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A high prevalence of malnutrition in acute geriatric patients predicts adverse clinical outcomes and mortality within 12 months

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Abstract

Background & aims Older malnourished patients experience increased length of hospital stay and greater morbidity compared to their well nourished counterparts. This study aimed to assess whether nutritional status at hospital admission predicted clinical outcomes at 12 months follow-up. Methods Secondary data analysis of 2602 consecutive patient admissions to an acute tertiary hospital in New South Wales, Australia on or before 1st June 2009. Twelve-month data was analysed in a sub-sample of 774 patients. Nutritional status was determined within 72 h of admission using the Mini Nutritional Assessment (MNA). Outcomes, obtained from electronic patient records included hospital readmission rate, total length of stay (LOS), change in level of care at discharge, and in-hospital mortality. Results A third (34%) of patients were malnourished and 55% at risk of malnutrition. Using a Cox proportional hazards regression model, controlling for underlying illness and age, patients at risk of malnutrition were 2.46 (95% CI: 1.36, 4.45; p = 0.003) times more likely to have a poor clinical outcome (mortality/discharge to higher level of care), while malnourished patients had a 3.57 (95% CI: 1.94, 6.59; p = 0.000) times higher risk. Conclusions A poor nutritional status carries a substantially greater risk of death and/or loss of dependency in older adults. Interventions to improve the nutritional status of patients during their hospital stay, and following discharge back to the community, are needed to lower the risk of adverse outcomes.

Keywords

geriatric, patients, predicts, adverse, prevalence, acute, malnutrition, 12, months, outcomes, clinical, mortality, high, within

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Results: A third (34 %) of patients were malnourished and 55 % at risk of malnutrition. Using a cox proportional hazards regression model, controlling for underlying illness and age, patients at risk of malnutrition were 2.46 (95%CI: 1.36, 4.45; p=0.003) times more likely to have a poor clinical outcome (mortality/discharge to higher level of care), while malnourished patients had a 3.57 (95%CI: 1.94, 6.59; p=0.000) times higher risk.

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Introduction

Malnutrition is a commonly reported problem amongst hospitalised elderly patients, with estimates of between 30 and 43 % in acute Australian hospitals.[1-3] However the prognostic impact on adverse clinical outcomes in this age group is not well quantified. Many studies have reported increased surgical complications, delayed wound healing, greater morbidity and increased length of hospital stay, as well as a decreased quality of life in malnourished older adult[4, 5] but comparisons between studies are hampered by the use of different nutrition assessment criteria and varied lengths of follow-up.

Despite the existence of clinical guidelines that recommend malnutrition screening in all older patients admitted to hospital,[6, 7] malnutrition often remains undetected and untreated because it is not considered to be a clinical priority.[8] The Mini Nutritional Assessment (MNA) has been used extensively in older patients in community, hospital and nursing home settings in many countries around the world and is considered to be the most appropriate instrument to use in this age group[9, 10] Globally, the prevalence of malnutrition in older adults, using this method, has been reported to be highest in rehabilitation (51 %) and acute (39%) hospital settings, but has also been detected in 14% of nursing home residents and 6 % of community-dwelling elderly.[11]

Seven studies of older patients admitted to acute hospitals that have used the MNA instrument have found that malnutrition predicts mortality, both at discharge and over periods of up to 5 years. These studies have mostly been conducted in European countries,[12-15] as well as in Israel[4] and Taiwan.[16] In Australia, Visvanathan et al.,[17] reported higher rates of mortality associated with malnutrition over 12 months in older people receiving domiciliary care in Adelaide, however data from other settings is unavailable. A secondary analysis of older patients admitted to an acute hospital was undertaken to investigate the association between nutritional status and clinical outcomes, including total length of hospital stay, number of hospital readmissions, discharge to a higher level of care and mortality within a 12-month period of follow-up.

