: never (no rhinitis in any season), occasional (rhinitis in <3 seasons), frequent (rhinitis in ≥3 seasons but <4 consecutive seasons), and persistent (rhinitis in ≥4 consecutive seasons).

We used multiple linear regression analysis to investigate lung function parameters, and multinomial logistic regression analysis to investigate rhinitis patterns.

TABLE 1. Baseline characteristics of participants

Variables	Value
Age, y	11.3±0.9
Male	1255 (47.9)
Body mass index, kg/m^2	17.3±3.1
Self-reported asthma	100 (3.8)
Rhinitis	1118 (42.7)
Self-reported bronchitis	112 (4.3)
Self-reported bronchiolitis	36 (1.3)
Self-reported pneumonia	31 (1.2)
Atopic status, yes	346 (13.2)
Average area of housing for each household member, m^2	15.2±7.9
Present at home when cleaning products used, yes	1008 (38.5)
Keeping a pet at home, yes	333 (12.7)
Home renovation, yes	746 (28.5)
Passive smoking at home, yes	503 (19.2)

* Data are presented as mean±standard deviation or No. (%) of participants

Results

The mean age of students was 11.3±0.9 years; the mean body mass index was 17.3±3.1 kg/m^2; and 47.9% of the students were boys (Table 1). Increased use of cleaning products was associated (though not significantly) with smaller positive growth in the FEV1 and FVC, but was significantly associated with smaller positive growth in the MMEF, after adjusting for confounders (Table 2). Every 10-unit increase in the total chemical burden score was associated with an increase in the risks of occasional rhinitis (odds ratio [OR]=1.21, 95% confidence interval [CI]=1.05-1.41), frequent rhinitis (OR=1.36, 95% CI=1.13-1.60),

TABLE 2. Associations between lung function growth and the use of household cleaning products

Lung function growth	Total chemical burden score	Basic model (adjusted for age, sex, body mass index, and height growth rate)		Adjusted model (further adjusted for born in Hong Kong or elsewhere, asthma, passive smoking in the household, father's and mother's education levels, and physical activity level)	
		Estimate (95% confidence interval)	P value	Estimate (95% confidence interval)	P value
Forced expiratory volume in the first second, mL	1st tertile	Reference		Reference	
	2nd tertile	-12.3 (-25.6 to 5.9)	0.24	-9.2 (-21.4 to 3.9)	0.40
	3rd tertile	-7.5 (-18.8 to 4.6)	0.35	-6.8 (-11.5 to 3.6)	0.65
	P for trend	-	0.42	-	0.54
	Every 10-unit increase	-8.5 (-15.1 to 10.8)	0.38	-8.1 (-13.7 to 12.7)	0.48
Forced vital capacity, mL	1st tertile	Reference		Reference	
	2nd tertile	-11.7 (-26.8 to 13.4)	0.42	-10.5 (-26.6 to 15.5)	0.57
	3rd tertile	-10.4 (-22.7 to 14.7)	0.12	-9.4 (-19.6 to 17.7)	0.61
	P for trend	-	0.31	-	0.47
	Every 10-unit increase	-16.3 (-29.3 to 1 2.9)	0.65	-14.9 (-22.2 to 14.3)	0.77
Maximum mid-expiratory flow, mL/s	1st tertile	Reference		Reference	
	2nd tertile	-10.7 (-29.8 to -2.5)	0.048	-9.5 (-22.8 to 2.5)	0.52
	3rd tertile	-15.1 (-53.9 to -3.8)	0.039	-13.4 (-42.6 to -4.7)	0.031
	P for trend	-	0.036	-	0.039
	Every 10-unit increase	-19.5 (-63.2 to -8.7)	0.032	-18.1 (-59.7 to -3.6)	0.033

TABLE 3. Association between the rhinitis pattern and total chemical burden score*

Rhinitis pattern	Unadjusted model		Multivariable model	
	Odds ratio (95% confidence interval) for a 10-unit increase in the score	P value	Odds ratio (95% confidence interval) for a 10-unit increase in the score	P value
Never	1.00	-	1.00	-
Occasional	1.26 (1.09-1.46)	0.002	1.21 (1.05-1.41)	0.012
Frequent	1.46 (1.24-1.72)	<0.001	1.36 (1.13-1.60)	0.001
Persistent	1.28 (1.07-1.64)	0.032	1.12 (1.01-1.56)	0.037

* Adopted from Liu X, Lao XQ, Wong CC, et al. Frequent use of household cleaning products is associated with rhinitis in Chinese children. J Allergy Clin Immun 2016;138:754-60.

and persistent rhinitis (OR=1.12; 95% CI=1.01-1.56) after adjusting for potential confounders (Table 3).

Discussion

Among primary school children, the use of household cleaning products correlated with the growth in MMEF, and frequent use of household cleaning products increased the risk of rhinitis. Three lung function parameters were investigated: MMEF, FVC, and FEV_1. MMEF refers to the average expiratory flow over the middle half of the FVC and is an indicator of small airway function. FVC refers to the volume of air that can be forcibly expelled and is an indicator of restrictive ventilatory disorder. FEV_1 refers to the volume of air that can be forcibly expelled during the first second and is an indicator of both large and small airway functions. Our study showed that exposure to cleaning product was associated with a reduction of MMEF growth, suggesting harmful effects to small airway function.

The association between rhinitis and use of cleaning products was robust, even after adjusting for potential confounders. Frequent use of household cleaning products increases the risk of rhinitis. The underlying mechanism between rhinitis and the use of cleaning products remains unclear. Nonetheless, chemical ingredients (including propylene glycol and glycol ethers, alkyl phenol ethoxylates, volatile organic compounds, ethylene diamine tetra acetic acid, and nitrilotriacetic acid) of cleaning products have harmful effects.

Strengths of the present study were (1) a prospective cohort study that could investigate the association between cleaning product and the growth of lung function, (2) taking into account of effects of a wide range of potential confounders, (3) a relatively large sample size, and (4) using primary school children, the most vulnerable group, as study subjects.

Conclusion

Our findings have important public health implications because household cleaning products are common. There is a need to develop healthier cleaning products for households.

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Results of this study have been published in: (1) Liu X, Lao XQ, Wong CC, et al. Frequent use of household cleaning products is associated with rhinitis in Chinese children. J Allergy Clin Immun 2016;138:754-60. (2) Liu X, Wong CC, Yu IT, et al. Dietary patterns and the risk of rhinitis in primary school children: a prospective cohort study. Sci Rep 2017;7:44610.

References

1. Nazaroff WW, Weschler CJ. Cleaning products and air fresheners: exposure to primary and secondary air pollutants. Atmos Environ 2004 6;38:2841-65.
2. Bernstein JA, Brandt D, Rezvani M, Abbott C, Levin L. Evaluation of cleaning activities on respiratory symptoms in asthmatic female homemakers. Ann Allergy Asthma Immunol 2009 1;102:41-6.
3. Sherriff A, Farrow A, Golding J, the ALSPAC Study Team, Henderson J. Frequent use of chemical household products is associated with persistent wheezing in pre-school age children. Thorax 2005;60:45-9.
4. Nickmilder M, Carbonnelle S, Bernard A. House cleaning with chlorine bleach and the risks of allergic and respiratory diseases in children. Pediatr Allergy Immunol 2007;18:27-35
5. Liu X, Lao XQ, Wong CC, et al. Frequent use of household cleaning products is associated with rhinitis in Chinese children. J Allergy Clin Immun 2016;138:754-60.

Oral chloral hydrate versus intranasal dexmedetomidine for sedation of children undergoing computed tomography: a multicentre study

VMY Yuen *, DKL Cheuk, TWC Hui, ICK Wong, WWM Lam, MG Irwin

KEY MESSAGES

1. Intranasal dexmedetomidine at 3 μg/kg can be used as primary sedative for young children during non-painful procedures. The rate of successful sedation is similar to that achieved by oral chloral hydrate at 50 mg/kg.
2. Intranasal dexmedetomidine is associated with better acceptance by young children compared with oral chloral hydrate.
3. Adverse effects of vomiting and gastrointestinal problems associated with chloral hydrate sedation may be avoided with the use of intranasal dexmedetomidine.
4. The time to resume normal activities after chloral hydrate and dexmedetomidine sedation is similar.

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Introduction

Chloral hydrate is a widely used sedative for young children undergoing imaging studies, with a high success rate. However, post-discharge adverse effects of chloral hydrate sedation are significant, including sleepiness for >4 hours, unsteadiness, hyperactivity, poor appetite, and vomiting.[1] In 54% of the children, normal activity is not resumed within 4 hours of discharge.

Dexmedetomidine is a highly selective alpha-2 agonist for paediatric sedation. It produces sedation similar to natural non-rapid eye movement sleep and has respiratory-sparing effect. It can be administered in an intravenous formulation or intranasally at 1-2 μg/kg to produce sedation before anaesthesia induction in children.[2,3] As dexmedetomidine has a much shorter half-life than chloral hydrate, its recovery profile is better. This study aimed to determine whether children sedated with intranasal dexmedetomidine resume normal activity more quickly than those with oral chloral hydrate.

Methods

This double-blinded, randomised controlled trial was approved by the Institutional Review Board of The University of Hong Kong / Hospital Authority Hong Kong West Cluster. It was conducted at Queen Mary Hospital and Guangzhou Women and Children's Medical Center. Children with American Society of Anesthesiologists physical status of 1 or 2 who required sedation for computed tomography study were recruited. After obtaining written informed consent from parents or legal guardian, children were enrolled. Exclusion criteria included allergy or hypersensitivity to dexmedetomidine, organ dysfunction, cardiac arrhythmia, congenital heart disease, or mental retardation.

The primary objective was to compare the proportion of children who could resume normal activity within 4 hours. Secondary outcomes included the success rate of sedation and completion of the imaging studies, the incidence of poor behaviour with oral and nasal drug administration, adverse respiratory and haemodynamic events, sleepiness for >4 hours, unsteadiness, hyperactivity, poor appetite, and vomiting.

Recruited children was randomly allocated to the chloral hydrate or dexmedetomidine group. The oral and nasal drug and placebo was produced by the Department of Pharmacy of either hospital. The pharmacists who prepared the drugs were not involved in recruitment or data collection.

