Supplementary Online Content

Acharya R, Kafle S, Shrestha DB, et al. Use of computed tomography of the head in patients with acute atraumatic altered mental status: a systematic review and meta-analysis. *JAMA Netw Open*. 2022;5(11):e2242805. doi:10.1001/jamanetworkopen.2022.42805

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This supplementary material has been provided by the authors to give readers additional information about their work.
**Table 1. Database Search Strategy**

| Building block approach to search database |
|-------------------------------------------|
| Altered mental status: "altered mental status"[tw] OR confusion[tw] OR disorientation OR unconscious*[tw] OR AMS[tw] |
| CT head: "Tomography, X-ray Computed"[Mesh] OR "CT Head" OR CTH |

| PubMed/MEDLINE, PubMed Central |
|--------------------------------|
| ("altered mental status"[tw] OR confusion[tw] OR disorientation OR unconscious*[tw] OR AMS[tw]) AND ("Tomography, X-Ray Computed"[Mesh] OR "CT Head"[tw] OR CTH[tw]) |

**PubMed/Medline: 2308 Hits**

[Link](https://pubmed.ncbi.nlm.nih.gov/?term=%22altered+mental+status%22%5Btw%5D+OR+confusion%5Btw%5D+OR+disorientation+OR+unconscious*%5Btw%5D+OR+AMS%5Btw%5D%29+AND+%28%22Tomography%2C+X-Ray+Computed%22%5BMesh%5D+OR+%22CT+Head%22%5Btw%5D+OR+CTH%5Btw%5D%29&size=200)

**PubMed Central: 4671 Hits**

[Link](https://www.ncbi.nlm.nih.gov/pmc/?term=(%22altered+mental+status%22%5Btw%5D+OR+confusion%5Btw%5D+OR+disorientation+OR+unconscious%5Btw%5D+OR+AMS%5Btw%5D)+AND+(%22Tomography%2C+X-Ray+Computed%22%5BMesh%5D+OR+%22CT+Head%22%5Btw%5D+OR+CTH%5Btw%5D)

| CINAHL: 628 Hits |
|------------------|
| ("altered mental status" OR confusion OR delirium OR disorientation OR unconscious OR AMS) AND ("Tomography, X-Ray Computed" OR "CT Head" OR CTH) |

[Link](https://web-p-ebscohost-com.proxy.campbell.edu/ehost/results?vid=1&sid=315f5b5a-d468-4b0d-9b3c-cal1abed29ccbb4redis&bquery=%22altered+mental+status%22+OR+confusion+OR+delirium+OR+disorientation+OR+unconscious+OR+AMS%29+AND+%28%22Tomography%2C+X-Ray+Computed%22+OR+%22CT+Head%22+%29&bdata=JmRiPWNjbSZ0eXBIPTAmc2YhemNoTW9kZT1TdGFuZGFvZCZzaXRIPWVob3N0LWxpdmU%3d)

| EMBASE: 1731 hits |
|--------------------|
| ('altered mental status'/exp OR 'altered mental status' OR 'confusion'/exp OR confusion OR 'delirium'/exp OR delirium OR 'disorientation'/exp OR disorientation OR 'unconscious'/exp OR unconscious OR ams) AND ('tomography, x-ray computed'/exp OR 'tomography, x-ray computed' OR 'ct head' OR cth) |

[Link](https://www.embase.com/?phase=continueToApp#advancedSearch/resultspage/history.1/page.1/25.items/orderby.date/source)
éTable 2. The Joanna Briggs Institute’s (JBI) critical appraisal checklist for case-control study. Total quality scores ≤ 4, 5 to 7, and ≥ 8 were considered as low, moderate and high quality respectively