Methods

Study design

Secondary analysis of patient records was conducted, whereby nutritional data was cross-referenced and merged with other patient data from electronic patient medical records at a major tertiary care referral hospital in the Illawarra Shoalhaven Local Hospital District of regional New South Wales, Australia. It is protocol within this associated hospital network for all patients aged 65+ y to undergo a nutritional assessment using the 18-item MNA, administered by a clinical dietitian, within 72 hours of hospital admission. For the assessment of prevalence of malnutrition, all patients aged 65 years and older who were admitted to the acute geriatric units of a single major tertiary hospital on or before 1st June 2009 made up the sample. The MNA is scored as follows: Malnourished (score < 17); At risk of malnutrition (17 – 23.9); and Well nourished (≥ 24).[18]

Eligibility for inclusion in the 12-month follow-up study included: admission to one of three acute geriatric care wards (where the frailest elderly acute patients are placed) between 1st January 2009 and 31st December 2010 (this allowed for follow-up data over a 12-month period in all recruited patients) and a complete MNA assessment documented during their index hospital admission(i.e. first admission during the defined time period). Data was available for 2602 patients from which a sub-sample of n = 774 was included in the 12-month analysis; the selection process thereof is shown in Figure 1. Detailed information was retrieved from electronic patient records on subsequent hospital admissions, including presentations to the Emergency Department and length of hospital stay (LOS) within the 12 month period, as well as destination of discharge, change of level of residential care compared to admission, and Major Disease Classification (MDC) (used as a proxy for underlying illness). Mortality was recorded as an in-hospital recorded death during the follow-up time. Original scanned copies of patients' files were reviewed to obtain missing information and date of hospital discharge obtained from the computerized patient information system.

Ethical approval was obtained from the University of Wollongong Human Research Ethics Committee and site specific approval obtained from the South Eastern Sydney Illawarra Area Health Service. All data retrieval and merging into a composite database occurred on-site at the hospital and the final dataset contained de-identified data.

Statistical analyses

All statistical analyses were carried out using SPSS statistical program (V17.0-19.0: IBM SPSS, IBM Corporation Armonk, NY). One Way ANOVA and Kruskall Wallis tests were used to determine differences according to nutritional status categories. Spearman correlation coefficients were determined to assess associations between variables of interest.

Analysis of covariance (ANCOVA) was conducted to investigate difference in total 12-month LOS (ln transformed), according to category of nutritional status, adjusting for MDC and age. Summary estimates prior to transformation are presented for ease of interpretation. Binary logistic regression analysis was performed, controlling for age, gender, and MDC to investigate the association between malnutrition and change in level of care dichotomized as unchanged or increased/death.

Cox proportional hazards regression analyses were performed with time to death as the dependent variable and death as the event. Both unadjusted and adjusted models that included the covariates (independent variables) of MNA category (reference category is ‘well nourished’), MDC (reference category is ‘other’) and gender (reference category is ‘female’), were performed. For the purpose of regression modelling the nine MDC categories were collapsed into five, due to small numbers in some categories. Diabetes, gastroenterology and renal were included into “other,” while falls were included with acopia/syncope/frailty and neurology moved into cognitive disorders.

Results

The total sample of N = 2 602 acute geriatric patients admitted to Wollongong Hospital for whom MNA data was available had a mean age of 83 (7.2) years with 60 % comprising women. Men were significantly ($P<0.001$) younger, taller and heavier, but had a similar BMI, and MNA score to women (data not shown). Well nourished individuals were younger and heavier than the other two categories of nutritional risk (Table 1). Prevalence of malnutrition is compared with other published studies that have used the MNA in acute hospitals in Table 2.

The sub-sample of 774 patients included in the 12-month analysis was similar in mean age, BMI and MNA score, and had a similar prevalence of malnutrition, to the total sample (Table 3). The median overall MNA score was 19.5 (IQR15.5-22.0) which falls within the "At Risk of Malnutrition" category. Major Disease Classification (MDC) data identified that orthopaedic conditions were the predominant cause of index hospital admission, accounting for 41% of all patients, followed by respiratory pathologies (13%). 'Other' medical conditions that included cancer, multiple co morbidities, anaemia, post-operative infections or complications, DVT, fever and sepsis, accounted for 12% of patients. MDC did not differ according to MNA category (p= 0.064). Of note is the high prevalence of malnutrition in those who had experienced a fall or who had cognitive disorders (41 % and 48 %, respectively).