After baseline blood pressure, pulse rate, and oxygen saturation were recorded, children in the chloral hydrate group received oral chloral hydrate at 50 mg/kg 30 minutes before imaging study and intranasal placebo. Children assigned to the dexmedetomidine group received 3 μg/kg intranasal dexmedetomidine 30 minutes before imaging study

and oral placebo. The acceptability of intranasal drug and oral drug was assessed using the behavioural scale, with crying or resisting defined as 1, anxious but accept as 2, and calm and cooperative as 3. All adverse events including vomiting, desaturation to <95%, apnoea episodes, requirement of airway support and intervention, and haemodynamic disturbances were recorded. Blood pressure, pulse rate, and oxygen saturation was recorded every 5 minutes. Sedation status was assessed and recorded every 5 minutes using the University of Michigan Sedation Scale, with awake/alert defined as 0, minimally sedated (tired/sleepy, appropriately responds to verbal conversation and/or sounds) as 1, moderately sedated (somnolent/sleeping, easily aroused with light tactile stimulation) as 2, deeply sedated (deep sleep, arousable only with significant physical stimulation) as 3, and unarousable as 4. Children was judged to be successfully sedated when the sedation score was ≥2 and computed tomography was performed as planned.

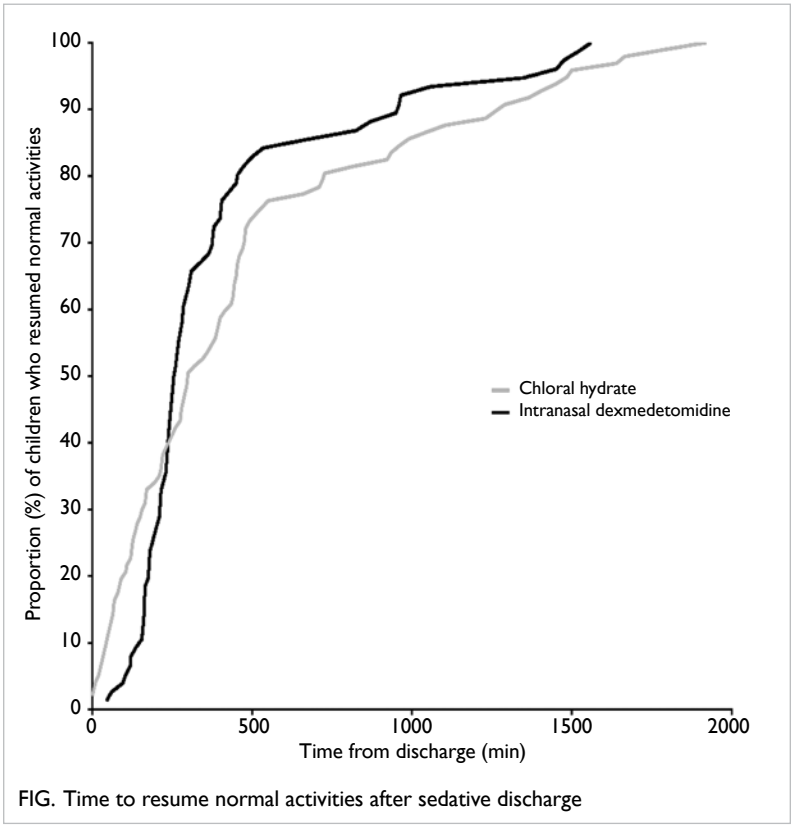

FIG. Time to resume normal activities after sedative discharge

TABLE. Proportion of patients who experienced hypotension, bradycardia, and hypoxia

	Chloral hydrate (n=107)	Dexmedetomidine (n=87)	P value
Incidence of hypotension			0.0058
<12 months	0/21	0/8	
13-36 months	5/64	4/52	
>36 months	4/23	5/28	
Incidence of bradycardia			0.0016
<12 months	3/21	6/8	
13-36 months	0/64	4/52	
>36 months	0/23	4/28	
Incidence of hypoxia requiring oxygen therapy	2/108	0/88	0.048

Before discharge, parents were given a post-sedation survey related to their child's behaviour and recovery at home to be completed over the next 24 hours. Parents were contacted the following day for collection of data on the time of resumption of normal activity, duration of sleepiness, presence of unsteadiness, and adverse effects including hyperactivity, poor appetite, and vomiting. Children was considered to have resumed normal activity when their University of Michigan Sedation Scale score was 0 or 1, when they were able to tolerate clear fluid or normal diet, ambulate or support himself, and communicate in the usual way.

Only 46% of the children could resume normal activity within 4 hours of discharge.[1] Our sample size estimation was based on the number of children needed to demonstrate clinically significant difference in return to normal activity within 4 hours of discharge. A total of 93 children per group is required if the proportion of children who resumed normal activity within 4 hours was increased by 20% with intranasal dexmedetomidine, with 80% power and 5% false positive rate.

The Chi-squared test was used to compare the proportion of children who resumed normal activity within 4 hours of discharge. The time taken for children to resume activities was shown in cumulative frequencies and compared using the log-rank (Mantel-Cox) test. The association between drug, age, and successful sedation was assessed using binomial logistic regression analysis. Behaviour during oral or nasal drug administration was categorised as poor when the behaviour score was 1, and acceptable when the score was 2 and 3. The incidence of poor behaviour and vomiting of the two groups was compared using Chi-squared test or Fisher's exact test. Hypotension and bradycardia was defined as blood pressure and heart rate of <20% of the age-specified normal range.[4] Hypoxia is a decrease of oxygen saturation to <95% or >5% from baseline. Statistical analyses were performed using SPSS (Windows version 20; IBM Corp, Armonk [NY], US). A P value of <0.05 was considered statistically significant.

Results

A total of 196 children were randomised to receive allocated sedation. Of them, two withdrew after drug administration: one from the chloral hydrate

group because of high fever and the other from the dexmedetomidine group because of refusal of data collection by the parent. Ten patients from the chloral hydrate group and 11 from the dexmedetomidine group failed to return the post-sedation survey. Therefore, data of 194 children were analysed for association between drug and successful sedation, behaviour, and adverse effects. Data from 175 children were analysed for the time to resume normal activities and post-sedation adverse effects.

The chloral hydrate and dexmedetomidine groups were comparable in terms of the proportion of children who resumed normal activities within 4 hours of discharge (39% vs 42%, P=0.76), the mean time to resume normal activities (469.9 vs 396.4 minutes, P=0.129, Fig), and the proportion of children with successful sedation (75.7% vs 73.6%, P=0.459). More children from the chloral hydrate group had poor behaviour during oral drug administration (P=0.0075). The two groups were similar in terms of behaviour during nasal drug administration (P=1.00). Six (5.6%) of 108 children from the chloral hydrate group and none from the dexmedetomidine group vomited after drug administration (P=0.0337). Two children and none in the respective groups experienced hypoxia required oxygen supplementation; the magnitude of hypotension and bradycardia was mild, and no child required medical intervention for haemodynamic disturbances (Table). None experienced bradycardia had hypotension. Overall, more children who received chloral hydrate had hypotension (P=0.0058) and hypoxia requiring oxygen therapy (P=0.048), and more children who received dexmedetomidine had bradycardia (P=0.0016).

The incidence of post-sedation adverse effects was low and did not significantly differ between groups except for motor imbalance (6.2% vs 0%).

Discussion

The rate of successful sedation was similar in children who received oral chloral hydrate (50 mg/kg) or intranasal dexmedetomidine (3 μg/kg). Chloral hydrate is the most common sedative for non-painful procedures in young children because of the low cost and high success rate. Nevertheless, chloral hydrate is bitter to taste with pungent odour and associated with spitting and vomiting. Intranasal dexmedetomidine has similar success rate and can be an alternative.

Although dexmedetomidine is a more expensive than chloral hydrate, it is easier to administer and is associated with less aversive behaviour during drug administration. It was difficult to elucidate the incidence of nausea associated with oral chloral hydrate; approximately 5% of the children vomited after its administration. Fewer than 2% of the children who received chloral hydrate experienced oxygen desaturation and required oxygen therapy. The incidence is similar to that reported in previous study.[5] Incidence of desaturation is even lower with dexmedetomidine sedation.

Similar to previous reports, the most common complications associated with chloral hydrate after discharge is motor imbalance. The incidence of other adverse effects (restlessness, hyperactivity, agitation, and gastrointestinal disturbance) was low and similar between groups.

Although dexmedetomidine has a much shorter half-life with no active metabolites, the time to resume normal activities was similar between groups. This is a surprising finding; it is possible that the difference is small and our sample size is inadequate to detect such a small difference. It is also possible that young children are more sensitive to the effect of sedatives which in turn leads to prolonged recovery.

Conclusions

Intranasal dexmedetomidine 3 μg/kg and oral chloral hydrate 50 mg/kg are comparable in terms of the success rate for sedation in young children for imaging study. Although dexmedetomidine is associated with better behaviour and fewer gastrointestinal adverse effects during drug administration, the recovery profile of the two drugs is similar.

Acknowledgement

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References

1. Kao SC, Adamson SD, Tatman LH, Berbaum KS. A survey of post-discharge side effects of conscious sedation using chloral hydrate in pediatric CT and MR imaging. Pediatr Radiol 1999;29:287-90.
2. Yuen VM, Hui TW, Irwin MG, et al. A randomised comparison of two intranasal dexmedetomidine doses for premedication in children. Anaesthesia 2012;67:1210-6.
3. Yuen VM, Hui TW, Irwin MG, Yao TJ, Wong GL, Yuen MK. Optimal timing for the administration of intranasal dexmedetomidine for premedication in children. Anaesthesia 2010;65:922-9.
4. Hartman ME, Cheiftz IM. Pediatric emergencies and resuscitation. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE, editors. Nelson Textbook of Pediatrics. 19 ed. Philadelphia: Elsevier; 2011: 279-96.
5. Malviya S, Voepel-Lewis T, Prochaska G, Tait AR. Prolonged recovery and delayed side effects of sedation for diagnostic imaging studies in children. Pediatrics 2000;105:E42.

Mirror therapy with bilateral arm training for hemiplegic upper extremity motor functions in patients with chronic stroke

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KEY MESSAGES

1. Mirror therapy has an incongruent visual feedback induced by mirror, which makes it different from bilateral arm training.
2. Mirror therapy and bilateral arm training are useful in enhancing hemiplegic arm functions in patients with chronic stroke, with significant benefits to the distal hand functions in mirror therapy.
3. In an electroencephalographic study to observe a mirror illusion attributed to mirror neuron system for stroke and healthy participants, event-related desynchronisation in beta bands particularly the Beta rhythm (17-35 Hz) in both contralateral and ipsilateral motor cortices reflected that action observation for motor preparation in stroke patients was much reduced and might affect motor learning.

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Introduction

We hypothesised that a mirror visual feedback illusion enhanced hemiplegic arm functions in mirror therapy (MT) compared with bilateral arm training (BAT), and that there was recruitment of the mirror neurons, as reflected by event-related desynchronisation (ERD), mediating the recognition of the mirror illusion during MT, in patients with chronic stroke. We aimed (1) to compare the effects of MT with those of BAT on improving the motor functions of the hemiplegic upper extremity for patients with chronic stroke; and (2) to examine, using electroencephalography (EEG), whether recruitment of the mirror neurons, as reflected in the form of ERD, mediated recognition of the mirror visual feedback during MT, and to compare with that in BAT, in patients with chronic stroke and their healthy counterparts.

