ORIGINAL ARTICLE

Prevalence of Frailty And Its Associated Factor Among Rural Community Dwelling Elderly In Sarawak

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ABSTRACT

Introduction: Frailty, a condition of increased vulnerability to stressors, contributes to adverse health outcomes among the elderly, yet its prevalence and associated risk factors in rural Sarawak remain understudied, necessitating localized research and interventions to mitigate its impact. This study evaluated the prevalence of frailty and its association with socio-demographic factors, social factors, health status, and nutritional status among community dwelling elderly in Bau, Sarawak. **Materials and methods:** This cross-sectional study sampled 268 community-dwelling elderly aged 60 and older in Bau, Sarawak, using stratified random sampling over 16 weeks. Face-to-face interviews on socio-demography, health, social factors, anthropometric measurements, and assessment of frailty via the Malay Pictorial Fit-Frail Scale, with frailty defined by scores of 6 and above, analysed using SPSS version 29.0. **Results:** The response rate was 95%. The mean age in this study was 70.2 (7.34). The prevalence of frail elderly was 35%. Binary logistic regression showed the elderly living alone (OR= 6.34, 95% CI= 1.695-23.665, p <0.05), without mobile devices (OR= 2.97, 95% CI= 1.132-7.766, p<0.05), with 1-year fall history (OR= 11.8, 95% CI= 2.559-54.408, p <0.05), and with low social support (OR= 3.43, 95% CI= 1.552-7.593, p <0.05) face significantly higher risks of frailty. **Conclusion:** The study found sociodemographic, social, and health factors affecting frailty. Thus, a community-based multimodal aged care program that targets both physical and social methods of reducing frailty in the elderly by enhancing physical strength, fostering social connections, and empowering elderly individuals through technology use would be beneficial to the communities of rural Sarawak.
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INTRODUCTION

Frailty is a state of vulnerability to stressors exacerbated by physiologic decline that increases health risk. Frailty is a growing health issue that increases with age and puts people at risk for poor health outcomes (1). Frailty was coined to describe health heterogeneity, notably in older people (2). Over the past four decades, many gerontology studies have examined frailty and its conceptualisations and controversies to conclude that it is a major public health issue that threatens the elderly and that identifying it benefits individuals, families, carers, and society (1, 3). In recent decades, many epidemiologic studies have examined the prevalence of frailty in various settings and found several biophysical, psychological, and social factors that are linked to it (3). Elderly face more health risks. Chronic medical conditions increase their risk of morbidity and disability. Elderly people also utilise more health services and need more specialised care (3). The growing expansion of the elderly will affect all aspects of society, including health care. Frailty changes with age and life stage (1). Various frailty related studies shown that frailty can be prevented if risk factors or predictors are detected early.

Age-related decline in reserves and resiliency capacity increases vulnerability to stressors (4, 5). Early frailty detection may prevent health problems. Recent cohort studies in Malaysia found that frail old were 6 times more likely to suffer unfavourable outcomes at 18 months than non-frail elderly using the Malay Pictorial Fit-Frail Scale. The study included a small sample of Sarawak (6). Nevertheless, it presents a solid argument for Malaysia, especially Sarawak, to identify frailty risk factors and groups to design effective preventative policies to lessen frailty's impact on individuals and the health system.

Frailty is a growing concern among elderly populations in Malaysia, with prevalence ranging from 5.7% to 56.5%. However, most studies have been conducted in Peninsular Malaysia, leaving a critical gap in

understanding frailty in Sarawak, a region with distinct sociodemographic and geographical differences (7).

Furthermore, it was hypothesized that the observed disparities among different groups of elderly were attributable to socioeconomic and sociocultural factors (4). Following this, frail individuals were susceptible to synergistically exacerbated health disparities due to their heightened vulnerability and limited resources with which to compensate (8). Research indicates that frailty prevalence is higher in rural areas, likely due to socioeconomic factors such as lower income, education levels, and limited healthcare access (7). These disparities highlight the urgent need for localized studies in Sarawak to identify the factors contributing to frailty and the high-risk groups requiring early intervention.
Hence, this study aimed to determine the prevalence of frailty and its association with socio-demographic factors, social factors, health status, and nutritional status among community dwelling elderly in Bau, Sarawak.