Table 3 details the descriptive statistics for the total sample and sub sample, and Table 4 shows the characteristics of the sub sample by MNA category. MNA score was inversely associated with age ($r = - 0.145$; $p = 0.000$), BMI ($r = - 0.216$; $p = 0.000$) and total summed LOS ($r = - 0.114$, $p = 0.002$).

After the index hospital admission, 74 % of well nourished patients were discharged home, compared to 53% of 'at risk' patients and 36% of 'malnourished' patients ($P<0.001$). Of those discharged to a low level of care, 55% and 37%, were classified as 'at risk' and 'malnourished,' respectively while of those discharged to High Level of Care (HLC) facilities, 54% and 42% were 'at risk' and 'malnourished, ' respectively.

Of those who had died by the end of the 12 month follow-up period, 94% were classified as either malnourished or 'at risk' at their index admission (Table 5). A significantly greater percentage of 'malnourished' and 'at risk' patients had an increase in level of care at discharge over 12 months, compared to well nourished patients (p = 0.000) (Table 5).

Using a logistic regression model to assess the effect of malnutrition on poor clinical outcome, those at risk of malnutrition were 2.46 (95%CI 1.36, 4.45 p=0.003) times more likely to be deceased or require an increased level of care, compared to well nourished patients and those who were malnourished were 3.57 (95%CI 1.94, 6.59 p=0.000) times more likely to be deceased or require an increased level of care, compared to well nourished patients (overall model significant; χ^2 of 49.63, 9df; p =0.000). In the unadjusted survival analysis, those who were malnourished were 3.68 (95%CI 1.58, 8.58) times more likely to die than those who were well nourished (P=0.003), while those who were at risk of malnutrition were 1.89 (95%CI 0.81, 4.41) times more likely to die compared to those who were well nourished (P=0.143). When the analysis was adjusted for age and MDC, those who were malnourished were 3.55 (95%CI 1.52, 8.32) times more likely to die than those who were well nourished (P=0.003) (Figure 2). Those at risk of malnutrition were 1.79 (95%CI 0.76, 4.18) times more likely to die than those who were well nourished but this was not significant (P=0.182), and the wide confidence intervals reflect the small number of events in the well nourished group (n = 6 events).

In the ANCOVA analyses, adjusted for Major Disease Classification (MDC) and age, total 12-month LOS was significantly higher in malnourished patients (mean = 41.0 days (SE = 2.19); 95 % CI 36.6, 45,3) compared to those who were well nourished (29.6 (3.51); 95 % CI 22.7, 36.5) (P=0.001). Those at risk of malnutrition had a higher LOS (44.4 (1.68); 95 % CI 41.1, 47.7) than the well nourished group (P=0.003).

Discussion

Our study provides convincing evidence that, within an acute hospital setting, the majority of older patients admitted are either malnourished or at risk of malnutrition. A major strength of

this study was the use of a validated instrument (full MNA), administered by trained dietitians, to assess nutritional status in older people in what is possibly the largest sample reported worldwide in this setting (n = 2602). The MNA has been used extensively in older patients in community, hospital and nursing home settings in many countries around the world.[9] Our finding that a third of patients are malnourished and a further 55 % were at risk of malnutrition validates findings from much smaller samples.

