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Can delirium research activity impact on routine delirium recognition? A prospective cohort study

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Can delirium research activity impact on routine delirium recognition? A prospective cohort study

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Abstract

Objective: To assess if ongoing delirium research activity within an acute admissions unit impacts upon prevalent delirium recognition

Design: Prospective cohort study

Setting: Single site tertiary university teaching hospital

Participants: 125 patients with delirium, as diagnosed by an expert using DSM-IV reference criteria, were recruited to a prospective cohort study investigating use of informant tools to detect unrecognised dementia. This study evaluated recognition of delirium and documentation of delirium by medical staff.

Interventions: The main study followed an observational design; the intervention discussed was the implementation of this study itself.

Primary and secondary outcome measures: The primary outcome was recognition of delirium by the admitting medical team prior to study diagnosis. Secondary outcomes included recording of or

description of delirium in discharge summaries, and factors which may be associated with unrecognised delirium.

Results: Delirium recognition improved between the first half (48%) and second half (71%) of recruitment (p=0.01). There was no difference in recording of delirium or description of delirium in the text of discharge summaries.

Conclusion: Delirium research activity can improve recognition of delirium. This has the potential to improve patient outcomes.

Article summary - strengths and limitations

- This is the first study to demonstrate the impact of delirium research activity upon delirium recognition.
- Delirium was diagnosed in this study by an expert using DSM-IV reference criteria. Results, therefore, represent true delirium recognition.
- Due to the design of this study, we did not measure delirium recognition rates prior to or after recruitment to the main study. We do not know if the effect was maintained following completion of the main study.

Background

Hospital trusts with high clinical research activity have better patient outcomes (1-4). Reasons for this association remain undetermined. The effect remains after adjustment for staffing, radiology service provision, operating theatres and critical care beds (1). Patient outcomes might be improved by increased local awareness of research topics (1-4).

Delirium is an acute severe neuropsychiatric syndrome. It is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM V) as acute onset fluctuating symptoms of disturbed arousal and awareness, and cognitive impairment (5). Delirium affects 20% of hospitalised adults (6), not including Intensive Care Unit (ICU) admissions; prevalence within ICU rises to 80% (7). Delirium prevalence also increases with age (8). However, delirium remains under-recognised in practice (6, 9-12).

Unrecognised delirium, delayed delirium treatment, and increased delirium duration are associated with increased mortality (13-16). Delirium recognition ensures careful evaluation of precipitating factors and implementation of prevention strategies to avoid worsening of delirium (8, 17). Recognition can thus assist to shorten delirium duration and improve outcomes. Delirium has been shown to be under-recognised in 30-75% of patients (6, 9-12), and is also under-reported in the NHS (18). It is recommended that any diagnosis of delirium made in secondary care be clearly communicated to primary care (19).

Methods

Objective

This study aimed to assess if ongoing delirium research activity within an acute admissions unit could impact upon prevalent delirium recognition. We also aimed to explore factors which may be associated with unrecognised delirium.

Study design and setting

The study design for the main study has been described elsewhere (20). Briefly, patients aged 70 and older were screened for evidence of delirium within 24 hours of admission to the acute medical admissions unit at Queen Elizabeth Hospital Birmingham (QEHB). Delirium was diagnosed using DSM-IV reference criteria by an expert consultant geriatrician (TAJ). Patients with delirium were recruited to a prospective cohort study investigating use of informant tools to detect unrecognised dementia. Acute Mental Test Score (AMTS), digit span score, and presence or absence of delirium were recorded in the medical notes of all screened patients. These findings were recorded regardless of whether or not they were recruited to the main study. Clinicians were not specifically educated about delirium whilst the study was ongoing, but had the opportunity to access notes of recruited patients and consult study literature.