MATERIALS AND METHODS

This was a community-based cross-sectional study conducted in Bau where data on socio-demographic, social factors, health status, and nutritional status via anthropometric measurements were collected. This study design was chosen because of its low resource and time needs, as well as its capacity to collect elderly frailty prevalence and risk variables, which fit the study's limits.

Sarawak is the largest state in Malaysia with an area of 124,449 km2 where administratively it is divided into 12 divisions and 43 districts. Due to its vast geographical area, Sarawak can be broadly divided into 3 zones which are the northern zone, central zone, and southern zone. Based on the 2020 Population and Housing Census of Malaysia, it was estimated that for year 2023, the state of Sarawak has a population of about 2.5 million and it is among the top states with the highest proportion of elderly population at approximately 12.8% or 319,900 population (9).

The study population included all aged men and women in Sarawak's communal settings, while the sample frame included elderly in the district of Bau, Sarawak. Bau is a sub-urban district with close to 90,000 population. Agriculture drives these populations' economies, with minor businesses in the main town.

This district was chosen due to its higher proportion of elderly residents, estimated at 15.5%, which surpasses that of other districts within the Kuching division. Additionally, Bau's population demonstrates significant ethnic diversity among its elderly, with 71% native ethnic groups, 19% Chinese, and 6% Malay (9). This composition provides a distinctive opportunity to study the interplay between socioeconomic, cultural, and geographical factors affecting frailty. Such insights may not be directly generalisable to other regions of Sarawak, where the demographic and economic profiles might vary, underscoring the importance of localized research in this district.

This study was conducted over the period of 9 months starting from the month of October 2023 and end by June 2024. Data was collected from March 2024 to June 2024, over a period of 16 weeks.

The inclusion criteria were those aged 60 years and above, consented Malaysians and permanent resident in the community or at least 1 year residing at the same place while the exclusion criteria were those not consented, failed three attempts of interview, had physical deficits such as auditory impairment, visual impairment, hemiparesis, and aphasia and also severe cognitive deficits such as Alzheimer disease or severe dementia.

The single proportion method from OpenEpi Version 3 yielded 270 samples after accounting for 5% non-response. Nine Bau regions were stratified by ethnicity into Bidayuh, Chinese, and Malay subgroups. This study surveyed elderly in randomly selected villages from the three groupings. Villages were chosen from Bau's district office list. Final sample unit was chosen from the village headman's (Ketua Kampung) list of households. Villages and sampling units were randomly selected using the Random Number Generator and assigned ascending numbers from one. At least one elderly person was assumed in every family. If a household had multiple elderly, they were all sampled.

Face-to-face interviews were conducted in the sample population, and data was collected one time at home without follow-up. Individual interviews were conducted in Bahasa Malaysia by the same researcher. Before the interview, all respondents or their caretakers were informed about the objectives and methods of the study based on the Respondent Information Sheet. The Informed Consent Form was used to gain written informed consent from all study participants.

The development of the instruments in this study consists of 5 sections which are section A for socio-demographic related questionnaires, section B for social factors related questionnaires, section C for health status related questionnaires, section D for frailty assessment and section E on anthropometric measurements for nutritional status where all were completed by every respondent or their caretaker via interviewer assisted self-administer method.

Data were collected using structured questionnaires which consist of 4 sections. Section A was to explore the socio-demographic factors of the respondent where it has a total of 7 questions namely: age, gender, ethnicity,

education level, marital status, household income and work status.

Section B was to explore the social factors of the respondent such as living status, use of mobile device and social support measurement where it was measured using the validated shortened 11-items Malay version of Duke Social Support Index (DSSI) (10). The DSSI were divided into 2 subscales namely social interaction (4 items) and subjective support (7 items). The grading ranged from 3 to 33 in 3 points increment where scores were categorised as low (≤ 26), high (27-29) and very high (30-33).

Section C was to explore the health status of the respondent where it has a total of 5 questions namely presence of medical illness diagnosed by a doctor, history of fall, history of hospitalisation, presence of psychiatric illness diagnosed by a doctor and cognitive status assessed using the Malay version Mini Mental State Examination scale (MMSE) with the recommended cut-off point adjusted for education as 14 with no prior schooling, 17 with at least primary education and 22 for those with secondary education and above based on the translation and validation study by (11).

