

A multimodal approach to improve asthmatic adolescents' self-efficacy in Taiwan

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Background: An efficient asthma self-management for adolescents must be based on adolescents' needs, increase self-efficacy and adherence to treatment. The effects of such program are likely be dose dependent.

Aim: To examine the impact of the dose-effect of multiple components on an asthma self-management program for adolescents aged 12–18 years in Taiwan.

Methods: A scoring system was developed to classify intervention groups into high- (19–23), medium- (11–18) and low (< 11) dose according to the number of components completed by participants. The impacts of the dose level on outcomes of asthma self-efficacy, prevention behaviors, asthma medication adherence, and asthma symptoms were examined.

Results/Conclusion: Our results suggest that a high dose of the intervention can improve adolescents' self-efficacy, asthma prevention behavior, and medication adherence.

Trial Registration: Trial Registration No: ACTRN12613001294741.

Keywords: adolescents, asthma, secondary data analysis, dose-effect, self-efficacy.

Introduction

Adolescents aged 10–14 y with asthma have a lower adherence to prescribed medications compared with other age groups and this can lead to poorer health outcomes and more emergency department (ED) visits.¹ National Taiwan statistics show an ED visit rate of 14.1% in adolescents, with only 9.7% of the young people using bronchodilators when having an asthma attack compared with a 1.6% ED visit rate and 60% of adults, respectively.²

Effective asthma self-management for adolescents must be based on adolescents' needs, increase self-efficacy and adherence to treatment, reduce exacerbations and improve overall quality of life.³ The effects of such programs are likely be dose (the quantity and strength of the program delivered) dependent.⁴

Methods

A secondary data analysis of a randomized controlled trial^{5,6} dataset was undertaken to evaluate the effects of intervention dose. Recruited adolescents aged 12–18 y were randomly allo-

cated to either the control or the intervention group. The end-points of asthma management self-efficacy, preventive behaviors and asthmatic symptoms were measured by the Self-efficacy and Prevention Behavior Index³ and Asthma Control Test questionnaires.⁷ The outcome of asthma medication adherence was examined via patients' self-report diaries.

A scoring system was developed and used to categorize participants (n=83) into three groups (high-, medium- and low-dose) according to completing different components of the intervention.⁴ Patients who completed all the components had a total dose score of 23 (12+2+8+1) comprising: 4×3 times face-to-face meetings; 2×1 telephone consultation; 1×8 text messages; and/or 1×1 booklet. The intervention dose was categorized into high (19–23), medium (11–18) and low (<11) according to the number of components completed.

An ANOVA was used to determine differences in continuous variables between the low-, medium- and high-dose groups. For data that were not normally distributed (i.e. medication adherence), the Kruskal–Wallis test was used. Categorical variables were compared with a χ^2 test.

Table 1. Mean differences in self-efficacy, preventive behavior, symptoms of asthma and asthma medication adherence

Group/outcome	Intervention (n=40)			ANOVA	Pairwise comparison ¹
	Control (n=43)	Medium (11–18) (n=14)	High (19–23) (n=26)		
Self-efficacy				F=3.7 (p=0.03)	High>low (p=0.038)
M (SD) at baseline	85.1 (22.4)	87.2 (26.5)	93.4 (19.2)		
M (SD) at week 4	91.7 (26.6)	106 (26.2)	112 (20.6)		
Differences within group (paired t-test)	t=2.27 (p=0.03)	t=2.94 (p=0.01)	t=5.09 (p=0.00)		
Preventive behavior				F=7.0 (p=0.002)	High>low (p=0.02) Medium>low (p=0.002)
M (SD) at baseline	20.6 (5.5)	19.2 (4.3)	21.5 (5.1)		
M (SD) at week 4	21.3 (5.0)	24.1 (4.3)	24.9 (5.0)		
Differences within group (paired t-test)	t=1.25 (p=0.23)	t=5.95 (p=0.00)	t=3.32 (p=0.03)		
Asthmatic symptoms				Kruskal-Wallis $\chi^2=5.07^{ns}$	
Mean ranks	38.4	36.2	50.7		
Medication adherence				$\chi^2=10.61$ (p=0.01)	High>low (p=0.004)
Mean ranks	33.94	51.04	50.46		

^{ns}, non-significant.

