**Document Title:**  
**FDA510k\_AI\_Refined\_Methodologies\_from\_Iteration\_2024-12-19**

**Purpose:**  
To provide a clear overview of the iterative improvements made to the predictive model estimating cadaveric tissue usage likelihood among FDA 510(k) applicants. This document focuses on the methodologies refined through testing, analysis, and logical reassessment, ensuring greater accuracy, granularity, and alignment with industry norms.

**Key Methodological Improvements**

1. **Adaptive Advisory Committee Assignment**  
   **Previous Approach:** Rigidly high weights for Orthopedic, Neurology, Dental, and Cardiovascular committees without differentiation.  
   **Refined Method:**
   * Adjusted committee weights to more realistic values (OR=0.85, NE=0.75, CV=0.58, DE=0.55, SU=0.50, Others=0.20).
   * Introduced the concept of recategorizing certain non-invasive, digital therapeutics (e.g., VR pain management devices) under “Others” rather than NE to prevent inflated tissue likelihood scores.
2. **Enhanced Use of Product Codes and Keywords**  
   **Previous Approach:** Uniformly high weights for certain product codes and keywords (e.g., all implants or grafts near 1.0).  
   **Refined Method:**
   * Broadened the range of product code weights (HRS=0.80, MQV=0.78, NKB=0.75, OVD=0.70, Others=0.20) to allow nuanced scoring.
   * Fine-tuned keyword weights (e.g., Bone/Implant/Fusion from 0.9 down to 0.85) for more granularity.
   * Emphasized contextual interpretation—“Allograft” still at 1.0, “Graft” at 0.90, while purely cosmetic terms at 0.10.
3. **Introduction of Negative Factors (NF)**  
   **Previous Approach:** No explicit negative factors were applied.  
   **Refined Method:**
   * Introduced NF for cosmetic (-2.00), diagnostic/software-only (-0.20), and clearly non-tissue scenarios (-0.20).
   * This ensures devices without plausible cadaveric testing (e.g., cosmetic hair removal, molecular diagnostic assays) receive scores near “Almost None” or very low likelihood.
4. **Granularity in Processing Time, Submission Type, and Location**  
   **Previous Approach:** Higher baseline values for these factors, influencing scores too strongly.  
   **Refined Method:**
   * Adjusted Submission Type (Special=0.70, Traditional=0.60, Direct=0.50) and Processing Time (>172 days=0.65, 162–172=0.60, <162=0.50) to modestly influence rather than dominate the score.
   * Geographic Location still provides slight adjustments (CA=0.60, NE US=0.55, Midwest=0.55, Others=0.50) for subtle regional differences.
5. **Holistic Approach to Complex Devices**  
   **Previous Approach:** Committees and product codes often led to uniformly high scores for any device under a certain category.  
   **Refined Method:**
   * Now consider device nature: A VR therapeutic device for neurological conditions does not automatically receive NE’s high baseline.
   * Cosmetics, digital therapeutics, and diagnostic software are handled carefully, often resulting in low or near-zero likelihood scores due to negative factors or low baseline assignments.
6. **Iterative Validation and Real-World Alignment**  
   **Previous Approach:** The model started from a theoretical standpoint with uniformly high weights.  
   **Refined Method:**
   * Iteration through numerous examples revealed patterns prompting systematic downscaling of some weights and the introduction of negative factors.
   * Adjustments ensure better alignment with how actual cadaver labs are used: for invasive, implant, or graft-related training and testing, not for digital therapeutics, cosmetic lasers, or straightforward diagnostic kits.

**Results of the Refined Methodologies**

* **Improved Discrimination:** The model no longer overestimates cadaveric tissue likelihood for simple or non-invasive devices.
* **Realistic Scoring:** Orthopedic implants and graft-based devices still achieve high or very high scores, while diagnostic, cosmetic, or VR-based solutions settle into low or very low ranges, matching practical expectations.
* **Framework for Future Adjustments:** The granular approach with negative factors and flexible keyword/committee assignments makes it easy to integrate new device categories or evolving technologies in the future.

**Conclusion**

These refined methodologies, captured as of December 19, 2024, mark a significant enhancement in the predictive model’s realism and accuracy. By blending initial structured approaches with iterative insights and logical reasoning, we have developed a more balanced, nuanced, and context-aware system to estimate cadaveric tissue requirements for FDA 510(k) applicants.