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The effectiveness of the Complete Health Improvement Program (CHIP) in Australasia for reducing selected chronic disease risk factors: a feasibility study

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Abstract

Aim To examine the effectiveness within the Australasian context of the Complete Health Improvement Program (CHIP) lifestyle intervention, which has been shown to produce meaningful reductions in selected chronic disease risk factors in the United States.

Methods Changes in body weight, blood pressure, blood lipid profile and fasting plasma glucose were assessed in 836 self-selected participants (age=55.9±12.7 yrs, 35% male/65% female) from 18 sites throughout New Zealand (N=731) and Australia (N=105).

Results In the 30 days of the program, significant overall reductions ($p<0.001$) were recorded in the participants' body mass (-3.8%; 87.1±22.4 versus 83.9±21.5 kg), systolic blood pressure (-5.6%; 135±19 versus 127±17 mmHg), diastolic blood pressure (-4.6%; 80±12 versus 76±12 mmHg), total cholesterol (-14.7%; 5.17±1.08 versus 4.41±0.96 mmol/L), low-density lipoprotein cholesterol (-17.9%; 3.17±0.95 versus 2.60±0.83 mmol/L), triglycerides (-12.5%; 1.51±0.98 versus 1.32±0.71 mmol/L) and fasting plasma glucose (-5.6%; 5.55±1.49 versus 5.24±1.11 mmol/L). Participants at program entry with the highest classifications of total cholesterol, low-density lipoprotein, triglycerides and fasting plasma glucose experienced over 20% reductions in these measures in 30 days.

Conclusions Significant reductions in selected chronic disease risk factors were observed in 30 days using the CHIP intervention and the improvements were comparable to that observed in cohorts from the United States. The results of this feasibility study indicate that lifestyle interventions like CHIP may be useful for combating the burgeoning epidemic of chronic disease and further research is warranted.

Chronic diseases are the major cause of death and disability throughout Australasia and are a burden on sufferers, carers, communities and the population at large.[1] There is an increasing awareness that Lifestyle Medicine, which involves the application of environmental, behavioural and motivational principles to the management of lifestyle related health problems,[2] is efficacious for the primary, secondary and even tertiary prevention of chronic diseases.

The Complete Health Improvement Program (CHIP) is an intensive, community-based lifestyle intervention that originated in the United States and has demonstrated significant benefits for the management of cardiovascular disease,[3–5] type 2 diabetes mellitus[5] and depression.[6,7]

The 30-day program, involving 16 group sessions, encourages participants to move towards a distinctive plant-based diet, become physical activity, abstain from substance use and practice stress management techniques.

The objective of the CHIP intervention is to educate and empower individuals towards intelligent self-care through enhanced understanding of the epidemiology and aetiology of many chronic diseases while providing the skills and support to enable positive behaviour change.[3]

The CHIP intervention has been delivered in a variety of community settings by both health professionals[4] and non-health trained volunteers who were equipped with a comprehensive package for delivering the program.[5] It is estimated that over 50,000 individuals have completed the program in the United States.[8]

The aim of this study was to examine the potential effectiveness of the CHIP intervention in the Australasian context for reducing selected risk factors for chronic disease.

Methods

The study examined the changes in selected chronic disease risk factors of 836 individuals (age = 55.9±12.7 yrs, 35% male/65% female) who chose to participate in one of 31 CHIP interventions presented in 18 locations throughout Australasia (731 participants from 14 sites in New Zealand and 105 participants from 4 Australian sites).

The programs ranged in size from 5 to 101 participants (mean group size = 26.3±23.0). Consent for the study was obtained from Avondale College of Higher Education Human Research Ethics Committee (Approval No. 20:10:07). Participants were encouraged to engage in the program in consultation with their personal health care provider.

The CHIP interventions were advertised in the local media (newspapers, radio) of the communities in which the programs were being offered and in some instances local medical practitioners recommended their patients to the program. Of the 836 participants who enrolled in the program, 790 (94%) completed the 30-day intervention after which they were encouraged to join a support group that met monthly.

