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ORIGINAL ARTICLE

The Determinants of Participation in Physical Activity in Malaysia

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Abstract
Objectives: In light of the importance of physical activity, the aim of the present study is to examine the factors affecting participation in physical activity among adults in Malaysia.
Methods: A logistic regression model and the Third National Health and Morbidity Survey consisting of 30,992 respondents were used.
Results: Age, income, gender, education, marital status, region, house locality, job characteristics, and medical conditions are significantly associated with participation in physical activity. In particular, old individuals, high income earners, females, the well-educated, widowed or divorced individuals, East Malaysians, urban dwellers, the unemployed, and individuals who are not diagnosed with hypercholesterolemia are less likely to be physically active than others.
Conclusion: Because sociodemographic and health factors play an important role in determining physical activity, the government should take them into account when formulating policy.

1. Introduction

Physical inactivity is a leading risk factor of mortality and morbidity worldwide. Each year, about 3 million deaths and 32 million disability-adjusted life years are associated with physical inactivity [1]. Physical inactivity increases the risks of noncommunicable diseases such as diabetes, stroke, cancer, and cardiovascular diseases [1–3]. Nicklett et al [4] found physically active adults to be 40–50% less likely to die prematurely than physically inactive adults. Helmrich et al [5] and LaMonte et al [6] found that frequent participation in physical activity could reduce the likelihood of acquiring diabetes by up to 45%. In Malaysia, 36% of adults did not adopt a physically active lifestyle [7]. Using the Malaysian Adults Nutrition Survey and a

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Penang (Malaysia) sample, Poh et al [8] and Cheah [9], respectively, found alarming evidence that only 11−15% of adults in Malaysia were physically active.

Because physical activity plays an important role in preventing diseases, there is a growing number of studies examining the factors affecting participation in physical activity in well-developed countries [3,10−15]. The studies found that sociodemographic and health factors such as income, age, gender, education, marital status, ethnicity, and self-perceived health status could affect an individual's decision to participate in physical activity. Although a better understanding of the factors associated with participation in physical activity is important, there is only one nationwide study focusing on this topic in Malaysia [8]. However, the study did not explore the likelihood of participating in physical activity among the respondents, and also did not consider the influence of health on participation in physical activity. The aim of the present study is to fill this research gap.

Briefly, the contributions of the present study to the literature and society are four fold. First, in addition to sociodemographic variables, the present study includes several important health variables such as being diagnosed with hypertension, hypercholesterolemia, or diabetes. Second, a nationally representative data consisting of a large sample size and detailed information on an individual's sociodemographic, lifestyle, and health profiles is used for a robust analysis. Third, the focus of the present study is on a multiethnic developing country, Malaysia, where physically inactive adults are highly prevalent and only a few studies exist. Fourth, the findings of the present study can provide the government with baseline information for policy development.

2. Materials and methods

2.1. Data

This study used data from the Third National Health and Morbidity Survey, which was a nationally representative cross-sectional population-based survey conducted by the Ministry of Health Malaysia over the period from April 2006 to January 2007. The survey covered all urban and rural areas in the 13 states of Malaysia, as well as the Federal Territory of Kuala Lumpur, Malaysia. Following the sampling frame designed by the Department of Statistics Malaysia, a two-stage stratified sampling approach proportionate to the size of the population in Malaysia was used to collect the data. The first stage sampling unit was based on geographically contiguous areas of the country [enumeration blocks (EB)]. The second stage sampling unit was based on the Living Quarters (LQ) in each EB, and all the households and individuals that resided in the selected LQ participated. In particular, each EB consisted of 80-120 LQ with a population of about 600. The EB were based on the population of gazetted and built-up areas [i.e., urban (population $\geq$ 10,000) and rural (population $<$ 10,000)].

The inclusion criteria of the survey were: (1) all adults aged 18 years and above; (2) both sexes; (3) all ethnic groups; and (4) Malaysian citizens. The target sample size was calculated based on three criteria: (1) 95% confidence interval; (2) the prevalence and response rate of the Second National Health and Morbidity Survey; and (3) the calculated margin of error and design effect. More detailed information about this calculation was published previously [16]. The calculated target sample size was 34,539 respondents, which represented 12,923,504 Malaysian adults. The targeted household member was classified as "no response" after three consecutive unsuccessful visits. The overall response rate was about 98.20% (33,933 respondents).