Section D consist of frailty assessment via Malay version Pictorial Fit-Frail Scale (PFFS-M) where this scale was used to assess frailty and determined to be the dependent variable of this study. The PFFS-M is an assessment tool developed to assess and detect frailty in a simpler manner. It conforms to the multidimensional approach comprising of 14 health related domains where all aspect of health determinants were considered during the development of this tool. The 14 domains consist of mobility, function, balance, medication, mood, social, tiredness, memory, vision, hearing, pain, weight loss, aggression, and bladder control. The grading for each domain began with 0 representing no or least impairment with an increment of 1 level for each of subsequent grades. The overall summed up score for all 14 domains would range from 0 to 43. This study leverage on the fact that this assessment tool is in pictorial format and has been translated and validated in Bahasa Malaysia which made the assessment easy to administer and adaptable to the Malaysian context (12). The Malay version PFFS categories frailty as non-frail (PFFS-M scores 0-3), at-risk of frailty (PFFS-M scores 4-5), and frail (PFFS-M scores 6 and above) (6).

Section E comprised of anthropometric measurements for assessment of nutritional status where measurements of weight was taken using the same calibrated digital electronic body weight scale throughout the collection period. All measurements were taken twice, and the average was recorded. Simple instructions were given to the respondent to be clothed lightly, remove all personal items from the body, stand still in an upright manner with feet positioned in the middle of the scale platform. Respondents were signalled to step up to the scale platform when the display panel indicated zero digits and to step down the scale platform when display panel indicated static digits. Measurement of height was taken using standard measuring tape placed on a flat surfaced wall. All measurements were taken twice, and the average was recorded. Simple instructions were given to the respondent to be barefooted, stand upright looking forward while leaned against the wall where the measuring tape was, with both legs straight, flattened feet and knees positioned side by side, head, buttock and heels touched the wall. Waist circumference was taken using standard measuring tape and the measurement was done to the nearest centimetre. All measurements were taken twice, and the average was recorded. Measurement followed the NHANES III Protocol where the measuring tape was placed at the intersection point of 2 imaginary lines drawn horizontally from both sides of uppermost lateral border of superior iliac crest and vertically at midaxillary line. The tape was placed parallel to the flood and well snugged to the skin of the body without compressing it (13).

Raw data were entered into Microsoft Office Excel 365 and was carefully verified. Data cleaning was carried out then underwent coding and recoding. Statistical analysis was conducted using the Statistical Package for Social Science (SPSS) version 29 from IBM software. Descriptive analysis described the profile of the respondents where the findings were explained using frequencies and percentages for categorical variables while using mean and standard deviation for continuous variables.

The Chi Square test was used to look at the relationship between frailty and other variables. These variables included socio-demographic factors (age, gender, ethnicity, education level, marital status, household income, and work status), social factors (social support, living situation, and use of mobile device), health status (present illness, history of falls, history of hospitalisation, and cognitive status), and nutritional status through anthropometric measurements (BMI and waist circumference). The dependent variable in this study did not have a normal distribution, even after normality checks using tables and graphs. So, a non-parametric test was used. Binary logistic regression was used to find the factors that could predict frailty. Variables that were statistically significant with a p-value of less than 0.05 in the univariate analysis were added to the multivariate model using the enter method and adjusted with the known confounders such as age, gender, marital status, education level and household income. The results were given as an odds ratio (OR) with a 95% confidence interval for each of the independent factors. Hosmer-Lemeshow test was used to see how well the models fit, and a significance level of 0.05 was chosen for all of the analyses.

Ethical approval for this study was obtained from the Ethical Committee of University Malaysia Sarawak with the reference number of UNIMAS/TNC(PI)/09 – 65/01 Jld.3 (30) and dated 22nd February 2024. Permission to use the instruments were requested from the authors and granted for use in this study. Permissions to conduct the study in the selected villages in Bau district were obtained from the community leader or locally known as K*etua Kampung* of each village. Informed consent were also obtained from the respondents prior to data collection whereby the respondents were briefed in accordance to the information in the Respondent Information Sheet.