Participants were deemed to have completed the program if they attended 13 of the 16 sessions and underwent both pre and post-intervention blood testing. As shown in Table 1, at program entry the participants were representative of an at-risk population with a mean BMI in the 'obese' category (31.2 kg/m^2), borderline 'prediabetic' fasting plasma glucose (FPG) levels (5.55 mmol/L), and elevated systolic blood pressure (134.8 mmHg) and low-density lipoprotein (LDL) cholesterol levels (3.17 mmol/L).

The programs were facilitated by volunteer directors (age = 55.1±9.5, 5 males/13 females) who had an interest in positively influencing the health of members of their local community. The volunteer directors were not required to be health professionals, although 6 of the 18 were.

All directors underwent two days of training to develop group facilitation skills after which they were provided with a comprehensive CHIP resource package that included a curriculum guide for program delivery, 16 pre-recorded educational lectures presented by qualified experts, a cookbook and participant textbook and journal. The role of the volunteer director was to organise and facilitate the proceedings of the group sessions, not to educate. Even in the case that the director had medical training, the supplied resources were used and the program delivery was consistent.

The CHIP intervention involved 16 two-hour group sessions over 30 days. Each session typically involved viewing a one-hour pre-recorded lecture, a cooking demonstration, group discussion and a behaviour change challenge. Also incorporated into the program when local health experts could be sourced were shopping tours, nutrition workshops and guided exercise sessions. Participants paid a fee of approximately $250 to cover the cost of venue hire, food samples distributed throughout the program, resources including reading materials and pedometer, and biomedical assessments.

Table 1. Mean changes in selected chronic diseases risk factors from baseline to post-intervention

Factor	N	Baseline Mean (SD)		Post-intervention Mean (SD)		Mean Change	% Change	t statistic	p value
Weight (kg)	790	87.1	(22.4)	83.9	(21.5)	-3.2	-3.8%	37.5	<0.001
BMI (kg/m^2)	718	31.2	(7.7)	30.0	(7.4)	-1.2	-3.8%	37.2	<0.001
SBP (mmHg)	787	134.8	(19.0)	127.4	(16.7)	-7.6	-5.6%	13.4	<0.001
DBP (mmHg)	787	80.0	(11.5)	76.3	(11.5)	-3.7	-4.6%	10.7	<0.001
TC (mmol/L)	779	5.17	(1.08)	4.41	(0.96)	-0.76	-14.7%	30.0	<0.001
LDL (mmol/L)	775	3.17	(0.95)	2.60	(0.83)	-0.57	-17.9%	26.1	<0.001
HDL (mmol/L)	779	1.32	(0.36)	1.21	(0.32)	-0.11	-8.3%	15.8	<0.001
TG (mmol/L)	778	1.51	(0.98)	1.32	(0.71)	-0.19	-12.5%	6.7	<0.001
FPG (mmol/L)	772	5.55	(1.49)	5.24	(1.11)	-0.31	-5.6%	7.6	<0.001

BMI – Body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure; TC – Total cholesterol; LDL – low density lipoprotein; HDL – high density lipoprotein; TG – triglycerides; FPG – fasting plasma glucose; SD – Standard deviation.

The CHIP intervention advocated daily exercise (30 minutes of moderate intensity or 10,000 steps) and included elements of positive psychology, but nutrition was the focus of the program. The intervention advocated a distinctive eating pattern as participants were encouraged to move towards a whole food, plant-based diet *ad libitum*, with emphasis on the consumption of whole-grains, legumes, fresh fruits and vegetables. This diet was recommended in order to achieve a daily target of fewer than 20% of calories from fat and less than 10 teaspoons of added sugar, 5,000 mg of salt (2000 mg of sodium) and 50 mg of cholesterol. Participants were also encouraged to consume 2 - 2.5 litres of water daily.[3]

At the beginning and end of the program the participants' height, weight, blood pressure and 12-hour fasting blood samples were taken. The blood samples were collected by trained phlebotomists and analysed by local pathology laboratories for total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglycerides (TG) and fasting plasma glucose (FPG) levels.

Statistical analysis—The data were analysed using PASW™ Statistics (version 18) software. Data are expressed as mean ± standard deviation. Paired t-tests were used to assess changes in the biometric measures from baseline to post-intervention, both for the overall and stratified data. McNemar Chi-squared test was used to determine changes from program entry to post-intervention in the distribution of participants across the various risk factor categories. Cohen's d statistic was calculated to present effect size.

