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Review Article

The prevalence time trend and risk factors of weight loss among the Chinese elder people over the period from 2011-2013

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Abstract

Objectives: To investigate the prevalence, time trend and risk factors of unintentional weight loss for individual elder people in China.

Design: Observational study.

Setting: We used the data from China Health and Retirement Longitudinal Study in 2011 and 2013.

Participants: People aged 60 and older were included.

Measurements: Unintentional weight loss was measured when the elder people made positive response to the question that "Have you lost 5 or more kilograms in the last year? (excluding pregnancy)". The time trend was analyzed through chi-square and the risk factors were analyzed by the binary logistic regression model.

Results: In 2011 we had 5767 individuals and 7980 individuals in 2013, respectively. The prevalence of unintentional weight loss was 7.39% (95% CI, 6.76%, 8.08%) in 2011 and 7.44% (95% CI, 6.90%, 8.02%) in 2013. No significant variation of prevalence on unintentional weight loss could be found. Elder people aged between 71 and 75 had a decreased prevalence of unintentional weight loss significantly. The risk factors significantly associated with weight loss were age, gender, self-rated health, BMI, number of chronic diseases and physical functioning.

Conclusion: About 7.4% elder people had weight loss in 2011 and 2013 and no time trend for prevalence of unintentional weight loss was found. Risk factors identified in our study can help screen people at high risk of unintentional weight loss and make targeted prevention strategies.

Introduction

Unintentional weight loss is an indicator of frailty in elder people with its universal definition of unintentional weight loss is not existed. Its definition in most observational studies is a 5% or more reduction in body weight over 6-12 month [1,2,3]. Unintentional weight loss is a common and long-term health concern in elder people which is difficult to diagnosis. It was said that 13% of ambulatory patients and more than 50% nursing-home residents were affected by unintentional weight loss [4], for adult outpatients up to 8% encountered in weight loss [1] and for frail people aged 65 years and older, nearly 30% experienced weight loss [5].

Factors for unintentional weight loss were multifarious and interrelated. Some studies indicated that unintentional weight loss was linked to malnutrition [6] or reduction in food intake [7] and its etiology may due to a host of physiological and non-physiological causes. Physiologic variations because of ageing, poverty, psychosocial problems and chronic diseases were the potential explanations for unintentional weight loss [4,1]. Clinically, anorexia, sarcopenia, cacexia and dehydration are the four major causes of weight loss [8].

Unintentional weight loss, a complex and frequent syndrome [9], had devastating consequences in elder people. The prominent adverse health outcome was mortality. Unintentional weight loss was associated with increased mortality [10]. Evidence suggested that subjects who lost 15% or more of their maximum weight had over twice the mortality risk of those who lost less than 5% [11] and Locher et al indicated that unintentional weight loss was a greater mortality threat to older adults than was obesity or intentional weight loss [12]. Retrospective record review showed that elder people whose weight lost more than 5% within one month were 4.6 times more likely to die within 1 year [13]. After weight loss occurred, mortality could be as high as 16% during the first year [9].

For elder people, unintentional weight loss, associated with multiple illness, can be an indicator of underlying disease process. Aktas et al found that for patients with mild symptoms of heart failure, they found adverse clinical outcomes which was associated with weight loss [14]. For Alzheimer disease, weight loss, as a manifestation of the disease itself, frequently occurred in the first stages of the diseases [15] and actually was usually used as a symptom for diagnosing Alzheimer disease [16]. Studies showed that weight loss could be a predictor of disease progression in HIV infection [17]. There was a clear relation between weight loss and the increased risk of individual opportunistic complications of HIV. Weight loss, ranged from 0% to 5% over a

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4-month period, was predictive of the development of an opportunistic complication of HIV. Compared with people who kept stable weight, the relative risk of opportunistic complications of HIV for people experienced 5% to 10% over 4 months was 1.89 while for people who lost 0% to 5% of their body weight was 1.19.