Data abstraction

Delirium recognition was defined as a written diagnosis of delirium documented in the patient care record by the usual care team during the first 24 hours of admission, prior to screening for study purposes. Healthcare staff outside of the research team were unaware that delirium recognition was being assessed or recorded. Delirium motor subtype and dementia status, using IQCODE-SF > 3.82(20), were recorded. Following discharge, formal discharge letters were examined for documentation of delirium as a discharge diagnosis. Text was examined for description of delirium using informal terms. In cases where patients died during admission, the medical certificate of cause of death and letter to GP were examined. Analysis of discharge summaries was completed by a single researcher (CW) who was unaware if delirium had been recognised on admission.

Statistical analysis

Admissions were divided into categorical halves and quartiles of consecutive recruitment for analysis. Due to an odd total number, the additional participant was randomly allocated to the first

half and the final quartile. Significance of differences in delirium recognition across groups were examined using Fisher's exact test and Chi-squared tests as appropriate using IBM SPSS Statistics 22. Data was examined with respect to differences between age, gender, delirium motor subtype, and dementia status between groups, and between recognised and unrecognised delirium. If any significant differences were found between those recognised and unrecognised, we planned logistic regression models to identify factors that predicted unrecognised delirium.

Patient involvement

The James Lind Alliance published priority setting partnerships related to dementia in 2013, which informed further work led by the Alzheimer's society. It was identified that some of most important priorities to patients and carers of individuals with dementia were the impact of early diagnosis, caring for people with dementia during acute hospital admissions, and how to effectively implement research findings into practice (21). Locally, a pilot study of nine individuals was undertaken prior to the initial study, which demonstrated that patients and their consultees found the assessments acceptable. Written consultee declaration was obtained from personal consultees for research participation where patients were deemed to lack capacity to consent. The results of the main study were presented at the Age Well conference in Birmingham and disseminated to study participants and their consultees.

Results

Delirium was diagnosed in 228 (17.2%) of 1,327 patients screened for delirium. 125 participants were recruited between March 2013 and November 2014. Reasons for non-recruitment included lack of available consultees, risk of imminent death, inability to communicate in English, consultee declining participation, or previous recruitment. This has been described elsewhere in more detail (20). Table 1 depicts demographic data, delirium subtype, dementia status, and delirium recognition between groups. There was no difference in age, gender, delirium subtype, dementia status or mortality between the two halves.

Admission recognition

Delirium was recognised in 74/125 (59%) overall. Delirium was recognised in 30/63 (48%) in the first half, and 44/62 (71%) in the second half (p=0.01). There was no difference in age, gender, delirium subtype, dementia status, or mortality between recognised or unrecognised delirium (Table 1). Table 2 demonstrates our results divided by quartiles. Delirium recognition improved from the first quartile when compared to the second, third, and fourth quartiles (42%, 52%, 74%, 69%, p=0.034). Motor subtype was specified on admission in 8 patients with delirium; seven of these were concordant with expert assessment at recruitment (all hypoactive).

Discharge documentation

There was no difference in recording of delirium as a diagnosis, or description of delirium in discharge summaries between the first and second halves of recruitment. There was a trend towards increased documentation of delirium as a discharge diagnosis in the second, third, and fourth quartiles compared to the first quartile (29%, 55%, 48%, 62%, p=0.052). There was a clinical description of delirium in the discharge text of 62/113 (55%) patients. Of these patients, confusion was described in 56/62 (88%), drowsiness in 12/62 (19%), and agitation in 5/62 (8%). No patients were described as being disorientated. Of the 12 in whom drowsiness was described, all except for one patient had a diagnosis of hypoactive delirium confirmed with expert assessment. 12 patients died during admission. None of these included delirium as a diagnosis that had caused or contributed towards their death on formal death certification, or included delirium in summaries sent to the GP in relation to the admission.

