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Participation effects of workplace promoting activities on healthy eating behavior

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ABSTRACT

Objective: The study intends to examine the effect of participating healthy eating related games or activities in workplace on changes of employee's self-reported behavioral stage for adopting healthy eating.
Study design: A quasi-experimental study.
Methods: A multi-strategic intervention for 8-month was designed and implemented in a main staff canteen area within a non-profit academic organization. The initial event included exhibition of custom-made dining plates filled with correct portions of food models for three caloric levels and provision of user-friendly online resources, which were followed by three promotion activities (long-term exhibition of my balanced plates, matching games for six food groups, and do-it-yourself healthy plate) in the 8 months.
Results: A total of 86 adult participants (males = 37, female = 49) who had completed pre- and post-surveys were included in the analysis. Participants who participated all three promotion activities presented greater advancement in stage of healthy eating behaviors (HEB) than those who did not participate any activity (β= 1.118, 95% CI = 0.428–1.808, P = 0.001 among male participants; β = 0.740, 95% CI = 0.145–1.336, P = 0.015 among all participants). Adjustment has been made for significantly-associated covariates including types of promotion activities, initial-HEB and gender.
Conclusions: A multi-strategic intervention providing balanced food plates and online resources followed by consecutive promotion activities are effective in advancing HEB for the workplace adults. Differential impacts of promotion activities and gender should also be considered for designing workplace interventions.

1. Introduction

According to the reported data of World Health Organization, health promotion strategies that encourage healthy eating are critical in reducing overweight and obesity rates and preventing non-communicable diseases [1]. Since workplaces are where health promotion campaign may reach most adult population [2], this study intends to design and examine efficacy of workplace strategies for promoting and maintaining healthy eating behaviors (HEB).

1.1. HEB status and factors influencing HEB in adults

Di Noia, Contento & Prochaska described HEB in stages, including pre-contemplation, contemplation, preparation, action, and maintenance [3,4]. Studies have pointed out that, more than half of adults' HEB are in the pre-contemplation stage [5–7]. Adults in this stage most likely have poor understanding of the relations between healthy diets and disease prevention and thus treasure palatability more than health [5–7]. On the other hand, adults with some health risks, such as pre-diabetes, tend to be in the preparation stage [6–8]. Evidently, a large proportion of adult population has not been able to recognize the importance of healthy eating and are not ready to commit to it.

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Studies showed that people who are less conscious about health such as adults with higher BMI are more likely to deviate from healthy habits and tend to be paralyzed by barriers of healthy eating [9–11]. These self-perceived barriers include long-standing poor eating habits, personal or familial taste preference, time constraints for food preparation, inaccessibility to healthy items, lack of willpower or low self-control on practicing healthy eating, inability to afford healthy foods, and the nature of fruits and vegetables being easily spoiled [5,12–14]. Conversely, it was found among individuals with multiple chronic diseases that the higher the BMI, the higher motivation to engage in healthy eating [15]. Furthermore, healthy foods readily accessible or those well recognized to have significant benefits to specific medical conditions are more likely to be adopted [13].

Several studies observed gender differences in healthy eating literacy, behaviors, and motivations. Maintaining muscularity is a driving force for young-males to choose protein foods. Weight control is deemed important by both young adult men and women [16]. Bruce et al. (2017) reported that women are more confident than men in reducing sugar-sweetened beverage (SSB) consumption and replacing SSB with water [17]. With regards to the barriers of executing healthy eating behaviors, studies showed that males tend to select all-you-can-eat type of eating environment in part due to poor nutrition-related knowledge or for muscle building purposes [18,19]. For females who cannot perform healthy eating, it is mainly due to personal and family reasons, work-related circumstances, and lack of social support [18,19]. Females with more access to healthy food options tended also to perform regular physical activities and to have normal BMI. They are usually older, nonsmoking, and have higher education level and higher socioeconomic status [20,21]. Nevertheless, Leblanc et al. (2014) indicated that males are more responsive than females to dietary intervention [22]. As such, strategies to promote healthy eating behavior should consider gender differences in making use of the positive motives and in mitigating barriers for behavioral change.