| Study                        | Were the groups comparable other than the presence of disease in cases or the absence of disease in controls? | Were cases and controls matched appropriately? | Were the same criteria used for identification of cases and controls? | Was exposure measured in a standard, valid and reliable way? | Was exposure measured in the same way for cases and controls? | Were confounding factors identified? | Were strategies to deal with confounding factors stated? | Were outcomes assessed in a standard, valid and reliable way for cases and controls? | Was the exposure period of interest long enough to be meaningful? | Was appropriate statistical analysis used? | Score | Quality |
|------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------|----------|
| Callen A et al. (2020)       | yes                                                                                               | n/a                                            | yes                                                             | yes                                                       | n/a                                                         | n/a                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 7       | moderate |
| Chen H et al. (2020)         | yes                                                                                               | Yes                                            | yes                                                             | yes                                                       | yes                                                         | yes                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 10      | high     |
| Detweiler M et al. (2020)    | yes                                                                                               | Yes                                            | yes                                                             | yes                                                       | yes                                                         | no                                                | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 9       | high     |
| Detweiler M et al. (2017)    | yes                                                                                               | Yes                                            | yes                                                             | yes                                                       | yes                                                         | no                                                | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 9       | high     |
| Finkelmeier F et al. (2019)  | no                                                                                                 | n/a                                            | yes                                                             | yes                                                       | unclear                                                    | yes                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 7       | moderate |
| Lai M et al. (2010)          | yes                                                                                               | No                                             | yes                                                             | yes                                                       | yes                                                         | yes                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 9       | high     |
| Patel M et al. (2012)        | yes                                                                                               | Yes                                            | yes                                                             | yes                                                       | unclear                                                    | yes                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 8       | high     |
| Rahimi R et al. (2016)       | yes                                                                                               | Yes                                            | yes                                                             | yes                                                       | unclear                                                    | yes                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 9       | high     |
| Segard J et al. (2013)       | no                                                                                                 | Yes                                            | yes                                                             | yes                                                       | unclear                                                    | yes                                               | yes                                             | yes                                                                                                                               | yes                                                                                        | yes                                                                                                                             | 8       | high     |
**eTable 3.** The Joanna Briggs Institute’s (JBI) critical appraisal checklist for cohort study. Total quality scores ≤ 4, 5 to 7, and ≥ 8 were considered as low, moderate and high quality respectively.

| Study                   | Were the two groups similar and recruited from the same population? | Were the exposures measured similarly to assign people to both exposed and unexposed groups? | Was the exposure measured in a valid and reliable way? | Were confounding factors identified? | Were strategies to deal with confounding factors stated? | Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)? | Were the outcomes measured in a valid and reliable way? | Was the follow up time reported and sufficient to be long enough for outcomes to occur? | Was follow up complete, and if not, were the reasons to loss to follow up described and explored? | Were strategies to address incomplete follow up utilized? | Were appropriate statistical analysis used? | Score | Quality   |
|-------------------------|-------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------|----------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|--------|-----------|
| Bent C et al. (2015)    | n/a                                             | yes                                                                             | yes                                           | no                               | yes                                             | yes                                             | yes                                             | yes                                                            | n/a                                                            | yes                                                            | 7                  | moderate  |
| Chokshi F et al. (2016) | n/a                                             | yes                                                                             | no                                            | n/a                              | yes                                             | yes                                             | yes                                             | yes                                                            | n/a                                                            | yes                                                            | 6                  | moderate  |
| Donovan L et al. (2015) | yes                                             | n/a                                                                             | yes                                           | no                               | n/a                                             | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 7                  | moderate  |
| Hanna A et al. (2021)   | n/a                                             | n/a                                                                             | yes                                           | yes                              | yes                                             | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 7                  | moderate  |
| Hufschmidt et al. (2008)| yes                                             | yes                                                                             | yes                                           | unclear                          | unclear                                        | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 8                  | high      |
| Khan S et al. (2014)    | yes                                             | yes                                                                             | yes                                           | yes                              | yes                                             | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 10                 | high      |
| Lim BL et al. (2009)    | yes                                             | yes                                                                             | unclear                                       | unclear                          | yes                                             | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 8                  | high      |
| Nesselroth D et al. (2021) | n/a                                          | yes                                                                             | n/a                                           | n/a                              | yes                                             | yes                                             | yes                                             | yes                                                            | n/a                                                            | yes                                                            | 6                  | moderate  |
| Patel R et al. (2019)   | n/a                                             | yes                                                                             | n/a                                           | n/a                              | yes                                             | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 6                  | moderate  |
| Shuaib W et al (2014)   | n/a                                             | yes                                                                             | n/a                                           | n/a                              | yes                                             | yes                                             | yes                                             | yes                                                            | yes                                                            | n/a                                                            | 6                  | moderate  |
| Study                                | n/a | n/a | yes | n/a | n/a | yes | yes | yes | n/a | yes | 6  | moderate |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----------|
| Sinclair D et al. (1993)             |     |     |     |     |     |     |     |     |     |     | 6  | moderate  |
| Thacker P et al. (2021)              |     |     | yes | n/a | n/a | yes | yes | yes | n/a | yes | 6  | moderate  |
| Theisen-Toupal J et al. (2014)       |     |     | yes | unclear | unclear | yes | yes | yes | n/a | yes | 6  | moderate  |
| Tu L et al. (2021)                   |     |     | yes | n/a | n/a | yes | yes | yes | n/a | yes | 5  | moderate  |
| Wang X et al. (2013)                 | yes | yes | yes | unclear | yes | yes | yes | yes | n/a | yes | 9  | high      |
| Wong J et al. (2014)                 | yes | yes | yes | no  | n/a | yes | yes | yes | n/a | yes | 8  | moderate  |
**eTable 4.** The Joanna Briggs Institute’s (JBI) critical appraisal checklist for quasi-experimental study. Total quality scores ≤ 4, 5 to 7 and ≥ 8 were regarded as low, moderate, and high quality, respectively.

