

Study on Assessment of Fitness for Elderly People from 2006-2016 Using Content Analysis Method

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Abstract

The Ministry of Welfare and Health (R.O.C.) will introduce the Elderly Care Act 2.0 in 2017, hence raising the attention towards elderly fitness issues, which was due to the rise of global elderly population which brings upon rise of elderly health issue related to aging such as obesity, fall, and cardiovascular diseases. Hence, prevention or reduction of these health issues were done by maintaining the physical fitness of the elderly. Our research motivation was to understand how to provide effective strategies for solving elderly health issues and preventing elderly injuries under the concept of preventive medicine studies, with the aim of ensuring elderly fitness and reducing the impact of rise in elderly population on the society and national burden. There were many methods to assess physical fitness, such as the Senior Fitness Test introduced by Rikli and Jones. However, there were also other assessment batteries or indicators which can assess specific health conditions or physical capacities. This study was aimed to study the trend and objective of fitness assessment on elderly using content analysis method on academic articles published within the last 10 years (2006-2016). The result of the study indicates that 13 articles were published in both 2015 and 2016, with an emphasis on physical capabilities assessment, which was the most within the past 10 years. At the same time, cardiorespiratory illnesses were the main health issue concerned in the articles analyzed. Other health topics especially

training methods to maintain fitness was also mentioned often in the selected articles, and was shown to be effective in improving elderly fitness. Hence, the results were useful in providing inquiries for elderly health and for evaluation of elderly health policies. In conclusion, research on assessment batteries can help researchers to understand the methods of elderly fitness assessment better and to help monitor elderly fitness and health more effectively, while reducing the impact of increase in healthcare expenses due to the rise of elderly population.

Keywords: elderly care policy, functional fitness assessment, frailty, physical activity, health issues

高齡體適能檢測之內容分析：2006-2016

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摘要

政府於 2017 年推出長照政策 2.0，因此高齡等相關議題備受關注，主要原因是高齡人士的人口逐年提升，相對之下也帶來高齡健康問題（如：肥胖、老年人摔倒、心血管疾病等）的增加。為了讓高齡者能擁有健康的身體及正常的日常生活作息，從預防醫學的概念下，當我們面對高齡化社會來臨所造成國家的負擔及衝擊，如何提供對策解決高齡健康問題的傷害發生是本研究之動機。目前的高齡體適能檢測方式有很多種，例如 Rikli 與 Jones 的老年人功能性體適能測驗。但是，要測體適能的測驗還有很多，尤其是針對不同的身體功能或病症。本研究對近 10 年（2006-2016）的學術文章以內容分析法分析高齡體適能檢測的趨勢及目的。研究結果發現，2015、2016 年各出版 13 篇有關於高齡體適能的文章，而且也著重在體適能檢測。同時心肺疾病也是多數文章裡備受關注的疾病議題；另外，研究維持健康的訓練方式在很多學術文獻中也曾被提及，上述結果都有助於提供高齡者的健康諮詢管道及政府有效性評估高齡者的健康衛生政策。結論，對於體適能檢測測驗的研究可以讓研究人員更瞭解檢測身體素質的方式，有效地達到高齡者體適能和健康的監控，同時可減少高齡化對國家社會之醫療保健經濟負擔的最佳方法。

關鍵詞：長照政策、功能性體適能檢測、衰老、運動、健康議題

Introduction

According to United Nations, the definition of people at old age, or elderly, is male and female which are 60 years old and above (United Nations, 2015). In 2015, the elderly population in the world was estimated at 901 million, which accounted for 12% of the total world population (United Nations, 2015). Moreover, it was found that the population of elderly will increase to 21.5% by 2050 along with the world population, with an observable decrease in the percentage of people aged below 60 (United Nations, 2015). It was suggested that although medical advances are at its best now, the elderly had not experienced better health compared to previous generations, and may have higher risk of poor health over their lifetime. Hence, during the 69th World Health Assembly in 2016, a strategy and action plan on ageing and health was adopted by assembly members. One of the key concepts for healthy ageing is to improve measurement, monitoring, and research on healthy ageing. However, the World Health Organization had pointed out that research of ageing was constrained, hence hampering the efforts on understanding of health problems experienced by the elderly and ways to intervene in those health issues.

Aging will result in the gradual deterioration of bodily functions due to the degeneration of body cells. Furthermore, the deterioration of muscles and bone in elderly was the main causes to the deterioration in bodily functions, and it could result in action impairment (Lee, Chang, Lin, & Shiang, 2015), accompanied with decrease in functional fitness, which means the decrease in the ability to perform daily activities safely and independently (Vagetti, Filho, de Oliveira, Mazzardo, Moreira, Comes, & de Campos, 2015). Hence, means of assessing ability of elderly to maintain their independence in activities of daily life was being research for a long time to get an objective, appropriate, and standardized measure of their functional status. This led to the development of functional fitness batteries.

