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**Pain reporting in older adults: the influence of cognitive impairment – Results from the Cambridge City >75 Cohort Study**

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*Abbreviations*

CC75C – the Cambridge City over-75s Cohort

MMSE – Mini Mental State Examination

*Key words*

Back pain, cognitive impairment, older people, dementia

## **ABSTRACT**

### *Objectives*

Evidence suggests that, while disabling back pain, and rheumatic diseases associated with pain, continue to increase with age, the prevalence of non-disabling back pain reaches a plateau, or even decreases, in the oldest old. This study aimed to determine whether this age-related pattern of non-disabling back pain is a function of increasing cognitive impairment.

### *Methods*

Cross-sectional study of adults aged >77yrs. Participants answered interviewer-administered questions on back pain and cognitive function, assessed using the Mini-Mental State Examination, categorised into normal, versus mild, moderate or severe impairment. The relationship between cognitive function and back pain was examined using multinomial logistic regression, adjusted for age, sex and residence.

### *Results*

Of 1174 participants with back pain data, 1126 (96%) completed cognitive assessments. The relationship between cognitive function and back pain differed for disabling and non-disabling back pain. Across categories of cognitive impairment, increasingly higher prevalence of disabling back pain was reported, compared to those with normal cognition, although this was not statistically significant (odds ratio: 1.7; 95%CI: 0.7-4.6). No association was found between cognitive function and non-disabling back pain (0.8; 0.4-1.6).

### *Conclusions*

This study found no association between the reporting of back pain and level of cognitive impairment, suggesting that increasing cognitive impairment is an inadequate explanation for age-related decline in self-reported non-disabling back pain. Future research should determine the reasons for the decline in non-disabling pain in older adults although, meanwhile, it is important to ensure that this group receive appropriate pain assessment and pain management.

## **INTRODUCTION**

Many epidemiological studies have shown a decrease in the prevalence of back pain (BP) in later life [11;14;22]. However, recent evidence suggests that this decrease may be limited to non-disabling BP, whereas disabling BP continues to increase in the oldest old [2;3;20]. The reason for the decrease in the prevalence of non-disabling BP in older adults is unknown. It may be due to changes in exposures (e.g. older adults ceasing employment and no longer being exposure to detrimental occupational exposures). It may be that other pains are considered to be more disabling or bothersome (e.g. pain in the hip or knee), and that these are preferentially reported. The relationship between pain and subsequent mortality has been well established [9;12;21], and it may be that the older population represents a group of healthy survivors. Or, it may be a function of increasing cognitive impairment in this age group, and a diminished ability to report pain.

Several studies have shown the prevalence of self-reported pain is lower among individuals with higher levels of cognitive impairment, compared to those who are cognitively intact, while the prevalence of conditions likely to cause pain is similar [15;17]. Among nursing home residents, Ferrell et al demonstrated that 17% of patients found clinically to be in pain were unable to complete five common pain assessment scales [5]. Meanwhile, others have investigated pain descriptions from individuals with intact cognition and those with mild-moderate dementia [18] and found that, while some scales (e.g. coloured analogue scale) were comprehensible by all of those with intact cognition/mild dementia, they could be adequately completed by only 80% of those with moderate dementia. These authors also found that those without dementia reported more intense pain and pain affect, compared with those with mild / moderate dementia, suggesting that people with dementia may be less able to describe their pain. Memory loss may affect pain reporting and, also, it has been proposed that cognitively impaired individuals may experience a decreased affective component of pain perception [8]. In addition, there may be a difference between non-disabling pain report and disabling pain report, with increased cognitive impairment, due to the fact that disabling pain is more memorable and has a greater impact on activities of daily living.

The aim of the current study was to investigate the impact of cognitive impairment on BP reporting in older adults in the general population. We hypothesised that, among individuals with cognitive impairment, the prevalence of self-reported non-disabling BP would be lower, compared to those with normal cognitive function.

## **METHODS**

The Cambridge City over-75s Cohort (CC75C) study is one of the longest and largest population-based prospective cohort studies among the very old [6]. Comprehensive methods, are provided elsewhere: [www.cc75c.group.cam.ac.uk](http://www.cc75c.group.cam.ac.uk). In brief, in 1985-87, all individuals aged >75yrs from a selection of geographically and socially representative primary care practices in Cambridge were contacted, of whom 95% participated. Successive interviews and assessments have been carried out since baseline, with remaining participants, who are alive and able, still being contacted now this study has been running for over 28 years. However, the current study only utilises cross-sectional data from survey 2 (1988-89) when BP questions were first asked, 83% of survivors participated (n=1177). The study was approved by the Cambridge Research Ethics Committee (current reference numbers: 08\_H0308\_3) and participants gave written informed consent.