¹Pairwise comparisons were made to determine which pairs of groups differed significantly.

Results and Discussion

A total of 83 patients completed the study. There were no significant differences in demographic data among the three groups. Average time to asthma diagnosis was 6.09 y. The majority of adolescents were male (n=47, 56%, p=0.18), with a median age (IQR=3) of 14 y (p=0.37). The median time to diagnosis with asthma was 6.0 (IQR=5), 6.5 (IQR=7.5) and 4.5 (IQR=7) y for participants in the low-, medium- and high-dose Asthma Self-Management Program (ASMP), respectively (p=0.60).

The results examined by ANOVA revealed that participants who completed all components (high dose) had significantly greater self-efficacy, prevention behaviors and medication adherence than the low-dose group (see Table 1 for the mean differences). This is an improvement over previously implemented approaches that failed to improve asthma self-management in adolescents.³ The high-dose group demonstrated adolescents' improved self-confidence ($F(2, 80)=3.7$, p=0.03) in carrying out asthma self-management behaviors ($F(2, 80)=7.04$, p=0.002). It is likely that varied channels used in ASMP enhanced patients' learning interests and subsequently enabled behavioral changes.⁴

The results of adherence to asthma medication from the Kruskal-Wallis test showed that there was a statistically significant effect of ASMP dose on medication adherence ($\chi^2=10.6$, p<0.01), with a mean rank of asthma adherence of 38.4 for the low dose of ASMP, 36.2 for the medium dose of ASMP and 50.7 for the high dose of ASMP. Pairwise comparisons were made to determine which pairs of groups differed significant. The only significant difference in medication adherence among the groups was between patients who had received a high dose of ASMP and those who had received a low dose ($U=333.5$, p<0.01). The

scores of the asthma control test measuring asthmatic symptoms among the three dose groups after completion of the intervention ($\chi^2=5.07$, p=0.08) suggested that the ASMP did not produce any significant improvement (Table 1).

The results suggest that multiple delivery modes (face-to-face, telephone follow-ups and text messages) can contribute to effective preventive behaviors. The face-to-face meeting encourages interactions between facilitators and participants; therefore, it is more likely to have an influence on promoting commitment to behavior change.⁴ An additional point of concern noted was the length of time to asthma diagnosis (median 5 y). This highlights a need for further research and resources for young people to be diagnosed and learn effective self-management techniques in a timely manner.

Limitations

Some limitations must be noted. First, there were the potential accumulative effects of the intervention. Our study reported the dose effect of a multicomponent ASMP. However, comparisons of outcomes from individual components (face-to-face, telephone or text messages) were not examined. Thus, there is the possibility of overestimating the effect of the intervention. Second, participants who did not receive all components of ASMP may have reported fewer outcomes. Third, age-stratified analysis was not conducted, and the outcome of adherence may vary between a 12- and an 18-y-old participant. Another limitation acknowledged is the dependence on self-reported diaries of medication adherence. Patients in the low or medium group may be adhering to their medication regimen, but not reporting adherence in their diaries.

Practical implications

High dose levels through multiple components resulted in an increase in self-efficacy, preventive behaviours and treatment adherence. It is important to note that as long as the medium dose was reached, asthma preventive behaviors were positively impacted. Hence, it is recommended to aim for high dose levels of intervention in the planning phase of delivering asthma self-management programs for adolescents, in order to reach at least a medium dose level for the majority of participants in the implementation phase.

Conclusion

Our results suggest that a high dose of ASMP can improve adolescents' self-efficacy, asthma prevention behavior and medication adherence.

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Data availability: Data sharing is not applicable to this article as no new data were created.

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