Functional fitness batteries were designed to assess the physical capacity of elderly to perform normal everyday activities safely and independently. Most functional fitness batteries include a combination of health and performance related test such as aerobic capacity, muscular strength, endurance, flexibility, coordination, balance. The earliest known functional fitness battery was created by the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) and was one of the most popular batteries. However, it had weaknesses of lacking assessment

for lower body muscle functional test, and some of the tasks in endurance and flexibility was hard for many elderly people (Varela, Ayan, & Cancela, 2008). Despite that, the AAHPERD had led the trend for the research of new and standardized ways for assessment of functional fitness.

While functional fitness batteries can assess the physical capacities of elderly, it cannot fully monitor their health conditions or daily activities. Hence, many researches into elderly fitness includes pathological examinations with functional fitness batteries. This did not only help researchers to understand illness accompanied with aging, but it can also help to assess the effectiveness of physical activities in improving elderly health. Furthermore, with the advance in technology, accelerometers were used to monitor the daily physical activities of the elderly for a period of time, which helped researchers to understand the effect of daily physical activities in improving fitness and health of elderly (de Carvalho Bastone, Ferriolli, Teixeira, Dias, & Dias, 2015).

The Ministry of Health and Welfare (R.O.C.) had implemented the Elderly Care Act since 1998 but the policy prioritized on tending the daily needs and requirements of the elderly, not the health of elderly. In 2016, the ministry had reviewed the performance of the act, and found several flaws especially the lack of manpower and budget from local government on the act, which caused disparities of elderly care in different counties. After reviewing the flaws in the act, the ministry had made improvement to the act, and will implement the Elderly Care Act 2.0 in 2017, with addition of illness prevention and reduction methods to improve the physical fitness of the elderly.

This study was conducted to understand the trend and aim of elderly fitness assessment using qualitative research method, specifically content analysis to understand the main issues concerned in elderly fitness research for the past 10 years. Qualitative research is a way to learn about the social reality (Yin, 2016) and can be used across disciplines to study a wide diversity of topics (Leavy, 2014). Content analysis under the umbrella of qualitative research is associated with the study of inscription contained in documents such as newspapers, books, journal articles, and other forms of documentations (Prior, 2014). In addition, from content analysis we can conduct quantitative research to determine the main themes and trend of issues concerned using statistical software. The application of content analysis can be extended to evaluate the effectiveness or value of programs, e.g.: government policies,

training programs, educational programs, etc., which can provide an advantage when the evaluation issues was not clear in advance (Brandon & Ah Sam, 2014). Since the addition of 'improving elderly physical fitness' was new in the Elderly Care Act 2.0, its effectiveness was still unknown. Hence, our research motivation was to use content analysis to get a first glimpse on elderly fitness assessment methods and effective health policies which can improve the fitness of elderly.

The use of content analysis in sports and health academic papers was quite uncommon, but it provides an alternative to understand certain health issues based on various criteria, e.g.: training methods, treatments (Dodd, Taylor, Denisenko, & Prasad, 2006). Then, by selecting specific articles of interest, the articles were further categorized in terms of research priorities or themes such as research methodology, area of research, and understanding on issue (Lee & Poretta, 2013). Afterwards, empirical data can be obtained by recording the number of occurrence on the themes in the articles (Borell, Nygard, Asaba, Gustavsson, & Hemmingsson, 2012). Although content analysis was considered as fundamental and simple, it can still produce research with good quality as a reflection on subject of interest (Vaismoradi, Turunen, & Bondas, 2013).

Research Methodology

Sample Selection

The articles in this study were selected from SPORTdiscus database provided by EBSCOhost. We had searched articles with full text published within the last 10 years (2006-2016) with the keywords 'elderly' and 'fitness'. A total of 390 articles were found, among them, 350 were academic articles whereas 40 articles were magazine articles. After excluding articles which were not peer reviewed academic articles, a remainder of 61 articles based on highest relevance and citations were selected as the sample of this research.

