Headaches in Children

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Objectives

• 1. Discuss diagnostic criteria for migraines, and identify "red flag" historical and physical exam features in children with secondary headache disorders

• 2. Expand differential diagnosis for headache conditions based on presenting features

• 3. Discuss treatment options for migraines, and demonstrate and apply knowledge of accepted standards in Osteopathic principals and practice
Background

- 60% of children and adolescents experience headaches at some time in their life
- Nearly 1 in 10 children experience recurrent headaches attributable to migraine
  - 3-7 yoa up to 3.7% M>F; 7-11 yoa up to 11% M=F; 11->/=15 up to 23% F>M*
- Major cause of disability
  - Missed school and activities
  - Impaired school performance
  - Impaired quality of life
- Up to 2/3 children will respond to available therapy
- One of the leading predictors of appropriate treatment is the appropriate diagnosis
- *Lewis D, et al. AAN Practice Parameter: Evaluation of children and adolescents with recurrent headaches
History

- Intermittent/new/escalating
- Ask the child’s input regarding quality of pain
- Use age appropriate terms and pain scales
- Drawing
- Location/pointing
- Ask caregiver how child acts/appears during the headache
- Associated features
ICHD-3 Criteria for Migraine without aura

• Diagnostic criteria:
  • A. At least five attacks fulfilling criteria B–D
  • B. Headache attacks lasting 2*–72 hours (untreated or unsuccessfully treated)
  • C. Headache has at least two of the following four characteristics:
    • 1. unilateral location (or bilateral and often frontal in kids <18yrs)
    • 2. pulsating quality
    • 3. moderate or severe pain intensity
    • 4. aggravation by or causing avoidance of routine physical activity (e.g. walking or climbing stairs)
  • D. During headache at least one of the following:
    • 1. nausea and/or vomiting
    • 2. photophobia and phonophobia
  • E. Not better accounted for by another ICHD-3 diagnosis

• Probable Migraine without aura: Fulfilling all but ONE of B-D

* shorter duration in children than adults (4 hr minimum for adults), kids more likely to be bilateral
Pearls for Migraines in Children

• Almost 1/10 children have migraines
• When compared with adult migraines
  • Less likely to have aura
  • More likely to be bilateral
  • May be shorter in duration
• May have to infer associated symptoms by behavior
ICHD-3 Criteria for Abdominal Migraine

- Diagnostic criteria:
  - A. At least **five attacks** of abdominal pain, fulfilling criteria B–D
    - B. Pain has **at least two** of the following three characteristics:
      - 1. midline location, periumbilical or poorly localized
      - 2. dull or ‘just sore’ quality
      - 3. moderate or severe intensity
  - C. During attacks, at least **two** of the following:
    - 1. anorexia
    - 2. nausea
    - 3. vomiting
    - 4. pallor
  - D. Attacks last 2–72 hours when untreated or unsuccessfully treated
  - E. Complete freedom from symptoms between attacks
  - F. Not attributed to another disorder
Pearls for Abdominal Migraine

• Recurrent attacks of moderate to severe midline abdominal pain
• Mainly children
• Headache does not occur during these episodes
• History and PE do not show signs of gastrointestinal or renal disease, or such disease has been ruled out by appropriate investigations
• Severe pain, interferes with normal daily activities
• In young children the presence of headache is often overlooked
  • If headache occurs, a diagnosis of migraine without aura should be considered
• Children may find it difficult to distinguish anorexia from nausea
• Pallor is often a/w dark shadows under the eyes
• Flushing may be the predominant vasomotor phenomenon
• Most children will develop migraine headache later in life
ICHD-3 Criteria for Migraine with aura