Discussion

Delirium recognition improved between the first half of recruitment and second half. There was no change in local trust policy during this time period that may have affected this. Formal delirium diagnosis was made during the initial study using recognised DSM-IV criteria by an expert; results are representative of true delirium recognition. Increased knowledge of delirium through awareness of ongoing recruitment to the main study may have aided to increase recognition. This demonstrates a potentially indirect means by which increased local research activity can improve patient outcomes.

Documentation of delirium in discharge summaries did not improve during this study. This may have been due to patients being discharged from clinical areas other than the acute admissions unit, and reduced awareness by discharging physicians of the main study. However, many medical staff working in discharging areas would have rotated through the acute admissions unit. Medical staff may have been unaware of the importance of documenting delirium on discharge summaries, as this was not an aspect included in the main study. To minimise potential bias, examination of discharge summaries was performed by a separate independent researcher who was not aware of the results of the admission recognition data.

Overall rates of delirium recognition compared better than previous research in other settings. The development of NICE guidelines in 2010 (19) and increased undergraduate teaching (22) are likely to have influenced this. We did not conduct follow-up assessments following completion of this study to assess if the effect was maintained. Baseline recognition rates prior to recruitment to this study were also not measured. Due to the design of this study, we were only able to assess the impact of our study upon recognition of prevalent delirium in patients included within the main study. We also did not assess the impact upon recognition of incident delirium or prevalent delirium in patients not included in the main study.

We did not demonstrate a significant difference in recognition of delirium between subtypes. This is in contrast to previous research, which has demonstrated that hypoactive delirium is recognised less frequently than other subtypes (11). However, our study was not powered to detect a difference in recognition between subtypes. A non-significant difference of 52% recognition amongst hypoactive patients compared to 67% recognition amongst hyperactive and mixed subtypes was observed overall.

This is the first study to show the effect of delirium research activity on delirium recognition. Our results correspond to previous studies that have demonstrated a positive effect of research activity on patient outcomes. Further research is needed to assess if similar effects are observed with research studies of alternative design. Demonstrating positive indirect benefits of research activity on patient outcomes may encourage increased engagement of hospital trusts in research.

Funding

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Competing interests

The authors declare that they have no competing interests.

Author contributions

TAJ was responsible for recruitment of patients to this study and recording of delirium recognition. CW was responsible for review of delirium documentation on discharge summaries. TAJ and CW jointly performed the analysis and agreed the text of the manuscript.

Ethical approval

This study involved participants who lacked capacity to consent; written consultee declaration was obtained from personal consultees. Ethical and regulatory approvals were obtained (Bradford Ethics Committee, part of the Yorkshire and Humber National research and Ethics Service, ref: 12/YH/0534).

Data sharing statement

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Table 1 – Comparison of results and patient demographics by halves

		All	First half *n=63*	Second half *n=62*	*p*	*Recognised n=74*	*Unrecognised n=51*	*p*
Age	**Mean (SD)**	84.4	83.78	85.03	0.18	85 (5.8)	84 (7.4)	0.65
Gender	**Male**	47 (38%)	27 (43%)	20 (32%)	0.27	27 (36%)	20 (39%)	0.85
Subtype	**Hyperactive**	37 (29%)	18 (29%)	19 (31%)		25 (34%)	12 (23%)	
	Hypoactive	67 (54%)	34 (54%)	33 (53%)	0.96	35 (47%)	32 (63%)	0.23
	Mixed	21 (17%)	11 (17%)	10 (16%)		14 (19%)	7 (14%)	
IQCODE > 3.82		71 (57%)	36 (57%)	35 (56%)	0.77	31 (42%)	15 (29%)	0.97
Inpatient mortality		12 (10%)	5 (8%)	7 (11%)	0.73	8 (11%)	4 (8%)	0.76
Delirium recognised		**74 (59%)**	**30 (48%)**	**44 (71%)**	**0.01**	NA	NA	NA
Delirium as discharge diagnosis		61 (49%)	26 (41%)	35 (56%)	0.11	NA	NA	NA
Delirium described on discharge		62 (50%)	33 (52%)	29 (47%)	0.59	NA	NA	NA

Delirium recognition improved between the first half of recruitment to the second half of recruitment. There was no difference in age, gender, delirium subtype, dementia status, mortality between halves or recruitment or between recognised and unrecognised delirium.