Classification Method

The articles were coded into a Microsoft Excel spreadsheet according to the following: journal name, year published, article title and keywords contained in the article specifically gender of participants, assessment methods, health issues (types of health issues involved in the research) or other topics related to health (training,

research methods) for cross reference. However, only the year published and keywords contained in the articles were analyzed to understand the trend in the number of articles within 2006-2016, and the main issues concerned within the articles. The detail on the classification method were shown in Figure 1:

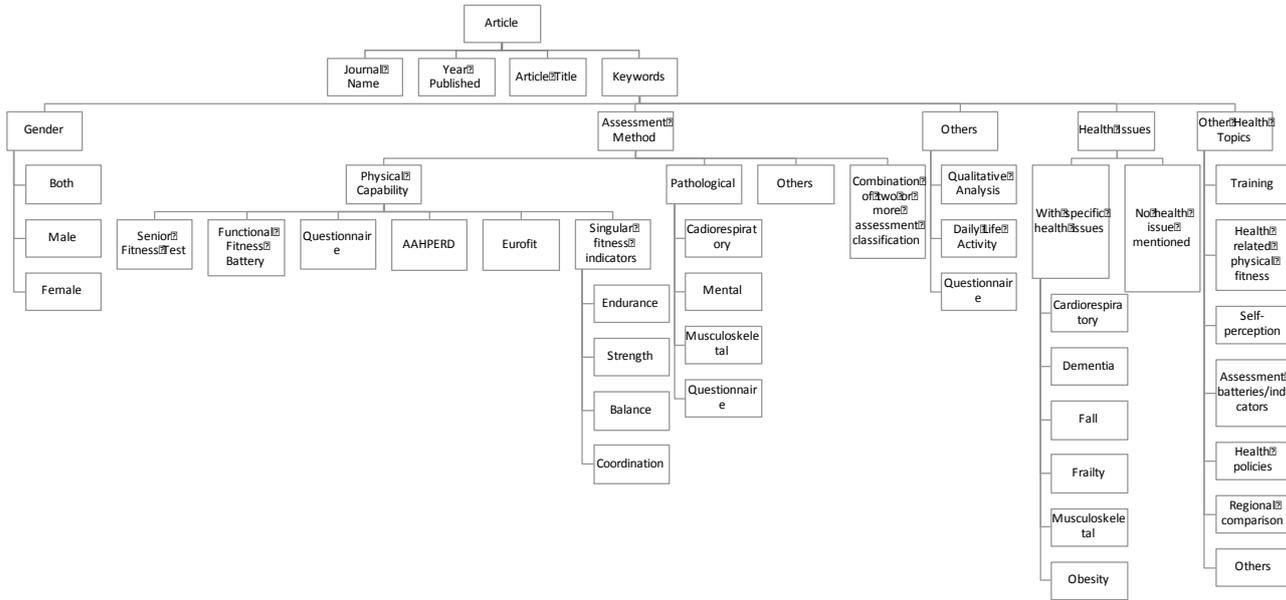


Figure 1. Details in classification of the articles

Data Evaluation Procedure

The data description was done in the following way. First, the number of selected articles published in each year was calculated to determine the trend of articles published with accordance to keywords elderly and fitness. Then, the contents of each articles were categorized according to the following:

1. Gender (Male, Female, Both)
2. General characteristics and assessment method used
3. Health issues (Overweight/Obesity, cardiovascular, muscle-skeletal, etc.)
4. Other health topics (health policies, training methods, etc.)

The data will be recorded by determining the number of occurrence of inscriptions related to the categories above.

Results

The results after compiling all the data are as follow:

Analysis on the articles published in each year

For the number of articles related to elderly fitness published in between 2006 to 2016, there were less than 3 articles published prior to 2011 with the keywords elderly and fitness in the SPORTdiscus database. However, from 2011 onwards, there were at least 6 articles published per year. The number of articles published had doubled in 2015 and 2016 (13 articles in both years) from 2014 (6 articles), shown below Figure 2.

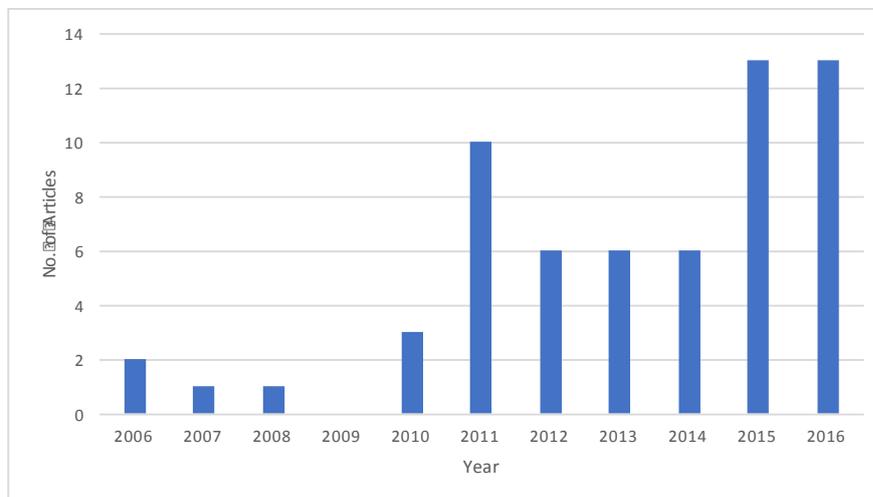


Figure 2. Number of articles published with the keywords 'elderly' and 'fitness' between 2006 and 2016

Content Analysis of the Articles

The articles were analyzed and classified in terms of 'gender', 'assessment methods', 'health issues', and 'other health topics', and the results were as following.