1.2. Healthy eating intervention studies in adults

Interventions to promote healthy eating are abundant in numbers. Most of them studied subjects with overweight or obesity [23–25]. Some of them targeted individuals with prediabetes [26] or those with other risk factors [22,27]. A number of studies included healthy and young adults as their participants [28,29]. These interventions generally showed improvement in healthy eating among the participants, but maintaining these acquired habits is often a challenge afterwards [29,30]. This phenomenon motivated us to find effective intervention strategies in maintaining behavior changes. Since more than half of the adult population spend most of their time at workplace, we are interested in workplace strategies that anyone in the setting can freely join. Therefore, we addressed the following research questions: (1) whether participating healthy eating promotion activities or frequency of participation is associated with a change in the stages of practicing healthy eating behaviors, (2) whether different health promoting education activities produce significant differences in stages of practicing healthy eating behavior, and (3) what are the characteristics of the participants whose behavioral stages showed improvement or maintaining effects.

2. Methods

2.1. Study design

A quasi-experimental design with two questionnaire surveys were adopted in this study. The key independent variables are those related to the participation status of the promotion activities. Since we adopted the hierarchical definition of the transtheoretical model to capture the behavioral stages, the change (difference) of HEB stages is the major dependent variable. For controlling the selection biases, the participant's age, BMI, healthy eating consciousness, healthy eating knowledge and HEB status at the beginning of intervention were included as covariates in this study. When analyzing the effect of the change on HEB stages for any given activity, the participation status of the other two promotion activities were also considered as covariates to control for confounding. The inter-relationships among variables have been proposed as shown in Fig. 1.

2.2. Design of the intervention activities

We designed one initial event and 3 promotion activities to encourage and to help improve or maintain employees' HEB during the intervention period.

The initial three-day event was held in the main restaurant area within a non-profit academic organization. The initial event included (1) displaying real-size custom-made dining plates filled with balanced amounts of food models for three most common caloric levels of Taiwanese, (2) take-away self-learning healthy eating materials of the above materials printed on a paper-based placemat, (3) QR Code to access the online learning tools and resources for continuous nutrition education on healthy eating, and (4) dietitian's presence in cafeteria for healthy eating consultation. The purposes of the initial event were to arouse the awareness and to encourage the intention of the employees to practice healthy eating as well as to inform on healthy eating content. Three weeks after the initial event, we assessed participants' HEB stage as the initial effects (initial-HEB) of this quasi-experiment and as the baseline data for evaluating the promoting or maintaining effects (post-HEB) of three later promotion activities.

Three promotion activities were designed for strengthening participants' cognition on healthy eating and for advancing or maintaining the HEB effects after the initial event. The educational materials for these designed promotion activities as shown in Fig. 2.

The designed promotion activities included one "Long-term Exhibition of My Balance Plates (LEMBP) in three caloric levels" and two 3-days spotlight activities: "Matching Game for the six food groups (MG)" and "Do-It-Yourself Healthy Plate (DIYHP)". LEMBP exhibition was a long-term activity which was performed right after the initial event by continuously exhibiting the real-size plates with three different caloric levels and providing the learning resource QR Code Access at the main entrance of the restaurant. The purpose of the long-term BP exhibition was to keep the momentum of practicing HEB and to provide the access of learning resource for knowledge comprehension of healthy eating. MG was a 3-days spotlight activity at the entrance location of the workplace restaurant, which was arranged 6 months after the initial event. Participants who match the food figures with the right food functions could earn a serving of fresh fruit as a reward. The purpose of the MG was to strengthen the participants' comprehension of the six food groups and their unique health functions. DIYHP arranged at seven months after the initial event was also designed as a 3-days spotlight activity at the entrance location of the workplace restaurant. In this activity, the participants were asked to use the online APP to estimate their daily recommended caloric level and the personalized serving numbers of the six food groups. Then, based on the estimations, participants were asked to plan their meals of a day and to construct a plate for one meal by using food piece models provided by the Taiwanese Nutrition and Health Survey team. A serving of fresh fruit was again the reward once the participants made their plates. The purpose of the DIYHP was to enhance participants' ability to make their own healthy plate and to remind them to apply the online APP and learning tools.