Overt malnutrition was associated with a three and a half times increased risk of in-hospital death and/or poor clinical outcome over a 12-month period, which is similar to findings from a 3-year study of Swedish elderly.[12] A novel finding of the present study is the quantification of a more than twofold increased risk of an adverse clinical outcome in older patients who were classified “at risk of malnutrition”. This is the group in whom interventions to address underlying risk factors may be most beneficial and cost-effective, however further well designed trials are required to identify which interventions are efficacious as well as feasible to implement on a large scale.[19, 20] An increased need for residential care, measured as discharge to a higher level of care compared to admission, is not commonly reported in studies of this nature and our data further contributes to estimation of service needs associated with a poor nutritional state. A lack of difference between the subsample (n = 774) and the larger dataset of consecutive patient admissions for age, weight status and prevalence of malnutrition suggests that our findings may be generalizable to older adults in other acute hospital settings.

Malnourished geriatric patients in our acute hospital sample had a length of hospital stay over the twelve month period of follow-up that was 11.4 days longer than their well nourished counterparts. This finding is supported by previously published data from patients admitted to rehabilitation (sub-acute) hospitals in the same local hospital district.[21] A potential confounder in assessing the impact of malnutrition on hospital length of stay is that LOS may be shorter in those who die as a result of severity of their underlying illness. We attempted to account for this anomaly by including patients’ disease classification as a covariate in the analysis.

The prolonged LOS related to malnutrition represents a potentially vast financial burden on the health services. Estimates from the UK indicate that malnutrition-related costs are £7.3 billion each year, more than double the projected £3.5 billion cost of obesity.[22] The bulk of these costs arise from the treatment of malnourished patients in hospital (£3.8 billion) and in long-term care facilities (£2.6 billion), followed by GP visits (£0.49 billion), outpatient visits (£0.36 billion), and enteral and parenteral nutrition, tube feeding and oral nutritional supplementation in the community (£0.15 billion).

Nutritional status has been shown to deteriorate in patients over the course of their admission and undoubtedly there is benefit in early implementation of nutrition therapy in those that need it.[23] Patients' appetite during hospital admission can be impacted by a number of reasons such as the illness itself, malabsorption, early satiety, lack of flavour perception, lack of variety, cognitive impairment, absence of feeding assistance, meal timing, social isolation, poor ambience in hospital wards, depressed mood, inappropriately large meal portions, swallowing and chewing difficulties, frailty, decreased functional capacity, restrictive diets, effect of polypharmacy, depression and/or dementia.[24, 25] We did not assess change in nutritional status or weight during the index hospital admission but best recommended practice, both in terms of routine nutritional assessment and nutrition management,[10] was implemented in the hospital setting from which the study sample were drawn. Despite this, malnutrition remained an important predictor of functional decline and mortality over the following 12 months.

Within the acute hospital setting, identified barriers to optimal nutrition care of patients are related to organizational barriers, including nursing staff shortages and lack of a coordinated approach, with regard to poor knowledge of nutrition care processes, poor interdisciplinary communication, and a lack of a shared responsibility approach to nutrition care.[8] Additionally, competing activities at mealtimes may leave staff feeling disempowered to prioritise nutrition in the acute medical setting. Redesigning the model of care to reprioritise meal-time activities and redefine multidisciplinary roles could support improved nutrition-related patient outcomes, however effectiveness would require substantial organisational change.

It is noteworthy that the majority of patients were discharged home. Following hospital discharge, many older patients fall between the gaps of health care delivery particularly during their period of convalescence, a time that may be critical to prevention of further nutritional decline. Interventions that allow a smooth transition from hospital to home/nursing home, and that take into account additional risk factors such as dementia, depression, decreased visual acuity, poor dentition, polypharmacy, social isolation and financial burden, are required. Even in those older adults in the community that receive regular services such as home nursing, malnutrition is a significant issue.[26] Better integration between inpatient and community services is required to ensure seamless delivery of patient-centred care and to maximise wellbeing in this group.