Gender

In the articles analyzed, there were a few researches which included both male and female, or were gender specific, as shown in Table 1 & Figure 3.

Table 1. Summary table of occurrence and percentage of each gender in the articles analyzed

Gender	Number of Occurrence	Percentage
Both	41	67.2%
Female	14	23.0%
Male	6	9.8%

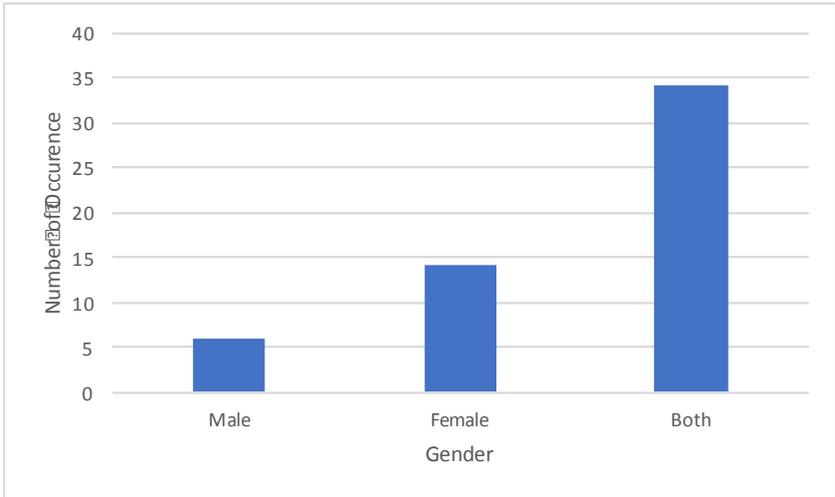


Figure 3. Number of occurrence of different genders in the articles

General Classification and Assessment Method

The articles were analyzed to determine the main issues which was brought up in the articles, and the explanation of the classifications were as shown below the Table 2.

Table 2. Summary for classification of assessment methods in the analyzed articles

General Classification	Assessment Method	Explanation
Physical Capability (The study focuses on assessment of the physical capabilities of the participants)	Senior Fitness Test, Endurance, Balance, Functional Fitness Test, etc.	Any tests that requires participants to undergo real physical tests in the studies
	Questionnaire (Physical)	The studies use questionnaires to study the physical capabilities of the participants
Pathological Assessment (The assessment focused on pathological issues such as cardiorespiratory diseases, musculoskeletal diseases)	Cardiorespiratory	Assessment methods which was related to cardiorespiratory problems such as blood sampling, echocardiography, blood pressure.
	Musculoskeletal	Assessment methods such as bone density or X-ray were used in the study.
	Cognitive	The study uses examinations on the mental state of participants.
	Questionnaire (Pathological)	The studies use questionnaires to study the participants regarding pathological issues.
Others (The assessment cannot be classified into either physical capabilities nor pathological assessments, e.g.: self-perception, literature review)	Daily Life Activity	The use of accelerometers to monitor the daily work rate of the participants.
	Questionnaire (Others)	The studies use questionnaires to study the participants regarding daily life.
	Qualitative Method	The study uses quality analysis method (content analysis, document analysis, literature review) in the article.

Some of the articles may contain more than one of the general classification since the more than one issues was brought up in the same article. For example, “The relation between physical/function fitness and the blood pressure of elderly men and women” (Kostic, Mladenovic, & Mikalacki, 2007) consist both physical capability assessment by using Senior Fitness Test and pathological assessment by using

cardiorespiratory methods. Hence, the analysis on general assessment was recorded as the number of occurrence for physical capability, pathological, or others. Shown below the Table 3, and represented in Figure 4.

