

# Voice Parameters & What They Indicate (Parkinson's Context)

These features are **biomarkers of vocal motor control**, which is affected early in Parkinson's disease.

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## 1. Fundamental Frequency (Pitch)

| Parameter           | What it measures | What it indicates                      |
|---------------------|------------------|--|
| <b>MDVP:Fo(Hz)</b>  | Average pitch    | Overall vocal cord vibration rate      |
| <b>MDVP:Fhi(Hz)</b> | Maximum pitch    | Pitch instability / vocal control      |
| <b>MDVP:Flo(Hz)</b> | Minimum pitch    | Reduced pitch range (monotonic speech) |

### In Parkinson's:

Reduced pitch range and unstable control of vocal folds

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## 2. Jitter (Frequency Instability)

Measures **cycle-to-cycle pitch variation**

| Parameter               | Meaning                    |
|-------------------------|----------------------------|
| <b>MDVP:Jitter(%)</b>   | Relative pitch instability |
| <b>MDVP:Jitter(Abs)</b> | Absolute pitch variation   |
| <b>MDVP:RAP</b>         | Short-term pitch variation |
| <b>MDVP:PPQ</b>         | Pitch perturbation         |
| <b>Jitter:DDP</b>       | Combined jitter measure    |

### In Parkinson's:

**Higher jitter = poor neuromuscular control**  
Indicates vocal tremor & rigidity

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## 3. Shimmer (Amplitude Instability)

Measures **cycle-to-cycle loudness variation**

| Parameter                 | Meaning                  |
|---------------------------|--------------------------|
| MDVP:Shimmer              | Loudness instability     |
| MDVP:Shimmer(dB)          | Amplitude variation (dB) |
| Shimmer:APQ3 / APQ5 / APQ | Loudness perturbation    |
| Shimmer:DDA               | Combined shimmer metric  |

**In Parkinson's:**

Soft, breathy, unstable voice

Reduced respiratory & laryngeal control

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## 4. Noise Measures (Voice Quality)

| Parameter | What it measures        | Interpretation           |
|-----------|-------------------------|--------------------------|
| NHR       | Noise-to-Harmonic Ratio | Breathiness / hoarseness |
| HNR       | Harmonic-to-Noise Ratio | Vocal clarity            |

**In Parkinson's:**

↑ NHR and ↓ HNR

Indicates weak vocal fold closure

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## 5. Non-linear & Complexity Measures

(VERY important for early PD detection)

| Parameter         | What it indicates                             |
|-------------------|---|
| RPDE              | Irregularity of vocal fold vibration          |
| DFA               | Loss of natural voice complexity              |
| spread1 / spread2 | Pitch distribution irregularity               |
| PPE               | Pitch Period Entropy (pitch unpredictability) |

**In Parkinson's:**

Voice becomes **less complex, more rigid**

These features are **strong early biomarkers**

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## 6. Clinical Severity Targets (Telemonitoring Dataset)

| Parameter   | Meaning                      |
|-------------|------------------------------|
| motor_UPDRS | Motor symptom severity       |
| total_UPDRS | Overall Parkinson's severity |

Used for regression, not classification.

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## 7. Demographic & Metadata Features

| Parameter | Purpose                        |
|-----------|--------------------------------|
| subject#  | Patient ID                     |
| age       | Risk stratification            |
| sex       | Gender-based voice differences |
| test_time | Disease progression tracking   |

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## Summary Table (Quick Reference)

| Feature Type      | What it Detects                    |
|-------------------|------------------------------------|
| Pitch (Fo)        | Reduced vocal flexibility          |
| Jitter            | Neuromuscular instability          |
| Shimmer           | Weak respiratory/laryngeal control |
| Noise ratios      | Hoarseness & breathiness           |
| Nonlinear metrics | Early neurodegeneration            |
| UPDRS             | Clinical disease severity          |