2.3. Subjects, instruments, and data collection procedures

The studied subjects were employees who ate lunch in the staff canteen of a selected non-profit organization during the experiment periods. Two self-administered anonymous questionnaires were designed for data collection. The first questionnaire was administered

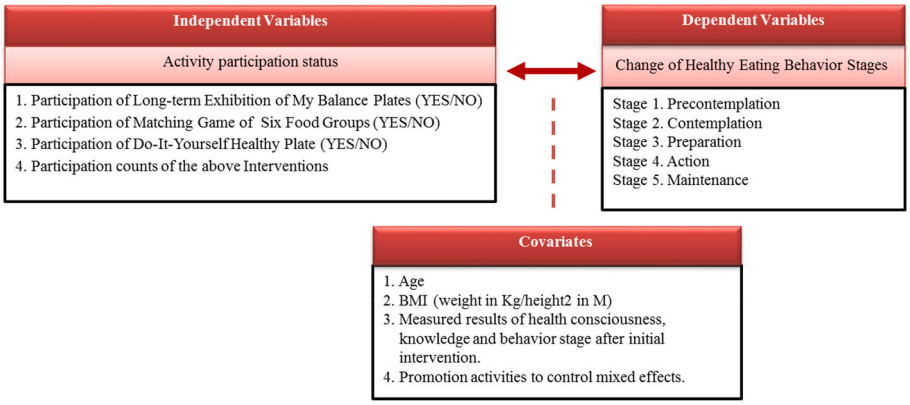

Fig. 1. The proposed outcomes, determinants, and covariates of the study.

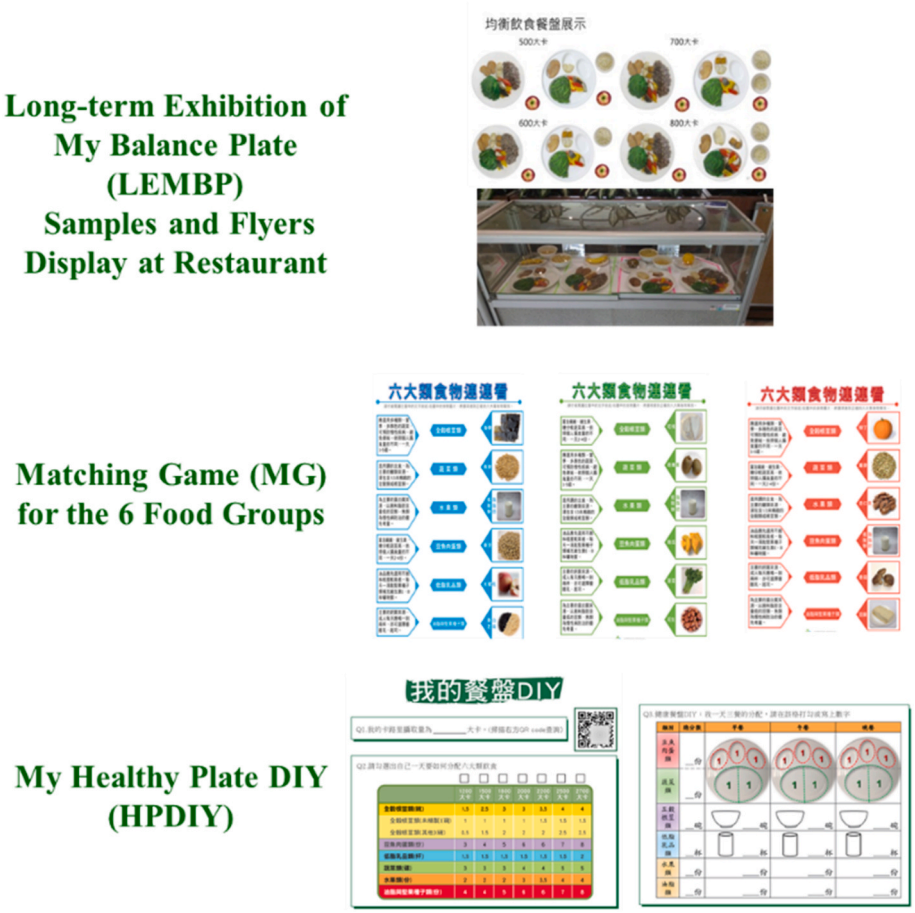

Fig. 2. Educational materials for three designed promotion activities.

three weeks after the days of initial event as Survey 1 and a post-intervention questionnaire was administered one month after the last three-day spotlight activity as Survey 2.