Table 3. Number of occurrence for different general classifications

General Classification	Number of Occurrence
Physical Capability	49
Pathological Assessment	19
Others	16
Combination of two or more classification	21

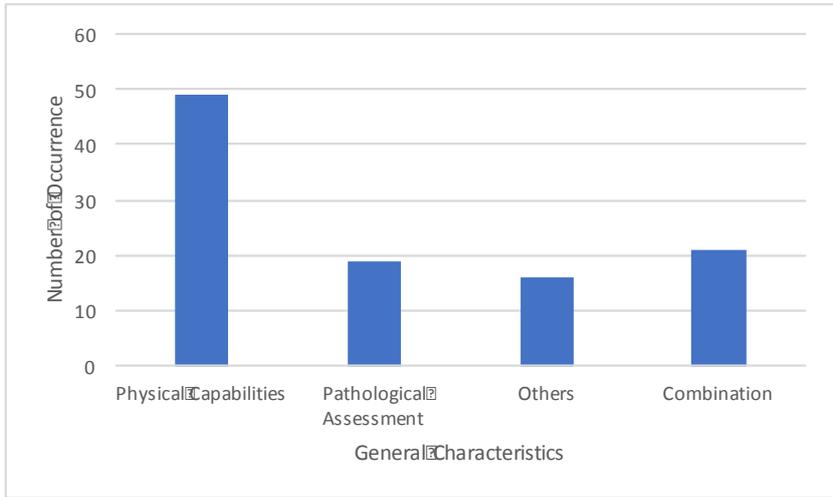


Figure 4. Number of occurrence for each general classification

From Figure 4, it was found that articles related to physical capabilities assessments (49 counts) was the most in the articles analyzed, followed by pathological assessments (19 counts). There were 21 articles which encompasses two or more issues especially the combination of physical capabilities and pathological assessments.

For the assessment methods, some of the articles may have more than one assessment method within one general classification subject, especially for physical capabilities. Hence, the assessment methods were recorded as number of occurrence in different type of assessment method depending on the type of fitness batteries used, e.g.: Senior Fitness Test, AAHPERD, or specific single fitness indicator that was not categorized in any of the fitness batteries, e.g.: balance, coordination, endurance. The number of occurrence for physical capability, pathological, and others were shown in

Table 4, while the graphs for each classification was shown in Figure 5, Figure 6, and Figure 7 for physical capability, pathological, and others respectively.

Table 4. Summary table for assessment methods according to different general classifications

General Classification	Assessment Method	Number of Occurrence
Physical Capability	Senior Fitness Test	18
	Functional Fitness Battery	19
	Questionnaire (Physical)	17
	AAHPERD	2
	Eurofit	2
	Single Fitness Indicator (Total)	15
	Endurance	9
	Strength	3
	Balance	2
	Coordination	1
Pathological Assessment	Cardiorespiratory	12
	Mental	6
	Musculoskeletal	3
	Questionnaire (Pathological)	1
Others	Qualitative Analysis	6
	Daily Life Activity	5
	Questionnaire	5

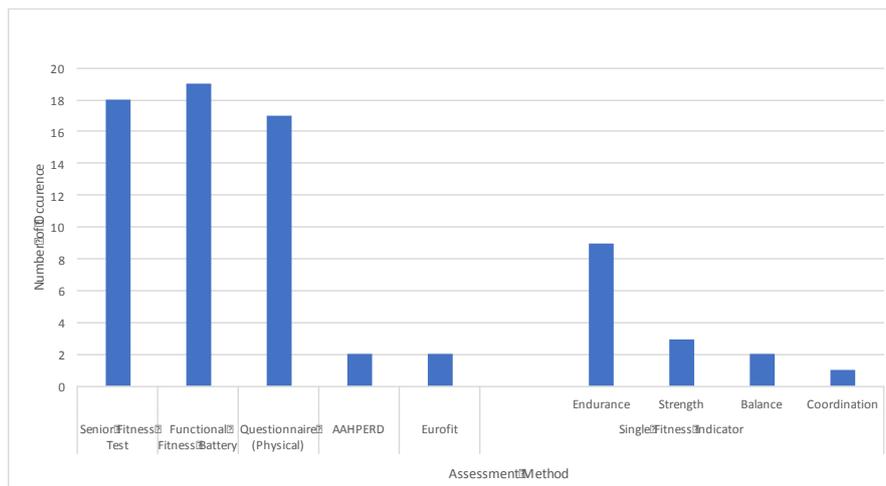


Figure 5. Number of occurrence for assessment method in 'physical capabilities'

From Figure 5, the most used assessment method was the generalized functional fitness battery as most of the studies requires more than one type of fitness indicators.

The second most used battery is the Senior Fitness Test which was proposed by Rikli & Jones (2013), and it was commonly used assessment battery in most studies. The use of questionnaires for physical capabilities was considered many (17 counts) in the articles analyzed to evaluate their readiness for physical tests or to understand their physical activity frequency. For singular fitness tests, endurance was the most tested (9 counts) as it was directly related to cardiorespiratory capabilities.