Unintentional weight loss indicated significant declination of health and function [18]. Weight loss could accelerate sarcopenia in elder adults [19]. The significant association between unintentional weight loss and reduction in ADL and IADL functions could also be found [20]. For older women experienced weight loss, they had higher rates of hip-bone loss and a two-fold greater risk of subsequent hip fracture [21] and the risk of frailty fracture had also been increased substantially [22]. Other consequences of unintentional weight loss included anemia, decreased cognition, edema, falls, immune dysfunction, muscles loss, osteoporosis and pressure sores [18].

Although weight loss is critical to elder people's health and may result in serious health outcome consequences, its research on prevalence, time trend and related risk factors are rare, especially for related research in China. So, in this study we aim to: (1) determine the prevalence of weight loss in China; (2) study the time trend in the prevalence of weight loss in China over the period 2011-2013; (3) identify which risk factor were independently associated with weight loss.

Methods

Study setting and populations

In this paper, our data comes from the China Health and Retirement Longitudinal Study (CHARLS) [23]. CHARLS is run by the National School for Development (China Center for Economics Research) at Peking University. CHARLS aims to collect a high-quality survey data for the individual of mid-aged and elderly in China. CHARLS has a sample of households with members aged 45 years or above. Information in CHARLS data covers a wide range of information from socio-economic status to health condition. More information about CHARLS can be found on CHARLS official website.

We had two wave data waves from CHARLS (wave 1 = 2011 and wave 2 = 2013). For the purpose of our study, we restricted the individual whose age were 60 years and older. In wave 1 we had 5767 observations and in wave 2, we had 7980 observations respectively. The variables in our study were created from the questionnaire. For the health outcome, weight loss, was from this question: have you gained 5 or more kilograms in the last year (excluding pregnancy)? There were 6 options for the elder people give response to this question: (1) yes, I only gained weight; (2) yes, I only lost weight; (3) yes, I first gained and then lost weight; (4) yes, I first lost and then gained weight; (5) no; (6) I don't know. To avoid bias, individual whose response was (6) would be deleted. And since gain weight and then lost weight or lost and then gain weight was obscure, we coded them as 0 which signaled this was not weight loss. Options (1) and (5) would also be coded as 0. So, at last there were 5767 individuals in wave 1 and 7980 individuals in wave 2 respectively.

Independent variables included socio-demographic characteristics such as age, gender, marital status, hukou, education, annual household income and insurance. We categorized age into 5 groups: 60-65 years (reference level), 66-70 years, 71-75 years, 76-80 years, 81 years and older. Gender had two levels: male (reference) and female. For marital status, we had two levels: unmarried (reference level) and married. For elder people, if their response were separated, divorced, widowed or never married, we attributed them to unmarried while for others, we considered them as married. Hukou is a unique household registration system in China. Each person would be assigned either rural or urban hukou in each place. The hukou status would remain stable unless a person completes a series formal hukou conversion procedure. Here we had two hukou levels: rural hukou (reference level) and urban hukou. Education variables had four levels: no studies (reference), primary school, middle school, high school and above. For elder people who did not finish primary school but capable of reading or writing, we still assigned them as no studies considering the educational years. Sishu/home school was regarded as the same level as primary school. Annual household income was consisted with six parts: (1) wage income, (2) personal transfer income, (3) agricultural income, (4) self-employment income, (5) government transfer income and (6) investment income. China had 9 kinds of insurance: (1) urban employee medical insurance, (2) urban resident medical insurance, (3) new cooperative medical insurance, (4) urban and rural resident medical insurance, (5) government medical insurance, (6) medical aid, (7) private medical insurance purchased by union, (8) private medical insurance purchased by individual, (9) other medical insurance. If elder person answered that he or she had one kinds of the above insurance, he/she would be considered as having insurance, otherwise we considered he/she had no insurance.

