Systematic Review of fNIRS Studies Reveals Inconsistent Data Reporting Practices

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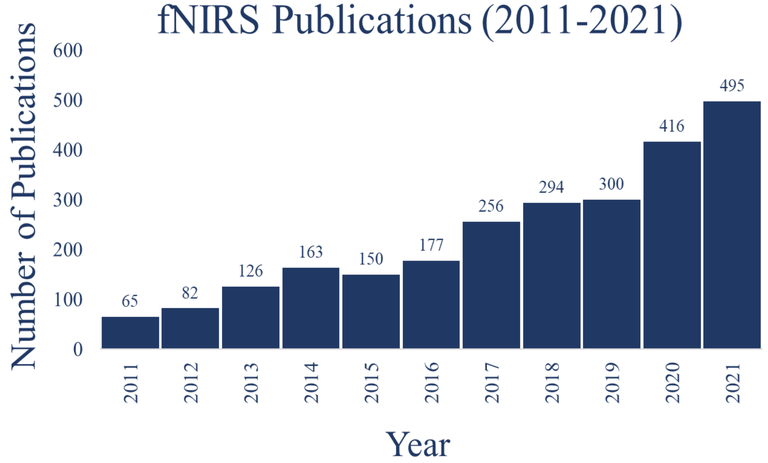
Introduction

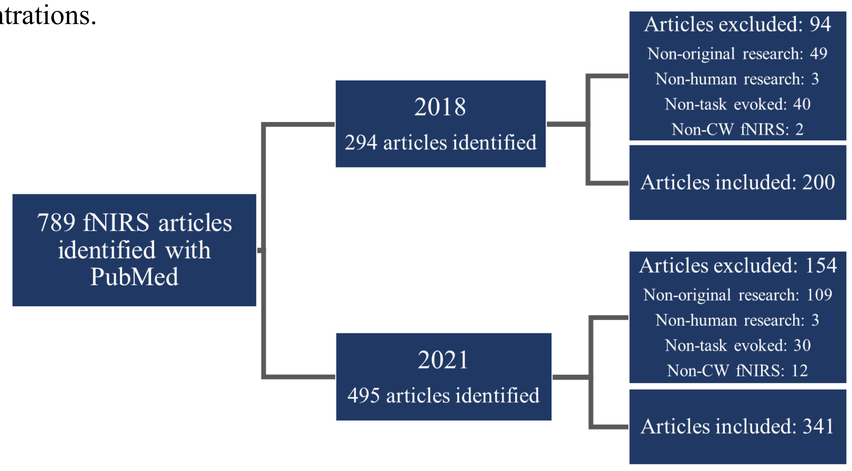
- fNIRS is unique among neuroimaging techniques in its ability to estimate changes in both oxyhemoglobin (HbO) and deoxyhemoglobin (HbR). However, **various combinations of HbO and HbR data have been characterized as neural activation** in the fNIRS literature (e.g., only reporting one or the other chromophore).
- fNIRS is rapidly rising in popularity, highlighting the growing need for standardized data reporting practices.
- **Aim:** To quantify the variability of fNIRS data reporting practices and examine recent data reporting trends in the fNIRS literature.



PubMed search results for the search query "fNIRS" from 2011 to 2021.