RESULTS

Referring to Table I, the study included 268 seniors aged 60–90 from villages in three Bau district groups, with a mean age of 70.2 years. Women comprised 57% of respondents, and 77% were aged 60–74. Bidayuh ethnicity was the largest group (40%), followed by Chinese (30%) and Malay (27%). Most participants (65%) had primary education, 85% were married, and 96% reported low household incomes, with only 5% being employed. Socially, 92% did not live alone, and 72% had low social support, while mobile device usage was high at 85%. Health data showed that 75% had one or no medical issues, 94% reported no recent falls, and 92% had no hospitalizations in the past five years. All respondents had normal cognitive function. Nutritional analysis revealed that 42% were overweight, 22% were obese type I, and 62% lacked abdominal obesity. These findings highlight a predominance of low income, low social support, and varying nutritional statuses among the elderly in Bau.

Table I: Socio-demographic, social, health factors and nutritional status of respondents (N=268)

	n(%)	Mean(SD)	Min, Max
Age (year)		70.2 (7.34)	60, 90
60 – 74 years	207 (77)		
≥ 75 years	62 (23)		
Gender			
Male	115 (43)		
Female	153 (57)		
Ethnicity			
Malay	74 (27)		
Chinese	80 (30)		
Bidayuh	106 (40)		
Others	8 (3)		
Education level			
No formal education	95 (35)		
Formal education	173 (65)		
Marital status			
Single/Widowed/Divorced	41 (15)		
Married	227 (85)		
Household income			
< RM 5,250 (Low)	257 (96)		
RM 5,250-11,820 (Middle)	11 (4)		
> RM 11,820 (High)	0		
Work status			
Not working	256 (95)		
Working	12 (5)		
Living status			
Not alone	247 (92)		
Alone	21 (8)		
Use of mobile devices			
No	41 (15)		
Yes	227 (85)		
Social support (Duke Score)		24.2 (4.25)	12, 33
≤ 26 (Low)	194 (72)		
27-29 (High)	34 (13)		
30-33 (Very high)	40 (15)		
Known Medical illness			
0-1 illness	202 (75)		
2 or more	66 (25)		
History of fall in recent 1 year			
No	253 (94)		
Yes	15 (6)		
History of hospitalisation in recent 5 years			
No	246 (92)		
Yes	22 (8)		
Cognitive status			
Normal	268 (100)		
Impaired	0		
BMI (kg/m^2)		24.2 (3.87)	15.2, 41.9
<18.5 (Underweight)	9 (3)		
18.5-22.9 (Normal)	70 (26)		
23-24.9 (Overweight)	111 (42)		
25-29.9 (Obese I)	59 (22)		
≥30 (Obese II)	19 (7)		
Abdominal obesity			
Abdominal obesity (≥90cm for men, ≥80cm for women)	166 (38)		
Normal	102 (62)		

From Table II, it is depicted that the prevalence of frailty among elderly in this study stood at 35% by using the PFFS-M. It is then followed by 37% fell into the category of non-frail and 28% of the elderly were at-risk of frail. The scoring ranged from 0 to 19 with a mean score of 5.2 + 3.83.

Table II: Prevalence of Frailty (N=268)

	n(%)	Mean (SD)	Min, Max
Pictorial Fit-Frail Scale		5.2 (3.83)	0, 19
0 – 3 (non-frail)	100 (37)		
4 - 5 (At-risk of frail)	75 (28)		
≥ 6 (Frail)	93 (35)		

In Table III, univariate analyses using the Chi-square test revealed significant associations between frailty and several factors across socio-demographic, social, and health domains. Among socio-demographic characteristics, gender (χ^2 = 14.9, p < 0.001), ethnicity (χ^2= 32.7, p = 0.001), and education level (χ^2 = 4.6, p = 0.033) were significantly associated with frailty. Social factors such as living status (χ^2= 5.1, p = 0.024), use of mobile devices (χ^2= 17.6, p < 0.001), and social support (χ^2 = 6.55, p = 0.013) also showed significant relationships. In terms of health status, known medical illness (χ^2= 5.8, p = 0.016) and a history of falls in the past year (χ^2= 10.5, p = 0.001) were significantly linked to frailty, while nutritional status, including BMI and abdominal obesity, was not significantly related.