Methods

The study was divided into two parts. Part 1 was a single-blinded randomised controlled trial comparing the MT and BAT groups. Data were collected at baseline, at 6 weeks after treatment, and at 3-month follow-up. Part 2 involved cross-sectional EEG measurement for consenting participants in both groups to investigate the instant brain response on MT compared with that in BAT.

Patients with chronic stroke from community self-help groups or referred from outpatient clinics in the Hong Kong Hospital Authority West Cluster were recruited by convenience sampling. Inclusion criteria were: (1) neurological condition with unilateral hemiparesis, (2) a Functional Test of Hemiplegic Upper Extremity – Hong Kong version score of levels 2 to 6, (3) chronic stroke with onset of neurological condition >6 months previously, (4) ability to understand and follow simple verbal instructions, (5) ability to participate in a therapy session lasting at least 30 minutes, and (6) community ambulant with or without aids. Individuals with severe neglect and severe spasticity were excluded. In part 2 of the study, similar numbers of healthy counterparts matched to the stroke group in terms of demographics were recruited as controls. The study was performed in accordance with the principles of the Declaration of Helsinki. Only participants who had given written informed consent were included.

Part 1

For both groups, the training programme consisted of 12 sessions (two per week for 6 weeks), each lasting for 30 minutes. The mirror box apparatus (406 × 432 mm) was placed at the midsagittal plane of the participant. The movement practice involved five table-top tasks. Participants were instructed to perform a maximum of 30 trials per task in each session, giving a total of 150 trials per session. The period of each training session (activities graded according to the levels of severity of affected arm impairment in the Functional Test of Hemiplegic

Upper Extremity) lasted for 30 minutes. The only difference between the two groups was the use of a mirror.

All participants had to complete the 6-week training programme delivered by two occupational therapists. In the MT group, each participant practiced the movements with the unaffected arm (including elbow, wrist, and hand). While watching the reflection of the unaffected arm in the mirror, the participant was asked to move the affected arm at the same time to imitate/synchronise the movement with the mirror reflection of the unaffected arm. If the participant was unable to move the arm, the therapist would passively assist the movement of the affected hand so as to synchronise it with the reflection of the unaffected hand. In the BAT group, the participant practiced bimanual arm exercises using the same movement strategies but without a mirror; a direct view of the affected hand was allowed.

A blinded assessor carried out outcome assessments of upper limb performance using the Fugl-Meyer Assessment, the Action Research Arm Test, and the Wolf Motor Function Test.

Part 2

Each participant sat in a comfortable chair and placed both arms on a table in front of them. EEG was recorded with a 64-channel cap referenced to left mastoid connected to SymAmps2 amplifier (Neuroscan, Charlotte [NC], USA). There were two task conditions for EEG capturing: (1) with the affected arm at rest while the unaffected arm is moving, and (2) viewing the unaffected arm while the mirror was covered (ie, sham mirror).

TABLE. Baseline characteristics of the study population*

Variable	Part 1				Part 2		
	Total (n=101)	Mirror therapy (n=51)	Bilateral arm training (n=50)	P value	Mirror therapy (n=11)	Bilateral arm training (n=9)	P value
Age, years	58.3±10.0	58.2±9.5	58.4±10.6	0.927	56.6±10.5	54.7±16.9	0.970
Sex				0.352			0.199
Male	65 (64.4)	35 (68.6)	30 (60.0)		8 (72.7)	4 (44.4)	
Female	36 (35.6)	16 (31.4)	20 (40.0)		3 (27.3)	5 (55.6)	
Duration from onset, months	26.8±38.9	30.2±46.8	23.3±29.1	0.371	63.6±85.4	54.0±41.9	0.676
Hemiplegic side				0.609			0.964
Right	56 (55.4)	27 (52.9)	29 (58.0)		5 (45.5)	4 (44.4)	
Left	45 (44.6)	24 (47.1)	21 (42.0)		6 (54.5)	5 (55.6)	
Recruitment site				0.756			-
Hospital	17 (16.8)	8 (15.7)	9 (18.0)		0 (0)	0 (0)	
Self-help groups	84 (83.2)	43 (84.3)	41 (82.0)		11 (100)	9 (100)	
Arm functioning				0.886			0.964
Higher	33 (32.7)	17 (33.3)	16 (32.0)		5 (45.5)	4 (44.4)	
Lower	68 (67.3)	34 (66.7)	34 (68.0)		6 (54.5)	5 (55.6)	
Functional Test for Hemiplegic Upper Extremity – Hong Kong version score	3.9±1.6	4.0±1.7	3.8±1.5	0.564	4.4±1.6	4.3±1.2	0.876
Fugl-Meyer Assessment score	29.0±16.4	29.3±17.1	28.6±15.9	0.829	29.5±13.1	27.7±18.6	0.704
Upper limb subscore	19.4±9.2	19.2±9.6	19.5±8.8	0.868	18.9±7.8	18.8±11.2	0.970
Hand subscore	9.6±8.3	10.0±8.6	9.1±8.0	0.572	10.6±6.4	8.8±7.8	0.401
Action Research Arm Test score	18.3±19.9	19.2±20.4	17.3±19.5	0.646	23.4±21.3	19.3±22.1	0.337
Grasp subscore	5.6±6.9	6.0±7.1	5.3±6.8	0.649	7.7±7.7	6.1±6.9	0.503
Grip subscore	4.2±4.7	4.3±4.7	4.0±4.6	0.729	5.3±5.2	4.8±5.2	0.781
Pinch subscore	4.0±6.4	4.2±6.6	3.9±6.4	0.842	4.8±6.9	4.8±7.4	0.714
Gross subscore	4.4±3.5	4.7±3.4	4.1±3.6	0.376	5.5±3.1	3.7±3.9	0.278
Wolf Motor Function Test							
Functional ability subscore	28.6±18.8	28.5±19.5	28.7±18.2	0.949	28.8±15.9	26.1±18.1	0.594
Grip subscore	5.7±6.4	6.1±6.4	5.3±6.4	0.482	5.1±4.5	6.0±3.6	0.594

* Data are presented as mean±standard deviation or No. (%) of participants

Results

Part 1

A total of 101 patients with stroke (17 from Tung Wah Hospital, 75 from self-help groups) were randomised to either the MT (n=51) or BAT (n=50) group. Two participants in the MT group and three participants from the BAT group dropped out who were eventually included in intention-to-treat analysis. The two groups were comparable in terms of baseline characteristics (Table). Both groups improved significantly after training, except for gross subscore of Action Research Arm Test in MT (P=0.069) and BAT (P=0.199). Repeated measures ANOVA showed a significant between-group treatment effect (F=4.360, P=0.050) and a significant group-time interaction (F=3.527, P=0.033) for the Fugl-Meyer Assessment hand subscore; there were no significant between-group differences for other outcome measures.

Part 2

Of 20 patients (11 with left hemiplegia and 9 with right hemiplegia from the self-help groups), 11 from the MT group and 9 from the BAT group voluntarily participated in EEG measurement. The two groups were comparable in terms of baseline characteristics.

Twenty (12 men and 8 women) healthy counterparts (mean age, 61.3 years) were recruited by convenience sampling from social networks in the community. They were asked to use their dominant hands (all right-handed) as active hands to move; therefore, only stroke patients with left hemiplegia were compared with the healthy counterparts for evaluation of instant training effects. After pre-processing, data of six healthy participants and one stroke patient with left hemiplegia were excluded, owing to insufficient clean epochs for further analysis. Data of 10 stroke patients with left hemiplegia and 14 normal healthy counterparts were analysed.

Event-related spectrum perturbations at C3 and C4 during 400-1100 ms were averaged in 8-10 Hz (alpha-1 band), 10-12 Hz (alpha-2 band), 12-16 Hz (sensorimotor rhythm [SMR] band), and the new beta band defined as 17-35 Hz. A mixed effects ANOVA was performed with the within-subject factor of task condition (real mirror vs covered [sham] mirror), hemisphere (contralateral vs ipsilateral to the trained hand), and the between-subject factor of group (normal heathy participant vs stroke patient) in the alpha-1, alpha-2, sensorimotor rhythm, and beta bands separately. In alpha-1 band, there was neither a significant main effect nor an interaction effect. In alpha-2 band, the ANOVA only revealed a marginal significant main effect of group [F (1, 22)=4.026, P=0.057]. The three-way ANOVA also failed to reveal any significant effect in sensorimotor rhythm band (12-16 Hz). However, in beta band (17-35 Hz), there was a significant interaction effect of hemisphere*group [F (1,22)=10.546, P=0.004] and a significant main effect of hemisphere [F (1, 22)=27.156, P<0.0001]. These findings suggest that stroke patients showed significantly less suppressed in beta band compared with healthy controls, and that both groups showed greater suppression on the contralateral motor area (C3). Further examination on the effect of mirror*group in contralateral and ipsilateral motor area found that there was a significant task condition effect at the contralateral motor area (C3) with a F ratio of F (1,22)=4.989, P=0.036, showing that both groups have more suppression at C3 in the covered mirror condition. Figure 1 shows the topography of the alpha and beta rhythm in unimanual hand movement task with mirror and covered mirror task conditions in the group of stroke patients and normal healthy participants.

An asymmetry index was calculated from the subtraction of the event-related spectrum perturbations between C3 (contralateral motor area) and C4 (ipsilateral motor area) to account for the difference of activity between contralateral and ipsilateral motor areas. ANOVA analysis was carried out to explore the effect of task condition and group on this index in alpha-1, alpha-2 and beta bands. Significant main effects of group on the asymmetry index were found in the beta band [F (1, 22)=8.680, P=0.007] (Fig 2).