Results

The participants' mean changes from baseline to post-intervention are presented in Table 1. Significant reductions were recorded in all the biometrics with the most notable being in TC, LDL and TG. While HDL also decreased following the intervention, the TC to HDL ratio improved from 3.92:1 to 3.64:1 ($p<0.001$). Table 2 displays the stratified data using conventional risk factor categories. The National Cholesterol Education Program Adult Treatment Panel III classification system[9] was used to categorise the participants for all risk factors except TC. The Framingham classification[10] was used for the TC data as it includes five categories, compared to three in the ATP III classification, thus allowing a more detailed analysis of the effect of the intervention on the highest risk participants.

Table 2. Changes in chronic disease risk factor levels within 30 days according to initial risk factor classification

Risk Factor	N Baseline	N Post-intervention	Chi-squared* (p)	Baseline Mean (SD)		Post-intervention Mean (SD)		Mean Change	% Mean Change	p value	Cohen's d
BMI (kg/m^2)											
18.5–24.9	137	168	78 (<0.001)	22.7	(1.6)	22.2	(1.6)	-0.6	-2.5%	<0.001	0.313
25–30	216	234		27.5	(1.4)	26.5	(1.4)	-1.0	-4.8%	<0.001	0.714
> 30	350	301		36.9	(7.0)	35.5	(6.9)	-1.4	-3.8%	<0.001	0.201
SBP (mmHg)											
<120	189	312	120 (<0.001)	112.9	(7.6)	114.2	(11.4)	1.3	1.2%	0.119	-0.134
120–139	314	297		130.2	(4.9)	125.1	(12.6)	-5.1	-3.9%	<0.001	0.533
140–160	226	151		148.9	(6.6)	136.5	(15.4)	-12.4	-8.3%	<0.001	1.047
>160	58	27		177.1	(12.7)	147.4	(16.5)	-29.7	-16.8%	<0.001	2.017
DBP (mmHg)											
<80	349	446	80 (<0.001)	70.1	(6.5)	70.2	(8.9)	0.1	0.1%	0.872	-0.013
80–89	277	258		82.9	(2.8)	78.2	(8.5)	-4.6	-5.5%	<0.001	0.743
90–100	133	63		93.5	(3.6)	84.2	(9.7)	-9.4	-10.1%	<0.001	1.271
>100	28	20		108.8	(5.3)	93.7	(10.9)	-15.1	-13.9%	<0.001	1.762
TC (mmol/L)											
< 4.00	93	268	407 (<0.001)	3.49	(0.40)	3.23	(0.55)	-0.26	-7.4%	<0.001	0.541
4.00–5.20	334	371		4.62	(0.37)	4.03	(0.59)	-0.59	-12.7%	<0.001	1.198
5.21–5.99	172	94		5.59	(0.21)	4.74	(0.63)	-0.85	-15.2%	<0.001	1.810
6.00–6.99	143	40		6.39	(0.29)	5.23	(0.74)	-1.16	-18.2%	<0.001	2.064
>7.00	37	6		7.62	(0.49)	6.01	(0.99)	-1.61	-21.1%	<0.001	2.061

LDL (mmol/L)											
<2.50	215	381	296 (<0.001)	2.06	(0.41)	1.80	(0.50)	-0.26	-12.6%	<0.001	0.569
2.50-2.99	140	171		2.79	(0.14)	2.39	(0.48)	-0.40	-14.3%	<0.001	1.131
3.00-4.00	271	181		3.49	(0.29)	2.84	(0.58)	-0.64	-18.3%	<0.001	1.418
>4.00	149	42		4.55	(0.45)	3.50	(0.72)	-1.05	-23.1%	<0.001	1.789
HDL (mmol/L)											
<1.00	147	201	96 (<0.001)	0.86	(0.10)	0.85	(0.12)	-0.01	-1.2%	0.546	0.091
1.00-1.55	439	470		1.26	(0.16)	1.17	(0.19)	-0.09	-7.1%	<0.001	0.512
>1.55	193	108		1.81	(0.23)	1.58	(0.29)	-0.24	-13.3%	<0.001	0.879
TG (mmol/L)											
<1.00	233	282	38 (<0.001)	0.75	(0.15)	0.82	(0.29)	0.08	10.7%	<0.001	-0.303
1.00-2.25	433	428		1.47	(0.33)	1.33	(0.48)	-0.15	-10.2%	<0.001	0.340
>2.25	112	68		3.21	(1.47)	2.31	(0.98)	-0.91	-28.3%	<0.001	0.720
FPG (mmol/L)											
<5.60	530	605	55 (<0.001)	4.91	(0.42)	4.87	(0.56)	-0.04	-0.8%	0.067	0.081
5.60-7.00	177	129		6.02	(0.39)	5.53	(0.55)	-0.48	-8.0%	<0.001	1.028
>7.00	65	38		9.47	(2.28)	7.42	(2.27)	-2.05	-21.6%	<0.001	0.901