The piloted bilingual (*Bahasa Malaysia* and English) questionnaires were used by the trained health professionals to interview face-to-face the respondents. During the interview, the respondents were asked to report their sociodemographic, lifestyle, and health profiles. Meanwhile, if the respondents reported that they did not have hypertension or hypercholesterolemia, their blood pressure and blood cholesterol were examined by the health professionals using Omron Digital Automatic Blood Pressure Monitor Model HEM-907 and Accutrend GC—Roche Diagnostic's battery-operated gluco-photometer. The respondents were classified as having hypertension if their systolic blood pressure was $\geq$140 mmHg and diastolic blood pressure was $\geq$90 mmHg, and were classified as having hypercholesterolemia if their blood cholesterol was $\geq$5.2 mM. If the respondents reported that they were not diabetics, their blood glucose was tested using Accutrend GC. If the respondents' blood glucose was $\geq$6.1 mM (after 8 hours of fasting), they were referred to the nearest clinics or hospitals for further examination.

2.2. Dependent variable

Physical activity was defined as "any bodily movement produced by the skeletal muscles resulting in energy consumption" [17]. Following the guideline of Ministry of Health Malaysia, the respondents who spent at least 150 minutes/week in moderate or 60 minutes/week in vigorous physical activities (including work, travel, and leisure) were considered as physically active, otherwise they were considered as physically inactive. The details of this measurement were published previously [16].

2.3. Independent variables

Based on the previous studies examining the factors affecting participation in physical activity [3,10,11,15,18−21] the following sociodemographic and health variables were hypothesized to have significant impacts on individuals' likelihood of being

physically active: (1) age; (2) income; (3) gender; (4) ethnicity; (5) education; (6) marital status; (7) region; (8) house locality; (9) job characteristics; (10) hypertension; (11) hypercholesterolemia; and (12) diabetes (Table 1).

Age (in years) and monthly individual income [in Malaysian Ringgit (RM)] were formatted as continuous variables. Ethnicity was categorized into three groups: Malay, Chinese, and Indian/others. Education was grouped into three categories: primary (≤6 schooling years), secondary (7−11 schooling years), and tertiary (≥12 schooling years). Marital status was divided into three groups: single, married, and widowed/divorced. Region was grouped into two categories: Peninsular Malaysia (more populated and more developed) and East Malaysia (less populated and less developed). Based on the guideline of the Department of Statistics Malaysia, house locality was categorized into two categories: urban [metropolitan and urban large (i.e., gazetted areas population ≥ 10,000)] and rural [urban small and rural (i.e., gazetted areas population < 10,000)]. Job characteristics were grouped into five categories: civil servant, private sector employee, self-employed, student, and unemployed (including housewife and retiree). Three health variables were included, i.e., hypertension, hypercholesterolemia, and diabetes. The respondents who reported to have hypertension, hypercholesterolemia, or diabetes, or were diagnosed with hypertension, hypercholesterolemia, or diabetes during the survey were all categorized as

Table 1. Descriptive analysis of variables in the statistical model

Variables	Definition	Mean/%[a]
Age	Age in years	42.10
Income	Monthly individual income (in Malaysian Ringgit)	1963.05
Gender		
Male	Gender is male	44.39
Female	Gender is female	55.61
Ethnicity		
Malay	Ethnicity is Malay	56.51
Chinese	Ethnicity is Chinese	21.56
Indian/others	Ethnicity is Indian or others	21.93
Education		
Tertiary	Highest level of education is tertiary	10.32
Secondary	Highest level of education is secondary	51.69
Primary	Highest level of education is primary	37.99
Marital status		
Married	Marital status is married	71.32
Widowed/divorced	Marital status is widowed or divorced	7.83
Single	Marital status is single	20.85
Region		
Peninsular Malaysia	Residents in Peninsular Malaysia	79.68
East Malaysia	Residents in East Malaysia	20.32
House locality		
Urban	Urban dwellers	59.42
Rural	Rural dwellers	40.58
Job characteristics		
Civil servant	Being a civil servant	9.93
Private sector	Being a private sector employee	28.82
Self-employed	Being self-employed	19.59
Student	Being a student	3.18
Unemployed	Being unemployed	38.48
Hypertension		
Yes	Being diagnosed with hypertension	38.75
No	Not being diagnosed with hypertension	61.25
Hypercholesterolemia		
Yes	Being diagnosed with hypercholesterolemia	23.81
No	Not being diagnosed with hypercholesterolemia	76.19
Diabetes		
Yes	Being diagnosed with diabetes	11.91
No	Not being diagnosed with diabetes	88.09