Table 2 – Comparison of results by quartiles

	First quartile (*n=31*)	Second quartile (*n=31*)	Third quartile (*n=31*)	Fourth quartile (*n=32*)	*p* value
Delirium recognised	**13 (42%)**	**16 (52%)**	**23 (74%)**	**22 (69%)**	**0.03**
Delirium as discharge diagnosis	9 (29%)	17 (55%)	15 (48%)	20 (62%)	0.052
Delirium described on discharge	18 (58%)	14 (45%)	12 (39%)	18 (56%)	0.37

Delirium recognition improved between the first quartile and the second, third and fourth quartile. There was a trend towards increased documentation of delirium as a discharge diagnosis between the first and the second, third and fourth quartiles.

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Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cohort reporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	3

	#6b	For matched studies, give matching criteria and number of exposed and unexposed	3
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	3
Bias	#9	Describe any efforts to address potential sources of bias	3
Study size	#10	Explain how the study size was arrived at	3
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4
	#12b	Describe any methods used to examine subgroups and interactions	4
	#12c	Explain how missing data were addressed	4
	#12d	If applicable, explain how loss to follow-up was addressed	4
	#12e	Describe any sensitivity analyses	4
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	4
	#13b	Give reasons for non-participation at each stage	4
	#13c	Consider use of a flow diagram	4
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential	8

		confounders. Give information separately for exposed and unexposed groups if applicable.	
	#14b	Indicate number of participants with missing data for each variable of interest	4
	#14c	Summarise follow-up time (eg, average and total amount)	4
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
	#16b	Report category boundaries when continuous variables were categorized	8
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	9
Key results	#18	Summarise key results with reference to study objectives	5
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	5
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	5
Generalisability	#21	Discuss the generalisability (external validity) of the study results	6
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

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Setting: Single site tertiary university teaching hospital

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Background

Hospitals with high clinical research activity have better patient outcomes (1-4). Reasons for this association remain undetermined. The effect remains after adjustment for staffing, radiology service provision, operating theatres and critical care beds (1). Patient outcomes might be improved by locally increased clinical knowledge extrapolated from ongoing research projects or through increased morale amongst clinical staff involved in research (1-4). Research that aims to decipher the reasons for associations between research activity and patient outcomes is vital as findings can be used to improve patient outcomes in hospitals with less clinical research activity.

Delirium is an acute severe neuropsychiatric syndrome. It has been defined most recently by the Diagnostic and Statistical Manual of Mental Disorders (DSM V) as disturbance in attention, awareness and cognition, which develops over a short time period (normally hours to days), is caused by direct physiological consequences of another medical condition, and is not better explained by another pre-existent neurocognitive disorder (5). Prior to this, delirium was defined by DSM IV as a disturbance of consciousness with a change in cognition or perceptual disturbance, which develops over an acute time period, tends to fluctuate and is caused by direct physiological consequences of another medical condition. Delirium affects 20% of hospitalised adults (6), not including Intensive Care Unit (ICU) admissions; prevalence within ICU rises to 80% (7). Delirium prevalence also increases with age (8). Delirium may be present on admission (prevalent delirium) or may develop during hospital admission (incident delirium), and may present as hyperactive, mixed, or hypoactive subtypes (9). However, delirium remains under-recognised in practice (6, 10-13).