BMI – Body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure; TC – Total cholesterol; LDL – low density lipoprotein; HDL – high density lipoprotein; TG – triglycerides; FPG – fasting plasma glucose; SD – Standard deviation. * McNemar Chi-squared test. SD – Standard deviation.

Participants who presented to the program with the highest risk factor classifications tended to experience the greatest improvements and the effect sizes were large.

Participants who entered the program with TC levels above 5.2 mmol/L experienced a mean reduction of 1.05 mmol/L which, according to the algorithm generated through meta-analysis by Gould and colleagues,[11] would result in a 19% decrease in the relative risk for all-cause mortality, a 26% reduced risk for coronary heart disease related mortality and a 31% reduced risk of a cardiac event.

As shown in Table 2, many of the participants who presented with the highest risk factor classifications at program entry had moved to lower risk factor classifications by the end of the intervention. Only 6 of the 39 individuals with TC levels above 7.0 mmol/L at program entry maintained these levels post-intervention. Of the 68 individuals with FPG levels indicative of diabetes at baseline, 30 (44%) reduced their scores below 7.0 mmol/L in the 30 days.

A comparison of the risk factor reductions observed in this study with those recently reported in a cohort of over 5,000 CHIP participants from the United States[5] is presented in Table 3. Clearly, similar outcomes were observed in this study and the United States cohort.

Table 3. Comparison of the mean changes in selected chronic disease risk factors from baseline to post-intervention in the present study and CHIP participants from the United States

Factor	% Change	
	Australasian CHIP (N=787)	US CHIP* (N=5070)
BMI	-3.8%	-3.2%
SBP	-5.6%	-4.9%
DBP	-4.6%	-5.3%
TC	-14.7%	-11.0%
LDL	-17.9%	-13.0%
HDL	-8.3%	-8.6%
TG	-12.5%	-7.7%
FPG	-5.6%	-6.1%

BMI – Body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure; TC – Total cholesterol; LDL – low density lipoprotein; HDL – high density lipoprotein; TG – triglycerides; FPG – fasting plasma glucose.
* From Rankin et al.[5]

While the low numbers in some of the program groups did not allow statistical comparisons, there was considerable variability between the groups in the extent of change observed in the outcome measures.

Discussion

The findings of this Australasian study supports data from the United States, suggesting that the CHIP lifestyle intervention appears to produce meaningful reductions in selected chronic disease risk factors in the Australasian context. The

outcomes observed were comparable between both regions, with the greatest reductions among those with the greatest risk. However, caution in the interpretation of the findings is required because of a number of limitations.

Several confounders may explain the magnitude of the changes in the chronic disease risk factors observed in this feasibility study. Firstly, as the participants were self-selected, they likely entered the program with an elevated readiness for change and hence willingness to engage in the intervention.

In accordance with the transtheoretical model of behaviour change,[12] a key objective of the first few sessions of the CHIP intervention is to move participants from pre-contemplation to action. Yet the participants were probably beyond the pre-contemplation stage at program entry. It would be interesting to compare the outcomes observed in this study with participants who had not shown an initial interest in the program.

Secondly, in the absence of a control group, the extent to which regression to the mean explains the observed improvements cannot be determined. Consistent with regression to the mean is that the individuals with the most extreme baseline measures tended to experience the greatest improvements and hence inclination towards the norm. However, given the large size of the sample and that in some of the outcomes measures the high risk classifications moved 1.5 to 2 standard deviations, regression to the mean likely only explains a small component of the observed results.