[a]*For age and income variables, the value refers to mean; for the other variables, the value refers to percentage.*

"being diagnosed with hypertension, hypercholesterolemia, or diabetes".

2.4. Statistical analysis

A logistic regression model was used to examine the factors affecting the odds of being physically active among the respondents. Likelihood ratio (LR) and Pearson χ^2 tests were conducted to test the goodness-of-fit of the regression model. Correlation coefficients between income, age, gender, residing area, education, and job characteristics variables were estimated in order to diagnose the potential multicollinearity problem. The significant level of all the tests was based on $p < 5\%$ (2-sided). Owing to incomplete information as reported by some, information from only 30,992 respondents was retained for analysis. The statistical analysis was performed using Stata statistical software [22].

3. Results

3.1. Characteristics of the survey respondents

Of the total 30,992 respondents, 17,519 (56.52%) were physically active, and 13,473 (43.47%) were physically inactive. The average age of the respondents was about 42 years. The average monthly individual income of the respondents was approximately RM 1963. The total sample comprised 44.39% males. The ethnic breakdown was 56.51% Malays, 21.56% Chinese, and 21.93% Indian/others. A large proportion of the respondents had secondary education (51.69%), followed by those with primary (37.99%) and tertiary education (10.32%). Around 71.32%, 20.85%, and 7.83% of the respondents were married, single, and widowed/divorced, respectively. Of the total respondents, 79.68% were resident in Peninsular Malaysia, and 59.42% in urban areas. A large proportion of the respondents were unemployed (38.48%), followed by private sector employees (28.82%), the self-employed (19.59%), civil servants (9.93%), and students (3.18%). About 38.75%, 23.81%, and 11.91% of the respondents were diagnosed with hypertension, hypercholesterolemia, and diabetes, respectively (Table 1).

3.2. Logistic regression analysis of being physically active

The value of LR χ^2 with 18 degrees of freedom was 1674.980 ($p < 0.05$). Further, the value of Pearson χ^2 with 28,933 degrees of freedom was 28,979.010 ($p > 0.05$). Taken together, these conclude that the current regression model is a very good fit (Table 2). The result of the collinearity test indicates that there is no serious multicollinearity problem in the current regression model (Appendix 1) [23].

The results of the present study show that an additional year of age reduces individuals' odds of being physically active [odds ratio (OR): 0.985; 95% confidence interval (CI): 0.985, 0.990]. Similarly, an increase of RM 1 in monthly individual income also decreases individuals' odds of being physically active (OR: 0.999; 95% CI: 0.998, 1.000). Males have higher odds of being physically active than females (OR: 1.531; 95% CI: 1.453, 1.613). Individuals with tertiary education have lower odds of being physically active than individuals with primary education (OR: 0.797; 95% CI: 0.723, 0.878). Widowed and divorced individuals have lower odds of being physically active than single individuals (OR: 0.869; 95% CI: 0.771, 0.979).

Peninsular Malaysians have higher odds of being physically active than East Malaysians (OR: 1.213; 95% CI: 1.136, 1.295), whereas urban dwellers have lower odds of being physically active than rural dwellers (OR: 0.830; 95% CI: 0.788, 0.875). In terms of job characteristics, civil servants (OR: 1.944; 95% CI: 1.775, 2.130), private sector employees (OR: 1.541; 95% CI: 1.444, 1.645), and self-employed individuals (OR: 1.857; 95% CI: 1.732, 1.990) have higher odds of being physically active than unemployed individuals. Individuals who are diagnosed with hypercholesterolemia have higher odds of being physically active than individuals who are not diagnosed with hypercholesterolemia (OR: 1.112, 95% CI: 1.051, 1.178).