Delirium is an independent risk factor for increased six-month mortality following hospitalisation of older adults (14). Particularly, unrecognised delirium, delayed delirium treatment, and increased delirium duration are associated with increased mortality (15-18). Delirium recognition ensures careful evaluation of precipitating factors and implementation of prevention strategies to avoid worsening of delirium (8, 19). Recognition can thus assist to shorten delirium duration and improve mortality and other outcomes (20). Delirium has been shown to be under-recognised in 30-75% of patients (6, 10-13), and is also under-reported in the National Health Service (NHS) (21). Previous research has shown that delirium recognition can be improved through educational interventions (22, 23). In addition, within the UK, it is recommended by the National Institute of Health and Care Excellence (NICE) that any diagnosis of delirium made in during a hospital admission be clearly communicated to their General Practitioner (GP) (24), this is important for follow-up and evaluation of underlying undiagnosed cognitive impairment (25). Identifying methods to improve delirium recognition and documentation can assist to improve patient outcomes.

Methods

Objective

This study aimed to assess if ongoing delirium research activity within an acute admissions unit could impact upon prevalent delirium recognition. We also aimed to explore factors which may be associated with unrecognised delirium.

Study design and setting

The study design for the main study has been described elsewhere (25). Briefly, patients aged 70 and older were screened for evidence of delirium within 24 hours of admission to the acute medical admissions unit at Queen Elizabeth Hospital Birmingham (QEHB). Delirium was diagnosed using DSM-IV reference criteria by an expert consultant geriatrician (TAJ). Patients with delirium were recruited to a prospective cohort study investigating use of informant tools to detect unrecognised dementia. Acute Mental Test Score (AMTS), digit span score, and presence or absence of delirium were recorded in the medical notes of all screened patients. These findings were recorded regardless of whether or not they were recruited to the main study. Screening for delirium for the purposes of this study took place only after the patient had been seen and assessed by the responsible medical team.

The researchers did not provide specific formal education or training about delirium diagnosis to clinicians outside of the research team. However, TAJ would frequently converse with clinicians working within the medical admissions unit who enquired about the research study and explain about the importance of recognising delirium. The results of delirium screening were very easily accessible to the clinical team, and where delirium was present, this was clearly documented with

advice for the clinical team to consider. Screening for delirium occurred between 09:00 – 17:00 each day and occurred alongside post-take ward rounds.

Data extraction

Delirium recognition was defined as a written diagnosis of delirium documented in the patient care record by the usual care team during the first 24 hours of admission, prior to screening for study purposes. Healthcare staff outside of the research team were unaware that delirium recognition was being assessed or recorded. Delirium motor subtype and dementia status, defined as an Informant Questionnaire on Cognitive Decline in the Elderly – Short Version score (IQCODE-SF) greater than 3.82 (25), were recorded. Following discharge, formal discharge letters (which communicated the admission details and diagnosis to the GP) were examined for documentation of delirium as a discharge diagnosis. Text was examined for description of delirium using informal terms. In cases where patients died during admission, the medical certificate of cause of death and letter to GP were examined. Analysis of discharge summaries was completed by a single researcher (CW) who was unaware if delirium had been recognised on admission.

Statistical analysis

Admissions were divided temporally into categorical halves and quartiles of consecutive recruitment for analysis (i.e. first half recruited and second half recruited; first, second, third, and fourth quartiles recruited). Due to an odd total number, the additional participant was randomly allocated to the first half and the final quartile. Significance of differences in delirium recognition across groups were examined using Fisher's exact test and Chi-squared tests as appropriate using IBM SPSS Statistics 22. Data was examined with respect to differences between age, gender, delirium motor subtype, dementia status, length of stay (LOS), and mortality between groups, and between recognised and unrecognised delirium. Significance of differences in LOS and mortality was determined using Kruskal-Wallis tests. If any significant differences were found between those recognised and unrecognised, we planned to conduct logistic regression models to identify factors that predicted unrecognised delirium.