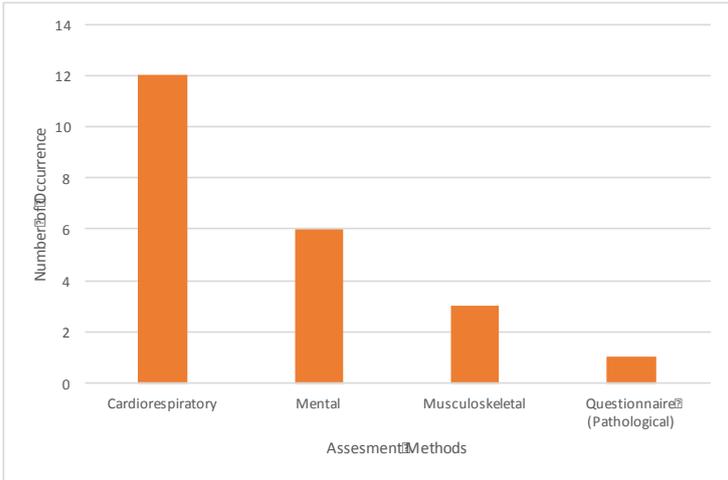


Figure 6. Number of occurrence for assessment method in 'pathological'

From Figure 6, most of the studies focused in pathological assessments of cardiorespiratory, mental, and musculoskeletal illness. In addition, the assessment on cardiorespiratory diseases was the most (12 counts), which was twice of the second ranked mental diseases (6 counts). The use of questionnaire for pathological studies was the least (1 count).

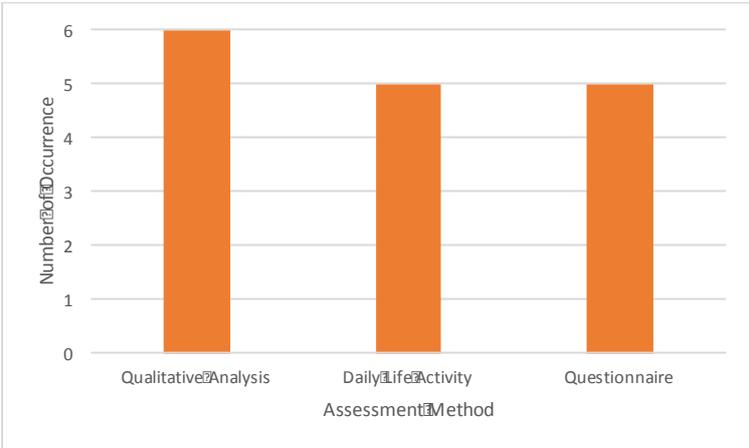


Figure 7. Number of occurrence for assessment method in 'others'

In the ‘others’ category as shown in Figure 7, most of the assessment method in the articles were done using qualitative analysis method (6 counts) such as content analysis or document analysis on health issues and no direct experimentation on participants was involved. The use of accelerometer for daily life activity monitoring (5 counts) was quite common in some articles for researches which require long term monitoring. The use of questionnaires in others were mostly based on self-perception and self-esteem of participants, hence it did not occur much in the articles analyzed.

Health issues

In the articles analyzed, there were some articles which was dedicated for specific health issues such as obesity, cardiorespiratory diseases, dementia, etc. Some articles did not have any specific health issues, while some have more than one. Hence, the data will be presented in two ways. First, based on articles with or without specific health issues mentioned. Second, number of counts on the health issues mentioned. The following are the analysis on health issues of the articles analyzed, as shown in Table 5. Figure 8 shows the comparison of percentage between articles with health issues and without health issues, and Figure 9 shows the number of health issues mentioned in the articles.

Table 5. Summary table on specific health issues mentioned in analyzed articles

With health issues	31
Cardiorespiratory	17
Dementia	2
Fall	5
Frailty	3
Musculoskeletal	5
Obesity	3
No health issues mentioned	30

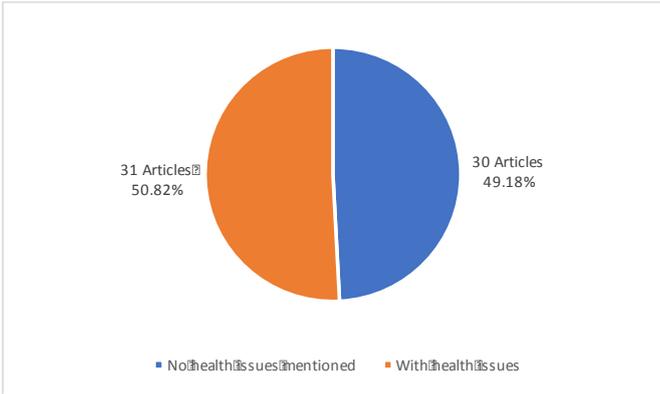


Figure 8. Number and percentage of articles with or without specific health issues mentioned

