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Editorial

The Role of Artificial Intelligence in Revolutionizing Frailty Diagnosis and Patient Care

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Keywords

Artificial intelligence; Frailty; Machine learning; Patient safety; Quality care

Abbreviations

AI: Artificial Intelligence; CGA: Comprehensive Geriatric Assessment; CNN: Convolutional Neural Network; EFS: Edmonton Frail Scale; RNN: Recurrent Neural Network; SNP: Single Nucleotide Polymorphism; TFI: Tilburg Frailty Indicator

Editorial

Artificial Intelligence (AI) refers to the design of computer programs and machines which simulate the rudiments of human intelligence independently [1]. Machine learning encompasses a multitude of deep learning algorithms, including Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) - both of which enable continuous analysis of large-scale data to make decisions consistent with previously detected patterns [1]. AI exhibits high potential for employment in the healthcare industry and research laboratories to accurately predict illness, maximize disease prevention, and refine treatment plans. As technological advancements are made, the application of AI will gradually become more feasible and appropriately lend itself to advancing quality care for frail patients even away from the hospital setting.

Frailty is somewhat of an ambiguous diagnosis due to lack of a universally agreed upon definition and frailty assessment tool. Efforts have been put forth to delineate frailty and standardize its method of measurement, but many physicians with minimal to none geriatric experience are more likely to eyeball the patient from the foot end of the bed. Although the Comprehensive Geriatric Assessment (CGA) is a gold standard for multidisciplinary and systematic approach of frailty recognition, it is time-consuming and depends upon administers' expertise [2]. The integration of AI into a frailty assessment strategy would not only cause a paradigm shift in the approach of physicians to this syndrome, but it would also revolutionize pre-existing protocols for management of frail and pre-frail status patients.

Sufficient neglect of the variables that comprise frailty results in inefficacious treatment plans and fuels the cost of patient care. International guidelines have come to appreciate the reversibility of frailty and concur that it should be a mandatory component of patient evaluation [3]. AI may be the solution to pinpointing unidentified vulnerabilities that characterize frailty and ensuring that this entity of geriatric practice is more readily incorporated into other subspecialties, too. Chang et al. (2013) conducted research using "household goods" in hopes of facilitating "early detection of frailty and, hence, its early treatment" [4]. eChair, for example, was used to detect "slowness of movement, weakness and weight loss" [4]. Other devices were featured to detect long-term variations in frailty-determining elements and overall functional decline [4]. Pressure sensors, for example, have been embedded into walkers to measure "risk of fall" [4]. Similarly, Canadian Cardiovascular Society Guidelines (2017) encourage the monitoring of orthostatic vital signs to "identify individuals at risk of falls" [3]. Therefore, gradual integration of AI into day-to-day appliances can be exceptionally beneficial when monitoring patients for development of frailty-like "symptoms".

The authors would like to emphasize that the safety and accuracy of aforementioned AI technologies necessitate careful configuration. Literature unveils the key issues surrounding the safety of AI in healthcare [1]. Addressing these concerns is a top priority because frailty must be handled delicately and demands meticulous planning to eliminate risk factors. The concerns include, but are not limited to, oblivious impact, confidence of prediction, unexpected behaviors, privacy and anonymity [1]. Steps taken for mitigation have been described and, if executed, AI may be utilized to monitor and manage frail patients easily. Models for personalized risk estimates "should be well calibrated and efficient, and effective updating protocols should be implemented" [1]. "Automated systems and algorithms should be able to adjust for and respond to uncertainty and unpredictability" [1]. By centering our focus on the safety and accuracy of AI, we can transform older person's homes into 'smart homes'.

Smart Homes are equipped with AI-embedded appliances; "networked sensors and devices that extend functionality of the home by adding intelligence" [5]. They collect data for continual analysis and predict potential physiological decline. These advancements would not only improve overall quality of life, but processed data supplements single visits to the primary care provider or geriatrician and eliminates the need for frequent journeys to the physician's office.