Table III: Factors associated with frailty (N=268)

	Frailty status		P value
	Non-frail	Frail	
Age			
60 – 74 years	132 (64)	74 (36)	0.444
≥ 75 years	43 (69)	19 (31)	
Gender			
Male	90 (78)	25 (22)	**<0.001***
Female	85 (56)	68 (44)	
Ethnicity			
Malay	67 (91)	7 (9)	**0.001***
Chinese	45 (56)	35 (44)	
Bidayuh	56 (53)	50 (47)	
Others	7 (87)	1 (13)	
Educational level			
No formal education	70 (74)	25 (26)	**0.033***
Formal education	105 (61)	68 (39)	
Marital status			
Single/Widow/Divorced	24 (58)	17 (42)	0.323
Married	151 (66)	76 (34)	
Household income			
< RM 5,250 (Low)	167 (65)	90 (35)	0.597
RM 5,250-11,820 (Middle)	8 (73)	3 (27)	
Working status			
Not working	168 (66)	88 (34)	0.604
Working	7 (58)	5 (42)	
Living status			
Alone	9 (43)	12 (57)	**0.024***
Not alone	166 (67)	81 (33)	
Use of mobile device			
No	15 (37)	26 (63)	**<0.001***

CONTINUE

Table III: Factors associated with frailty (N=268) (CONT.)

	Frailty status		P value
	Non-frail	Frail	
Use of mobile device			
Yes	160 (70)	67 (30)	**<0.001***
Social support			
≤ 26 (Low)	118 (61)	76 (39)	**0.013***
27-33 (High and very high)	57 (77)	17 (23)	
Known medical illness			
0-1 illness	140 (68)	62 (32)	**0.016***
2 or more	35 (53)	31 (47)	
History of fall in recent 1 year			
No	171 (63)	82 (37)	**0.001***
Yes	4 (27)	11 (73)	
History of hospitalisation in 5 years			
No	164 (67)	82 (33)	0.116
Yes	11 (50)	11 (50)	
BMI			
Underweight and normal	51 (65)	28 (35)	0.869
Overweight and Obese	124 (66)	65 (34)	
Abdominal Obesity			
Abdominal obese	108 (65)	58 (35)	0.917
Normal	67 (66)	35 (34)	

* $p < 0.05$, where, p-value derived from Chi Square Test.

Table IV shows binary logistic regression analysis of frailty predictors into non-frail and frail outcomes. All significant factors (p < 0.05) from univariate studies were incorporated into the multivariate model. Age, gender, marital status, education level, and family income were added to the model as confounders to correct for associations during regression analysis. All assumptions were tested to justify logistic regression for this analysis. The reference category was a non-frail result, with a statistical significance level of p < 0.05. As a result, living alone (OR= 6.34, 95% CI, 1.695-23.665), not using mobile devices (OR= 2.97, 95% CI, 1.132-7.766), low social support (OR= 3.43, 95% CI, 1.552-7.593) and history of fall in recent 1 year (OR= 11.8, 95% CI, 2.559-54.408) remained significant positive correlates of frailty.

Table IV: Binary logistic regression predicting frailty

	B	Exp (B)	95% CI for Exp (B)		P value
			Lower	Upper	
Living status					
Not alone (RC)					
Alone	1.846	6.34	1.695	23.665	**0.006***
Use of mobile device					
Yes (RC)					
No	1.087	2.97	1.132	7.766	**0.027***
Social support					
High & very high (RC)					
Low	1.233	3.43	1.552	7.593	**0.002***

CONTINUE

Table IV: Binary logistic regression predicting frailty (CONT.)

	B	Exp (B)	95% CI for Exp (B)		P value
			Lower	Upper	
History of fall in recent 1 year					
No (RC)					
Yes	2.468	11.80	2.559	54.408	**0.002***

* $p < 0.05$
Multivariate model using Enter method: Omnibus test (P= <0.001), Hosmer-Lemeshow (P= 0.742), Nagelkerke's R^2= 0.368
Model adjusted for age, gender, marital status, education level and household income
RC = reference category

This study found that elderly living alone are 6.34 times more likely to become frail, with a 95% confidence interval of 1.69 to 23.67. The odds of elderly not using mobile devices becoming frail are 2.97 times higher than those who do, with a 95% confidence interval of 1.13 to 7.77. The odds of elderly with inadequate social support becoming frail are 3.43 times greater than those with very high social support (95% confidence interval 1.55 to 7.59). Finally, elderly with a recent 1-year fall history are 11.8 times more likely to become frail, with a 95% confidence interval of 2.56 to 54.41.

