HFA II-i with Guided Progression Analysis (GPA)
Sample cases
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Part I. GPA Summary Report

The diagnosis and management of glaucoma critically relies on assessment of visual field status and progression. Now you can estimate the stage of visual field loss and its rate of progression, and assess your patient’s risk of future vision loss – all at a glance. The Humphrey® Field Analyzer II-i (HFA™ II-i) with Guided Progression Analysis™ (GPA™) software delivers current exam results, trends the overall visual field history and projects future vision loss all on a single page. The GPA Summary Report presentation format is designed to simplify and streamline clinical interpretation.

1. **Baseline Exams**
   Establish initial visual field status.

2. **VFI Value**
   A summary measurement of the patient’s visual field status, expressed as a percent of a normal age-adjusted visual field.

3. **VFI Rate of Progression Analysis**
   Trend analysis of the patient’s overall visual field history.

4. **VFI Plot**
   Regression analysis of VFI values and 3 to 5 year projection.

5. **VFI Bar**
   A graphical depiction of the patient’s remaining useful vision at the current VFI value along with a 3 to 5 year projection of the VFI regression line if the current trend continues.

6. **Current Visual Field Summary**
   Complete report of current visual field including VFI, MD, PSD, the Progression Analysis Plot and the GPA alert.

7. **GPA Alert**
   A message that indicates whether statistically significant deterioration was noted in consecutive tests.
Part II. Understanding the GPA Summary Report

GPA uses the Visual Field Index™ (VFI™), a summary measurement of a patient’s visual field status expressed as a percent of a normal age-adjusted visual field.

Pioneered by Boel Bengtsson, PhD¹ as a more intuitive assessment of visual function, VFI is optimized for progression analysis. VFI is center-weighted to correlate with ganglion cell density and visual function. It is less affected by cataract and other media changes compared with earlier indices. On the GPA Summary Report, VFI is used to quantify rate of progression, where it is plotted relative to patient age to calculate the rate of functional loss. This brochure provides an overview of the GPA software for the HFA II-i and some real life case examples showing how VFI is used in GPA.

The GPA Summary Report is a powerful one-page report that provides an overview of the patient’s entire visual field history. The report can be divided into three sections: the Baseline exams at the top, the visual field history and trend in the middle, and the current exam at the bottom. Elements of each section are described below.

GPA Baseline Exams
At the top of the report are the two Baseline Exams. Graytone and Pattern Deviation Plots are shown for both GPA Baselines, along with key indices such as VFI, MD, and PSD. By default, the oldest two exams of the same type are automatically selected as Baseline. Then the initial selection of a SITA Standard or a SITA Fast Exam determines which exams will be included as follow-up exams. It is critical that you ensure that tests included in the Baseline are representative of the patient’s actual Baseline status. SITA Standard and SITA Fast Exams cannot be combined in the GPA analysis. Also, GPA supports Central 30-2 and 24-2 tests in the same analysis, but when combined, GPA will analyze all tests as if they were 24-2 tests. GPA does not support FastPac tests or Central 10-2 tests for either Baseline or Follow-up.

VFI Plot
In the center of the report, the VFI Plot graphs the VFI values of all exams included in the GPA analysis as a function of the patient’s age. The VFI Plot also provides a linear regression analysis of the VFI over time when appropriate. A minimum of 5 exams over 3 years or more must be included in GPA for the linear regression results to be presented.

Note: The regression line slope may be positive due to statistical uncertainty or the Learning Effect.

**VFI Bar**
To the right of the VFI Plot is the VFI Bar that indicates the patient’s current VFI value. In addition, when the results of the regression analysis are displayed, the VFI Bar will also graphically indicate the 3 to 5 year projection of the linear regression line, shown as a broken line. The length of projection is equal to the number of years of GPA data that is available, up to a maximum projection time of 5 years.

**Deviation from Baseline Plot**
The deviation from Baseline Plot compares the pattern deviation of the most recent Follow-up test to the average of the pattern deviation values of the two Baseline tests, and indicates changes at each tested point, in dB notation.

**Progression Analysis Probability Plot**
The Progression Analysis Probability Plot gives the statistical significance of the dB changes shown in the deviation from Baseline Plot. It compares the changes between the Baseline and Follow-up exams to the inter-test variability typical of stable glaucoma patients and then shows a plot of point locations, which have changed significantly.

Points that have changed by more than the expected variability are identified with a simple and intuitive set of symbols:
- A **single, solid dot** indicates a point not changing by a significant amount.
- A **small open triangle** identifies a degree of deterioration expected less than 5% of the time at that location in stable glaucoma patients ($p < 0.05$).
- A **half-filled triangle** indicates significant deterioration at that point in two consecutive tests.
- A **solid triangle** indicates significant deterioration at that point in three consecutive tests.
- An **X** signifies that the data at that point was out of range for analysis. GPA cannot determine whether or not the encountered deviation at that point is significant. This occurs mainly with field defects that were already quite deep at Baseline.