- Diagnostic criteria:
  - A. At least two attacks fulfilling criteria B and C
  - B. One or more of the following fully reversible aura symptoms:
    - 1. visual
    - 2. sensory
    - 3. speech and/or language
    - 4. motor
    - 5. brainstem
    - 6. retinal
  - C. At least two of the following four characteristics:
    - 1. at least one aura symptom spreads gradually over \( \geq 5 \) minutes, and/or two or more symptoms occur in succession
    - 2. each individual aura symptom lasts 5-60 minutes\(^1\)
    - 3. at least one aura symptom is unilateral\(^2\)
    - 4. the aura is accompanied, or followed within 60 minutes, by headache
  - D. Not better accounted for by another ICHD-3 diagnosis, and transient ischaemic attack has been excluded
ICHD-3 Criteria for Infrequent Episodic Tension-Type Headache

• Diagnostic criteria:
  • A. At least 10 episodes of headache occurring on <1 day per month on average (<12 days per year) and fulfilling criteria B-D
     • B. Lasting from 30 minutes to 7 days
     • C. At least two of the following four characteristics:
       • 1. bilateral location
       • 2. pressing or tightening (non-pulsating) quality
       • 3. mild or moderate intensity
       • 4. not aggravated by routine physical activity such as walking or climbing stairs
     • D. Both of the following:
       • 1. no nausea or vomiting
       • 2. no more than one of photophobia or phonophobia
   • E. Not better accounted for by another ICHD-3 diagnosis
Tension-Type Headache Pearls

- Often do not come to attention
- Do not typically cause significant disability
- Typically bilateral
- Pressing or tightening in quality
- Mild to moderate intensity
- Lasting minutes to days
- Pain does not worsen with routine physical activity and is not associated with nausea, but photophobia or phonophobia may be present.
Primary vs Secondary Headaches

• Primary
  • Migraine
  • Tension type
  • Trigeminal autonomic cephalgias

• Secondary (“PIN” the diagnosis acronym*)
  • Pressure abnormalities: intracranial hypertension (Idiopathic Intracranial Hypertension and secondary), intracranial hypotension – CSF leaks, systemic HTN/PRES/hypertensive crisis,
  • Infection: meningitis, encephalitis, cerebritis, sphenoid sinusitis
  • Neoplastic disease: parenchymal and extraaxial neoplasms, meningeal carcinomatosis, pituitary tumor, brain metastases, “not the right blood flow”- vascular causes-dissection, thrombosis, hemorrhage

• *David Dodick, Diagnosing Secondary and Primary Headache Disorders. Continuum (Minneap Minn) 2021; 27(3, Headache): 573
Red Flag Features SNOOP4Y*

- Systemic signs/symptoms
- Neurologic signs/symptoms
- Onset sudden
- Onset in sleep/early morning
- Positional exacerbation
- Precipitated by valsalva
- Parents (lack of family history)
- Progressive or new
- Young age

*Used with permission

David Dodick, Diagnosing Secondary and Primary Headache Disorders. Continuum (Minneap Minn) 2021; 27(3, Headache): 573