By interviewer-administered questionnaire, data was collected on a wide range of information in addition to demographics (age; gender; marital status; place of residence; social class). Participants were asked: "Have you recently had an illness or condition which prevented you carrying out your normal day to day routine?", and persons answering positively were then asked whether this was related to a number of specific conditions, including back pain. Possible responses were: (1) No; (2) Yes; or (3) Yes, but not disabling. Disabling back pain was defined as back pain that interfered with daily tasks within the last month.

Cognitive function was measured using the Mini Mental State Examination (MMSE) [7]. This 11-item instrument is scored from 0 to 30, and responses were categorised as in published literature – i.e. normal cognition (26-30), mild impairment (22-25), moderate impairment (18-21) and severe impairment (0-17) [13].

### *Analysis*

Analyses were conducted using the CC75C data version 3.0 ([www.cc75c.group.cam.ac.uk/pages/dataavailable/default.htm](http://www.cc75c.group.cam.ac.uk/pages/dataavailable/default.htm)) using statistical software *Stata* v10.1 (StataCorp, College Station, TX), and *EpiInfo* v7 (Centers for Disease Control and Prevention, Atlanta, GA).

The relationship between BP and cognitive impairment was examined using multinomial regression with 'No BP' as the reference category. Results are expressed as odds ratios with 95% confidence intervals, adjusted for age, sex and place of residence – i.e. whether they lived independently, or in more supported settings. Other analytical methods, such as ordinal regression, would have been suitable for this analysis in that we could have modelled the increase in the odds of being in one outcome group, compared to the adjacent lower group (non-disabling versus no BP; and disabling versus non-disabling BP). Although not necessarily 'better' than ordinal regression, we considered the use of multinomial regression to be preferable as it would allow the comparison of disabling and non-disabling BP against the same reference category (no BP). It is also a more conservative approach.

All data were based on self-report. In addition to the primary aim, we hypothesised there would be an increased proportion of missing back pain or cognitive function data among persons with impaired cognition. We examined, firstly, whether (a) the proportion of participants with missing cognitive data varied according to whether back pain data was present: and (b) the proportion of participants with missing back pain data varied with cognitive function. Secondly, we conducted a simple sensitivity analysis to determine the relationship between cognitive function and back pain, assuming all persons with missing cognitive data were the most severely impaired.

## **RESULTS**

### *Characteristics of the study sample*

Data on both BP and cognitive function were available for 1126 individuals (96%). Their mean age was 83yrs (range: 77-101yrs), 66% were women and most were either married (39%) or widowed (47%). The majority (87%) still lived in their own home and 60% were social class III<sub>m</sub> (previously in skilled manual occupations) or lower. Most participants (82%) were currently taking medication.

### *Back pain and cognitive function*

The prevalence of disabling and non-disabling BP was 6% and 23% respectively. Although there was no difference in the prevalence of non-disabling BP with age, there was a significant increase in the prevalence of disabling BP with older age. Data on the prevalence of BP, and risk factors for BP onset, have been presented previously [3].

50% of participants were classified as having normal cognition, 31% mild impairment, 14% moderate, and 6% were categorised as having severe impairment. There was a clear relationship between cognitive function and age: approximately two-thirds of participants aged 77-79yrs had normal cognitive function, in comparison to around 15% of those aged  $\geq 90$ yrs. In contrast, the proportion of participants with moderate / severe impairment increased from 10% in those aged 77-79yrs to 38% in those aged  $>90$ yrs, and by 85yrs the majority of participants had at least some cognitive impairment (Figure 1).

<<Figure 1 here>>

The relationship between cognitive function and BP reporting differed for non-disabling and disabling BP. Cognitive impairment was not associated with the report of non-disabling BP ( $\chi^2_{\text{trend}}: 0.15; p=0.70$ ). Even



those with severe cognitive impairment were no more likely, or less likely, to report BP than those with normal cognition (odds ratio: 0.8; 95%CI: 0.4-1.6) (Table 1). In contrast, there was a trend of borderline significance suggesting that the reporting of disabling BP was more frequent in those with higher levels of cognitive impairment, ( $\chi^2_{\text{trend}}$ : 3.53;  $p=0.06$ ). Individuals with severe impairment were more than twice as likely to report disabling BP than those of normal cognition (2.3; 0.9-5.9). This relationship remained – albeit attenuated and still non-significant – after adjusting for age, sex and place of residence (1.7; 0.7-4.6) (Table 1).