4. Discussion

Drawing on a nationally representative sample, the present study finds the age, income, gender, education, marital status, region, house locality, job characteristics, and medical conditions to affect an individual's likelihood of being physically active. In particular, older individuals, high income earners, females, the well-educated, widowed/divorced individuals, East Malaysians, urban dwellers, the unemployed, and individuals who are not diagnosed with hypercholesterolemia are less likely to be physically active than others.

The negative relationship between age and the likelihood of being physically active is in line with the findings of the previous studies [19,20]. Kaplan et al [19] made use of the Canadian National Population Health Survey consisting of 12,611 respondents. The study observed that older individuals were less likely to be physically active than younger individuals. Downward and Riordan [20] found a similar finding using data from the 2002 General Household Survey. The biological process of aging is likely to be the reason for this outcome [24]. Older individuals tend to face a more serious deterioration in health than younger individuals, and thus have greater difficulties in performing physical activity. The implication of this finding is that intervention strategy focusing on promoting participation in physical activity among the elderly may appear promising. The government should consider building more elderly-oriented sport facilities,

Table 2. Results for logistic regression analysis of being physically active

Variables	Estimated coefficient	Standard error	Odds ratio	95% confidence interval	*p*
Age	−0.013	0.001	0.985	0.985, 0.990	<0.001
Income	−0.001	0.001	0.999	0.998, 1.000	<0.001
Gender					
Male	0.426	0.027	1.531	1.453, 1.613	<0.001
Female	—	—	1.000	—	—
Ethnicity					
Malay	−0.037	0.034	0.964	0.903, 1.030	0.275
Chinese	−0.069	0.039	0.933	0.866, 1.007	0.073
Indian/others	—	—	1.000	—	—
Education					
Tertiary	−0.227	0.050	0.797	0.723, 0.878	<0.001
Secondary	−0.005	0.031	0.995	0.937, 1.058	0.882
Primary	—	—	1.000	—	—
Marital status					
Married	0.041	0.036	1.042	0.971, 1.119	0.255
Widowed/divorced	−0.141	0.061	0.869	0.771, 0.979	0.021
Single	—	—	1.000	—	—
Region					
Peninsular Malaysia	0.193	0.033	1.213	1.136, 1.295	<0.001
East Malaysia	—	—	1.000	—	—
House locality					
Urban	−0.186	0.026	0.830	0.788, 0.875	<0.001
Rural	—	—	1.000	—	—
Job characteristics					
Civil servant	0.665	0.047	1.944	1.775, 2.130	<0.001
Private sector	0.432	0.033	1.541	1.444, 1.645	<0.001
Self-employed	0.619	0.035	1.857	1.732, 1.990	<0.001
Student	0.131	0.075	1.140	0.985, 1.319	0.079
Unemployed	—	—	1.000	—	—
Hypertension					
Yes	0.046	0.028	1.047	0.992, 1.106	0.096
No	—	—	1.000	—	—
Hypercholesterolemia					
Yes	0.107	0.029	1.112	1.051, 1.178	<0.001
No	—	—	1.000	—	—
Diabetes					
Yes	−0.046	0.038	0.995	0.886, 1.028	0.221
No	—	—	1.000	—	—
Constant	0.298	0.062	—	—	<0.001
Likelihood ratio χ^2 (18)	1674.980				
$p > \chi^2$	<0.001				
Pearson χ^2 (28,933)	28,979.010				
$p > \chi^2$	0.423				
R^2	0.605				
Observations	30992				

as well as organizing more weekly less-intense sports activities in the recreational parks to encourage the elderly to utilize their leisure time for physical activity.

The results of the present study show that the higher the level of individuals' income, the less likely that individuals are to be physically active. A plausible explanation is that higher income earners tend to incur greater opportunity costs of nonworking time than lower income earners because they earn higher hourly wages [3]. Therefore, higher income earners are more inclined to substitute working for leisure-time physical activities, causing them to live a more sedentary lifestyle. The effect of income on physical activity has been examined by Farrell and Shields [10] using a health survey of England, and Humphreys and Ruseski [3] based on the Behavioral Risk Factor Surveillance System. Surprisingly, however, the studies found income to be positively associated with individuals' likelihood of participating in physical activity. In terms of policy implication, the Ministry of Health Malaysia should

organize nationwide health awareness programs with a specific focus on the rich. These programs should include highlighting the notion that health is always more important than wealth.