Both questionnaires consisted of (1) demographic questions (sex, age, weight and height for calculating BMI), (2) a five-item single choice question to assess the HEB status, i.e. where individuals were located in the five stages of the "stage of change model", and (3) two multiple-choice with options to provide open-ended answers for reasons and justifications of participant's HEB status.

For measuring the covariates, the survey 1 questionnaire included three questions with five-point Likert scales for assessing healthy eating consciousness and five questions with true-or-false answers for scoring the healthy eating knowledge (one point for each right answer from a total 5 questions). Since the questionnaires consisted of factual questions and scale questions, we invited five experts to participate in the content validity evaluation meeting to modify each question until the consensus was reached.

2.4. Statistical analysis

Data analyses were performed by using IBM SPSS 22. Frequency, percentage, mean, standard deviation, and the lowest and the highest values were estimated to describe the data. Student t-test was employed to analyze changes (pre- and post-value differences) between groups.

Generalized linear model (GZLM) was applied to analyze the participation effects on the status and change of HEB. Significant differences were declared when P<0.05 was detected.

3. Results

Valid questionnaires collected at Survey 1 (n = 260) and Survey 2 (n = 307) were merged and used for the data analysis. A total of 86 participants (males = 37, female = 49) who had completed both questionnaires were included in the analysis.

3.1. Participants' characteristics, HEB and activities participation

Table 1 contains the demographics data of the participants and the descriptive statistics of the measured variables. The 86 participants' age ranged from 21 to 55 years with a mean age of 35.6 years which is not significantly different from the rest of the participants. The average BMI was 22.4. However, there is a significant gender difference in BMI values (P < 0.001) with a higher mean in males (24.03) than in females (21.1). The healthy eating consciousness measured by five-point Likert Scales had a mean of 3.62 for all participants, 3.72 for males and 3.54 for females. For the 5-point healthy eating knowledge, the average score was 4.03 (4.1 for males; 3.98 for females). The initial scores of HEB stage ranged from 1 to 4 with a mean of 2.12 (2.32 for males; 1.96 for females). Post-intervention scores of HEB stage ranged from 1 to 5 with a mean at 1.95 (1.89 for males; 2.00 for females). With regards to the activity participations, over 80% participants had participated at least one activity during the eight-month intervention and follow-up period and 26.7% participants joined all the three activities. A total of 33.7% of the participants (male: 37.8%; female: 30.6%) had paid attention to the LEMBP display activity and about half of participants had participated the three-days promotion activities (MG or DIYHP).

3.2. Participation effects on HEB changes

Table 2 presented the effects of the participation frequency on the change of HEB stages. The significant participation effect was detected in the male participants and in the analysis of males and females combined. Female had a non-significant improving trend. The participants who had participated all three activities presented a significantly greater beta coefficient to show improved (or maintained) staging than those who did not participate any activity (all: β=0.740, 95% CI=0.145–1.336; male: β=1.118, 95% CI = 0.428–1.808).

3.3. The participation effect of each promotion activity

The effect of the individual activity participation was tested by GZLM, shown in Table 3. The participants who had joined the LEMBP activity presented a significant effect on the improved or maintained HEB stage than those who did not participate (all: β = 0.474, 95% CI = 0.023–0.925; male: β= 0.827, 95% CI = 0.262–1.393). Similar phenomenon was detected in the participation of DIYHP among male participants. The male participants who had joined the DIYHP activity presented a significant effect on the HEB stage advancement than those who did not participate (β = 0.670, 95% CI = 0.045–1.294).

4. Discussion

4.1. Full participation of all activities presented positive effects on HEB

The subjects that participated all activities demonstrated significant improved or maintained effects in the post-intervention HEB stage compared to those that participated none of the activities. This result was not due to the influence of differential age, BMI, consciousness, knowledge or the initial HEB stage. And, the directions of the effect are consistent across gender, although the effect was not significant in females. In other words, most individuals with full attendance did not backslide. Therefore, we propose that periodically and consistently providing health eating promotion activities at workplace is a potential strategy to avoid relapse of unhealthy eating after intervention. Nonetheless, how to achieve a high attendance rate remains challenging.

4.2. Participating on LEMBP activity would maintain better HEB

In the health promotion activities we designed, LEMBP was a consistent and continuous exhibition of the health education materials,

Table 1
Descriptive statistics of measured variables (Mean, SD, Range, n, %).