Independent variables related to health was assess through the below variables: self-rated health, BMI, number of chronic disease, number of disability items, activities of daily living (ADLs), instrumental activities of daily living (IADLs), and physical functioning (PFs). Self-rated health was assessed with the one of the following two questions: (1) would you say your health is excellent, very good, good, fair, or poor? (2) would you say your health is very good, good, fair, poor or very poor? If the response was excellent, very good or good, we would be assigned he/she into very good/good group, otherwise the individual would go into fair/poor/very poor group. BMI was calculated from individual's body weight and height. We classified BMI into three groups: BMI $\geq$ 30 as obese, BMI between 25 and 29.9 as overweight and BMI $\leq$ 25 as normal weight. We collected number of chronic diseases for each person who responded to the following question: have you been diagnosed with the chronic diseases below by a doctor? There were 14 kinds of chronic diseases in the list. So, the maximum of the number of chronic diseases would be 14 and the minimum would be 0. For the disability items, we considered 5 options: (1) physical disabilities, (2) brain damage/mental retardation, (3) vision problem, (4) hearing problem and (5) speech impediment. So, the number of disability items ranged from 0 to 5. ADLs were obtained from the following question: because of health and memory problems, do you have any difficulty with dressing, bathing, eating, getting into or out of bed, using the toilet including getting up and down, controlling urination and defecation. IADLs were obtained whether the elder person have any difficulty with doing household chores, preparing hot meals, shopping for groceries, making phone calls, taking medications, managing money. PFs would be assessed by whether the individual have any difficulty with running or jogging about 1 km, walking 1 km, walking 100 meters, getting up from a chair after sitting for a long period, climbing several flights of stairs without resting, stooping, kneeling or crouching, reaching or extending your arms above shoulder level, lifting or carrying weights over 5 kilograms, like a heavy bag of groceries, picking up a small coin from a table. For ADLs, IADLs, PFs, participants were defined as having functional impairment for each specific task with the below response: "I have difficulty but can still do it", "Yes, I have difficulty and need help", "I cannot do it". We summarized the total number of functional impairment for ADLs, IADLs, and PFs.

Statistical analysis

All of our work was performed through R ("R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/."). We conducted the descriptive statistics analysis in wave 1 and wave 2. Then we made comparisons for weight loss prevalence and time trend by chi-square test over the period 2011-2013 based on the age groups. We also compared the total weight loss prevalence at the same period. To identify the risk factors, we used the binary logistic regression model. The estimated coefficients and odds ratio with 95% confidence intervals were also obtained.

Results

Table 1 shows the distribution according to study of elderly people included in CHARLS in wave 1 (2011) and wave 2 (2013). Total number of subjects aged ≥ 60 years in the study was 5767 in 2011 and 7980 in 2013, respectively. The mean age from 2011 (68.2 ± 6.79 years) to 2013 (68.4 ± 7.08 years) kept stable and didn't change significantly ($p = 0.103$). Specifically, considering the age groups, the proportion for elder people aged ≥ 81 increased significantly ($p < 0.001$) over the period 2011-2013 (5.91% vs 7.19%).

In general, the gender proportion also kept stable (Female: 49.42% vs 49.40%, $p = 0.995$). The unmarried elder people decreased from 2011 to 2013 but not significantly (21.47% vs 20.71%, $p = 0.295$). The hukou variable changed significantly. For the percentage of the elder people who held an urban hukou, it increased significantly ($p < 0.001$) from 21.97% to 24.92% over the period 2011-2013. This means that elder people were more easy access to better healthcare resources. Comparing with elder people in wave 1, elder people in wave 2 had higher education level since the percentage of elder people with no studies decreased significantly (81.79% vs 79.07%, $p < 0.001$) while the proportion of elder people completing middle school increased significantly (4.25% vs 5.74%, $p < 0.001$). Differently, elder people had less household income in wave 2. The percentage of elder people whose household income < 780 increased significantly (12.03% vs 20.76%, $p < 0.01$) while proportion of whom had income between 5001 and 25000 and more than 25000 decreased significantly (37.45% vs 21.92%, $p < 0.001$; 6.68% vs 3.96%, $p < 0.001$). Finally, the insurance coverage expanded significantly (92.86% vs 95.05%, $p < 0.001$).