Noteworthy, several studies of the CHIP intervention in the United States have demonstrated the effectiveness of the program using a randomised control design and the magnitude of change observed in the present study is similar to the treatment groups of these studies.[4] Certainly, a randomised control trial is need in the Australasian setting to extend upon the work done in this feasibility study.

The final potential confounder of the outcomes observed in this study is the Hawthorne effect. While the research team were not responsible for conducting all the interventions, the participant's behaviours and level of engagement with the program was undoubtedly influenced by the blood measures taken pre and post-intervention.

Given that the pre and post blood work is a standard component of the CHIP intervention, improvements achieved as a result of these accountability measures could be considered part of the intervention itself. However, further research is needed to elucidate the influence of the unique lifestyle recommendations of the CHIP intervention—namely its emphasis on a whole-food, plant-based eating pattern—from the motivational properties of the pre and post-intervention measurements made on the participants. Certainly, the inclusion of accountability measures is likely to be an important component of lifestyle interventions targeting chronic disease.

Notwithstanding the limitations in the research design, the results of this feasibility study are noteworthy given the size of the sample and the large effect sizes observed. Indeed, the results of this study indicate that the CHIP intervention shows promise for the management of chronic diseases in the Australasian context.

It is noteworthy that in only 30 days over 20% improvement was observed in the participants with the highest classifications of TC (21%), LDL (23%), TG (28%) and FPG (22%). The changes in TC and LDL compare favourably to those achieved by

pharmaceutical interventions involving statins[11] and far exceed the typical expectations of dietary interventions for lowering blood lipids.[13]

The large changes observed with the intervention is likely a result of the dietary recommendations of CHIP being more extreme than conventional guidelines. Despite its rigor, the participants anecdotally reported a high level of acceptability of the eating pattern, which was probably enhanced because the diet was not calorically restrictive and hence the participants were satiated.

In the United States, Barnard and colleagues[14] reported similar levels of acceptability of a plant-based eating pattern to the more moderate diet recommended by the American Dietetic Association, although acceptability needs to be determined in the Australasian context.

As described in the results section, a decrease in TC and LDL would offer substantial cardio-protection and reduce the relative risk for all-cause mortality. However, while the observed decrease in TC and LDL are beneficial, the reduction in HDL appears counterproductive. Noteworthy, individuals who adopt a whole-food, plant-based eating pattern, which is free from exogenous cholesterol and low in saturated fat, typically have lower blood concentrations of all cholesterol subfractions, including HDL.[15]

Notwithstanding, these individuals do not have compromised cardiovascular health and are not at increased risk of type 2 diabetes mellitus.[15] In fact, in the Lifestyle Heart Trial[16] that prescribed a low-fat, plant-based diet, participants experienced regression of atherosclerotic plaque and a reduction in cardiac events despite a concomitant decrease in HDL levels.

The lowered HDL levels associated with a plant-based eating pattern may be explained by less need for reverse cholesterol transport. Importantly, despite the decrease in HDL observed in the present study, the TC to HDL ratio improved.

There were several anecdotal reports in the present study of participants' having their medications (e.g. hypertensive, hypercholesterolemia, hyperglycaemic) decreased or even ceased by their personal doctor during the course of the 30-day intervention. While this is a desirable outcome, a reduction in medication usage may have caused the results presented in this report to be understated. It is a limitation of this study that medication changes were not recorded and this should be included in future studies.

Given that many chronic diseases have lifestyle underpinnings,[1] there is a growing awareness that lifestyle interventions have merit at all levels of prevention. In terms of primary prevention, results of the 52 country INTERHEART study[17] indicated that positive lifestyle practices, such as the consumption of fruits and vegetables, being physically active and avoiding the use of tobacco, can prevent up to 90% of myocardial infarctions.