DISCUSSION

This study examined the prevalence of frailty in elderly Bau residents of Sarawak and found that 35% were frail using the PFFS-M. Due to variation in population characteristics and frailty measurement methods, this study found a higher proportion of frail elderly than other similar studies. Systematic reviews of regional data showed that 19.6% of Latin American and Caribbean community-dwelling elderly were frail, 12% of European community elderly were frail, and 20.5% of Asian community elderly were frail. (14). Most of the systematic reviews noticed the difference in prevalence of frailty obtained when using different instrument tools to measure frailty. Based on a systematic review done by (15) the weighted prevalence using the phenotypical frailty measures was 12% compared to 14% obtained using the deficit accumulation model. Meanwhile in the setting of Asia, the weighted prevalence using the phenotypical frailty measures was 11% compared to 25% using the deficit accumulation model (14). This could be explained by the deficit accumulation model incorporates multi-dimensional criteria that are more sensitive than a physical phenotype's five criteria. Hence, yielding of higher estimates. The newly designed Pictorial Fit-Frail Scale found 20.3% frailty among patients 60 and older at primary health clinics in Selangor and Sarawak (6).

Several factors were identified by the regression analysis as being significantly associated with the likelihood of frailty among Malaysian older individuals who reside in the community setting. Those were living alone, not using mobile devices, low social support and history of fall.

History of falls often serve as a sign of an underlying illness or disability, which is a significant clinical indicator of frailty (16). A study conducted locally in Malaysia found that a previous occurrence of falls was linked to an increased likelihood of having a handicap, leading to higher scores indicating frailty (17). History of fall remained predictive as echoed by the similar findings from other locations (18-20). Falls are the consequences to the decline of physical parameters such as muscle strength, coordination and balance that occurs with ageing which were believed to contribute to the pathogenesis of frailty (21). Note that many studies on falls and frailty objectively measured the physical parameters to better demonstrate the association of both but often found to be focused on single phenotypic domain rather than conforming to the multidimensional approach which this study attempted to adapt.

The results indicated that living alone had 6 times more likelihood to progress to frail state compared to those not living alone. This was supported by a study conducted across five European countries using the validated Tilburg Frailty Indicator which also conformed to the multidimensional approach (22). Systematic review done in 2022 also further support the finding of this study (20). Elderly living alone have been linked to a larger percentage of safety related incidents, chronic diseases, multiple existence of comorbidities and depressive symptoms compared to those who live with their family. These factors make elderly who live alone more susceptible to negative effects on their physical, mental, and social well-being (20). Living status were found to be similarly investigated in a few Malaysian studies but where reported as insignificant which most likely due to their adoption of Fried Phenotypic Criteria as their tool which only measure frailty based on single phenotypic domain (23, 24).

In addition, this study also found out that not using mobile devices among the elderly had 2.9 times higher risk of developing frailty compared to those using mobile devices. Similar result was demonstrated in a population-based study conducted on 794 respondents in Northern Finland. The Finland study concluded that community-dwelling non-frail and frail elderly utilise information and communication technologies differently, both in use and acceptance among the non-users. These discrepancies were partly explained by older age, lower education, and more visual or cognitive impairments. The study also showed that psychological and social risk factors for social exclusion are clustered in the same susceptible group and that a digital divide was observed. The division has been noted not just among younger

and older individuals, but also within subsets of older individuals. The limited adoption of digital technology is attributed not only to insufficient access but also to inadequate utilisation. Hence, the digital divide (25).