<<Table 1 here>>

#### *Missing data*

All participants who completed cognitive assessments also provided BP data. However, of those with BP data ( $n=1174$ ) 48 failed to complete the questions on cognitive function (Table 2). There was no difference in the likelihood of incomplete cognitive function data across the three different categories of BP ( $\chi^2$ : 0.21;  $p=0.90$ ). In addition, there was no increase in the risk of disabling (1.0; 0.2-4.3) or non-disabling BP (0.8; 0.4-1.7) among persons with missing MMSE data, compared to those with normal cognitive function.

<<Table 2 here>>

## ***DISCUSSION***

Previous research has shown that while the prevalence of disabling pain continues to increase even among the oldest old, the same is not true of non-disabling pain and one explanation is that this is a function of cognitive impairment. However, we have demonstrated that, although the relationship between cognitive function and BP differs with BP disability, there is no significant association between the reporting of BP and level of cognitive impairment. These findings suggest that increasing cognitive impairment is not an adequate explanation for the absence of an age-related increase in non-disabling BP among the very elderly.

There are some methodological issues that must be considered when interpreting these results. Firstly, while the study population was representative of Cambridge's older population, this may differ from other geographical areas. Crucially, a high proportion of participants still lived independently in their own homes, suggesting a reasonable level of functioning. Although other populations may exhibit differences in the distribution of cognitive impairment, there are no plausible explanations as to why the relationship between cognitive function and BP would necessarily be different in other populations.

Secondly, the current analysis focused on individuals who provided complete cognitive function data on the MMSE. It is plausible that those who failed to complete the MMSE were those most cognitively impaired. There was no difference in the likelihood of incomplete MMSE data across the three different categories of BP suggesting that this is probably not the case, although it is impossible to say for certain.

Although we have shown that participants with severe cognitive impairment were more likely to report disabling BP than those with normal cognition (odds ratio: 2.3; 95%CI: 0.9-5.9), we have failed to show the (expected) same relationship in non-disabling pain and this raises concern about whether this finding was the result of a Type II error. However, a post hoc power calculation revealed that we had approximately

90% power to detect an association of the same magnitude, or greater, among participants reporting non-disabling pain. While this does not rule out Type II error, it suggests that it is unlikely.

Previous studies have reported decreased pain reporting with increased cognitive impairment [5;15;17;18]. Our findings contradict this, and it is not immediately clear why. Previous studies have generally considered older people living in institutions or hospitals. Whereas, in the current study, the majority (87%) still lived in their own home. While this may reflect a fundamental difference between the current sample and those of previous studies, it is interesting to note that statistical adjustment for place of residence had little effect on the current results. Regarding medication use, while we know that 82% were on medication it would have been interesting to know further details on the specific medications used, unfortunately this data was not available. Another consideration is the use of non-pharmacological pain management strategies and the use of assistive devices such as canes or walkers. These will influence the level of reported disability associated with pain, and may also be associated with age and cognitive function. It would therefore be useful for future research in this area to consider these factors.

Chibnall et al concluded that older, cognitively impaired patients are able to report their pain reliably and validly [1]. Others have reported that a sizeable proportion of in-patients with dementia [16], and nursing home residents [5], were able to adequately report pain using a number of common pain assessment instruments. In the current study, we found that individuals across all levels of cognitive function reported the same prevalence of back pain. It would have been interesting to have some other, objective, measure of pain against which to assess the reliability or validity of pain self-report however this data was not available.

We have recently shown that older persons, generally, are managed differently in primary care, following a GP consultation [10] although, examining evidence from the clinical trials that contributed to the UK National Institute for Health and Clinical Excellence ([www.nice.org.uk](http://www.nice.org.uk)) there is little evidence to justify this strategy [19]. Others have reported that cognitively impaired adults received significantly fewer opioid

analgesics, post-operatively, than cognitively intact individuals [4]. However, we have shown that pain reporting is independent of cognitive function. It may be the case, therefore, that clinicians' responses to pain reports vary with age and, in particular, with cognitive status, and this has important implications for pain management.

In summary, recent evidence suggests that, although the prevalence of non-disabling BP increases throughout most of life, it decreases in the oldest old. The reasons for this are unknown but may reflect increased cognitive impairment and decreased ability to self-report pain in this age group. However, our findings do not support this hypothesis. Future research should determine the reasons for the decline in non-disabling pain in older adults and establish whether this is a real phenomenon. If so, the reasons behind this are currently unexplained. Meanwhile, it is important to ensure that this group receive appropriate pain assessment and pain management – something which, in some circumstances, may get overlooked.