Patient involvement

The James Lind Alliance published priority setting partnerships related to dementia in 2013, which informed further work led by the Alzheimer's society. It was identified that some of the most important priorities to patients and carers of individuals with dementia were the impact of early diagnosis, caring for people with dementia during acute hospital admissions, and how to effectively implement research findings into practice (26). Locally, a pilot study of nine individuals was undertaken prior to the initial study, which demonstrated that patients and their consultees (non-statutorily defined personal representatives who knew the patient well and who could consider their past wishes) found the assessments acceptable. Written consultee declaration was obtained from

personal consultees for research participation where patients were deemed to lack capacity to consent. The results of the main study were presented at the Age Well conference in Birmingham and disseminated to study participants and their consultees.

Results

Delirium was diagnosed in 228 (17.2%) of 1,327 patients screened for delirium. 125 participants were recruited between March 2013 and November 2014. Reasons for non-recruitment included lack of available consultees, risk of imminent death, inability to communicate in English, consultee declining participation, or previous recruitment. This has been described elsewhere in more detail (25). Table 1 depicts demographic data, delirium subtype, dementia status, and delirium recognition between groups. There was no difference in age, gender, delirium subtype, dementia status or inpatient mortality between the two halves. The date range for the first half of patients recruited was 4/3/2013 – 11/11/2013 and the date range for the second half was 12/11/2013 – 18/11/2014. Date ranges for quartiles of admission were 4/3/2013 – 5/6/2013, 6/6/2013 – 11/11/2013, 12/11/2013 – 6/5/2014 and 7/5/2014 – 18/11/2014 respectively.

Admission recognition

Delirium was recognised in 74/125 (59%) overall. Delirium was recognised in 30/63 (48%) in the first half, and 44/62 (71%) in the second half (p=0.01). There was no difference in age, gender, delirium subtype, dementia status, or mortality between recognised or unrecognised delirium (Table 1). As we did not identify any significant difference between factors, we did not proceed to perform logistic regression models. Table 2 demonstrates our results divided by quartiles. Delirium recognition improved from the first quartile when compared to the second, third, and fourth quartiles (42%, 52%, 74%, 69%, p=0.034). Motor subtype was specified on admission in 8 patients with delirium; seven of these were concordant with expert assessment at recruitment (all hypoactive). Data on LOS was available for all 113 patients who were alive at discharge. 12 month mortality (including those patients who died during admission) was available for 107 patients. There was no statistically significant difference in either LOS or 12 month mortality between patients in whom their delirium recognised compared to those in whom delirium was unrecognised.

Discharge documentation

There was no difference in recording of delirium as a diagnosis, or description of delirium in discharge summaries between the first and second halves of recruitment. There was a trend towards increased documentation of delirium as a discharge diagnosis in the second, third, and fourth quartiles compared to the first quartile (29%, 55%, 48%, 62%, p=0.052). There was a clinical description of delirium in the discharge text of 62/113 (55%) patients. Of these patients, confusion was described in 56/62 (88%), drowsiness in 12/62 (19%), and agitation in 5/62 (8%). No patients were described as being disorientated. Of the 12 in whom drowsiness was described, all except for

one patient had a diagnosis of hypoactive delirium confirmed with expert assessment. 12 patients died during admission. None of these included delirium as a diagnosis that had caused or contributed towards their death on formal death certification, or included delirium in summaries sent to the GP in relation to the admission.

Discussion

Delirium recognition improved between the first half of recruitment and second half. There was no change in local hospital policy during this time period that may have affected this. Local hospital policy was concordant with British Geriatrics Society (BGS) and NICE guidelines, which recommend that all patients aged 65 years and older who are newly admitted to hospital are screened for delirium (24). This guidance existed throughout the course of this research project and did not change during this time. Formal delirium diagnosis was made during the initial study using recognised DSM-IV criteria by an expert; results are representative of true delirium recognition. The protocol for this study was developed and approved prior to the introduction of DSM-V and we recognise that there are differences between DSM-IV and DSM-V. However, concordance of 91% between DSM-IV and DSM-V has been demonstrated when using a relaxed approach to the DSM-V criteria (27).