	Overall (N = 86)		Male (N = 37)		Female (N = 49)	
Age (mean, SD, range)	35.6, 6.9	21–55	34.8, 7.4	21–53	36.2, 6.5	22–55
Consciousness[a] (mean, SD, range)	3.62, 0.53	2.33–5	3.72, 0.57	2.67–5	3.54, 0.50	2.33–4.67
Knowledge[a] (mean, SD, range)	4.03, 1.10	1–5	4.10, 1.17	1–5	3.98, 1.05	2–5
Initial-HEB[a,c] (mean, SD, range)	2.12, 0.96	1–4	2.32, 1.11	1–4	1.96, 0.84	1–4
Post-HEB[b,c] (mean, SD, range)	1.95, 1.04	1–5	1.89, 1.02	1–4	2.00, 1.06	1–5
BMI[d,*] (mean, SD, range)	22.4, 3.3	16.7–33.4	24.0, 3.5	16.7–33.4	21.1, 2.5	16.8–8.7
Activity participation (n, %)						
3	23	26.7	8	21.6	9	18.4
2	20	23.3	9	24.3	17	34.7
1	26	30.2	9	24.3	11	22.4
0	17	19.8	11	29.7	12	24.5
LEMBP (n, %)						
Yes	29	33.7	14	37.8	15	30.6
No	57	66.3	23	62.2	34	69.4
MG (n, %)						
Yes	53	61.6	22	59.5	31	63.3
No	33	38.4	15	40.5	18	36.7
DIYHP (n, %)						
Yes	41	47.7	15	40.5	26	53.1
No	45	52.3	22	59.5	23	46.9

*P < 0.05. There are no significant differences between gender in all variables except BMI.
LEMBP, long-term exhibition of my balance plates; MG, matching game; DIYHP. do-it-yourself healthy plate.
[a] Initial scores of healthy eating consciousness, knowledge and behavior stages.
[b] Post-activities scores of healthy eating behavior stages.
[c] The score number of behavior stages: 1= precontemplation, 2=contemplation, 3=preparation, 4=action, 5=maintenance.
[d] Independent *t*-test compared by gender groups.

Table 2
The effects of participation frequency on the change of healthy eating behavior stages.

	Overall				Male				Female			
Frequency	β	SE	95% CI		β	SE	95% CI		β	SE	95% CI	
3	0.740*	0.304	0.145	1.336	1.118**	0.352	0.428	1.808	0.647	0.450	−0.235	1.529
2	−0.052	0.271	−0.582	0.479	0.042	0.336	−0.617	0.700	0.106	0.374	−0.627	0.839
1	−0.037	0.286	−0.597	0.523	−0.575	0.345	−1.251	0.101	0.474	0.397	−0.303	1.251
0	0				0				0			
Covariates												
Age	0.014	0.016	−0.018	0.045	0.014	0.018	−0.022	0.050	0.000	0.024	−0.047	0.046
BMI	0.014	0.032	−0.049	0.077	0.012	0.042	−0.069	0.094	0.024	0.057	−0.087	0.136
Consciousness	0.043	0.219	−0.387	0.473	0.131	0.287	−0.431	0.693	0.152	0.301	−0.438	0.742
Knowledge	−0.027	0.098	−0.219	0.166	0.195	0.124	−0.047	0.438	−0.135	0.139	−0.408	0.138
Initial-HEB	−0.698***	0.122	−0.938	−0.458	−0.870***	0.140	−1.143	−0.596	−0.545**	0.187	−0.912	−0.178

β, beta coefficient; SE, standard error; CI, confidence interval. *P < 0.05, **P < 0.01, ***P < 0.001.

Table 3
The effect of participating each promotion activity on the change of HEB stages.