Christina Szperka, Headache in Children and Adolescents. Continuum (Minneap Minn) 2021; 27(3, Headache): 703-731
<table>
<thead>
<tr>
<th>Red Flag</th>
<th>Significance</th>
</tr>
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</table>
| **Systemic signs/symptoms**                                | - Fever, acute symptoms: Infections ranging from minor to serious\(^{35}\) are the most common cause of headache in children in the emergency department  
- Head trauma: Relatively common cause for headache in the emergency department  
- Vomiting: Consistent with migraine\(^{38}\) but also a risk factor for brain tumors\(^{39}\)  
- Weight loss: Can be a symptom of malignancy  
- Comorbidities: Many systemic illnesses, including rheumatologic, oncologic, vascular, and hematologic conditions; genetic syndromes; and abnormalities of the immune system predispose to other serious causes for headache  
- Medications: Headache can be a medication side effect\(^{40}\)  
- Neurologic signs/symptoms: Abnormal gait, ataxia, papilledema, changes in personality/behavior/cognition, visual disturbances/eye movement abnormalities, and seizure\(^{35}\) are red flags for serious secondary headache  
- Onset sudden: Thunderclap onset of headache in which pain peaks instantly is rare in children but can signal serious causes such as cerebral hemorrhage or reversible cerebral vasocostriction syndrome; the full range of differential diagnosis from adults with thunderclap headache should be considered, and imaging should be pursued  
- Onset in sleep/early morning: Headache causing a child to awaken from sleep or occurring early in the morning has been associated with intracranial lesions\(^{41}\) and can be suggestive of sleep apnea and other sleep disorders\(^{42}\); however, this diurnal pattern is also common in primary headache disorders\(^{43}\)  
- Positional exacerbation: Headache that resolves when supine and worsens immediately upon standing or slowly throughout the day can suggest spontaneous intracranial hypotension or postural tachycardia syndrome\(^{35}\)  
- Worse upright: Consider increased intracranial pressure from tumor or idiopathic intracranial hypertension  
- Precipitated by Valsalva: Brief headaches triggered by Valsalva maneuvers can signal intracranial abnormalities; headache triggered by cough along with signs/symptoms of brainstem/cerebellum/cervical spinal cord dysfunction\(^{38}\) may suggest Chiari malformation (although Chiari malformation may be found incidentally with other headaches and is of varying significance)  
- Parents (lack of family history): Several studies have found that lack of family history of headaches is associated with higher odds of having a serious cause of headache in children\(^{44}\); most children with migraines have a family history of migraine, although the parent(s)/guardian(s) may not be aware of the diagnosis  
- Progressive or new: Significant change in the headache pattern, new headache, or progressively escalating headache raises the level of concern for secondary cause\(^{44}\); however, many new-onset headaches are not caused by structural brain abnormalities\(^{44}\) and may be attributed to relatively benign causes such as viral infections; furthermore, studies have used different cutoff points from days to months\(^{45}\) when trying to determine when a “recent-onset” headache is worrisome, so the newness of the headache must be interpreted with the presence or absence of other headache features  
- Young age: Some studies have found that children of younger age (defined as either ≤5 years\(^{45,46}\) or ≤7 years\(^{36}\)) were more likely to be diagnosed with a life-threatening headache, whereas other studies have refuted that concern\(^{44}\)  

\(^{a}\) The mnemonic SNOOP4Y is adapted from the SNOOP4 used in adults\(^{37}\)
Evaluation? AAN Practice parameter: Evaluation of children and adolescents with recurrent headaches

- LP: Not to be used routinely for recurrent headaches
  - Indications: subarachnoid hemorrhage, acute or chronic meningitis, idiopathic intracranial hypertension, immunocompromised and suspicion for infection, demyelinating conditions, nuchal rigidity, signs of increased ICP, mental status changes (following acute imaging)

- EEG: Not included in routine evaluation of children with recurrent headaches, consider if symptoms are associated with seizure disorder
  - Children with migraine have higher risk to have abnormal EEG with paroxysmal abnormalities, but risk for future seizures was found to be negligible in absence of clinical findings associated with seizure
Evaluation? AAN Practice parameter: Evaluation of children and adolescents with recurrent headaches

- Imaging
  - Variables predictive of space-occupying lesion
    - Headache less than 1 month in duration
    - Absence of FHx migraine
    - Abnormal neurological examination
    - Gait abnormalities
    - Seizures
  - Highest risk group for space-occupying lesion
    - Headache <6 months and at least one other predictor of surgical space occupying lesion
      - Sleep related headaches
      - Vomiting
      - Confusion
      - Absence of visual aura
      - Absence of family hx of migraine
      - Abnormal neurological exam
**Recommendations:**

- Obtaining a neuroimaging study on a routine basis is not indicated in children with recurrent headaches and normal neurological exam.

- Neuroimaging should be considered in children with an abnormal neurological exam (focal findings, signs of increased ICP, significant alteration of consciousness), the coexistence of seizures, or both.