Elder people's health status was becoming worse since number of chronic diseases, number of disability items and IADLs exhibited worse variation significantly. Elder people in wave 2 had more chronic diseases compared with wave 1 (1.64 ± 1.47 vs 2.11 ± 1.70, $p < 0.001$) and more disability items (0.31 ± 0.61 vs 0.47 ± 0.76, $p < 0.001$). Others

Table 1. Distribution according to study of elderly people included in the China Health and Retirement Longitudinal Study in 2011 and 2013.

Variables	Categories	China Health and Retirement Longitudinal Study				*p* value
		Wave 1: 2011 N = 5767		Wave 2: 2013 N = 7980		
		N	%	N	%	
Age (mean) [SD]		(68.2)	[6.79]	(68.4)	[7.08]	0.103
Age group (years)	60-65	2534	43.94	3497	43.82	0.905
	66-70	1395	24.19	1833	22.97	0.100
	71-75	913	15.83	1249	15.65	0.793
	76-80	584	10.13	827	10.36	0.672
	81+	341	5.91	574	7.19	< 0.001
Gender	Female	2850	49.42	3942	49.40	0.995
	Male	2917	50.58	4038	50.60	0.995
Marital status	Married	4529	78.53	6327	79.29	0.295
	Unmarried	1238	21.47	1653	20.71	0.295
Hukou	Rural	4500	78.03	5991	75.08	< 0.001
	Urban	1267	21.97	1989	24.92	< 0.001
Education level	No studies	4717	81.79	6310	79.07	< 0.001
	Primary school	696	12.07	1050	13.16	0.062
	Middle school	245	4.25	458	5.74	< 0.001
	High school and above	105	1.82	159	2.00	0.509
Annual household income (RMB)	< 780	694	12.03	1657	20.76	< 0.001
	780-5000	1356	23.51	1873	23.47	0.971
	5001-25000	2160	37.45	1749	21.92	< 0.001
	> 25000	1557	27.00	1752	21.95	< 0.001
Insurance	No	385	6.68	316	3.96	< 0.001
	Yes	5355	92.86	7585	95.05	< 0.001
Self-rated health	Very good/good	1103	19.13	1712	21.45	< 0.001
	Fair/bad/very bad	4663	80.86	6250	78.32	< 0.001
BMI	<25	4088	70.89	4026	50.45	< 0.001
	25-30	1235	21.41	1481	18.56	< 0.001
	>30	261	4.53	301	3.77	< 0.031
Number of chronic diseases (mean) [SD]		(1.64)	[1.47]	(2.11)	[1.70]	< 0.001
Number of disability items (mean) [SD]		(0.31)	[0.61]	(0.47)	[0.76]	< 0.001
ADLs (mean) [SD]		(0.66)	[1.28]	(0.66)	[1.29]	0.913
IADLs (mean) [SD]		(0.66)	[1.25]	(0.90)	[1.48]	< 0.001
PFs (mean) [SD]		(2.47)	[2.20]	(2.56)	[2.37]	0.033

like PFs had worse variation but not significantly. Self-rated health had the opposite variation. Elder people who thought them were in good status increased significantly (19.13% vs 21.45%, $p < 0.001$).

The observed prevalence of weight loss among elder people in the two waves were shown in Table 2. Totally, the prevalence of weight loss over the period 2011-2013 kept stable with 0.05% growing but without significantly [7.39% (95% CI, 6.76% - 8.08%) vs 7.44% (95% CI, 6.90% - 8.02%), $p = 0.940$)]. For all age groups, only elder people aged between 71 and 75 exhibited slight decrease in prevalence of weight loss significantly [1.28% (95% CI, 1.02% - 1.60%) vs 0.97% (95% CI, 0.78% - 1.20%), $p = 0.090$] while others had no significantly variation.