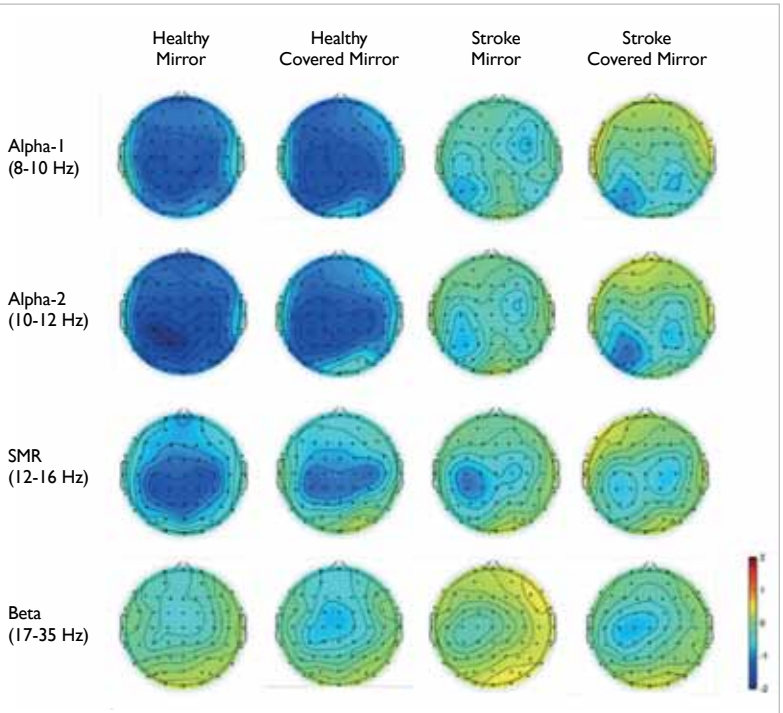

FIG 1. Topography of the alpha and beta rhythm in unimanual hand movement task with mirror and covered mirror task conditions in stroke and healthy participants

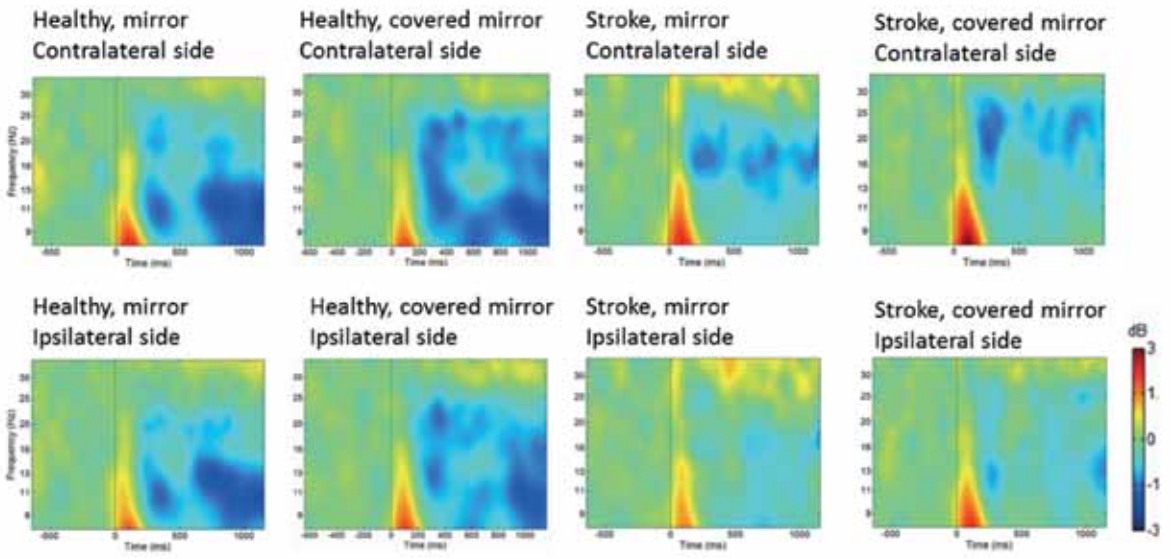

FIG 2. Comparison of event-related spectral perturbation at electrode C3 (contralateral motor area) and C4 (ipsilateral motor area) in unimanual hand movement task with mirror and covered mirror in the groups of stroke patients and healthy participants

Discussion

We found that effects of MT and BAT were similar and able to improve all clinical outcomes except for the gross subscore of the Action Research Arm Test. Although we could not find any significant difference in clinical effects between MT and BAT, our findings are in congruent to those reported in a recent Cochrane review[1] that most studies with significant effects between experimental and control groups might have been influenced by the type of control treatment. The effects on motor function are robustly significant in studies that compared MT with a sham intervention that used a covered mirror, thus avoiding any view of the affected limb. However, there is no advantage in effects when the experimental group is compared with no mirror or a transparent window with an unrestricted view (ie without the use of mirror) in the control group. Our clinical study did not use a sham mirror for comparison, but instead adopted a comparable intervention: bimanual arm training with the same customised movement tasks but without a mirror, which should be viewed as more powerful than a sham mirror condition. The only difference with or without mirror visual feedbacks between the two group possibly accounts for the significant between-group difference and the significant group-time interaction for the distal hand functions. This is consistent to a study that reported significant and larger effects of MT benefited the distal hand functions[2].

There was a significant main effect of groups in both contralateral and ipsilateral motor areas, particularly the contralateral motor area (C3) in both healthy and stroke participants in the alpha-2 band. Bilateral alpha/mu suppression during movement execution was expected; however, the findings of ERD in both hemispheres reflected that the problem of motor learning after stroke might be explained by reduced ability in action observation, leading to a poorer preparation in movement execution.

There was ERD in beta band, an overall more pronounced suppression over the contralateral hemisphere than the ipsilateral hemisphere, in both healthy and stroke participants. A magnetoencephalographic study reported similar results of movement-related beta desynchronisation in patients and healthy controls.[3] However, another study reported that more pronounced suppression in EEG analysis was found over the right than left hemisphere sites during action observation, regardless of the hand that moved.[4] Our findings are consistent to our previous review article that suggested mirror visual feedback may contribute to stroke recovery by revising the interhemispheric imbalance caused by stroke due to the activation of the mirror neuron system and that action observation may promote motor relearning in stroke individuals by activating the mirror neuron system and motor cortex[5].

Conclusion

MT is more useful than BAT in improving distal arm functions, and that mirror visual feedback is likely to activate the contralateral sensorimotor cortex, making the brain more symmetrical during the course of motor recovery after hemiplegia in stroke.

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References

1. Thieme H, Mehrholz J, Pohl M, Behrens J, Dohle C. Mirror therapy for improving motor function after stroke. Cochrane Database Syst Rev 2012;3:CD008449.
2. Deconinck FJ, Smorenburg AR, Benham A, Ledebt A, Feltham MG, Savelsbergh GJ. Reflections on mirror therapy: a systematic review of the effect of mirror visual feedback on the brain. Neurorehabil Neural Repair 2015;29:349-61.
3. Rossiter HE, Borrelli MR, Borchert RJ, Bradbury D, Ward NS. Cortical mechanisms of mirror therapy after stroke. Neurorehabil Neural Repair 2015;29:444-52.
4. Frenkel-Toledo S, Bentin S, Perry A, Liebermann DG, Soroker N. Dynamics of the EEG power in the frequency and spatial domains during observation and execution of manual movements. Brain Res 2013;1509:43-57.
5. Zhang JJQ, Fong KNK, Welage N, Liu KPY. The activation of the mirror neuron system during action observation and action execution with mirror visual feedback in stroke: a systematic review. Neural Plast 2018;2018:2321045.

Prenatal exposure to dioxins and subsequent neurocognitive and developmental function in Hong Kong Chinese children

LL Hui *, HS Lam, EYY Lau, EAS Nelson, TW Wong, R Fielding

KEY MESSAGES

1. There was no significant difference in the neurocognitive functions in terms of full-scale IQ, fine motor coordination, verbal and non-verbal reasoning, memory, learning, and attention in 11-year-old children by levels of prenatal dioxin exposure proxied by maternal dioxin body load soon after delivery.
2. There was no detectable deficit in neurocognitive function in older children even at the high-end of prenatal exposure to background dioxins.
3. Nonetheless, it is recognised that growing foetuses are vulnerable to the harmful effects of environmental pollutants. Continued efforts should be directed towards identifying and controlling environmental sources of these substances in Hong Kong and Mainland China.

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Introduction

Dioxins and polychlorinated biphenyls (PCBs) are a group of structurally related organic pollutants in the environment and in animal sources of food and human tissues. High levels of dioxins and PCBs are neurotoxic.[1] The impact of transplacental and lactational transfers of very low level of dioxins and PCBs on neurocognitive function in infants and children is of particular concern. Early prospective cohort studies have reported subtle adverse effects of prenatal exposure to dioxins and dioxin-related compounds on psychomotor development in infancy. However, findings were mixed on whether these neurocognitive deficits in infancy persist[2] or diminish in childhood. Given the endocrine disrupting effect of dioxins, assessment of other health impacts from prenatal dioxin exposure is needed, including growth, timing of puberty, immunity, reproductive health, and metabolic health.

To assess any potential impact of prenatal dioxin exposure on cognitive ability and intellectual function, we recalled the mothers who participated in a study on dioxin in breast milk in Hong Kong in 2002[3] to prospectively follow up their children at the age of 11 years. We also assessed associations of prenatal dioxin exposure with other health markers.

Methods

The 2002 study followed the protocol of the 2002/03 World Health Organization dioxins exposure study.[3] A total of 316 first-time mothers with recent singleton births were recruited from 16 well baby clinics. Of them, 161 were followed up for medium-term (at 11 years old) consequences of prenatal dioxin exposure. This study was approved by the Institutional Review Board of The University of Hong Kong/ Hospital Authority Hong Kong West Cluster. We obtained informed consent from the participating mothers and children.

Prenatal dioxin exposure was proxied by maternal dioxin body load soon after delivery (dioxin content in breast milk collected at 2 to 6 weeks postpartum). The dioxin content in individual breast milk samples was measured by the dioxin responsive chemical-activated luciferase gene expression (CALUX) bioassay, which reported toxic equivalents (TEQs) benchmarked against the most toxic dioxin congener, as maternal CALUX-TEQs.[4] The bioassay was performed by BioDetection Systems b.v. in the Netherlands.

The Wechsler Intelligence Scale for Children, Fourth Edition (Hong Kong) (WISC-IV-(HK)), the Hong Kong List Learning Test, the Tests for Everyday Attention for Children (TEA-Ch) and the Grooved Pegboard Test were administrated to the children to measure a wide range of neurocognitive domains, including full-scale IQ, fine motor coordination, verbal and non-verbal reasoning, learning and attention. Neuropsychological assessments were performed by clinical psychologist trainees or senior research assistants blinded to the children's dioxin

exposure. A clinical psychologist was responsible for ensuring assessment quality and interpreting the assessment results. All assessments were carried out in a classroom setting except for nine which were carried out at participants' home at the family's request.

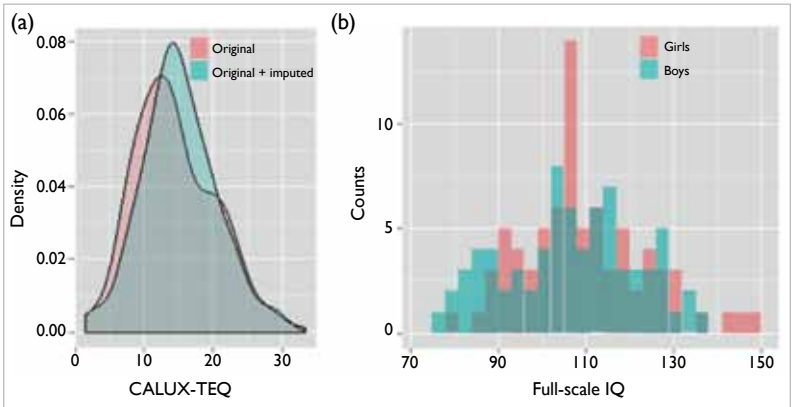

FIG 1. Distribution of (a) maternal dioxin responsive chemical-activated luciferase gene expression – toxic equivalents (CALUX-TEQ) with and without imputed data and (b) full-scale IQ by sex.