The finding on gender is consistent with those of Scheerder et al [25], Downward [11], and Wicker et al [13]. Drawing on three Belgium large-scale cross-sectional surveys, Scheerder et al [25] found that women had a lower likelihood of participating in physical activity than men. Using the 2002 General Household Survey, Downward [11] found that males were more likely to participate in physical activity than females. Wicker et al [13] corroborated these findings using a survey data of Stuttgart (Germany). This is likely to be attributable to the traditional role of gender. Because women possess the natural characteristic as a family care taker, women tend to allocate more time for home activity than leisure-time physical activity [9]. Nevertheless, as emphasized by Davis et al [26], being a frequent traveler is highly correlated with a high level of physical activity. Because the daily tasks performed by men involve more travelling activities, men are usually more physically active compared to women [26]. Therefore, public policy makers should pay more attention to females than males. Home TV fitness programs, for instance, should be made more available throughout the day in an effort to encourage females to stay physically active even without joining a fitness center or going to a recreational park.

The causal relationship between education and participation in physical activity has been evidenced by the previous studies using data from the Health and Retirement Study [18] and German Socio-Economic Panel [21]. Surprisingly, however, their findings on education contradict that of the present study that well-educated individuals have a lower likelihood of being physically active than less-educated individuals. Perhaps, this is due to the fact that well-educated individuals often work in white-collar jobs, which involve only little physical effort. Hence, well-educated individuals are generally less physically active compared to their less-educated counterparts who are usually blue-collar workers. However, such argument may have to be tested more rigorously in future studies that include white- and blue-collar jobs as the explanatory variables. In terms of policy implication, an intervention strategy paying special attention to increasing physical activity level among well-educated individuals can ensure effective outcomes. Office-based exercise promotion programs should be widely introduced to educate well-educated individuals about how to stay physically active in the office, for example use of walking meetings and staircases.

Consistent with the findings of Downward and Rasciute [14] and Eberth and Smith [15], marital status is significantly associated with physical activity, as single individuals have a higher likelihood of adopting a physically active lifestyle than nonsingle individuals. Downward and Rasciute [14] examined participation in sports among adults in England. The study found that unmarried adults were more likely to participate in sports than married adults. Similarly, using the 2003 Scottish Health Survey, Eberth and Smith [15] found that single women were more likely to participate in physical activity and also spent more time in physical activity than nonsingle women. Family commitment may be the contributing factor for this outcome [14,15]. Single individuals do not carry the responsibilities to look after their children and spouse, thus, they may have more time on hand for physical activity than nonsingle individuals. In view of this finding, an effective public health policy is suggested to be aimed particularly at promoting participation in physical activity among nonsingles. As a way to reduce the family commitments borne by nonsingle individuals, child care centers should be made more available in the residential areas, whereby people can send their children to the centers conveniently.

The influence of regional factor on health behavior has been analyzed by Yen et al [27] using data from the Malaysian Non-Communicable Disease Surveillance. The study found that individuals' propensity to adopt healthy eating practices could vary across their residing region. Somewhat similarly, the present study finds regional differences in participation in physical activity, as residents in Peninsular Malaysia are more devoted to spend time on physical activity compared to residents in East Malaysia. This finding concludes that regional factor plays an important role in affecting individuals' decision to live a healthy lifestyle. The main implication of this finding is that an intervention measure directed primarily at East Malaysians to increase participation in physical activity can be effective. The government should consider introducing physical activity related programmes in East Malaysia to advertise and promote the advantages of living a physically active lifestyle.

The finding on house locality is in contrast to that of Scheerder et al [25] focusing on population in Flanders (Belgium). Two plausible reasons may explain the fact that urbanites have a lower likelihood of being physically active compared to rural dwellers. First, urbanites often live a busy and hectic lifestyle, and thus would be less likely to allocate their time for physical activity [28]. Second, owing to the lack of advanced infrastructures in rural areas, the daily activities performed by rural dwellers may be more physically demanding. However, given the limited availability of data, an in-depth qualitative study is, thus, needed for supplementing a better understanding of the association between house locality and physical activity. As an intervention measure towards increasing the prevalence of physically active adults, a successful policy should

promote participation in physical activity among urban dwellers. The government should advocate organizing health related seminars, courses, and workshops in urban areas to educate the dwellers about how to incorporate physical activity into their hectic lifestyle.

