Evidence Index

Peer-Reviewed and Industry Sources that support Child-Optimized Fire Alerting Themes and References

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1) Executive summary

Across multiple peer-reviewed studies and industry guidance, a consistent conclusion appears:

- Many children do not reliably wake to standard residential smoke alarm sounds during sleep; especially younger children and during deeper sleep stages.
- Alternative alert signals (particularly voice and lower-frequency tones) show substantially improved awakening and self-rescue performance versus conventional high-frequency tones in controlled studies.
- In more naturalistic and in-home contexts, a meaningful subset of children still fail to awaken even with louder or closer alarms, reinforcing the need for better alerting approaches near sleeping children.
- Industry commentary notes limited availability of listed residential products that provide optimal low-frequency alerting, supporting the case for a companion/supplemental solution that can be adopted without redesigning existing alarm platforms.

2) References

A) Core peer-reviewed studies (children sleeping)

A.1 INTERNATIONAL ASSOCIATION FOR FIRE SAFETY SCIENCE (IAFSS): In-home/bedroom exposure study

Title: *Sleeping Children and Smoke Alarms*

Why it matters: Demonstrates that even with an alarm presented in the bedroom at higher received sound levels, many children still do not reliably awaken, especially younger children—reinforcing the need for child-optimized alert strategies.

Link: https://publications.iafss.org/publications/aofst/4/603

A.2 Fire & Materials: An International Journal (community-based / naturalistic evidence)

Title: *Community-based research on the effectiveness of the home smoke alarm in waking up children*

Why it matters: Adds real-world weight: suggests a substantial portion of children may not awaken to their home smoke alarm within a short window.

Link: https://onlinelibrary.wiley.com/doi/abs/10.1002/fam.1081

A.3 Pediatrics (Journal): Parent voice vs conventional tone

Title: *Comparison of a Personalized Parent Voice Smoke Alarm With a Conventional Residential Tone Smoke Alarm for Awakening Children*

Why it matters: A controlled comparison showing voice alarms can dramatically outperform conventional tone alarms for awakening children and enabling a simulated self-rescue procedure.

Link: https://publications.aap.org/pediatrics/article-abstract/118/4/1623/69128/Comparison-of-a-Personalized-Parent-Voice-Smoke

A.4 Academic Pediatrics: Mother voice vs stranger voice vs low-frequency vs high-frequency

Title: *Do Sleeping Children Respond Better to a Smoke Alarm That Uses Their Mother's Voice?*

Why it matters: Comparative testing indicates voice and low-frequency outperform high-frequency, and that personalization (mother's voice) is not strictly required—supporting more scalable product approaches.

Link: https://www.sciencedirect.com/science/article/abs/pii/S1876285919303286

B) Review / synthesis literature

B.1 Review paper on waking to fire alarms

Title: *The who, what, where and why of waking to fire alarms: a review*

Why it matters: A synthesis of factors influencing awakening (signal type, sleep stage, demographics, environment). Useful to support design requirements and justify test protocols.

Link: https://www.sciencedirect.com/science/article/abs/pii/S037971120100025X

C) Injury prevention / public safety context

C.1 BMJ Injury Prevention (children, smoke alarms, prevention)

Title: *Residential fire related deaths and injuries among children: fireplay, smoke alarms, and prevention*

Why it matters: Provides broader prevention and child-risk context that supports the “why now” and “why children” framing for safety-focused manufacturers.

Link: https://injuryprevention.bmj.com/content/8/2/128.short

D) Standards / industry guidance

D.1 NFPA: Low-frequency fire and smoke alarms

Why it matters: Industry guidance and market commentary indicating the practical availability gap for listed residential low-frequency solutions and describing alternative approaches—supportive of a companion/supplemental strategy.

Link: https://www.nfpa.org/News-and-Research/Publications-and-media/Blogs-Landing-Page/NFPA-Today/Blog-Posts/2021/01/22/Low-Frequency-Fire-and-Smoke-Alarms

E) Industry and public awareness coverage

*These sources are included to show visibility and stakeholder awareness. They are **not** the primary technical foundation (peer-reviewed sources above are).*

E.1 ABC News
Link:
https://abcnews.go.com/US/children-sleep-smoke-detector-alarm/story?id=46133010

E.2 Derbyshire Fire & Rescue
Link:
https://www.derbys-fire.gov.uk/news/news-items/research-into-children-not-waking-to-sound-of-smoke-alarms-concluded

E.3 Fire Industry Association
Link:
https://www.fia.uk.com/news/research-finds-children-do-not-respond-to-smoke-alarm-noise.html

E.4 Daily Mail
Link:
https://www.dailymail.co.uk/sciencetech/article-7456273/Most-children-sleep-fire-alarms-Watchdog-study-finds.html