TABLE 1. Characteristics by maternal dioxin responsive chemical-activated luciferase gene expression – toxic equivalents (CALUX-TEQ)

	Quartiles of maternal CALUX-TEQ*			
	1st	2nd	3rd	4th
CALUX-TEQ, pg/g fat	8.6	13.4	16.1	22.5
Boys, %	52	55	47	43
Birth weight, kg	3.1	3.2	3.2	3.2
Gestational age, weeks	39.2	39.5	39.4	39.4
Mother's age at delivery, years	29.2	30.7	30.0	31.8
Having a Hong Kong born mother, %	65	70	57	66
Having at least one sibling, %	67	51	56	45
Father's education, %				
Junior high or lower	28	22	21	18
Senior high	29	39	35	37
Tertiary or higher	43	40	43	45
Mother's education, %				
Junior high or lower	10	8.9	14	15
Senior high	55	52	64	51
Tertiary or higher	34	40	22	34
Household monthly income, %				
<HKD25 000	48	32	43	38
≥HKD25 000	51	68	56	61
Age at breast milk sampling, weeks	4.2	4.1	4.4	4.4
Exclusively breastfed at sampling, %	54	60	50	50
Breastfeeding duration, weeks	6.8	9.6	8.1	7.1

* Data are presented as mean or %

Weight, height, body fat percentage, and blood pressure were measured by trained research assistants. Self-reported Tanner stages on breast/genital development at the time of assessment and age of menarche for girls were collected. Participating mothers also reported other information of the children, including behaviour and emotional problems (using Child Behaviour Checklist), history of serious infections and autoimmune diseases, habitual fish consumption, duration of breastfeeding, previous experience with cognitive function tests, and previous diagnosis of cognitive function deficits.

Multivariate linear regression was used to assess the association of prenatal dioxin exposure with each neurocognitive or health endpoint. Whether the associations varied by the duration or exclusivity of breastfeeding was assessed from the significance of interaction term. We adjusted for potential confounding factors that were associated with CALUX-TEQ level, including child's sex, place of birth, age at delivery, habitual seafood consumption of the mother, markers of family socio-economic position (education and income of parents), and child's age at assessment.

In 33 participating mothers who only had dioxin levels (as WHO-TEQ) in pooled breast milk but not individual CALUX-TEQ in breast milk determined in 2002, multiple imputation was used to predict their maternal CALUX-TEQ, based on a flexible additive regression model with predictive mean matching incorporating data on CALUX-TEQ, pooled WHO-TEQ, factors associated with maternal dioxin body load, interactions of interest (ie, prenatal dioxin exposure and breastfeeding duration), and outcome measures. Results from 10 imputed datasets were summarised into single estimates with confidence intervals adjusted for missing data uncertainty. A complete case analysis was also performed.

Results

Of 316 mothers in the 2002 dioxin exposure study, 161 mother-and-child pairs participated in the follow-up study. Loss to follow-up was mainly due to loss of contact (n=101), particularly among new immigrant mothers who had lower education level. Included participants and the whole cohort were comparable in terms of distribution of maternal CALUX-TEQ (14.9±6.0 vs 14.5±5.8 pg/g fat, Fig 1a) and maternal age. The maternal CALUX-TEQ level was not associated with education attainment or household income before or after imputation.

The mean age of the children at follow-up was 11.3±0.3 years. Full-scale IQ obtained from the WISC-IV (HK) was normally distributed (Fig 1b). One child previously diagnosed as being mentally retarded was included in the data analyses but was excluded from the plots. On average children with

higher full-scale IQ from WISC-IV-HK also had a higher learning score in Hong Kong List Learning test (indicating a greater ability in learning and better verbal memory), lower scores in the TEA-Ch (indicating a greater ability to focus), and a shorter time taken for the Grooved Pegboard Test (indicating a better visual-motor coordination) [Table 1]. Girls had higher scores in verbal comprehension index and processing speed index and almost all scores in the Hong Kong List Learning tests, whereas boys had higher scores in the block design in WISC-IV (HK). Children of higher educated mothers had a higher perceptual reasoning index and a higher score in matrix reasoning but not a higher full-scale IQ or better performance in other tests.

The plots of mean test scores by quartiles of maternal CALUX-TEQ showed no sign of threshold effects or low-dose effects of maternal CALUX-TEQ on markers of neurocognitive functions (Fig 2). Maternal CALUX-TEQ, either as a continuous variable or categorical variable, were not associated with the performance in the four tests, after adjusting for child's sex, mother's age at delivery, mother's place of birth, mother's habitual seafood consumption, parents' education, household income, and age at assessment (Table 2). Maternal CALUX-TEQ were not associated with the markers of metabolic health (body mass index, % body fat and blood pressure), behaviour outcomes (attention and internalising and externalising behaviour), earlier pubertal development (reaching stage II for boys or stage III for girls and menarche earlier than 12 years for girls), presence of allergy, autoimmune disease, and history of serious infections (data not shown). Similar results were obtained using complete case analysis with 128 children without imputed data (data not shown).

Both breastfeeding duration (mean, 7.8 weeks; range, 2–24 weeks) and exclusivity at the time of sampling (54%) were not associated with any neurocognitive function indicated in the four tests. None of the associations of maternal CALUX-TEQ with neurocognitive or health endpoints varied by breastfeeding duration or exclusivity (data not shown).

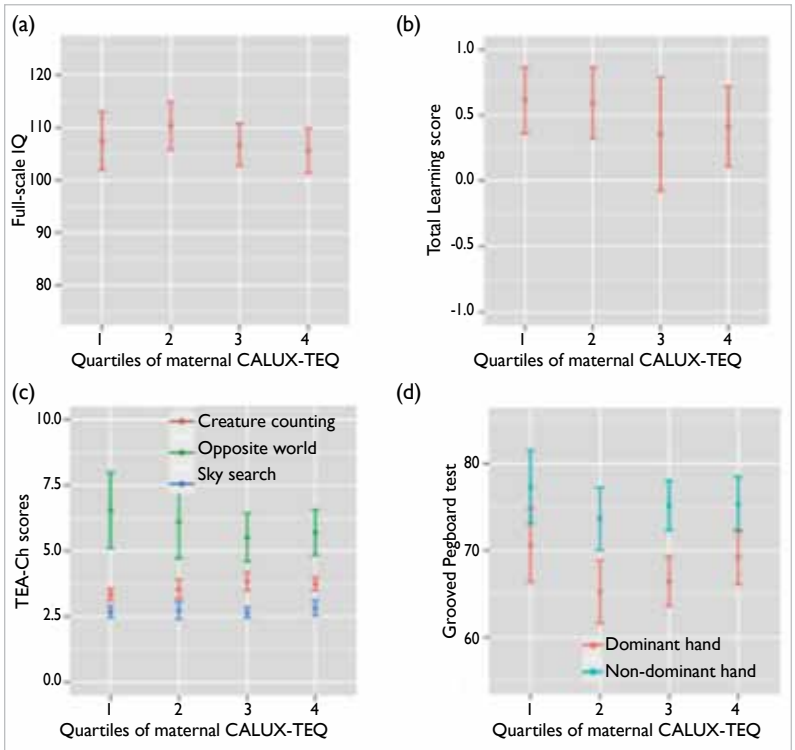

FIG 2. Mean scores of (a) the Wechsler Intelligence Scale for Children, Fourth Edition (Hong Kong) [WISC-IV-HK], (b) the Hong Kong List Learning Test, (c) the Tests for Everyday Attention for Children (TEA-Ch), and (d) the Grooved Pegboard test by quartiles of maternal dioxin responsive chemical-activated luciferase gene expression – toxic equivalents (CALUX-TEQ).

Discussion

We did not observe any significant difference in the neurocognitive functions in terms of full-scale IQ, fine motor coordination, verbal and non-verbal reasoning, memory, learning, and attention in 11 years old children by levels of prenatal dioxin exposure. There was no detectable deficit in neurocognitive function in 11-year-old children even at the high-end of prenatal exposure to background dioxins.

In-utero exposure to dioxins and related compounds has been reported to be associated with adverse neurocognitive development in infants. It is not clear whether such deficits in psychomotor abilities and cognitive function persist to childhood. There are only few studies on children born after 2000s; both positive and null associations of prenatal dioxin or PCB exposure have been reported with markers of neurodevelopment in infants. Our 2002 birth cohort reported that prenatal background dioxin exposure was not associated with child neurocognitive function at 11 years, regardless of breastfeeding duration. Associations of prenatal PCB exposure with poorer intellectual function and deficit in attention have been observed at 11-year-olds in the Michigan cohort and at 9-year-olds in the Dutch cohort, particularly among children with a shorter breastfeeding duration or less optimal home environments. Compared with these two cohorts, our cohort had a much lower PCBs levels in the breast milk samples and probably lower in-utero dioxin exposure. The lack of association in our study was consistent with the similar IQ in children with middle to low PCB exposure in the Michigan study. The US Collaborative Perinatal Project, with a lower mean maternal serum PCBs (2.8 ng/mL) than that of the Michigan mothers (6 ng/mL),

TABLE 2. Association of prenatal dioxin exposure with neurocognitive function at 11 years old

