

Promoting physical activity among physically inactive people with impaired glucose tolerance and/or impaired fasting glucose: a clustered randomised controlled trial (abridged secondary publication)

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KEY MESSAGES

1. The intervention programme increased moderate/vigorous physical activity and related perceptions (eg perceived self-efficacy) among sedentary pre-diabetes patients.
2. Detection of pre-diabetic status plus supply of simple information improved moderate/vigorous physical activity levels.
3. Community-based screening could identify sedentary pre-diabetic cases.
4. Most participants were satisfied with the programme and would recommend it to others.

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Introduction

The prevalence of diabetes mellitus (DM) among Hong Kong adults is high, as is the prevalence of pre-diabetes (impaired glucose tolerance and/or impaired fasting glucose). Up to 70% of pre-diabetes patients eventually develop DM.¹ Risk factors of DM include older age, obesity, family history of DM, physical inactivity, and gestational diabetes. The large-scale Da Qing randomised controlled trial reported that moderate/vigorous physical activity (MVPA) of >150 minutes/week reduced the DM incidence by 41.1% among patients with impaired glucose tolerance.²

The Health Belief Model was used to design the intervention programme. The model has been applied to promote physical activity, with perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cue to action, and self-efficacy as determinants of health-related behaviours.³ In Hong Kong, 47.7% of the population reside in public housing estates and are of lower socio-economic status and older age, which are factors of DM and low testing rate.

Using clustered randomised controlled trial design, we tested efficacy of a theory-based, support-group-based, and setting-based intervention in increasing MVPA level in the last week and related cognitions such as the Health Belief Model

constructs among Chinese adults aged 40 to 69 years who had impaired glucose tolerance or impaired fasting glucose (based on the oral glucose tolerance test) and were sedentary (<150 minutes of MVPA in the last week). Mechanisms that potentially explain any intervention effect were explored.

Methods

According to the 2006 World Health Organization, DM is defined as a fasting plasma glucose level of ≥ 7.0 mmol/L or a 2-hour plasma glucose level of ≥ 11.1 mmol/L. According to the American Diabetes Association, impaired glucose tolerance and impaired fasting glucose were defined as a fasting plasma glucose level of < 7.0 mmol/L and ≥ 5.6 to ≤ 6.9 mmol/L, respectively, and a 2-hour plasma glucose level of ≥ 7.8 to < 11.1 mmol/L and < 7.8 mmol/L, respectively.

In phase I of the study, Chinese adults aged 40 to 69 years who resided in four public housing estates in Shatin were screened for DM risk using a risk-assessment questionnaire. Those who scored ≥ 12 and had < 150 minutes of MVPA in the last week (based on the International Physical Activity Questionnaire [IPAQ]) were invited to take an oral glucose tolerance test.

In phase II of the study, inclusion criteria were (1) impaired glucose tolerance and/or impaired

fasting glucose, (2) <150 minutes of MVPA in the last week, and (3) provision of written informed consent. The four public housing estates in Shatin were equally randomised into the intervention and the control groups.

In the intervention group, there were three meetings to address different issues that participants might experience. Examples of meeting activities included presentations, games, contests, and exercise demonstrations, designed to generate participants' motivation to increase physical activity, reinforce their cognitive changes and foster their maintenance of MVPA level. After accredited instructors assessed participants personally to clear safety issues, participants were introduced a scheme to achieve MVPA of 150 minutes/week through easy-to-do activities, with personal adjustment suggested. Four support groups were formed. Group members performed weekly group brisk walking, joined subsidised social gathering, and encouraged each other to increase MVPA.

In the control group, participants received a booklet about physical activity only.

Outcome measures included the amount of MVPA (minutes) in the last week, oral glucose tolerance test result, blood pressure, and cognitions related to the Health Belief Model (e.g. perceived self-efficacy). Assessments were conducted at baseline and at month 7 and month 10 (1 and 4 months after completion of the 6-month phase II study).

Results

Background characteristics of the intervention and control groups were comparable, including the prevalence of fulfilling the 150-minute MVPA recommendation. The intervention group was more efficacious in increasing the MVPA level than the control group. The intervention group also had significantly higher perceived self-efficacy, perceived susceptibility, perceived benefits, and perceived barrier than the control group.

Most participants in the intervention group found the programme useful/very useful in increasing knowledge on diabetes/benefits of physical activity, and received strong support from group members for increasing their MVPA. Over 90% of participants in both intervention and control groups felt satisfied/very satisfied with the programme and would recommend it to others. The intervention group showed greater subjective improvement in health and mood and stronger confidence in maintaining their physical activity level in the future than the control group.

At month 7, the intervention group showed significantly larger increase in perceived self-efficacy in performing the recommended MVPA level than the control group; perceived self-efficacy

also partially explained the intervention effect on increasing mean MVPA time.

Discussion

Residents of public housing estates were responsive to our screening plus free oral glucose tolerance test programme. This programme allows for earlier detection of DM. The control group that were given only simple printed materials showed significant increase in MVPA, with about 50% meeting the 150-minute MVPA recommendation at month 7 and month 10, compared with 0% at screening. Therefore, knowing the pre-diabetic status and being given basic health promotion significantly increased the MVPA level, with the increase sustained for a 10-month period. This finding justifies implementation of a large-scale community-based screening plus oral glucose tolerance test.

In the intervention group, the increase in MVPA level was even higher, with the prevalence of meeting the 150-minute MVPA recommendation being close to 70% at month 7 and month 10, compared with 0% at screening. It is likely that the higher level of MPVA achieved could be maintained, as both intervention and control groups showed high prevalence of behavioural intention to perform ≥ 150 minutes/week of MVPA at follow-up period.

Components corresponding to constructs of perceived self-efficacy, perceived barriers, perceived benefit, perceived susceptibility, perceived severity, and cue to action were built into the programme. The larger increase in perceived self-efficacy in the intervention group partially explained the intervention effect on the mean MVPA time. The findings were consistent with the theory used and the intervention contents.

The process evaluation further showed that not only was knowledge increased, participants subjectively felt improvement in health and mood, and were highly satisfied with the programme. Such positive experiences are important in maintaining newly formed health-related behaviours. Most participants would recommend the programme to others, confirming feasibility and acceptance of the programme.

The setting in public housing estates facilitated social interaction, group exercises, and utilisation of local resources (e.g. exercise classes held in the estates). Some participants in the intervention group pledged to serve as volunteers of similar programmes in the future.

Limitations

The MVPA data were self-reported. The sample size was relatively small. The follow-up period was 10 months; longer-term intervention effect needs to be ascertained. The housing estates, though typical,

were not randomly selected, and included only four clusters. More studies are needed to understand responses of similar programme with and without subsidisation.

Conclusion

The programme included (1) screening of sedentary individuals at-risk of DM using a risk assessment questionnaire, (2) identifying pre-diabetes using the oral glucose tolerance test, and (3) promoting MVPA among sedentary elderly people with pre-diabetes through a theory-based and support-group-based intervention. The intervention programme was effective in increasing MVPA levels and related cognitions. Perceived self-efficacy partially explained the intervention effect. Consistencies across the applied theory (Health Belief Model), the intervention design, and the findings demonstrated that this was a theory-based study. The study was menu-based and is highly replicable.

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