**GPA Alert**
The GPA Alert is a message in plain language terms that indicates whether the GPA progression criteria were met. The GPA Alert assists you in recognizing deterioration in consecutive tests. In cases where three or more points show deterioration in at least two consecutive tests, the progression analysis indicates “Possible Progression.” In cases where three or more points show deterioration in at least three consecutive tests, the progression analysis indicates “Likely Progression.” When neither of the foregoing conditions applies, a message of “No Progression Detected” is displayed.

Three Possible GPA Alerts:
1. "Likely Progression"
2. "Possible Progression"
3. "No Progression Detected"

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Part III. Sample Case 1

Slow progression

Slow progression may not necessarily be vision threatening

This is an example of a patient with slowly progressing visual field loss. The event analysis (GPA Alert) indicates “Likely Progression”. However, the VFI slope is nearly flat and the confidence intervals are narrow. This patient’s visual field loss is measurably progressing (based on the change probability map) but only very slowly, and the patient may not be at significant risk of visual impairment during his lifetime.

Patient is 74 years old.

VFI slope is nearly flat and the confidence intervals are narrow.

Event analysis (GPA Alert) indicates “Likely Progression”.

Previous Follow-up Exams:
- 01-19-2004
  - FL: 8 STS
  - MD: 7.90 dB P < 0.5%
  - P < 0.5%

- 01-14-2004
  - FL: 8 STS
  - MD: 9.00 dB P < 0.5%
  - P < 0.5%

Notes:
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Part III. Sample Case 2
Resetting the baseline

Updating baseline after significant treatment change
The first four exams showed fast progressing visual field loss, followed by a change in treatment. Post-treatment exams are severely depressed, and it is not clear whether the patient’s visual field stabilized after the fourth exam.

Before: with default baseline selections

1. First four exams showed fast glaucoma progression, followed by change in treatment.
2. Has the patient’s visual field stabilized after the fourth exam?
3. Severely depressed visual field on latest exam.

By re-establishing baseline after a significant therapeutic change, it is easier to see that the patient’s visual field has somewhat stabilized. The GPA analysis now displays a shallower VFI progression line, along with the label “Slope not significant”. While this patient’s vision is already so damaged that further increases in therapy may still be needed, this analysis gives a more complete picture for assessing risks vs. possible benefits.

After: with adjusted baselines
Part III. Sample Case 3

Excluding a non-representative exam

Excluding non-representative exams

Notice that the third exam on this report has a markedly worse VFI. In this case the patient probably was just having a bad day, because the next visit shows a much improved field, more like the first and second exams. In a case like this, it is important to deselect that particular exam and not use it in the GPA.

Before: with poor exam included

After: with poor exam excluded

1) The third exam on this report has a markedly worse VFI.

2) Notice that the VFI regression line in the “After” example with the poor exam deselected is a much more typical looking regression line than in the “Before” example.
Part III. Sample Case 4

Life expectancy considerations

Life expectancy can be an important consideration
A progression rate that might be acceptable at age 90 may not be acceptable at age 65.

1. Age at most recent exam is 65.
2. VFI progression is $-3.0 \pm 0.9\%$ per year.
3. Event analysis (GPA Alert) indicates “Likely Progression”.

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Event analysis (GPA Alert) indicates “Likely Progression”. 

GPA Summary

<table>
<thead>
<tr>
<th>Baseline SITA Standard</th>
<th>Pattern Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-30-1997 GHT: Within normal limits</td>
<td></td>
</tr>
<tr>
<td>Central SD-2 Threshold Test</td>
<td></td>
</tr>
<tr>
<td>09-10-1997 GHT: Outside normal limits</td>
<td></td>
</tr>
</tbody>
</table>

FL: 0/10 Fovea: OFF VFI: 92% 
FN: 0% FP: 0% 
VFI: 3.10 dB P < 0.5% 
VFI: 3.45 dB P < 0.5%

Rate of Progression: $-3.0 \pm 0.9\%$/year (95% confidence)

See full GPA printout for complete analysis.

Notes:

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VFI reduces the effect of cataract\textsuperscript{3,4}

This is an example of an eye with concomitant glaucoma and cataract where the MD values reflect much more loss than the VFI. The time of cataract surgery is marked by the red arrow in both graphs.


\textsuperscript{1} After surgery, MD levels approach those seen in the baseline exams.

\textsuperscript{2} Here is the same series of fields with Guided Progression Analysis. As opposed to MD, VFI is hardly influenced by cataract and the corrected rate of progression is almost zero. This patient has stable glaucoma and it is much easier to see this with the VFI plot.
Part III. Sample Case 6

Insufficient exams

A patient with only one exam

When there are insufficient exams to perform a GPA analysis, the default report is the Single Field Analysis (SFA) Report. Single Field Analysis remains the standard until follow-up is established.

1 VFI is calculated along with MD and PSD for each reliable exam.