Increased knowledge of delirium through awareness of ongoing recruitment to the main study may have aided to increase recognition. This demonstrates a potentially indirect means by which increased local research activity can improve patient outcomes. However, we did not identify any statistically significant difference in LOS, inpatient mortality, or 12 month mortality between patients in whom delirium was recognised compared to those in whom delirium was unrecognised. This may have been due underpowering of this study and missing data at follow-up but we acknowledge that no clear correlation between delirium recognition and LOS has been demonstrated. We did not collect data on other outcomes that may have correlated with delirium recognition such as inpatient falls, avoidance of sedative medications, reduction in anticholinergic drug burden, functional status on discharge, or need for institutionalisation. Additionally, it is important to note that following delirium screening for study purposes, the presence or absence of delirium was documented in the medical notes so that intervention strategies could be put into place by the medical team. As all patients were recruited to this study within the first 24 hours of admission this will have allowed early intervention to be put into place for all patients regardless of initial recognition by the admitting team.

Documentation of delirium in discharge summaries did not improve during this study. This may have been due to patients being discharged from clinical areas other than the acute admissions unit, and reduced awareness by discharging physicians of the main study. However, many medical staff working in discharging areas would have rotated through the acute admissions unit. Medical staff may have been unaware of the importance of documenting delirium on discharge summaries, as this was not an aspect included in the main study. To minimise potential bias, examination of discharge summaries was performed by a separate independent researcher who was not aware of the results of the admission recognition data.

Early patient and public involvement in the planning of our research project ensured that this project was of relevance to the interests of older adults and their carers. In particular, our pilot study assisted to refine the protocol for the main study and verify the acceptability of the assessments performed. Dementia remains a priority research topic for older adults and their carers. Delirium is often less well understood by patients and members of the public compared to dementia but is considered an important problem when the condition is explained to them.

Overall rates of delirium recognition compared better than previous research in other settings. The development of NICE guidelines in 2010 (24) and increased undergraduate teaching (28) are likely to have influenced this. We did not conduct follow-up assessments following completion of this study to assess if the effect was maintained. Baseline recognition rates prior to recruitment to this study were also not measured. Due to the design of this study, we were only able to assess the impact of our study upon recognition of prevalent delirium in patients included within the main study. We also did not assess the impact upon recognition of incident delirium or prevalent delirium in patients not included in the main study.

We did not demonstrate a significant difference in recognition of delirium between subtypes. This is in contrast to previous research, which has demonstrated that hypoactive delirium is recognised less frequently than other subtypes (12). However, our study was not powered to detect a difference in recognition between subtypes. A non-significant difference of 52% recognition amongst hypoactive patients compared to 67% recognition amongst hyperactive and mixed subtypes was observed overall.

This is the first study to show the effect of delirium research activity on delirium recognition. Our results correspond to previous studies that have demonstrated a positive effect of research activity on patient outcomes. Further research is needed to assess if similar effects are observed with research studies of alternative design. Demonstrating positive indirect benefits of research activity on patient outcomes may encourage increased engagement of hospital trusts in research. Our study demonstrates that delirium recognition can be improved through informal education and collaborative working within an acute admissions unit; a similar approach of embedding a specialist delirium or geriatric medicine team within the acute admissions unit could have a similar positive impact in clinical practice.

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Competing interests

The authors declare that they have no competing interests.

Author contributions

TAJ was responsible for recruitment of patients to this study and recording of delirium recognition. CW was responsible for review of delirium documentation on discharge summaries. TAJ and CW jointly performed the analysis and agreed the text of the manuscript.

Ethical approval

This study involved participants who lacked capacity to consent; written consultee declaration was obtained from personal consultees. Ethical and regulatory approvals were obtained (Bradford Ethics Committee, part of the Yorkshire and Humber National research and Ethics Service, ref: 12/YH/0534).