| Study | Is it clear in the study what is the ‘cause’ and what is the ‘effect’ (i.e. there is no confusion about which variable comes first)? | Were the participants included in any comparisons similar? | Was there a control group? | Were there multiple measurements of the outcome both pre and post the intervention/exposure? | Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed? | Were the outcomes of participants included in any comparisons measured in the same way? | Were outcomes measured in a reliable way? | Was appropriate statistical analysis used? | Score | Quality |
|-------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------|---------------------------------------------|--------|--------|
| Covino M et al. (2019) | yes | yes | n/a | n/a | yes | Yes | yes | yes | yes | 7 | moderate |
**eFigure 1.** Funnel Plot Showing the Asymmetric Distribution of Studies Suggesting Significant Publication Bias for Computerized Tomography of Head (CTH) Events.
**eFigure 2.** Funnel Plot Showing the Asymmetric Distribution of Studies Suggesting Significant Publication Bias for Positive Computerized Tomography of Head (CTH) Events
| Omitted study                          | CTH Prevalence with 95% CI | p-value |
|--------------------------------------|----------------------------|---------|
| Bent C et al, citation 10, [2015]    | 0.85 [0.74, 0.95]          | 0.000   |
| Callen A et al, citation 11, [2020]  | 0.85 [0.74, 0.95]          | 0.000   |
| Chen H et al, citation 12, [2020]    | 0.87 [0.77, 0.97]          | 0.000   |
| Chokshi F et al, citation 13, [2016] | 0.85 [0.74, 0.95]          | 0.000   |
| Covino M et al, citation 14, [2019]  | 0.85 [0.74, 0.95]          | 0.000   |
| Detweiler M et al, citation 15, [2020]| 0.85 [0.75, 0.96]          | 0.000   |
| Donovan L et al, citation 17, [2015] | 0.85 [0.74, 0.95]          | 0.000   |
| Finkelmeier F et al, citation 18, [2019]| 0.85 [0.74, 0.95]        | 0.000   |
| Hanna A et al, citation 19, [2021]   | 0.85 [0.74, 0.95]          | 0.000   |
| Hufschmidt A et al, citation 20, [2008]| 0.86 [0.76, 0.97]        | 0.000   |
| Khan S et al, citation 21, [2014]    | 0.85 [0.74, 0.95]          | 0.000   |
| Lai M et al, citation 22, [2010]     | 0.85 [0.74, 0.95]          | 0.000   |
| Lim B et al, citation 23, [2009]     | 0.87 [0.76, 0.97]          | 0.000   |
| Nesselroth D et al, citation 24, [2021]| 0.85 [0.74, 0.95]        | 0.000   |
| Patel M et al, citation 25, [2002]   | 0.88 [0.78, 0.97]          | 0.000   |
| Patel R et al, citation 26, [2019]   | 0.85 [0.74, 0.95]          | 0.000   |
| Rahimi R et al, citation 27, [2016]  | 0.86 [0.76, 0.97]          | 0.000   |
| Segard J et al, citation 28, [2013]  | 0.85 [0.74, 0.95]          | 0.000   |
| Shuaib W et al, citation 29, [2014]  | 0.85 [0.74, 0.95]          | 0.000   |
| Sinclair D et al, citation 30, [1993]| 0.85 [0.74, 0.95]          | 0.000   |
| Thacker P et al, citation 31, [2021] | 0.85 [0.74, 0.95]          | 0.000   |
| Theisen-Toupal J et al, citation 32, [2014]| 0.85 [0.74, 0.95]    | 0.000   |
| Tu L et al, citation 5, [2021]       | 0.88 [0.80, 0.97]          | 0.000   |
| Wang X et al, citation 33, [2013]    | 0.85 [0.74, 0.95]          | 0.000   |
| Wong J et al, citation 34, [2014]    | 0.85 [0.75, 0.95]          | 0.000   |