Limitations of the study include potential errors in recording of clinical outcomes due to compromised quality of electronic patient records. Original patient folders were accessed where necessary to obtain missing data or to validate queries. Only in-hospital deaths were recorded in the database, and the relatively small number of patients and patient deaths in the well nourished group reduced the power of the Cox regression model. In conclusion, the majority of patients admitted to acute care geriatric wards of a regional Australian tertiary hospital are either malnourished or at risk of malnutrition. Patients within these categories have a significantly increased total length of hospital stay, and are more likely to be discharged to a higher level of care, or die in hospital within this time frame. Interventions to improve the nutritional status of patients both during their hospital stay, as well as following discharge back to the community are required to lower the risk of adverse outcomes.

Acknowledgements/Conflict of interest

Karen Charlton serves on the Nestle Malnutrition Advisory Board and has received honoraria from Nestle Healthcare Nutrition for educational presentations on the topic of malnutrition in the elderly. Karen Charlton was a member of the international working group to revise and validate the Mini Nutritional Assessment which was funded by an educational grant from Nestle Nutrition Institute, Switzerland. None of the other authors have any conflict of interest

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Author contributions:

Karen Charlton – conceptualisation of study design; data analysis; primary responsibility for writing the article.

Marijka Batterham – statistical data analysis, editing the article

Steven Bowden – study design, data collection, entry and cleaning, data analysis.

Abhijeet Ghosh – data entry, data analysis, editing the article.

Katherine Caldwell – data entry, data analysis, editing the article.

Barbara Meyer – study design, editing the article

Jan Potter – study design, editing the article

Lilliana Barone – data collection, data entry, writing the article.

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Marianna Milosavljevic – study design, writing the article.

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Tables1-5

Table 1: Age and anthropometrical indices, according to nutritional risk (total sample, N = 2602)

Variable	Malnourished (MNA < 17)	At risk of malnutrition (MNA = 17 to 23.9)	Well nourished (MNA ≥ 24)
N	882	1420	300
%	33.9%	54.6%	11.5%
Age (yr)**	n = 855	n = 1382	n = 291
Mean (SD)	83.9 (7.2) [a]	83.3 (7.2) [b]	82.0 (7.5) [c]
Median (IQR)	84.6 (73.8,88.9)	83.9 (78.7,88.4)	81.9 (76.8,86.8)
Weight (kg)**	n = 882	n = 1418	n = 300
Mean (SD)	53.9 (12.3)[a]	66.2 (14.8) [b]	73.5 (14.8)c[c]
Median (IQR)	52.0 (45.0,61.2)	64.9 (55.0,75.0)	70.9 (63.0,81.8)
BMI (kg/m^2)**	n = 882	n = 1418	n = 300
Mean (SD)	20.3 (4.0)[a]	24.7 (4.8)[b]	27.6 (4.9)[c]
Median (IQR)	19.8 (17.7,22.3)	23.9 (21.3,27.0)	26.4 (24.2,29.6)
MNA^	n = 882	n = 1418	n = 300
Mean	13.1 (2.8)	20.2 (2.0)	25.1 (1.0)
Median (IQR)	13.5 (11.4,15.5)	20.0 (18.5,22.0)	25.0 (24.0,26.0)

**P<0.001; *P<0.05; ANOVA for differences between MNA categories

Post hoc Bonferroni Test : Groups with different superscripts (a,b,c) are significantly different

^ significance testing not performed as MNA score is used to create the MNA categories.

Table 2: Prevalence of mortality and malnutrition in selected studies of acute geriatric patients that used the MNA instrument

Study Authors, Year Published Mean follow-up time	**Sample Size (N) and Location**	**Mean Age** (years)	**Mortality** (% sample)	**Prevalence of Malnutrition**	
				At Risk of Malnutrition (MNA = 17 to 23.9)	**Malnourished (MNA < 17)**
Present study, 2012 12 mths	2602, Australia	84	14	55	34
Chang et al., 2010[15] 380 – 925 days	1008, Taiwan	77	19	50	29
Gazzotti et al., 2000 [14] Hospital discharge	175, Belgium	80	6	48	22
Kagansky et al., 2005[4] 2.7 yr	414, Israel	85	30	33	49
Persson et al., 2002[11] 3 yr	83, Sweden	84	Not reported for total sample	56	26
Van Nes et al., 2001 [13] Hospital discharge	1319, Switzerland	84	7	60	19
Vischer et al., 2012 [12] 4 yr	444, Sweden	85	51	51	26