Test	n	Mean±SD	β (95% CI) adjusted for confounders		P for interaction	
			CALUX-TEQ	CALUX-TEQ at 4th quartile*	Breastfeeding duration	Breastfeeding exclusivity†
Wechsler Intelligence Scale for Children, Fourth Edition (Hong Kong)						
Full-scale IQ	152	107±15	-0.1 (-0.6 to 0.4)	-1.3 (-7.6 to 4.9)	0.75	0.95
Verbal comprehension index	160	107±17	-0.2 (-0.8 to 0.3)	-1.8 (-8.5 to 4.8)	0.99	0.64
Working memory index	153	105±15	-0.0 (-0.5 to 0.5)	-0.4 (-6.3 to 5.5)	0.53	0.48
Perceptual reasoning index	161	108±14	0.0 (-0.4 to 0.5)	-1.0 (-6.8 to 4.0)	0.99	0.61
Processing speed index	161	101±16	0.0 (-0.6 to 0.6)	0.4 (-6.8 to 7.6)	0.65	0.99
Score (scaled) from subtest						
Similarities (verbal reasoning)	152	11.7±3.2	-0.04 (-0.15 to 0.07)	-0.7 (-2.0 to 0.6)	0.52	0.48
Block design (visual abstract ability)	161	11.1±3.0	0.01 (-0.09 to 0.11)	-0.3 (-1.5 to 0.9)	0.32	0.42
Matrix reasoning (spatial reasoning ability)	161	11.4±3.1	-0.01 (-0.11 to 0.09)	-0.4 (-1.6 to 0.9)	0.52	0.61
Cancellation (visual-perceptual speed)	152	11.0±3.1	0.00 (-0.10 to 0.11)	0.2 (-1.2 to 1.5)	0.85	0.97
The Hong Kong List Learning Test (z-score)						
Learning	161	0.47	-0.01 (-0.04 to 0.03)	0.0 (-0.4 to 0.4)	0.90	0.69
Short delay recall difference	161	0.60	0.01 (-0.03 to 0.04)	0.2 (-0.3 to 0.7)	0.67	0.88
Long delay recall difference	161	0.76	-0.00 (-0.04 to 0.03)	0.2 (-0.3 to 0.7)	0.87	0.77
Trials 1-3 intrusion errors	160	-0.19	0.02 (-0.02 to 0.06)	0.2 (-0.3 to 0.7)	0.84	0.34
Trials 1-3 preservation errors	161	0.06	0.01 (-0.03 to 0.04)	0.2 (-0.2 to 0.7)	0.96	0.88
Test for everyday attention for children						
Creature counting	159	3.6±1.0	-0.05 (-0.18 to 0.08)	-0.2 (-1.9 to 1.6)	0.32	0.45
Opposite world	161	6.1±4.0	0.02 (-0.01 to 0.05)	0.1 (-0.3 to 0.5)	0.94	0.39
Sky search	161	2.8±0.9	0.00 (-0.03 to 0.04)	0.1 (-0.3 to 0.5)	0.68	0.79
Grooved Pegboard Test, seconds						
Dominant hand	161	68±13	-0.2 (-0.7 to 0.3)	0.3 (-5.1 to 5.6)	0.60	0.84
Non-dominant hand	161	76±14	-0.2 (-0.7 to 0.3)	-0.0 (-6.0 to 6.0)	0.59	0.99

* Compared with children with maternal CALUX-TEQ of 1st to 3rd quartiles

† When breast milk sample was collected

similarly reported no association of prenatal PCB with neurodevelopment at both infancy and childhood. In addition, the North Carolina cohort, the New York Oswego cohort, and the German Dusseldorf cohort reported a diminishing effect of PCBs on neurodevelopment in infancy to childhood. Such 'transient' neurotoxic effect may be due to compensatory mechanisms by intellectual stimuli from the environment or endogenous functional recovery.[5] The lack of association in our study could be partly due to such compensatory mechanisms, although we were unable to confirm it owing to unknown neurocognitive function at younger ages.

The endocrine disrupting effect of dioxins has been reported to be associated with disrupted reproductive health, altered immune systems, and increased diabetes risks. However, we did not observe any difference in related endpoints by prenatal dioxin exposure. The impact of prenatal exposure to low background levels of dioxins may only induce small changes, if any, to markers of metabolic, reproductive, and immunological health, as compared with other factors such as diet, stress, and genetic susceptibility. A larger sample size that includes subgroups with higher exposure to dioxins, together with adjustment of confounding factors, is required to detect such subtle endocrine disrupting effects.

There are limitations to this study. Only 51% of the original cohort were included. However, the distribution of maternal CALUX-TEQ of those included was similar to the whole cohort. The bias secondary to loss of follow-up should be small. In addition, the sample size was small, which allowed an 80% power to detect an effect size of 0.45 between groups (equivalent to 6.6 full-scale IQ points). However, this is similar to what was detected in the Michigan study. Furthermore, we did not have

cord blood dioxin content. However, dioxin in early breast milk highly correlates with cord blood dioxin and provides a proxy for prenatal dioxin exposure. Finally, only 20% of maternal CALUX-TEQ were imputed; however, the complete case analysis obtained similar results.

Conclusion

Prenatal exposure to background levels of dioxins is not associated with any deficit in neurocognitive function in terms of intelligence, learning, memory, and attention at 11 years of age. Although this null association is reassuring, it is still important to recognise that growing foetuses are vulnerable to the harmful effects of environmental pollutants. Continued and enhanced efforts should be directed towards identifying and controlling environmental sources of these substances.

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References

1. Birnbaum LS. Developmental effects of dioxins. Environ Health Perspect 1995;103(Suppl 7):89-94.
2. Jacobson JL, Jacobson SW. Evidence for PCBs as neurodevelopmental toxicants in humans. Neurotoxicology 1997;18:415-24.
3. Hedley AJ, Wong TW, Hui LL, Malisch R, Nelson EA. Breast milk dioxins in Hong Kong and Pearl River Delta. Environ Health Perspect 2006;114:202-8.
4. Nelson EA, Hui LL, Wong TW, Hedley AJ. Demographic and lifestyle factors associated with dioxin-like activity (CALUX-TEQ) in human breast milk in Hong Kong. Environ Sci Technol 2006;40:1432-8.
5. Stewart PW, Reihman J, Lonky EI, Darvill TJ, Pagano J. Cognitive development in preschool children prenatally exposed to PCBs and MeHg. Neurotoxicol Teratol 2003;25:11-22.

Psychometric properties of Chinese version of Dementia Management Strategies Scale among family caregivers

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KEY MESSAGES

1. Psychometric properties of the Chinese version of the Dementia Management Strategies Scale have good reliability and validity among Chinese family caregivers for people with dementia in Hong Kong.
2. Levels of adaptive and non-adaptive management strategies used by family caregivers are moderate. Females, spouses, those who perceived better current health than 1 year ago, and those who received two to three community support services indicated higher levels of management strategies used.
3. The levels of management strategies used by family caregivers correlate with their distress and self-efficacy and dementia relatives' symptom severity.

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Introduction

Dementia is a neurodegenerative disorder that typically occurs in old age. It is characterised by cognitive impairment and behavioural and psychological symptoms such as agitation, apathy, and personality changes; its prevalence increases from 0.8% at age 60 to 64 years to 19.1% at ≥85 years.[1] Caregiving stress and burden are common in families having a relative with dementia. Family education on dementia management strategies can reduce the functional decline in people with dementia, lower familial burden of care, enhance self-efficacy of family caregivers in handling disruptive behaviours of demented relatives, and reduce the likelihood of institutionalisation of dementia relatives to aged care facilities.[2-4]

A study using the 28-item Dementia Management Strategies Scale (DMSS) identified three major types of caregiving strategies in dementia care (criticism, encouragement, and active management) that are correlated with caregiving burden and intention of institutionalising their relatives.[3] Modification of dementia management strategies is associated with families' self-efficacy and coping ability in caregiving and may lead to a better sense of competence and a more rewarding experience, contributing to a therapeutic homecare environment.[4] The DMSS covers a wide range of adaptive and non-adaptive strategies in dementia care and is useful for health care professionals to assess and identify family caregivers who are lack of appropriate and effective strategies in coping with challenges in caregiving. Unlike the Task Management Strategy Index (TMSI)[5] that only assesses positive coping tasks, DMSS can be used to examine both adaptive and non-adaptive strategies of caregivers in dementia care. Therefore, it is important to translate and validate the DMSS in a Chinese population and to assess the levels of different management strategies used by caregivers in caring for their dementia relatives.

Methods

This was a two-phase study to test the psychometric properties of the Chinese version of DMSS. Phase 1 tested the semantic equivalence of the original English and translated Chinese version and examined content validity and test-retest reliability of the Chinese version. Phase 2 assessed internal consistency, reproducibility, responsiveness, and construct validity of the Chinese version, and identified the management strategies used by caregivers and related factors by completing the questionnaire twice over 6 months.

Study subjects were recruited from two elderly service centres that provide day and residential dementia care for over 500 families in Kowloon and Hong Kong Island. In phase 1, a bilingual nurse researcher and a Chinese-English translator translated and back-translated the DMSS independently. An expert panel comprising five mental health professionals and three family

caregivers were recruited to rate the relevance of items of DMSS in assessing the management strategies in dementia care. A convenience sample of 20 Chinese-English bilingual caregivers of dementia relatives completed the original English and translated Chinese versions of DMSS for testing the semantic equivalence. In addition, another convenience sample of 40 caregivers completed the Chinese version twice over a 2-week interval for assessing the test-retest reliability. In phase 2, about 210 pairs of family caregivers and their dementia relatives were randomly selected from the client lists to participate. This sample size could achieve a 95% confidence interval for each of the three DMSS subscales (standard deviation=6.6-6.9, n=107) within a margin-of-error of ±1.0 from the population mean.[4]

The inclusion criteria for caregivers were: (1) being the main primary caregiver (age ≥18 years) of a dementia relative for ≥3 months on activities of daily living for ≥2 hours per day; and (2) able to understand and read Chinese language. The inclusion criteria for the dementia relatives were: (1) age ≥60 years, (2) with mild to moderate stage of dementia according to the DSM- IV or the Clinical Dementia Rating[4] assessed by a psychiatrist, and (3) able to understand verbal Cantonese/Mandarin. Family caregivers presenting with acute psychiatric symptoms or cognitive impairments were excluded, as were dementia relatives presenting with serious deteriorating health conditions or moving to long-term aged care facilities in the upcoming 6 months.

In phase 2, four instruments were used: the Chinese version DMSS, TMSI, Self-Efficacy Questionnaire for Chinese Family Caregivers, and Neuropsychiatric Inventory. All four instruments demonstrated good internal consistency and construct validity.[1-5] After informed written consent was obtained, each participant was assisted by a research nurse to complete the questionnaires by reading the questionnaire items and rating scales. Six months later, the participants completed a similar set of questionnaires at home or the study centres.

The item equivalence between the Chinese and English versions of the DMSS was evaluated using weighted kappa value, and their total scale/subscale equivalences were assessed by intraclass correlation coefficient. Content of validity index of the translated DMSS was calculated at both item and scale levels based on percentage of agreement between panel members on the relevance of each item to dementia management strategies, and Pearson's moment correlation test was used to evaluate the test-retest reliability of the Chinese version at a 2-week interval.

Construct validity of the translated DMSS was established by: (1) testing the correlations between each of its subscale score and TMSI total score for convergent and divergent validity; and (2) using exploratory factor (principal components analysis followed by varimax rotation) with half of the sample randomly selected from the full data set and confirmatory factor analyses using LISREL 9.1 to generate and conclude the factor solution as explained by the scale items. Internal consistency of the DMSS was calculated using Cronbach's alpha coefficients.