Random-effects REML model

**eFigure 3.** Sensitivity Analysis of Studies for Computerized Tomography of Head (CTH) Event
**Figure 4.** Sensitivity Analysis of Studies for Positive Computerized Tomography of Head (CTH) Events

| Omitted study                                      | Positive CTH Prevalence with 95% CI | p-value |
|----------------------------------------------------|------------------------------------|---------|
| Bent C et al, citation 10, [2015]                   | 0.13 [0.08, 0.19]                 | 0.000   |
| Callen A et al, citation 11, [2020]                 | 0.14 [0.08, 0.20]                 | 0.000   |
| Chen H et al, citation 12, [2020]                   | 0.14 [0.08, 0.19]                 | 0.000   |
| Chokshi F et al, citation 13, [2016]                | 0.13 [0.07, 0.19]                 | 0.000   |
| Donovan L et al, citation 17, [2015]                | 0.14 [0.08, 0.20]                 | 0.000   |
| Finkelmeier F et al, citation 18, [2019]            | 0.14 [0.08, 0.19]                 | 0.000   |
| Hanna A et al, citation 19, [2021]                  | 0.14 [0.08, 0.20]                 | 0.000   |
| Huenschmidt A et al, citation 20, [2008]            | 0.13 [0.07, 0.19]                 | 0.000   |
| Khan S et al, citation 21, [2014]                   | 0.14 [0.08, 0.20]                 | 0.000   |
| Lai M et al, citation 22, [2010]                    | 0.13 [0.07, 0.19]                 | 0.000   |
| Lin B et al, citation 23, [2009]                    | 0.11 [0.07, 0.16]                 | 0.000   |
| Nesselroth D et al, citation 24, [2021]             | 0.13 [0.07, 0.19]                 | 0.000   |
| Patel M et al, citation 25, [2002]                  | 0.14 [0.08, 0.19]                 | 0.000   |
| Patel R et al, citation 26, [2019]                  | 0.13 [0.07, 0.19]                 | 0.000   |
| Rahimi R et al, citation 27, [2016]                 | 0.13 [0.07, 0.19]                 | 0.000   |
| Segard J et al, citation 28, [2013]                 | 0.12 [0.07, 0.17]                 | 0.000   |
| Shuaib W et al, citation 29, [2014]                 | 0.13 [0.07, 0.19]                 | 0.000   |
| Sinclair D et al, citation 30, [1993]               | 0.13 [0.07, 0.19]                 | 0.000   |
| Thacker P et al, citation 31, [2021]                | 0.14 [0.08, 0.19]                 | 0.000   |
| Theisen-Toupal J et al, citation 32, [2021]         | 0.14 [0.08, 0.20]                 | 0.000   |
| Tu L et al, citation 5, [2021]                      | 0.14 [0.08, 0.20]                 | 0.000   |
| Wong J et al, citation 34, [2014]                   | 0.14 [0.08, 0.20]                 | 0.000   |

Random-effects REML model
**eFigure 5.** The Proportion of Computerized Tomography of Head (CTH) in Patients With Altered Mental Status (AMS) Among Studies

ES= Effect size representing the proportion of CTH in AMS patients. The model used is the random effect model. USA= United States of America