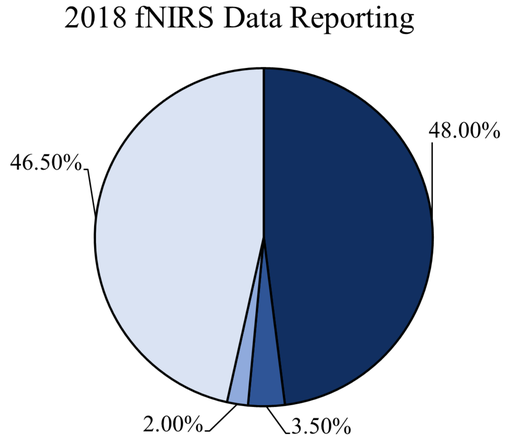
Methods

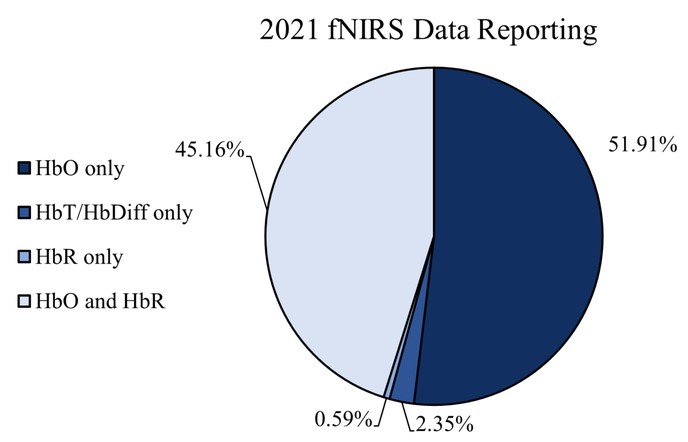
- We reviewed 541 fNIRS articles from 2018 and 2021 to extract information on fNIRS data reporting practices.
- Exclusion criteria: non-empirical, non-task evoked, non-human research, non-CW fNIRS, or an unclear data reporting practice.
- **Extracted information**: From each fNIRS article we extracted 1) the chromophore or combination of chromophores reported to interpret neural activation and 2) the justification (if any) provided for the data reporting practice if only one chromophore was reported.
- We categorized chromophore reporting practices into four groups: 1) HbO only, 2) HbR only, 3) HbO and HbR, and 4) either the total (HbT) or difference (HbDiff) between chromophore concentrations.

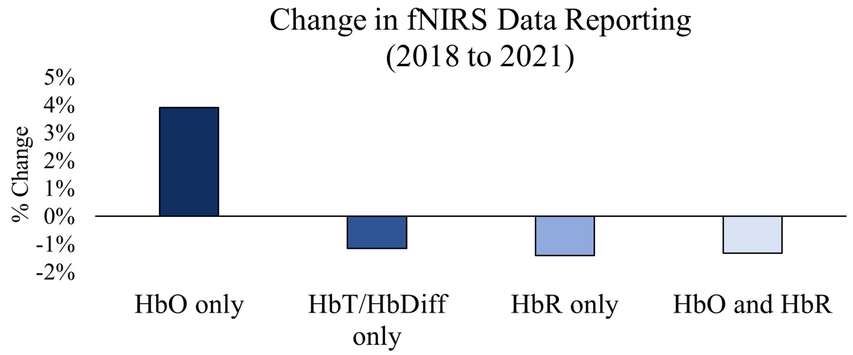


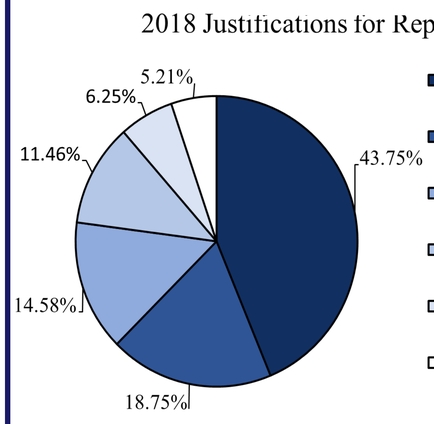
Flow chart detailing the search strategy and selection criteria.

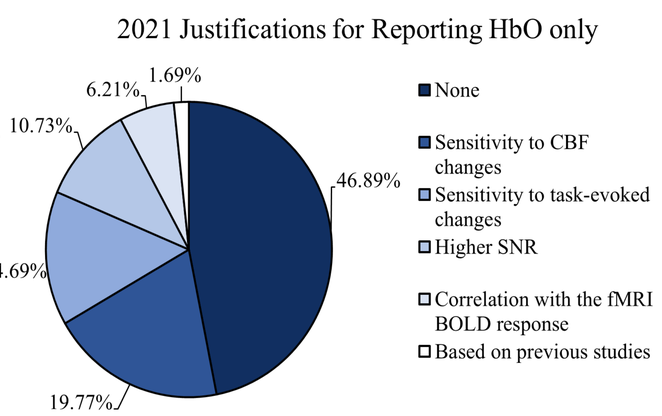
Results











Discussion

- Overall, we found high heterogeneity in the fNIRS data reporting practices used to characterize neural activation and draw conclusions.
- The most common practice was to report only one chromophore, HbO. However, there was strong disagreement in the fNIRS field over which practice to implement.
- These findings raise the important question of how neural activation should be operationalized across the field to improve replicability and study comparison efforts, and interpretation of results.
- Our general recommendation is that both HbO and HbR data should be reported to establish that they are negatively correlated, consistent with the neurovascular coupling process and its expected hemodynamic response.