Data sharing statement

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Table 1 – Comparison of results and patient demographics by halves

		All	First half *n=63*	Second half *n=62*	*p*	*Recognised n=74*	*Unrecognised n=51*	*p*
Age	**Mean (SD)**	84.4	83.78	85.03	0.18	85 (5.8)	84 (7.4)	0.65
Gender	**Male**	47 (38%)	27 (43%)	20 (32%)	0.27	27 (36%)	20 (39%)	0.85
Subtype	**Hyperactive**	37 (29%)	18 (29%)	19 (31%)		25 (34%)	12 (23%)	
	Hypoactive	67 (54%)	34 (54%)	33 (53%)	0.96	35 (47%)	32 (63%)	0.23
	Mixed	21 (17%)	11 (17%)	10 (16%)		14 (19%)	7 (14%)	
IQCODE > 3.82		71 (57%)	36 (57%)	35 (56%)	0.77	31 (42%)	15 (29%)	0.97
Inpatient mortality		12 (10%)	5 (8%)	7 (11%)	0.73	8 (11%)	4 (8%)	0.76
Delirium recognised		**74 (59%)**	**30 (48%)**	**44 (71%)**	**0.01**	NA	NA	NA
Delirium as discharge diagnosis		61 (49%)	26 (41%)	35 (56%)	0.11	NA	NA	NA
Delirium described on discharge		62 (50%)	33 (52%)	29 (47%)	0.59	NA	NA	NA
		All	**First half *n=57***	**Second half *n=56***	***p***	***Recognised n=66***	***Unrecognised n=47***	***p***
Median LOS (days)		16	17	13.5	0.43	17	13.5	0.18
		All	**First half *n=54***	**Second half *n=53***	***p***	***Recognised n=64***	***Unrecognised n=43***	***p***
12 month mortality		42 (39%)	24 (44%)	18 (34%)	0.27	26 (41%)	16 (37%)	0.72

Delirium recognition improved between the first half of recruitment to the second half of recruitment. There was no difference in age, gender, delirium subtype, dementia status, or mortality between halves of recruitment or between recognised and unrecognised delirium.

Table 2 – Comparison of results by quartiles

	First quartile (*n=31*)	Second quartile (*n=31*)	Third quartile (*n=31*)	Fourth quartile (*n=32*)	*p* value
Delirium recognised	**13 (42%)**	**16 (52%)**	**23 (74%)**	**22 (69%)**	**0.03**
Delirium as discharge diagnosis	9 (29%)	17 (55%)	15 (48%)	20 (62%)	0.052
Delirium described on discharge	18 (58%)	14 (45%)	12 (39%)	18 (56%)	0.37

Delirium recognition improved between the first quartile and the second, third and fourth quartile. There was a trend towards increased documentation of delirium as a discharge diagnosis between the first and the second, third and fourth quartiles.

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Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cohort reporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	3

	#6b	For matched studies, give matching criteria and number of exposed and unexposed	3
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	3
Bias	#9	Describe any efforts to address potential sources of bias	3
Study size	#10	Explain how the study size was arrived at	3
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4
	#12b	Describe any methods used to examine subgroups and interactions	4
	#12c	Explain how missing data were addressed	4
	#12d	If applicable, explain how loss to follow-up was addressed	4
	#12e	Describe any sensitivity analyses	4
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	4
	#13b	Give reasons for non-participation at each stage	4
	#13c	Consider use of a flow diagram	4
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential	8

		confounders. Give information separately for exposed and unexposed groups if applicable.	
	#14b	Indicate number of participants with missing data for each variable of interest	4
	#14c	Summarise follow-up time (eg, average and total amount)	4
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
	#16b	Report category boundaries when continuous variables were categorized	8
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	9
Key results	#18	Summarise key results with reference to study objectives	5
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	5
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	5
Generalisability	#21	Discuss the generalisability (external validity) of the study results	6
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6