With regards to secondary prevention, the Diabetes Prevention Program Research Group[18] showed a 16-session lifestyle education program to be twice as effective as pharmaceuticals (metformin) for preventing at-risk people with pre-diabetes developing established diabetes. At the tertiary level, the potential for disease reversal is emerging as an area of interest in the field of lifestyle medicine.[16,19-22]

Several studies have explored the potential of lifestyle interventions for chronic disease reversal and most have centred around a whole-food, plant-based diet high in fibre (>30 grams) and low in fat (<20%), cholesterol and refined sugar. Esselstyn[19] showed regression of heart disease using a low-fat (<10%) plant-based diet alone, while the Lifestyle Heart Trial[16] demonstrated cardiovascular disease reversal through plant-based nutrition combined with exercise, social support and stress management techniques.

Similarly, the role of lifestyle in potential reversal of type 2 diabetes has been known for over 30 years.[20,21] Barnard and associates[22] reported ~40% of people with type 2 diabetes treated with insulin could discontinue its use through participation in a 26-day residential program involving a near vegetarian, low-fat diet in conjunction with exercise.

In the present study, over 40% of participants who entered the program with FPG levels indicative of diabetes reduced their levels below this classification in 30 days. This observation is comparable to our recent report of over 5,000 CHIP participants from the United States.[5]

The results observed in this study of a free-living population are encouraging for a 30-day intervention, however, the question of sustainability remains. Maintenance of behaviour change following involvement in the CHIP intervention has been documented for up to 18 months in the United States[23] but a sustainability study in the Australasian context is needed.

Anecdotally there are numerous case reports of individuals involved in this project who experienced continued, and even profound, health improvements beyond their involvement in the CHIP intervention. However, achieving long-term compliance to interventions that aim to improve patient outcomes over time is a challenge. This is the case for both lifestyle or pharmaceutical interventions.[24,25]

While the CHIP intervention incorporates elements to promote long-term health behaviour change—including education, social support, accountability measures, and a focus on one's environment and how to re-engineer it to support positive lifestyle choices—questions surrounding how to optimise engagement with lifestyle interventions need to be further explored.

A greater understanding of what makes lifestyle interventions most efficacious is required. For example, while improvements in participants' biometrics were recorded for all groups involved in this study, some groups appeared to achieve better outcomes than others. Given the intervention was essentially the same for all groups in terms of duration, intensiveness and content, the varying outcomes could conceivably be explained by factors relating to either the group participants and/or elements of the program that did vary between the groups.

Participant factors may include age, gender, social class, ethnicity, who they participated in the intervention with, baseline health status and the extent of engagement with the intervention and the lifestyle recommendations it advocated.

Other factors may include group size, social class, venue or setting, and characteristics relating to the facilitator such as their level of training and experience conducting lifestyle interventions. How these factors contribute to the success of a

lifestyle intervention remains to be elucidated. Further, it would be interesting to study the outcomes of a CHIP intervention conducted in a less intense manner, given that the current program involves 16 sessions over a one-month period.

A unique element of the study was the use of volunteers to administer a professionally generated lifestyle intervention. Only one third of the facilitators involved in this study had medical or health training, but regardless, all underwent two days of training that focused on the logistics of administering the program and providing them with group facilitation skills. It was mandated that the facilitators not provide lifestyle counsel as this was presented in the pre-recorded educational presentations provided as part of the CHIP resource.

Harnessing the energy of volunteers to facilitate lifestyle interventions, as employed in this study, represents a potentially powerful and cost-effective mode for administering lifestyle interventions. Many of the volunteer directors of the programs in this study had previously participated in a CHIP intervention and therefore had a strong investment and bond with the program. Indeed, passionate volunteers can be powerful agents of change and possess motivational properties to incite their peers to action.[26]

Conclusions

The results of this feasibility study indicate that lifestyle medicine programs like the CHIP intervention show promise for the management of selected chronic diseases within the Australasian context. Further, volunteers can be valuable social capital in the combat of chronic diseases by facilitating well-designed and appropriately resourced lifestyle interventions.

A randomised control trial is warranted that investigates the effectiveness and sustainability of the lifestyle choices acquired during the CHIP intervention and the associated long-term reductions in chronic disease risk factors. A further investigation of the acceptability of the specific nutritional recommendations of the CHIP intervention in the Australasian setting is also required.

Finally, in order to optimise the outcomes achieved by lifestyle interventions such as the CHIP, research is required to elucidate how factors relating to the participant as well as the structure, content and facilitation of the program contribute to the success of the intervention.

Competing interests: Nil.

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