Previous studies suggested that participation in physical activity was significantly associated with job characteristics, given that different job characteristics of workers may face a different level of stress associated with the job, which, in turn, influences the workers' physical activity level [15,18]. These findings are supported by the present study, suggesting that unemployed individuals have a lower likelihood of adopting a physically active lifestyle than employed individuals (i.e., civil servants, private sector employees, and the self-employed). Because unemployed individuals possess fewer work commitments, they often live a laid-back lifestyle and consequently would be less physically active [29]. Considering this finding, government is suggested to pay special attention to encouraging unemployed individuals to spend more time on physical activity by building more public sport centers and recreational parks, as well as organizing physical activity campaigns around the residential areas.

The association between health and physical activity has been considered in the context of Western countries [10,15,19,20]. In Malaysia, it is found that individuals who are diagnosed with hypercholesterolemia are more likely to live a physically active lifestyle than individuals who are not diagnosed with hypercholesterolemia. This is simply because individuals who are diagnosed with a medical condition are more alert to their health [26], and thus would be more inclined to adopt healthy physical practices. Therefore, public health authorities should devote their attention to increasing health awareness among healthy individuals. A nationwide health awareness program that one should exercise regularly regardless of one's health condition should be widely introduced. Nonetheless, a concerted effort should also be put into informing healthy individuals of the fact that physical inactivity is the main causing factor of diseases.

Owing to the secondary nature of the data, the present study has several limitations. First, numerous variables such as household income, household size, and distance from workplace or home to physical activity settings could not be included. Second, the present study could not segregate physical activities into work, travel, and leisure categories for a more detailed individual analysis. In spite of these limitations, the present study is the first in-depth study in Malaysia that uses such a large dataset to explore the factors affecting physical activity. Also, unlike most other studies focusing only on sociodemographic factors, the present study includes several important health variables.

Conflicts of interest

All contributing authors declare no conflicts of interest.

Appendix 1. Correlation coefficients between income, age, gender, residing area, education, and job characteristics variables[a]

Variables	Income	Age	Male	Urban	Primary	Secondary	Tertiary
Income	—	−0.066 (<0.001)	0.017 (0.003)	0.211 (<0.001)	−0.202 (<0.001)	0.028 (<0.001)	0.277 (<0.001)
Age	−0.066 (<0.001)	—	0.011 (0.053)	−0.066 (<0.001)	0.539 (<0.001)	−0.420 (<0.001)	−0.169 (<0.001)
Male	0.017 (0.003)	0.011 (0.053)	—	0.024 (<0.001)	−0.060 (<0.001)	0.043 (<0.001)	0.025 (<0.001)
Urban	0.211 (<0.001)	−0.066 (<0.001)	0.024 (<0.001)	—	−0.190 (<0.001)	0.092 (<0.001)	0.153 (<0.001)
Civil servant	0.083 (<0.001)	−0.067 (<0.001)	0.064 (<0.001)	0.023 (<0.001)	−0.201 (<0.001)	0.056 (<0.001)	0.230 (<0.001)
Private sector	0.097 (<0.001)	−0.281 (<0.001)	0.180 (<0.001)	0.137 (<0.001)	−0.185 (<0.001)	0.126 (<0.001)	0.089 (<0.001)
Self-employed	−0.022 (<0.001)	0.094 (<0.001)	0.220 (<0.001)	−0.149 (<0.001)	0.119 (<0.001)	−0.064 (<0.001)	−0.085 (<0.001)
Student	0.007 (0.201)	−0.255 (<0.001)	−0.013 (0.024)	0.056 (<0.001)	0.141 (<0.001)	0.091 (<0.001)	0.075 (<0.001)
Unemployed	−0.121 (<0.001)	0.222 (<0.001)	−0.382 (<0.001)	−0.020 (<0.001)	0.196 (<0.001)	−0.097 (<0.001)	−0.153 (<0.001)

[a]*The number in parentheses is p. The calculated correlation coefficients between income, age, gender, residing area, education, and job characteristics variables are all < 0.8, implying that there is no serious multicollinearity problem in the current regression model [23].*

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