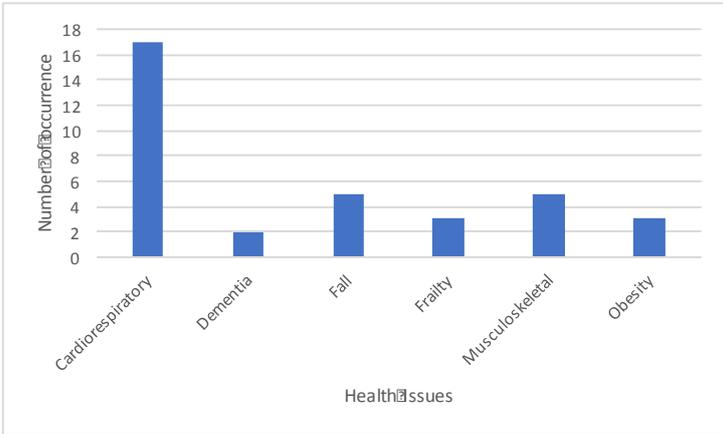


Figure 9. Number of occurrence for health issues mentioned in the analyzed articles

From Figure 8, 50.82% of the articles mentioned about specific health issues (31 articles) while the rest did not (30 articles, 49.18%). Figure 9 indicated that cardiorespiratory illness was the most concerned health issue in the articles analyzed (17 counts), followed by fall and musculoskeletal problems (5 counts each). Obesity and frailty both had 3 mentions in the articles analyzed, while the lowest was dementia with 2 counts.

Other health topics

While most of the articles were studied along with certain health issues, there were some articles which were not, or had both health issues and other health topics. Other health topics related to assessment batteries, health policies, and training methods were also mentioned in many articles. The data was recorded by number of occurrence, and the summary was shown in Table 6 and Figure 10.

Table 6. Summary table for health topics mentioned in the analyzed articles

Health Topics	Number of occurrence
Training	23
Health related physical fitness	10
Self-perception	5
Assessment batteries/indicators	3
Health policies	2
Regional comparison	2
Others	1

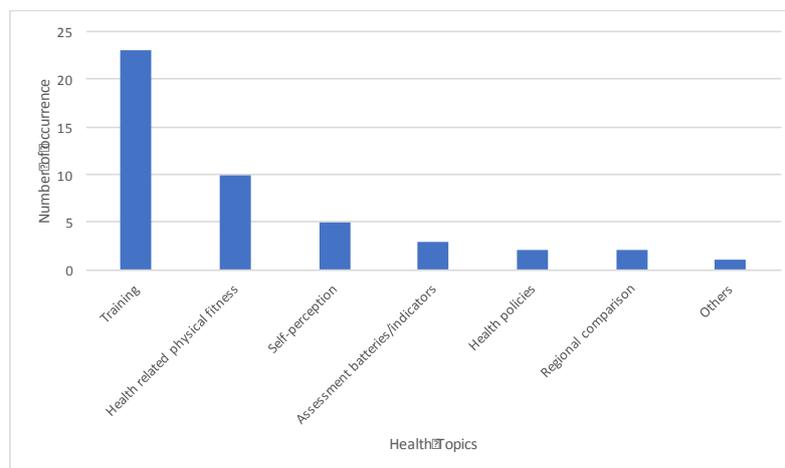


Figure 10. Number of occurrence for 'other health topics' mentioned in analyzed articles

Base on Figure 10, other health topics which were not directly related to illness can be categorized into 7 types in which training had the highest count (23 counts) among all the categories followed by health related physical fitness (10 counts). Articles regarding self-perception had 5 counts and was ranked third.

There were 3 or less counts for assessment batteries/indicators, health policies, regional comparison, and others. The studies on assessment batteries and indicators were aimed to discover the relationship between the assessment batteries or as a review on the assessment batteries and indicators which were common. Furthermore, some of the studies were used assess the effectiveness of government health policies on the elderly fitness. There were also studies on the comparison between 2 or more country regarding the physical capabilities of the elderly.

Discussion

The research on elderly fitness for the past 10 years had gained much attention since 2011 due to the rising elderly population which even gained the attention of world leaders to implement a global strategy and action plan on aging and health in 2016 (United Nations, 2015; World Health Organization, 2016). Moreover, with the advances of technology in recent years, new methods to assess elderly fitness was introduced, such as the use of accelerometers to monitor the daily activity of elderly (Oudegeest-Sander, Thijssen, Smits, van Dijk, Olde Rikkert, & Hopman, 2015; Szeklicki, Osinski, Maciaszek, Stemplewski, & Salamon, 2013) which helped researchers to understand the relationship between habitual physical activity and improvement of health and fitness. In addition, there were also new methods introduced to assist in balance and coordination capabilities training for elderly, such as the Three-Dimensional Multiple Object Tracking Task (3D-MOT) which was proven effective in increasing attention and dynamic balance ability and thus preventing falls among the elderly (Jono & Tujishita, 2016).