Table 3: Comparison of age, gender, BMI and nutritional status between the total sample (N = 2602) and the 12-month sub-sample (N = 774)

Characteristic		Total study population (N = 2602)	12-month sub-sample (N = 774)
Age (years)	N	2528	774
	Mean (SD)	83.4 (7.3)	83.5 (7.3)
	Median (IQR)	84.0 (78.7,88.5)	84.2 (79.1,88.5)
BMI (kg/m^2)	N	2600	728
	Mean (SD)	23.6 (5.2)	23.5 (5.2)
	Median (IQR)	22.9 (20.0,26.3)	23.0 (20.0,26.0)
MNA Score	N	2602	774
	Mean (SD)	18.4 (4.6)	18.5 (4.8)
	Median (IQR)	19.0 (15.3,22.0)	19.5 (15.5,22.0)
Gender (%)	Male	39.7	37.7
	Female	60.3	62.3
MNA Categories (%)	Malnourished	33.9	32.4
	At Risk of Malnutrition	54.6	54.9
	Well Nourished	11.5	12.7

Table 4: Nutritional, anthropometric and hospital admission data, according to nutritional status

Characteristic	Malnourished (MNA < 17) N = 251 (32.4 %)	At risk of malnutrition (MNA = 17 to 23.9) N = 425 (54.9 %)	Well nourished (MNA ≥ 24) N = 98 (12.7 %)	Total N = 774	*p* value
Mean Age at Index admission (years) (SD)	84.7 (6.9)	83.2 (7.3)	82.1 (7.7)	83.5 (7.3)	0.004†
Median (IQR)	85.5 (80.8,89.2)	83.9 (78.8,88.1)	82.2 (76.8,86.6)	84.2 (79.1,88.5)	
MNA Score (SD)	12.8 (3.2)	20.3 (2.0)	25.0 (1.0)	18.5 (4.8)	††
Median (IQR)	13.5 (11.0,15.5)	20.5 (18.5,22.0)	25.0 (24.0,25.6)	19.5 (15.5,22.0)	
BMI (kg/m^2) (SD)	19.7* (3.2)	24.6 (4.8)†	27.9 (5.2)	23.5 (5.2)	0.000†
Median (IQR)	19 (18,22)	24 (22,27)	27 (24,30)	23 (20,26)	
Mean No. of 12-month Admissions (SD)	1.70 (1.03)	1.86 (1.37)	1.82 (1.09)	1.80 (1.24)	0.481†††
Median (IQR),max	1 (1,2),6	1 (1,2),10	1(1,2),6	1 (1,2),10	
Mean No. of 12-month ED Presentations (SD)	0.36 (0.75) [a]	0.58 (1.24) [b]	0.55 (0.90) [b]	0.51 (1.07)	0.046†††
Median (IQR), max	0 (0,0),5	0 (0,0),12	0(0,1),4	0 (0,1),12	
Mean 12-month Total Length of Stay (SD)	40.7 (31.5) [a]	44.5 (37.2) [a]	29.9 (29.9) [b]	41.3 (34.9)	0.000†††
Median (IQR)	36.0 (17.0,54.0)	37.0 (14.0,61.0)	20 (9.8,41.3)	33.5 (15.0,56.0)	

Post hoc Tests : Groups with different superscripts (a,b) are significantly different P<0.05.