In binary logistic regression model, the risk factors associated with weight loss incidence were age, gender, self-rated health, BMI, number of chronic diseases and PFs. Elder people with more chronic diseases [OR 1.18 (95% CI, 1.13 - 1.24)] and more PFs [OR 1.12 (95% CI, 1.07-1.18)] were more likely to experience weight loss. Female elder people were less likely to have weight loss [OR 0.77 (95% CI, 0.65 - 0.91)]. So, did the elder people in good self-rated health status [OR 0.73 (95% CI, 0.55 - 0.96)]. Compared with elder people aged between 60 and 65, people aged 71 and older had less probability to lose weight. People had higher BMI were also less likely to have weight loss.

Discussion

Unintentional weight loss was a huge threat to elder people's health, compared with studies about diseases such as diabetes or hypertension, the related study in China were blank. To the best of our knowledge, we could not find any related research about weight loss in China. In this study we were the first to study the prevalence of weight loss in China. The prevalence of weight loss in China was more than 7% while the time trend was not significant. Prevalence of unintentional weight loss among elderly people varied tremendously. This prevalence was a little lower than others. The prevalence of unintentional weight loss in the population of older veteran outpatients was 13.1% [24]. For high risk populations such as free-living frail elderly people who received community services the prevalence could be as high as 27% [5]. And over 5-10 years, about 15% - 20% experienced weight loss [25,26,27]. The difference on prevalence of unintentional weight loss may due to the following reasons. First, it may assign to the population sample. As showed in the method, we included elder people whose response was only loss weight with some response to first gain weight then loss weight or first loss weight then gain weight were not considered as weight loss subject while in fact some may experience weight loss and reached the selection criteria. Second, psychology may be another cause. Some elder people may experience unintentional weight loss but were afraid of reporting the real fact, thus it may bring the biased data. Follow-up may be the way to solve the problem. Although our result was lower than others, it revealed that unintentional weight loss was a serious problem in China and had a slowly increasing time trend but not significantly which should pay more attention on this health problem (Table 3).

Identifying the associated risk factors with unintentional weight loss was of great importance and helpful for the target unintentional weight loss strategy. The risk factors identified in this study were much similar to the literature. Previous studies indicated that unintentional weight loss was associated with multiple illness [28], a decline in physical function [25]. We found that worse health condition (more PFs, more chronic diseases, bad self-rated health) were more likely to have higher likelihood for unintentional weight loss. The health conditions or health risk factors in our results were a little different but similar to them. Given the high prevalence of chronic diseases among Chinese elders, this was of great importance for unintentional weight loss prevention. Low baseline body weight had been showed was negatively related to unintentional weight loss [29]. Our results indicated that low BMI was associated with unintentional weight loss. Our results were consistent with it. Unmarried elder people had higher risk for unintentional weight loss, a finding similar to previous research that weight loss was associated with death of a spouse [27]. Some studies showed that there were little differences between sexes [25]. However, we showed a different result with them. In our research male had higher likelihood to experience unintentional weight loss. This difference may be due to the population difference since our population located in China while theirs were in Dutch. This suggested that we should pay more attention to male elder people when making related target prevention strategies.

Several studies showed that increasing age [27,29], disability [27,30], low education level [29,31] played important role in unintentional weight loss. However, in our study we could not confirm that disability and education level were risk factors of importance and significance. And for age risk factors, we had opposite of significance role which should be noted. This may be due to the population sample difference or the confounding effects in the model and should be further explored.

Another relevant result of our study would be that we revealed the health variation among the Chinese elder people. We found that their mean age was becoming older while the percentage elder people of low income was increasing and their health status or conditions were getting worse. Considering the prevalence of unintentional weight loss, its time trend and its higher potential prevalence, this was a warning signal that the effort was needed to be taken to prevent the unintentional weight loss occurrence. The risk factor identified here may provide evidence for screening people at high risk of unintentional weight loss and making prevention programmed.

Table 2. Prevalence of weight loss by age group, in 2011 and 2013.