- Neuroimaging should be considered in children in whom there are historical features to suggest recent onset of severe headache, change in type of headache, or if there are associated features that suggest neurological dysfunction.
Treatment options

• Lifestyle changes
  • SMART Healthy Habits
    • Sleep
    • Meals/Hydration
    • Activity
    • Relaxation
    • Triggers

• Acute options
• Prophylactic options
Acute Migraine Treatment

• AAN Practice guideline update: Acute treatment of migraine in children and adolescents
• 1. Establish diagnosis of headache type based on ICDH-3 criteria
• 2. Treat at headache onset when possible
Acute Migraine Treatment

- **1st line**: Ibuprofen 10 mg/kg as initial treatment option
- **2nd**: Triptan
  - FDA approved
  - Rizatriptan ODT (age 6-17 years): (5 mg or 10 mg)
  - Almotriptan (12 yrs +): (6.25 or 12.5 mg)
  - Sumatriptan/naproxen oral tab (12 yrs +): 10/60, 30/180, 85/500 mg
  - Zolmitriptan Nasal spray (12 yrs +): 5 mg
  - Sumatriptan NS
  - If response to triptan alone is incomplete, may try triptan + NSAID
- **Treat associated symptoms**
  - Consider antiemetic

*Clinicians should counsel patients and families to avoid medication overuse headaches*

  - No more than:
    - 14 days/month ibuprofen or acetaminophen
    - 9 days/month of any combination of triptans, analgesics

Opiates are not recommended for acute treatment of headache pain
Acute Migraine Treatment

• AAN Guidelines: Clinicians should counsel adolescent patients with migraine with aura that taking their triptan during a typical aura is safe, but that the triptan may be more effective if taken at onset of head pain

• Triptan side effects: flushing, somnolence, chest pain, paresthesias
  • Contraindications: history of ischemic vascular disease, accessory conduction pathway disorders, poorly controlled hypertension

• Next steps
  • If in ER: ketorolac/diphenhydramine/prochlorperazine
  • Valproic acid
  • Magnesium
  • Steroids
  • Peripheral nerve blocks
  • External trigeminal nerve stimulation (Cefaly)
Reasons to avoid opiates and barbiturates

• Increased risk of medication overuse headache
• Increased risk of chronic migraine
• Decreased likelihood of responding to a migraine preventative medication
• Decreased likelihood of responding to a triptan acutely
• CNS side effects, tolerance, addiction, withdrawal
Menstrual Migraine

• NSAIDs
  • Naproxen 550mg BID x 5-6 days starting 1 day before expected HA onset
• Triptans: ideally beginning 1 day before expected HA onset
  • Frovatriptan 2.5 mg BID x 6 days
  • Naratriptan 1mg BID x 5-6 days
  • Zolmitriptan 2.5 mg 2-3 times daily up to 7 days
• Magnesium
• Vitamin E
• Estrogen
Prophylactic treatment

- Consider if 4+ headache days/month
- Trials find high placebo response rate limits ability for medications to demonstrate efficacy
- Childhood and Adolescent Migraine Prevention (CHAMP) Trial: Amitriptyline (1 mg/kg/day) vs Topiramate (2 mg/kg/day) vs Placebo
  - 328 children ages 8-17 yrs, 24 weeks
  - Primary outcome relative reduction of 50% of headaches
  - No significant reduction between groups
    - 52% amitriptyline, 55% topiramate, 61% placebo improved
Prophylactic treatment

- AAN Guideline recommends consideration of:
  - Topiramate (2-3 mg/kg)
  - Amitriptyline (0.25-1 mg/kg)
  - Propranolol (20-40 mg TID)
  - Any + cognitive behavioral therapy