A recent systematic review revealed that individual characteristics could influence the adoption of information and communication technologies in which such technologies were more likely to be adopted by elderly who had good coping abilities with uncertainty and unfamiliar situations. The significance of self-efficacy was also emphasised as it might impact the adoption of technologies. Their confidence in their own capacity to use these solutions successfully is crucial. Similarly, elderly may hinder their own acceptance of solutions by imposing constraints on their skills and demands (26). Prior research has shown that pre- and post-exposure to information and communication technologies might help elderly to embrace and adopt them by reducing the initial scepticism and lack of interest. Additionally, elderly who can learn and are supported in their learning are more likely to use technology-mediated mobility options (27). The open-mindedness and adventurous nature in elderly are critical for the successful adoption of information and communication technologies in their daily lives. These attributes enable them to view these solutions as opportunities rather than challenges (28).

There is currently limited evidence about the use of information and telecommunication technology in managing frailty among older adults. A systematic review reported that the most typical uses of information and telecommunication technology for frailty management were for detection, monitoring, and detection, while interventional studies were rare. (29). Nevertheless, the adoption of information and communication technologies could be a sensible choice for elderly with genuine limitations in health condition such as frailty (26).

The result of this study also indicated that elderly with low social support had 3.4 times higher risk for frailty compared to those with high social support. The significance of social support as a predictor of frailty has been examined (30). Malaysian study using the Duke Social Support Index to determine the social support status was able to echo similar findings where poor social support was associated with frail elderly (31). In Asia, social support among older persons is commonly equated with familial support, which serves as a safeguard against the onset of depression. Furthermore, the elderly individual frequently relies entirely on their adult offspring for both their medical and social needs (32). Social support can be derived from several sources such as family, respite services, friends, neighbours, and associations. This support can manifest in the form of emotional and instrumental assistance, boosting self-esteem, facilitating social integration, and providing concrete aid (33). The absence of social support is correlated with detrimental effects on health, particularly among the older population (34).

At univariate analysis, there were a few variables that were independently associated with frailty such as gender, ethnicity, education level and known medical illness. However, the significance could not be proven when included into multivariate analysis. According to the National Quality Forum in 2014, socio-demographic characteristics should be included in adjustments during statistical analysis due to its likely confounding effect in health-related outcome studies. Similar to the socio-demographic characteristics in previous frailty related studies, age, gender, marital status, education level and household income have been reported to be possible confounders for frailty where adjustment were done for its correlations during regression analysis (17, 34). Although, it is known that there is a definite and strong independent association between age and frailty as shown in many studies where it was frequently reported as prevalence of frailty increased with age (4, 14). Other studies showed that age strongly correlated with frailty, especially the physical domain of frailty. Interestingly, age did not affect psychological or social fragility. Age may be a risk factor for physical health owing to human physiology, but not for psychological and social fragility. If an individual loses their spouse and lives alone, they may become isolated and psychologically frail. These conditions can occur at any age and are not limited to older people. This view holds that a specific traumatic life event, not age, might alter psychological and social frailty (35). These explained the possible reason for the insignificance of age in this study which adopted a multidimensional approach. Moreover, cross-sectional studies may find age less significant if they capture a broad range of age groups without accounting for the cumulative effects of aging. In contrast, longitudinal studies that follow individuals over time may better capture the impact of age on frailty as it evolves (36).

In the context of gender as a risk factor for frailty, various systematic reviews have discovered that elderly women had a higher prevalence of frailty than elderly men using either the phenotypical or the multidimensional cumulative deficit models (2, 15) similarly in the Malaysian setting (31) (23). More research indicated that women possess a comparatively elevated risk of experiencing general, physical, and psychological frailty in contrast to men (37). Studies indicated that elderly men were more prone to abrupt death, whereas women typically exhibited a gradual decline linked to an escalation in co-morbidity and disability. Consequently, women exhibited greater frailty than men (38). Notably, in another study, sex did not correlate with social frailty (22). This lack of consensus may stem from varying dimensions used to assess frailty. Nonetheless, social frailty remains a comparatively underexamined topic. To investigate the relationship between sex and social frailty, a more nuanced understanding of social frailty

and its developmental processes must be thoroughly examined. Elderly with low educational level such as primary or secondary education were associated with higher risk of being frail compared to those who received tertiary education (31). All these suggested that the association of the above mentioned with frailty is modifiable with other factors.