Age	Prevalence of weight loss				Trend *p* value
	Wave 1: 2011 N = 6114		Wave 2: 2013 N = 8683		
	N	% (95% CI)	N	% (95% CI)	
60-65	202	3.30 (2.88, 3.79)	313	3.60 (3.23, 4.02)	0.348
66-70	112	1.83 (1.52, 2.21)	150	1.73 (1.47, 2.03)	0.681
71-75	78	1.28 (1.02, 1.60)	84	0.97 (0.78, 1.20)	0.090*
76-80	38	0.62 (0.45, 0.86)	54	0.62 (0.47, 0.82)	0.090*
81+	22	0.36 (0.23, 0.55)	45	0.52 (0.38, 0.70)	0.197
Total	452	7.39 (6.76, 8.08)	646	7.44 (6.90, 8.02)	0.940

* denotes the significance of 0.1, ** is significant at 0.05 and *** is the significance level of 0.01.

Table 3. Binary logistic model for weight loss among Chinese elderly people in the China Health and Retirement Longitudinal Study in 2011 and 2013.

Variable	Categories	Fall	
		Coefficients	OR (95% CI)
Age group (years)	60-65		1
	66-70	-0.073	0.93(0.77, 1.13)
	71-75	-0.405***	0.67 (0.52, 0.84)
	76-80	-0.681***	0.51 (0.37, 0.69)
	81+	-0.642***	0.53 (0.35, .77)
Gender	Male		1
	Female	-0.257***	0.77 (0.65, 0.91)
Marital status	Unmarried		1
	Married	-0.046	0.95 (0.78, 1.17)
Hukou	Rural		1
	Urban	0.110	1.12 (0.89, 1.39)
Education level	No studies		1
	Primary school	0.015	1.01 (0.78, 1.31)
	Middle school	0.060	1.06 (0.68, 1.60)
	High school and above	0.108	1.11 (0.53, 2.13)
Annual household income (RMB)	< 780		1
	780-5000	0.030	1.03 (0.81, 1.32)
	5001-25000	0.158	1.17 (0.93, 1.48)
	> 25000	0.043	1.04 (0.80, 1.36)
Insurance	No		1
	Yes	0.241	1.27 (0.87, 1.94)
Self-rated health	Fair/poor/very poor		1
	Very good/good	-0.312**	0.73 (0.55, 0.96)
BMI	<25		1
	25-30	-0.389***	0.68 (0.55, 0.82)
	>30	-0.638***	0.53 (0.35, 0.77)
Number of chronic diseases (mean) [SD]		0.167***	1.18 (1.13, 1.24)
Number of disability items (mean) [SD]		0.019	1.02 (0.91, 1.13)
ADLs (mean) [SD]		0.065	1.07 (0.99, 1.15)
IADLs (mean) [SD]		0.047	1.05 (0.97, 1.13)
PFs (mean) [SD]		0.115***	1.12 (1.07, 1.18)

* denotes the significance of 0.1, ** is significant at 0.05 and *** is the significance level of 0.01.

Conclusion

The strength of our study was that we examined a large dataset of elder people and a diverse range of risk factors were assessed which may provide evidence for intervention and prevention schemes.

Our study also had some limitations. First, it may be the misclassification. Some elder people who first loss weight then gain weight or first gain weight then loss weight was not included. This may bring bias. Second, some risk factors were not analyzed. For instance, evidence showed that additional smoking [27] may be important to unintentional weight loss. However, the unhealthy behavior such as smoking or drinking were another aspect of risk factors which should not be included in socio-economic factors or basic health status. Third, missing information may produce potential bias. We excluded elder people whose response were "I don't know". These people may be more likely to experience unintentional weight loss since their health awareness were lower.

Ethical standard

This was an opening data and the CHARLS team work had been approved by ethics committees at Peking University, so there were no ethical problems for this paper.

Conflicts of interest

There was no conflict of interest for all authors in this paper.

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