Data from dementia relatives reported little or no change in neuropsychiatric symptoms at the 6-month interval. Reproducibility of the Chinese version was assessed using the intraclass correlation coefficients (random effects one-way ANOVA). Responsiveness of the DMSS to change in neuropsychiatric symptoms was evaluated by (1) observed change for two measurements (mean difference [test 1 minus test 2]) and (2) effect sizes (observed change divided by standard deviation of baseline score), examining whether a change in DMSS mean scores followed the expected change patterns in Neuropsychiatric Inventory symptom scores.

Results

Phase 1

Convenience samples of 20 and 40 family caregivers were recruited for assessing equivalence and test-retest reliability, respectively, with response rates of 95% and 93%. Non-response was mainly due to time constraints and unwilling to discuss their family issues.

The 34-item Chinese version of DMSS had a good semantic equivalence with the original English version on both the items and total scale; 30 items had a kappa value of 0.87-0.94 and the remaining 4 (items 10, 20, 24, and 28) had a kappa value of 0.80-0.84, which is slightly below the acceptable value of 0.85. The intraclass correlation coefficients between the two versions were 0.89 (P=0.01) for the total scale and 0.82-0.93 for the three subscales.[3] Only minor amendments on the key wordings of a few items were made. The Chinese version also showed good content validity, with the content of validity index being 0.90-1.00 at the item level and 0.96 at the scale level. Test-retest reliability coefficients for the Chinese version of DMSS over 2-week interval were r=0.90 for the total scale (P=0.01) and 0.87-0.93 for the three subscales (P=0.02-0.007).

Phase 2

A total of 211 family caregivers (and their dementia relatives) completed the questionnaire (response rate, 75.4%). Seventy caregivers refused to participate mainly due to lack of interest (n=32) or too busy and time inconvenience (n=30). Respondents and those refused to participate were comparable in terms of socio-demographics and clinical characteristics (P>0.10, Table 1).

TABLE 1. Characteristics of family caregivers and dementia relatives*

Characteristics	Respondents (n=211)	Those refused to participate (n=70)	χ^2 / t	P value
Family caregivers			1.38	0.36
Female	141 (66.82)	42 (60.00)		
Male	70 (33.18)	28 (40.00)		
Age, y	48.76±19.12 (21-62)	49.48±20.16 (20-64)	1.30	0.20
Relationship with dementia relative			1.49	0.33
Spouse	81 (38.39)	25 (35.71)		
Child	79 (37.44)	25 (35.71)		
Sibling/parent	40 (18.96)	15 (21.43)		
Others (eg, granddaughter)	10 (4.74)	5 (7.15)		
Monthly household income, HK$			1.80	0.19
≤10 000	50 (23.70)	15 (21.43)		
10 001–20 000	93 (44.08)	30 (42.86)		
20 001–40 000	57 (27.01)	19 (27.14)		
>40 000	10 (4.74)	6 (8.57)		
Education level			2.19	0.12
Primary or below	33 (15.64)	14 (20.00)		
Secondary	142 (67.30)	39 (55.71)		
Tertiary	36 (17.06)	17 (24.29)		
Persons sharing with caregiving			2.48	0.10
Spouse	49 (23.22)	16 (22.86)		
Child	55 (26.07)	18 (25.71)		
Sibling/other relatives	67 (31.75)	26 (37.14)		
Domestic helper	40 (18.96)	10 (14.29)		
Duration of caregiving, mo	18.34±9.91 (8-32)	17.19±9.98 (7-36)	1.34	0.25
Time of caregiving, hr/wk	4.84±1.98 (2-8)	4.10±2.07 (2-7)	2.08	0.10
Types of daily tasks assisted for relative (eg, bathing, dressing and toileting)	7.81±2.25 (4-12)	8.90±4.02 (4-14)	1.98	0.11
General health conditions				
Visiting medical doctor (1=none to 4= >2 times per month)	2.12±1.01 (1-4)	-		
No. of hospital admission	1.52±1.01 (0-4)	-		
Use of psychotropic drugs	98 (42.65)	-		
Level of sleeping difficulty (1=generally sufficient to 3=generally insufficient)	2.05±0.80	-		
Weight change >5 pounds	105 (49.76)	-		
Perceived current health (1=much better to 5=much worse than 1 year ago)	3.51±1.32 (1-5)	-		
Presentation of physical symptoms (1=none to 3=often)				
Headache	1.59±1.02	-		
Dizziness	2.01±0.70	-		
Heart palpation	1.36±1.12	-		
Worsening of memory	1.98±0.60	-		
Unstable emotion	2.31±0.40	-		
Anxiety	2.10±0.52	-		
Constipation	1.33±0.89	-		
Stomach ache	1.59±0.93	-		

* Data are presented as mean±SD (range) or No. (%) of subjects

TABLE 1. (cont'd)

Characteristics	Respondents (n=211)	Those refused to participate (n=70)	χ^2 / t	P value
Community support services received			2.48	0.10
Community psychiatric team (psychogeriatric)	89 (42.18)	25 (35.71)		
Family therapy	36 (17.06)	9 (12.86)		
Respite care	49 (23.22)	17 (24.29)		
Self-help/mutual support group	42 (19.91)	11 (15.71)		
Cognitive behaviour therapy / mindfulness training	32 (15.17)	10 (14.29)		
Others (eg, day care centre)	78 (36.97)	20 (28.57)		
Dementia relatives			1.74	0.25
Male	96 (45.50)	31 (44.29)		
Female	115 (54.50)	39 (55.71)		
Age, y	66.40±8.29	67.49±9.21	1.38	0.30
55-60	14 (6.64)	4 (5.71)		
61-65	40 (18.96)	8 (11.43)		
66-70	71 (33.64)	24 (34.29)		
>70	86 (40.76)	34 (48.57)		
Type of dementia			1.25	0.24
Alzheimer's disease	98 (46.45)	34 (48.57)		
Vascular/frontotemporal	53 (25.12)	17 (24.29)		
Lewis bodies/semantic	42 (19.91)	13 (18.57)		
Others	18 (8.53)	6 (8.57)		
Hospitalisation in the past 3 months				
No. of hospitalisation	1.12±0.90	1.30±0.81	1.10	0.30
Length of hospitalisation, d	10.18±5.90	9.01±4.79	1.89	0.23
No. of family members living with patient	2.15±0.90 (1-4)	2.34±0.98 (1-4)	1.56	0.20
Duration of dementia, mo	17.40±9.54 (8-35)	19.13±10.49 (7-34)	1.14	0.28
Mobility			2.13	0.11
Use wheelchair	58 (27.49)	18 (25.71)		
Walk with a stick/frame	79 (37.44)	30 (42.86)		
Walk independently	74 (35.07)	22 (31.43)		
Psychiatric medications			1.97	0.25
Anti-depressants	28 (13.27)	8 (11.43)		
Anti-convulsants	7 (3.32)	4 (5.71)		
Atypical anti-psychotics	12 (5.69)	8 (11.43)		
Conventional anti-psychotics	11 (5.21)	7 (10.00)		
Hypnotics	18 (8.53)	7 (10.00)		
Others (eg, lithium salts)	8 (3.79)	4 (5.71)		
Psychiatric treatments receiving			1.96	0.15
Community psychiatric team visits & education	78 (36.97)	19 (27.14)		
Cognitive remediation	32 (15.17)	9 (12.86)		
Memory training (eg, reminiscence)	59 (27.96)	10 (14.29)		
Exercise and self-care training	58 (27.49)	10 (14.29)		
Complimentary therapies	27 (12.80)	6 (8.57)		
Others (eg, relaxation & self-regulation)	30 (14.22)	10 (14.29)		

Construct validity

All corrected item–total correlations were positive, with 32 of 34 items within the range of 0.30-0.75. After confirmed the factorability with half of the randomly selected sample (n=143), principal components analysis and Catell's scree test indicated that there were three components (criticism towards older relative, showing encouragement, and active management strategies) with eigen-values of >1.2, with 32 items having factor loadings of ≥0.40. Only two items were deleted from item rotation: item 29: "I was kept busy just cleaning up or repairing things after the damage my older relative had done" (0.16) and item 33: "I tried to soothe my relative's emotions when he/she got upset" (0.18). After varimax rotation, all 32 items had high loadings of >0.40 on only one factor, except for item 30: "I made sure my older relative got enough medications to keep him/her calm/cooperative". The three-factor solution (criticism towards older relative [12 items], showing encouragement [10 items], and active management strategies [10 items]) explained 72.06% of total variance of management strategies (Table 2).

For confirmatory factor analysis, the three-factor model with paths between all factors showed much better fit based on all fit indices (χ^2/df=1.92, P=0.58, AGFI=1.01, TLI=1.04, RMSEA=0.034, WRMR=0.76) than the model suggested by the original authors. Critical ratios for regression weights were >2.0 indicating each item with a significant contribution at 0.05 level to its associated factors. Path diagram of the best fit three-factor model indicated moderate correlations between three factors (0.50-0.58) and their included items (0.49-0.73).

Internal consistency and convergent and divergent validity

Internal consistency of the Chinese version DMSS was high in caregivers, with Cronbach's alpha being 0.89 for overall scale and 0.86-0.90 for three subscales. All corrected item–total correlations were positive (0.30-0.69) and its overall scale and subscales were also moderately and positively intercorrelated (P<0.01). As expected, the total score and the three subscales were positively correlated with the mean total score of TMSI (*r*=0.50, P=0.008) and its subscales (*r*=0.46-0.56, P=0.09-0.007). As the subscale 'criticism towards older relative' was reversed coded, the adaptive strategies used (TMSI total score) were negatively associated with this subscale, indicating good divergent validity, whereas the total score and the other two subscales were positively associated with the TMSI total score indicating good convergent validity.

Reproducibility and responsiveness to change in neuropsychiatric symptoms

Reproducibility of the Chinese version DMSS between the two assessments (6-month interval) in the caregivers (n=107), who reported no major changes in both their distress level and the older relatives' neuropsychiatric symptoms, were good (intraclass correlation coefficient=0.87, F=5.12, df=105, P=0.01). In addition, the observed changes in mean DMSS score among the caregivers (n=104) in response to negative changes in neuropsychiatric symptom severity ranged from 9.26 to 15.89 for total score, and from 2.45 to 4.12 for the three subscales. The change in mean scores correlated with the patterns of changes in their TMSI total scores (*r*=0.50, P=0.005). The Chinese version also showed moderate effect sizes for detecting an increase in symptom severity in dementia relatives (n=52) in overall score (effect size Cohen's d=0.58), and in three subscales (effect size ranged from 0.50 for 'criticism towards older relative' to 0.60 for 'active management strategies'). There were small to moderate effect sizes for detecting symptom improvement (or decrease in Neuropsychiatric Inventory score; n=54) in the overall score (effect size=0.52) and three subscales (effect sizes=0.34-0.52).