- Amitriptyline: suicidality risk
- Topiramate: teratogenicity and risk of decreased effectiveness of hormonal contraception with high doses
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dose</th>
<th>Side effects</th>
<th>Other information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topiramate</td>
<td>2-3 mg/kg/day; typical 100 mg/day, max 200 mg/day</td>
<td>Paresthesias, weight loss, fatigue, decreased sweating, cognitive impairment, renal stones, depression, angle closure glaucoma, teratogenicity</td>
<td>Reduces potency of oral contraceptive pills esp at doses &gt;200 mg/day; folic acid *consider in overweight patients or patients with epilepsy</td>
</tr>
<tr>
<td>Amitriptyline</td>
<td>0.25-1 mg/kg/day QHS</td>
<td>Sedation, dizziness, constipation, dry mouth, weight gain, prolonged QTc</td>
<td>Risk for suicidal ideation, dangerous in overdose *consider in depressed patients with difficulty in sleep</td>
</tr>
<tr>
<td>Propranolol</td>
<td>20-40 mg TID</td>
<td>Sedation, hypotension, bradycardia, weight gain, may worsen depression and exercise-induced asthma</td>
<td>*consider in patients with HTN, anxiety</td>
</tr>
<tr>
<td>Divalproex sodium</td>
<td>15-30 mg/kg/day up to 1000 mg/day</td>
<td>weight gain, dizziness, somnolence, tremor, alopecia, elevated LFTs, thrombocytopenia, lymphopenia, pancreatitis, hypoerammonemia, teratogenicity</td>
<td>Not recommended for girls of child-bearing age due to teratogenicity, folic acid -Caution in obesity *may be beneficial for mood stabilization or in patients with epilepsy</td>
</tr>
<tr>
<td>Cyproheptadine</td>
<td>0.25-0.5 mg/kg/day up to 16 mg given at night or div BID</td>
<td>Sedation, increased appetite, weight gain</td>
<td>*beneficial in patients with poor sleep, underweight</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>50-400 mg /day, QD or DIV BID</td>
<td>Urinary discoloration</td>
<td>Limited studies</td>
</tr>
<tr>
<td>Magnesium</td>
<td>9 mg/kg/day elemental iron Or 250-500mg Magnesium Oxide</td>
<td>Diarrhea, belly upset</td>
<td>May have calming effect Limited studies</td>
</tr>
</tbody>
</table>
How are we doing?

• Retrospective, observational
• Included 38,926 patients ages 6-17 years with primary headache
• Mostly in primary care settings
How are we doing?

- <1/6 children received evidence based medicine (EBM) for primary headache
- Factors Predictive of receiving of EBM
  - Older children
  - Females
  - Diagnosis code of migraine or headache
    - 17% diagnosed with migraine
    - 36% diagnosed with headache NOS
    - 45% had CC of headache but ICD-9 code did not include migraine or headache
  - Non-Caucasian race
  - Government vs private insurance
  - Private vs No insurance

### Table 3. Patient and provider-level predictors of receiving EBM.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Odds ratio</th>
<th>95% Confidence interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 (patient)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (per year increase)</td>
<td>1.07*</td>
<td>1.06–1.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex (female vs. male)</td>
<td>1.14*</td>
<td>1.07–1.21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Race (Caucasian vs. non-Caucasian)</td>
<td>0.89*</td>
<td>0.82–0.96</td>
<td>0.002</td>
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<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
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<tr>
<td>Headache vs. no diagnosis</td>
<td>1.71*</td>
<td>1.55–1.88</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Migraine vs. no diagnosis</td>
<td>4.71*</td>
<td>4.17–5.33</td>
<td>&lt;0.001</td>
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<tr>
<td>Headache vs. migraine</td>
<td>0.36*</td>
<td>0.32–0.41</td>
<td>&lt;0.001</td>
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<tr>
<td>Insurance</td>
<td></td>
<td></td>
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<tr>
<td>Government vs. private</td>
<td>1.22*</td>
<td>1.12–1.32</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>None vs. private</td>
<td>0.58*</td>
<td>0.52–0.67</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Government vs. none</td>
<td>2.09*</td>
<td>1.80–2.43</td>
<td>&lt;0.001</td>
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<tr>
<td>Level 2 (provider)</td>
<td></td>
<td></td>
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<tr>
<td>Location (metro vs. non-metro)</td>
<td>0.65*</td>
<td>0.58–0.74</td>
<td>&lt;0.001</td>
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<tr>
<td>Specialty</td>
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<tr>
<td>Specialty care vs. primary care</td>
<td>0.71*</td>
<td>0.53–0.95</td>
<td>0.021</td>
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<tr>
<td>ED/UC vs. primary care</td>
<td>0.98</td>
<td>0.84–1.13</td>
<td>0.71</td>
</tr>
<tr>
<td>Specialty care vs. ED/UC</td>
<td>0.73*</td>
<td>0.53–0.99</td>
<td>0.045</td>
</tr>
</tbody>
</table>