Parameter	Overall				Male				Female			
	β	SE	95% CI		β	SE	95% CI		β	SE	95% CI	
LEMBP[a]	0.474*	0.230	0.023	0.925	0.827**	0.289	0.262	1.393	0.224	0.317	−0.397	0.846
MG[a]	−0.150	0.257	−0.654	0.354	−0.341	0.320	−0.969	0.287	0.109	0.352	−0.580	0.799
DIYHP[a]	0.331	0.247	−0.154	0.816	0.670*	0.319	0.045	1.294	0.078	0.357	−0.622	0.778
Covariates												
Age	0.011	0.017	−0.021	0.043	0.013	0.020	−0.025	0.051	0.003	0.025	−0.045	0.051
BMI	0.030	0.032	−0.032	0.092	0.055	0.043	−0.028	0.139	0.039	0.057	−0.072	0.151
Consciousness	0.035	0.222	−0.400	0.469	0.063	0.300	−0.524	0.649	0.160	0.312	−0.451	0.771
Knowledge	−0.025	0.100	−0.220	0.170	0.129	0.128	−0.123	0.380	−0.116	0.146	−0.402	0.169
Initial-HEB	−0.673***	0.123	−0.915	−0.431	−0.841***	0.145	−1.12	−0.557	−0.501**	0.193	−0.880	−0.123

β, beta coefficient; SE, standard error; CI, confidence interval; LEMBP, long-term exhibition of my balance plates; MG, matching game; DIYHP, do-it-yourself healthy plate.
*P < 0.05, **P < 0.01, ***P < 0.001.
[a] The participation status of the other two promotion activities were included as covariates for any given activity.

located at the entrance of the workplace restaurant. There, we had real-size custom-made dining plates filled with designated amounts of food models for three levels of caloric intakes, while at the same time providing related online resources for healthy eating via QR code. Such exhibition allows participants of interest to stay informed by creditable channels on health knowledge. We found that the participants who actively sought and engaged for further information about LEMBP had a significantly greater improvement on HEB stage (results showed as Table 3). This result suggests long-term health-eating exhibition and handy online resources along with periodical promotion activities can help to reduce backsliding of HEB stages, suggesting better healthy eating habits.

4.3. The gender differences were found on the participation effects

Major gender differences observed in our study are summarized and discussed here.

First, males on average had higher BMI than females prior to the intervention. About 40% male participants were overweight (24 < BMI < 27) and obese (BMI > 27) based on the BMI cut-offs in Taiwanese population, compared to fewer than 10% among female participants. This difference is in concordant with the published data of Nutrition and Health Survey in Taiwan (NAHSIT) during the 2013–2016 surveillance period [31]. The other two gender differences were on the participation frequency distribution and on the participation status of the LEMBP and the DIYHP. Male participants demonstrated a more significant improvement and maintenance effects on self-reported healthy eating stages than female participants. These differences were not due to those of covariates, but in line with some previous literatures, such that people (males in this case) with higher BMI and confronted with metabolic diseases might present higher motivation in practice HEB [15]. Furthermore, we observed that HEB improvement (the change of HEB stages) was associated with more frequent participation of intervention activities in males despite overall backslide of the mean HEB, indicating those who did not or less participate may had done worse in post-intervention evaluation than the baseline. In contrast, intervention effect was not apparent in females.

5. Limitation

1. Those who remained either in the Stage 1 or Stage 5 had no room for regression or improvement, which may result in underestimation of the improvement and challenge the data interpretation. However, if we dichotomized people to improved stage or remained at the highest stage as the outcome vs no improvement, the results were similar to the above.
2. This study was conducted with employees who ate lunch at the employee restaurant in a large non-profit academic organization. The application of the result from this study to other work settings needs further confirmation.

6. Conclusions

National reports from the Nutrition and Health Survey in Taiwan have pointed out that prevalence rates of obesity and metabolic disorders continue to rise among young males in Taiwan [31]. The approach to target healthy eating at the workplace is therefore very critical. This worksite intervention study to promote HEB demonstrated potential efficacy in improving and maintaining HEB among the young to middle-aged adults. As for the effects of the HEB health-promoting activities, our studies found the following. (1) Long-term health-promoting exhibition and user-friendly online resources that are highly accessible is an effective strategy in targeting workplace adults. (2) Within-worksite spotlight activities are helpful in reinforcing HEB

conscience and healthy eating behavior. Future research shall address the reasons underlying the limited impact of the current intervention on the female population.

7. Implications for practice and policy

Health policy should consider to design continuous health promotion activities for enhancing and maintaining the intervention effects of HEB and at the same time to provide ready-to-retrieve self-learning resources and tools to support the implementations of health promotion at workplace.

Ethical approval

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Medical Ethics Committee of National Health Institutes, R.O.C. IRB numbers are EC1040902-E-R2 and EC1040902-E-R3. Signed inform consent were not required since the data were collected by anonymous questionnaires.

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Competing interests

None.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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