In addition, the implementation of AI may pave a pathway for investigating genetic biomarkers associated with increased risk of frailty. Machine learning AI could accelerate research that correlates

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frailty and Single Nucleotide Polymorphisms (SNP). However, current genetic sequencing technologies remain costly, and sequence processing is time-consuming. Third-generation sequencing technologies, such as Oxford Nanopore's MinION and PromethION, are more cost-effective and agile solutions [6]. These advantages would make them more accessible and appropriate for use among suspected frail patients. Consequently, identification of SNPs already linked to frailty would be possible through deep RNNs that have been used to distinguish DNA modifications from the sequencing data provided by MinKNOW - the cloud-based platform responsible for data analysis [6,7]. Further advancement of "portable sequencing technology" would promote its use in smart nursing homes - enabling caregivers to closely monitor frailty-susceptible patients and tailoring their care based on the presence of specific SNPs.

Ultimately, the authors recommend that the search for underlying risk factors pertinent to frailty commences with: (1) the administration of a simple, yet effective, preliminary frailty assessment in the clinical setting, or (2) opting for installation of AI technology into everyday-use equipment in a controlled environment (such as a smart home). If risk has been determined, (1) a more thorough frailty diagnosing tool may be undertaken by an experienced geriatrician or (2) the decision to undergo an AI-based confirmatory test to assess biomarkers and genetic sequences or (3) a combination of both may be performed.

To summarize:

- AI can augment the delivery of quality patient care by making early diagnoses (or identifying pre-frail status patients) and be used for confirmatory testing (inspecting biomarkers and genetic sequences correlated with frailty).
- AI will help modify and individualize management plans, as well as predicting hospital course and out-patient outcomes.
- Frailty lacks objectivity and this has resulted in considerable neglection of frailty syndromes.
- Patients may segue into and qualify for the frailty spectrum by any disturbance in activities of daily living, for example, and, thus, exacerbating primary disease or comorbidity.
- Long-term application of AI, particularly in smart homes, may reduce socioeconomic burden associated with increasing hospital readmissions and mortality rates by consistently monitoring patients and allowing for tailored care.
- AI-driven devices are challenged by many limitations.
- Safety strategies are evolving and being presented to mitigate the hazardous elements of AI.
- Physicians should thoroughly understand and leverage AI to optimize the care of frail patients.
- Patient education on the benefits and potential drawbacks of AI when inspecting for frailty syndromes is imperative.
- Integrating AI into the heart of geriatric practice may refine our understanding of this disease and allow for more efficient use of healthcare resources.

Author Contributions

All authors participated in drafting and critical revision of the manuscript.

The authors agree to be held accountable for all aspects of the work and to ensure that questions related to the accuracy or integrity of any part of the work will be appropriately investigated and resolved.

References

1. Ellahham S, Ellahham N and Simsekler M. Application of Artificial Intelligence in the Health Care Safety Context: Opportunities and Challenges - Samer Ellahham, Nour Ellahham, Mecit Can Emre Simsekler, 2020. SAGE Journals. 2021.
2. Hassan M, Ibrahim H and Ellahham S. Frailty in Myocardial Infarction Patients: A Paradigm Shift. Longdom. 2019.
3. Hassan M, Ellahham S and Ibrahim H. Frailty in Heart Failure: A Coalesce of International Guidelines. Longdom. 2019.
4. Mugueta-Aguinaga I and Garcia-Zapirain B. Is Technology Present in Frailty? Technology a Back-up Tool for Dealing with Frailty in the Elderly: A Systematic Review. NCBI. 2017.
5. Bennett J, Rokas O and Chen L. Healthcare in the Smart Home: A Study of Past, Present and Future. Sustainability. 2017.
6. Oxford Nanopore Technologies. Oxford Nanopore and NVIDIA collaborate to partner the DGX AI compute system with ultra-high throughput PromethION sequencer. 2021.
7. Liu Q, Fang L, Yu G, Wang D, Xiao C and Wang K. Detection of DNA base modifications by deep recurrent neural network on Oxford Nanopore sequencing data. Nature. 2019.