Both frailty and co-morbidities increase the likelihood of mortality, morbidity, and hospitalization (3). Many studies had emphasized that co-morbidities and hospitalisation exhibited a positive correlation with frailty among community-dwelling individuals (4, 31, 39). However, their symptoms, associations, and long-term consequences often overlapped over the ageing continuum, making it impossible to distinguish their directionality. Hence, their relationship with frailty could also be modifiable with other factors too.

This study was not able to conclude on the relationship between nutritional status and frailty despite of conducting the standard nutritional assessment in the community setting. Study has shown that high BMI particularly those with truncal obesity were significantly associated with frailty (23). Many studies incorporated extensive anthropometric measurements using sophisticated equipment such as the bioimpedance analyser to measure size, build, muscle mass and fat reserve measurements. Growing reports suggested frailty is associated with a low muscle mass and/or high body fat mass and had a smaller size and build measurements (40, 41).

While anthropometry has commonly been employed to stratify the nutritional status in individuals, its complexity in obtaining accurate measurement became more intricate when applied to fragile elderly individuals who experience alterations in body composition. The results of these anthropometric measures are frequently misleading when it comes to frail older persons (42). More advanced nutritional evaluation methods, especially in low- and medium-income countries, or community-level research with limited resources may not be feasible. Complete nutritional assessment should include serum biomarkers, physical performance testing, advanced anthropometric measuring methods, and dietary assessments.

As for interventions, the effectiveness of community-intervention programs that focused on social interaction and exercise was investigated in Japan. The results indicated that programs that were self-managed or operated by a volunteer reduced the risk of functional disability (43, 44). A separate study investigated the effectiveness of a community-based frailty-prevention program that focused on a multifactorial approach, incorporating resistance exercise, nutritional education, and psychosocial interventions to postpone the onset of functional disability in community-dwelling older adults. The impact of a community-based intervention program on cause-specific functional disability was demonstrated in the study, which has not been reported in the aforementioned previous studies. (45).

This study should be interpreted in light of some limitations. It employs a cross-sectional study design, which does not allow for establishing temporal or causal relationships between variables. The study may not be representative of the wider population due to the exclusion of other major ethnic groups in Sarawak. Limitations in time and resources may also have affected the depth and extensiveness of the study. Non-response at 5%, the use of self-reporting, and the exclusion of environmental factors, as well as health and lifestyle behaviours such as diet and smoking, could have impacted some of the associations. Additionally, there may be an underestimation of the prevalence due to the inclusion of generally healthy respondents while excluding those with severe physical and cognitive impairments, who are essentially frail elderly individuals. The frailty assessment tool used in this study differ from majority of the existing studies which may affect the estimation of frailty. Although there are differences, these changes are comparable to those observed in other studies on frailty that have used a similar definition or multidimensional approach.

CONCLUSION

In conclusion, the frailty status among the elderly in Bau is a significant issue, with a high prevalence of 34%. Factors such as living alone, lack of mobile device usage, limited social support, and a history of falls contribute to frailty. The present results underscore the necessity of additional research on interventions that target both physical and social methods of reducing frailty in the elderly. Thus, proposing a multimodal aged care program incorporating resistance exercise, nutritional education, and psychosocial interventions that is community-based and self-managed or operated by a volunteer which would be particularly beneficial in the rural areas of Sarawak.

Health authorities should tailor healthcare programs to local contexts and strengthen interagency collaborations. Create or facilitate community centers or support groups that provide a space for social engagement, learning, and access to information and communication technology, as well as physical activities. This helps prevent isolation, promotes technology adoption, and enhances physical health for older adults. While there are significant challenges, such as logistical difficulties, resource limitations, and technological barriers, combining community-based strategies with innovative technological solutions can substantially improve the quality of elderly care in rural contexts. Evaluation studies should also be conducted on current aged care programs to assess their effectiveness in

preventing frailty among the elderly in the community. Further research is needed to determine differences in frailty status and associated factors between ethnic groups in Sarawak. Additional research is required to thoroughly evaluate the information and communication technology-related needs, enabling factors, and barriers to the adoption of such technology among the elderly. The study suggests community-based interventions for healthy aging, requiring multi-perspective, needs-based approaches and consensus among stakeholders with shared interests. The study highlights the need for cross-healthcare collaboration between health authorities, local government, social and welfare services, non-governmental organizations, and the community to improve elderly health.

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