In terms of gender, it was found that most of the research includes both male and female participants in their studies because it involves comparison of fitness between elderly male and female. Moreover, a larger sample size for more accurate data collection and analysis using computer software such as SPSS can be obtained by including both elderly male and female. However, when it comes to the classification between men and women, the number of studies dedicated for women was more than twice of men. The research on women may be more due to the change in social norms, where women needs to work while taking care of the family at the same time, hence limiting their time for doing physical activities (Lee, et al., 2015). Thus, justifying the need for research of elderly women functional fitness. Moreover, in some research which involves training programs or HRPF programs, the participation from men were very few (Vagetti, et al., 2015), hence the research will be focused in women.

Since the keyword was focused in elderly and fitness, most of the articles containing these keywords were related to the assessment of elderly fitness, especially using functional fitness batteries especially the Senior Fitness Test which was also known as Fullerton Fitness Test in some articles developed by Rikli & Jones (2013). The Senior Fitness Test focuses on the assessment of physical abilities which allow functional independence of the elderly. Moreover, Senior Fitness Test was easy to

perform and the exercises were safe for the elderly. In addition, the test can be conducted for large population size without taking much time. However, Senior Fitness Test was originally constructed base on the score of voluntary elderly who were physically fit, and hence may not be suitable to elderly who had some difficulties in movement (Varela, et al., 2008).

There were also some researches which included both functional fitness assessment and pathological assessments to assess the effectiveness of health training or programs on the improvement of fitness and health (Boguszewski, Slodkowska Adamczyk, & Ochal, 2012; Wehmeyer, Loots, Nortje, & Lategan, 2014). However, there were also a few researches which uses only questionnaire to assess the functional fitness of elderly, for example: International Physical Activity Questionnaire, with emphasis in pathological examinations, as a method to classify research participants according to their frequency of physical activities (Niederseer, Ledl-Kurkowski, Kvita, Patsch, Dela, Mueller, & Niebauer, 2011).

The results also show that most research emphasized on cardiorespiratory or cardiovascular diseases. This was mainly due to the fact that elderly people tend to have higher risks of cardiovascular diseases such as hypertension and stroke. However, cardiovascular risk factors can be reduced by altering the non-modifiable risk factor such as smoking habits, high blood cholesterol, physical inactivity, etc., and thus regular physical activity to maintain fitness was encouraged (Niederseer, et al., 2011) In addition, the risk of mental illnesses such as dementia was also quite common for the elderly. Although mental illnesses may not be prevented, physical health issues, e.g.: elderly fall, associated with mental illness may be reduced to ensure the safety of elderly (de Brito, Mendes, Sales, Neto, Brito, da Silva Grigoletto, & Ferreira, 2016).

The relationship of functional fitness and musculoskeletal problems was undeniable as most physical capacities in functional fitness assessments requires good functioning of psychomotor abilities. Hence, functional fitness assessment can be used to evaluate the deterioration of musculoskeletal abilities in elderly (Maciaszek, Osinski, & Szeklicki, 2006), and thus, training programs can be introduced to assist in reducing risk of musculoskeletal problems and health problems associated with musculoskeletal deterioration, such as elderly fall (Yoo, Jun, & Hawkins, 2010).

There were many articles that studied on the effectiveness of training methods in improving elderly health and fitness, such as the Salzburg Skiing Program (Müller, Gimpl, Kirchner, Kröll, Jahnel, Niebauer, Niederseer, & Scheiber, 2011), water

aerobics (Garrido, Silva, Novaes, Cirilo-Sousa, & Neto, 2016), and Pilates (Gildenhuis, Fourie, Shaw, Shaw, Toriola, & Witthuhn, 2013) to help improve the physical capabilities of elderly and thus improving their fitness and health. On the other hand, health related physical fitness (HRPF) programs which were community fitness programs organized by governments or local communities for the elderly to maintain habitual exercise were also studied quite much (Itotani, Maeda, Kawaguchi, Murakami, & Kato, 2012; Szeklicki, et al., 2013), for assessment on the effectiveness of community based physical activity programs.

In conclusion, the research on the healthcare of elderly population had gained much attention in recent years as the increase of elderly population may increase the cost in social welfare and healthcare costs, hence becoming a burden to the family, local government, and national government (Timonen, Rantanen, Mäkinen, Timonen, Törmäkangas, & Sulkava, 2008). The best method to decrease the financial burden due to ageing is by ensuring the elderly stays fit and healthy. Elderly who are physically and mentally healthy can still contribute to the community even after their retirement while decreasing the financial burden for their healthcare. Hence, the research on assessing elderly fitness is important to produce a simple and standardized method of evaluation for health.

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