† One-way ANOVA

†† significance testing not performed as scores were used to create categories

††† Kruskal-Wallis test

Table 5: Change in level of care according to baseline nutritional status

Change in level of care	Malnourished (MNA < 17) N = 246	At risk of malnutrition (MNA = 17 to 23.9) N = 414	Well nourished (MNA ≥ 24) N = 92	Total N = 774
Deceased n (%)	**51 (49)**	**48 (45)**	**6 (6)**	**105**
Increased Care^ n (%)	**56 (36)**	**91 (58)**	**9 (6)**	**156**
No Change n (%)	**139 (28)**	**275 (56)**	**77 (16)**	**491**

*****Excludes those with final destination of other or unknown

^ Home to LLC/ Home to HLC/LLC to HLC

Figure 1

Figure 1:

Sampling strategy

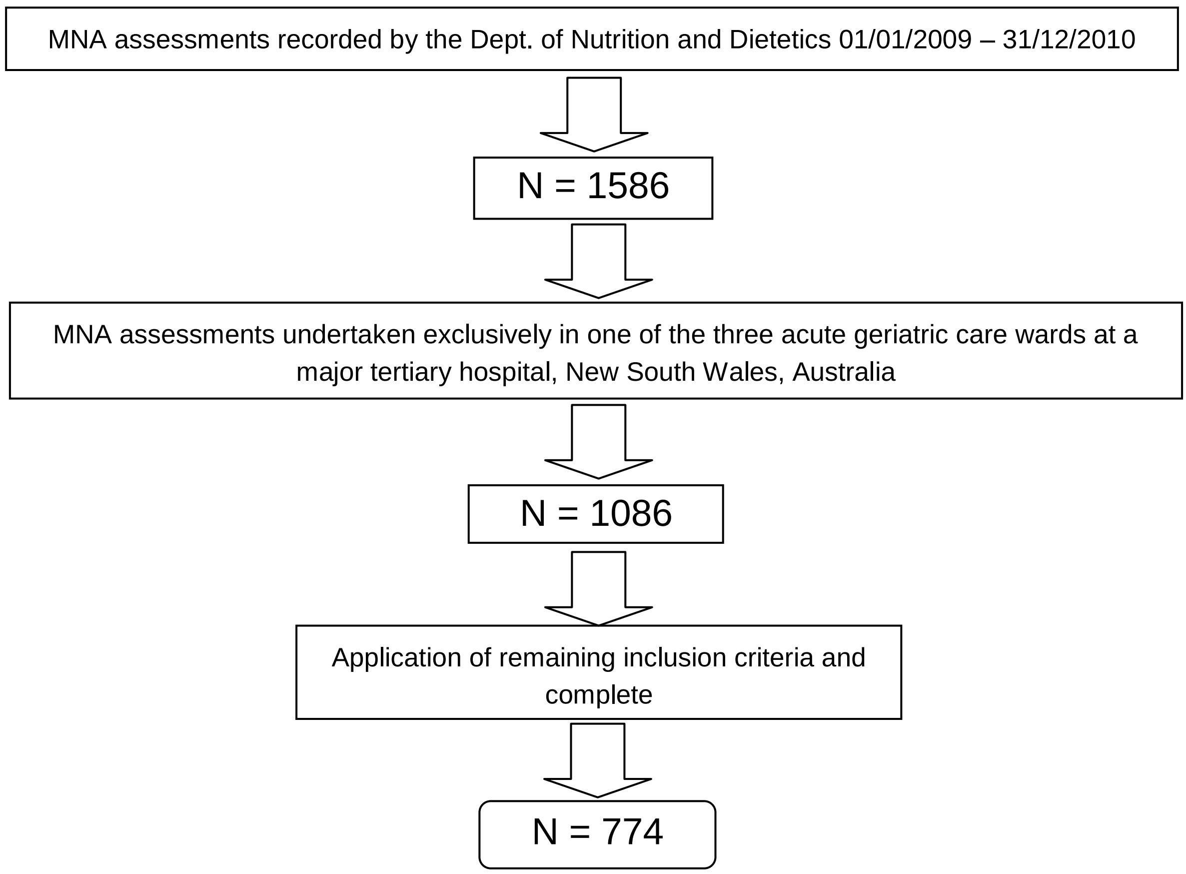

Figure 2

Figure 2: Survival curve over 12 months of follow-up, according to MNA category