DMSS scores among family caregivers and their correlates

The DMSS overall and/or subscale scores correlated negatively with distress (P=0.05-0.006) and positively with self-efficacy in caregiving (P=0.05-0.007), perceived current health (P=0.05-0.01), neuropsychiatric symptoms (P=0.05), amount of non-adaptive strategies used (P=0.01-0.008), time of caregiving (P=0.05-0.03), and caregiver's age (P=0.05) [Table 3].

There were positive correlations (using partial correlation coefficients) between the amount of non-adaptive strategies used and difficulty in sleeping, dizziness, memory worsening, unstable emotions, and anxiety (r_p=0.31-0.39, P=0.04-0.05). There were negative correlations between the DMSS subscale score of 'criticism towards older relative' and difficulty in sleeping, headache, unstable emotions, and anxiety (r_p=0.30-0.40, P=0.04-0.05).

Discussion

The Chinese version DMSS demonstrated good psychometric properties for assessing family caregivers' perusal of various active, positive, and encouraging strategies in dementia care, as well as avoiding for criticism and blame on the older relatives, or their illness and its related problematic behaviours. The high weighted kappa values and intraclass correlations indicated that the items were appropriately translated and retained the similar meaning as the original English version in assessing dementia management strategies among Chinese caregivers. The high test-retest reliability, internal consistency, and reproducibility also supported

TABLE 2. Results of varimax rotation of three factors identified in the Chinese version Dementia Management Strategies Scale*

Item		Factor loading		
		Factor 1 (Criticism towards older relative)	Factor 2 (Showing encouragement)	Factor 3 (Active management strategies)
1	I yelled or acted enraged; it was often the only way to get my way with him/her. (26)	0.68		
2	I criticised or scolded my older relative to try to prompt better behaviour from him/her. (15)	0.56		
3	I threatened my relative with undesirable consequences if he/she did not cooperate. (21)	0.60		
4	I withdrew from my older relative. (22)	0.59		
5	I blamed my older relative for having created the difficulties. (1)	0.53		
6	I was firm with my older relative, and insisted that he/ she live up to certain expectations I have for him/her. (13)	0.44		
7	I told my relative to stop doing things that caused worry because of what it did to me (or to other family members). (29)	0.51		
8	I left the situation for a while when relating to my older relative got too difficult. (27)	0.56		
9	I tried to get my relative to agree to do certain things, or to do them in a certain way. (31)	0.55		
10	I asked my relative to explain why he/she was doing something, to draw his/her attention to his/her mistakes. (11)	0.51		
11	I tried to communicate to my older relative how concerned or worried I was about him/her. (32)	0.48		
31	I overlooked or ignored my older relative's feelings when I suspected that paying attention to them might lead to unpleasantness between us. (8)	0.50		
12	I tried to engage my older relative in discussing his/her feelings and emotions. (4)		0.69	
13	I made a point of praising him/her when he/she did what I considered appropriate. (5)		0.64	
14	I tried to help my older relative look on the bright side of things. (20)		0.63	
15	I tried to reason with my older relative. (28)		0.58	
16	I encouraged my relative to adopt a fighting attitude toward his/her disability, and to do as much as possible for him/herself. (16)		0.56	
17	I tried to suggest ideas my older relative might accept and follow through on. (23)		0.52	
18	I showed special amounts of physical affection. (7)		0.49	
19	I encouraged my older relative to keep up with friends, to visit them by him/herself. (9)		0.48	
32	I tended to indulge my older relative. (17)		0.45	
34	I tried to hold my anger and frustration in, to protect my older relative from these feelings. (18)		0.49	
20	I tried to arrange my older relative's environment to safeguard him/her against causing problems, getting into trouble, or endangering him/herself. (10)			0.67
21	I tried to do many things for my relative since he/she is no longer capable of doing them. (6)			0.61
22	I tried to divert my relative's attention when he/she began to feel upset. (12)			0.56
23	I repeated the same things over and over again, to make sure my older relative got them. (19)			0.53
24	I tried to arrange situations I hoped would be stimulating to my older relative (mentally or emotionally). (2)			0.52
25	I kept a close eye on what my older relative was doing so that I could head off any problems before they developed too far. (3)			0.51
26	I tried to have my relative participate in as much of the ordinary family routine as possible. (25)			0.50
27	I tried to teach everyone involved to approach my older relative in the same, planned way. (33)			0.47
28	I tried to make sure my relative got enough physical activity or exercise. (34)			0.48
30	I made sure my older relative got enough medications to keep him/her calm or cooperative. (30)	(0.40)		0.47
	Eigen value	6.61	5.52	5.30
	Percentage of variance explained	27.57	23.80	20.69

* Item 3 had fairly high factor loading on two factors (1 and 3). It was retained in factor 3 only after consideration of its meaning and level of loading

TABLE 3. Correlations between Dementia Management Strategies Scale (DMSS), Task Management Strategy Index (TMSI), and other variables in 211 respondents

Measures	DMSS	DMSS			TMSI	Non-adaptive strategies used
		Criticism towards older relative	Showing encouragement	Active management strategies		
DMSS	1.00					
Criticism towards older relative	0.518†	1.00				
Showing encouragement	0.608‡	0.503†	1.00			
Active management strategies	0.540†	0.498†	0.583†	1.00		
TMSI	0.496†	0.458†	0.506†	0.562†	1.00	
Non-adaptive strategies used	-0.469†	-0.502†	-0.398*	-0.283	-0.383*	1.00
Neuropsychiatric Inventory (distress)	-0.468†	-0.382*	-0.564†	-0.431†	-0.451†	0.288
Neuropsychiatric Inventory (symptoms)	-0.312*	-0.346*	-0.265	-0.350*	-0.360*	0.344*
Self-Efficacy Questionnaire for Chinese Family Caregivers	0.502†	0.346*	0.489†	0.547†	0.679‡	0.551†
Time of caregiving (hrs/week)	0.358*	0.261	0.301*	0.398*	0.391*	0.238
Perceived current health	0.402†	0.310*	0.420†	0.400†	0.368*	0.386*
Caregiver age	0.298	0.246	0.287	0.324*	0.288	0.188
Dementia relative's age	-0.212	-0.234	-0.198	-0.224	-0.246	0.308*
Duration of dementia	0.298	0.283	0.278	0.238	0.216	0.198
Physical symptoms (partial correlation coefficients after adjusting for covariates)						
Sleeping difficulty	-0.189	-0.298*	-0.198	-0.102	-0.258	0.342*
Headache	-0.306*	-0.348*	-0.278	-0.236	-0.284	0.298
Dizziness	-0.252	-0.212	-0.276	-0.104	-0.302	0.380*
Heart palpation	-0.248	-0.234	-0.212	-0.131	-0.288	0.214
Memory worsening	-0.189	-0.220	-0.288	-0.182	-0.311	0.312*
Unstable emotion	-0.322*	-0.398*	-0.198	-0.202	-0.338*	0.364*
Anxiety	-0.316*	-0.348*	-0.274	-0.298	-0.364*	0.392*
Constipation	-0.168	-0.122	-0.188	-0.148	-0.156	0.245
Stomach ache	-0.214	-0.136	-0.202	-0.241	-0.234	0.261

* P<0.05
† P<0.01
‡ P<0.001

that the translated version has a high potential to be applied to families caring for a dementia relative in Chinese populations.[1,4] The overall scale and two subscales ('showing encouragement' and 'active management strategies') demonstrated good convergent validity with the TMSI, and the remaining one subscale ('criticism towards older relative') demonstrated good divergent validity with the TMSI indicating strong association with family caregivers' adaptive strategies used for dementia care. Therefore, the Chinese version DMSS with the three factors can measure both positive and negative coping/management strategies used by caregivers, and relationships with their families' distress and negative attitudes (criticism) towards the older relatives, as suggested by the original authors and other study.[4,6]

In addition, the Chinese version DMSS showed a good responsiveness to changes in these mental and behavioural symptoms of dementia with moderate effect sizes for detecting symptom deterioration over 6 months. The DMSS is useful, particularly the more active management strategies (effect size=0.60) and positive encouragement (effect size=0.56), to detect the changes in dementia symptoms and important predictors of caregivers' management of dementia relatives' problematic behaviours.[5,6]

With the association between the DMSS score and psychosocial variables, more efforts and time contributed to dementia management strategies, particularly the adaptive ones, is likely to reduce distress (ie, negatively correlated) and improve self-efficacy and perceived health status in caregiving by the caregivers.[3,5] The DMSS might be useful to reflect

the amount of non-adaptive strategies adopted by these caregivers, in turns detecting their perceived current health status and a variety of somatic symptoms such as sleeping difficulty, unstable emotions and anxiety state (which were correlated with both the DMSS and amount of non-adaptive strategies used in this study).

There are limitations to this study: (1) family caregivers' self-reports might be subjective or inaccurate to see the actual degree of their management strategies use in actual dementia care setting; (2) the participants were selective, recruiting from two community care centres only where similar socio-economic backgrounds and mental healthcare services; (3) the relationships between dementia management strategies and their socio-demographic, clinical and psychosocial characteristics were studied using cross-sectional descriptive but not a longitudinal and predictive design; and (4) there was not sufficient sample for either exploratory or confirmatory factor analysis, thus the model fitness might have been inflated. In addition, the use of confirmatory factor analysis was weak for testing model-fit of the data due to upward bias or overestimation with a large number of measured variables (items).

Conclusion

This study supports the reliability and validity of the Chinese version DMSS in measuring family caregivers' level of dementia management strategies. It can be applied to mental health practice for better understanding and measuring the levels of caregiving strategies among dementia populations. This self-report Chinese version DMSS is easy to administer and requires minimal training and simple interpretations from the caregivers' own perceptions. It can be further tested in and applied to various types and duration of dementia, as well as different Chinese communities.

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References

1. Chan SW. Family caregiving in dementia: the Asian perspective of a global problem. Dement Geriatr Cogn Disord 2010;30:469-78.
2. de Vugt M, Stevens F, Aalten P, et al. Do caregiver management strategies influence patient behaviour in dementia? Int J Geriatr Psychiatry 2004;19:85-92.
3. Hinrichsen G, Niederehe G. Dementia management strategies and adjustment of family members of older patients. Gerontologist 1994;34:95-102.
4. Au A, Lai M, Lau K, et al. Social support and well-being in dementia family caregivers: The mediating role of self-efficacy. Aging Ment Health 2009;13:761-8.
5. Gitlin L, Winter L, Dennis M, Corcoran M, Schinfeld S, Hauck W. Strategies used by families to simplify tasks for individuals with Alzheimer's disease and related disorders: Psychometric analysis of the Task Management Strategy Index (TMSI). Gerontologist 2002;42:61-9.
6. Lim J, Griva K, Goh J, Chionh HL, Yap P. Coping strategies influence caregiver outcomes among Asian family caregivers of persons with dementia in Singapore. Alzheimer Dis Assoc Disord 2011;25:34-41.

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