Level 1 (patient) n = 38,926; Level 2 (provider) n = 1617.
How are we doing?

- ~1/6 children received an opiate or barbiturate
- Predictors of receiving opiate or barbiturate medication
  - Older children
  - Females
  - Caucasian race
  - Diagnosis of HA or migraine
  - Government or No insurance
  - ED/UC providers

Table 4. Patient and provider-level predictors of receiving any medication.

<table>
<thead>
<tr>
<th>Effect</th>
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<th>p-value</th>
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<td>Level 1 (patient)</td>
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<tr>
<td>Age (per year increase)</td>
<td>1.02*</td>
<td>1.01–1.02</td>
<td>&lt;0.001</td>
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<tr>
<td>Sex (female vs. male)</td>
<td>1.02</td>
<td>0.98–1.07</td>
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<td>Race (Caucasian vs. non-Caucasian)</td>
<td>1.09*</td>
<td>1.03–1.15</td>
<td>0.004</td>
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<tr>
<td>Diagnosis</td>
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<tr>
<td>Headache vs. no diagnosis</td>
<td>0.85*</td>
<td>0.81–0.89</td>
<td>&lt;0.001</td>
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<td>Migraine vs. no diagnosis</td>
<td>1.40*</td>
<td>1.31–1.51</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Headache vs. migraine</td>
<td>0.61*</td>
<td>0.57–0.65</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Insurance</td>
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<tr>
<td>Government vs. private</td>
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<tr>
<td>None vs. private</td>
<td>0.53*</td>
<td>0.50–0.57</td>
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<tr>
<td>Government vs. none</td>
<td>2.29*</td>
<td>2.11–2.48</td>
<td>&lt;0.001</td>
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<tr>
<td>Level 2 (provider)</td>
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<tr>
<td>Location (metro vs. non-metro)</td>
<td>0.52*</td>
<td>0.46–0.61</td>
<td>&lt;0.001</td>
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<td>0.82</td>
<td>0.64–1.07</td>
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<tr>
<td>ED/UC vs. primary care</td>
<td>0.78*</td>
<td>0.67–0.91</td>
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<tr>
<td>Specialty care vs. ED/UC</td>
<td>1.06</td>
<td>0.80–1.40</td>
<td>0.68</td>
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Level 1 (patient) n = 38,926; Level 2 (provider) n = 1617.
Summary

• Primary care was the setting where children were most likely to receive EBM for migraine and primary headache
• Strongest predictor for EBM was receiving migraine diagnosis
• <1/6 children received evidence based medicine for acute migraine or primary headache
• Half received no treatment at all
• Younger children, boys, uninsured and Caucasians were less likely to received EBM
• Caucasians were more likely to receive a prescription or medication recommendation than non-Caucasian
References

• Dodick D. Diagnosing Secondary and Primary Headache Disorders. *Continuum* (Minneap Minn) 2021; 27(3, Headache): 573


• Szperka C. Headache in Children and Adolescents. *Continuum* (Minneap Minn) 2021; 27(3, Headache): 703-731

• DOI: 10.1542/pir.2017-0164