## **KEY POINTS**

- Prevalence of non-disabling back pain decreases in the oldest old.
- Some have proposed that this may be a function of cognitive impairment in older age, and an increasing inability to adequately report pain.
- Our findings do not support this hypothesis

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## **AUTHOR CONTRIBUTIONS**

- RED Conducted the analysis and produced first draft of the paper
- JF CC75C study investigator. Commented on draft of paper – including comments on analysis, results and interpretation
- CB CC75C study principal investigator. Commented on draft of paper – including comments on results and interpretation
- JZ CC75C study investigator. Helped prepare data for analysis. Commented on draft of paper – including comments on results and interpretation
- GJM Oversaw analysis. Commented on draft of paper
- GTJ Supervised analysis and drafting of manuscript

## **ETHICAL APPROVAL**

Each CC75C study phase was approved by Cambridge Research Ethics Committee (current reference numbers: 08\_H0308\_3).

## **CONFLICTS OF INTEREST**

The authors declare that they have no competing interests.

## **FUNDERS**

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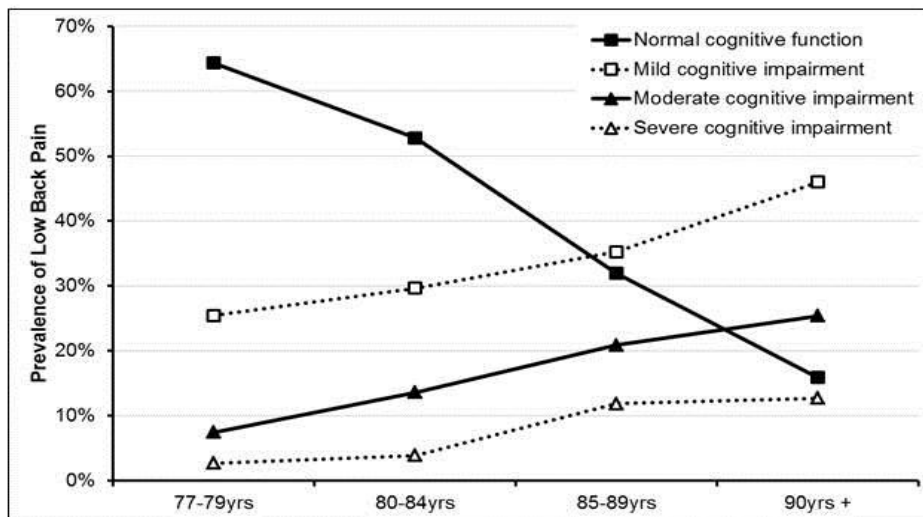
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Figure 1: The relationship between cognitive function and age



**Table 1: The relationship between cognitive function and back pain reporting for non-disabling and disabling back pain**

	No back pain		Disabling back pain		Non-disabling pain		
	n (%)	n (%)	Odds Ratio*	Odds Ratio**	n (%)	Odds Ratio*	Odds Ratio**
Normal cognition	403 (72%)	23 (4%)	1.0	1.0	133 (24%)	1.0	1.0
Mild impairment	237 (69%)	24 (7%)	1.8 (0.98-3.2)	1.5 (0.8-2.7)	83 (24%)	1.1 (0.8-1.5)	1.0 (0.7-1.4)
Moderate impairment	113 (72%)	10 (6%)	1.6 (0.7-3.4)	1.3 (0.6-2.8)	35 (22%)	0.9 (0.6-1.4)	0.9 (0.6-1.4)
Severe impairment	46 (71%)	6 (9%)	2.3 (0.9-5.9)	1.7 (0.7-4.6)	13 (20%)	0.9 (0.4-1.6)	0.8 (0.4-1.6)

\* Unadjusted odds ratio from multinomial logistic regression, with 95% confidence intervals

\*\* Odds ratio from multinomial logistic regression, with 95% confidence intervals, adjusted for age, sex, and place of residence

**Table 2: Missing data from the interviewer-administered questionnaire**

	Cognitive function data		Statistical association
	Complete	Incomplete	
No back pain	799 (71%)	36 (71%)	chi <sup>2</sup> : 0.21* p=0.90
Non-disabling back pain	63 (6%)	2 (4%)	
Disabling back pain	264 (23%)	10 (20%)	
Data on back pain missing	0 (0%)	3 (6%)	
Total	1126 (100%)	51 (100%)	

\*\* Chi<sup>2</sup> with Yates' correction