

**CENTER FOR DRUG EVALUATION AND
RESEARCH**

APPLICATION NUMBER:

201280Orig1s000

STATISTICAL REVIEW(S)



U.S. Department of Health and Human Services
Food and Drug Administration
Center for Drug Evaluation and Research
Office of Translational Sciences
Office of Biostatistics

STATISTICAL REVIEW AND EVALUATION CLINICAL STUDIES

NDA/Serial Number:

201-280 / SN 000

Drug Name:

Tardjenta¹ (Linagliptin, BI 1356)

Indication(s):

Treatment of patients with type 2 diabetes mellitus

Applicant:

Boehringer Ingelheim Pharmaceuticals Inc

Date(s):

Submitted July 2, 2010

Review Priority:

Standard

Biometrics Division:

Division of Biometrics VII

Statistical Reviewer:

Xiao Ding, Ph.D.

Concurring Reviewers:

Mat Soukup, Ph.D.

Aloka Chakravarty, Ph.D.

Medical Division:

Division of Metabolism and Endocrinology Products (DMEP)

Clinical Team:

Medical Officer: Somya (Verma) Dunn, M.D.

Medical Team Leader: Ilan Irony, M. D.

Project Manager:

Raymond Chiang, M.S. (DMEP)

Keywords: clinical studies, cardiovascular safety, meta-analysis

¹ At the time of filing of this review, the trade name under review is Tardjenta, but DMEPA has not reached a decision on the adequacy of such trade name.

Table of Contents

1 Executive Summary.....	5
1.1 Conclusions and Recommendations.....	5
1.2 Brief Overview of Clinical Studies	6
1.3 Statistical Issues and Findings.....	6
2 Introduction.....	8
2.1 Product Description.....	8
2.2 Clinical Trial Overview	8
2.3 Data Sources.....	8
3 Statistical Evaluation.....	9
3.1 Evaluation of Safety.....	9
3.1.1 Study Designs	9
3.1.2 Statistical Methodologies.....	11
3.1.2.1 Methods of Imputing Missing.....	11
3.1.2.2 Analysis of Event Incidence	12
3.1.2.3 Time-to-Event Analysis	12
3.1.2.4 Handling of Trials with zero events.....	12
3.1.3 Populations.....	13
3.1.4 Subject Disposition, Demographic and Baseline Characteristics.....	15
3.1.5 Endpoints	20
3.1.5.1 Primary Composite Endpoints	20
3.1.5.2 Secondary Endpoints	20
3.1.6 Results and Conclusions	21
3.1.6.1 Primary Composite Endpoint.....	21
3.1.6.1.1 Analysis of Incidence	21
3.1.6.1.2 Sensitivity Analyses of Incidence	22
3.1.6.1.3 Forest Plot of All Results for Primary Composite Endpoint	24
3.1.6.1.4 Time-to-Event Analysis of Primary composite endpoint	25
3.1.6.1.5 Sensitivity Time-to-Event Analyses.....	26
3.1.6.2 Secondary Endpoint	28
4 Findings in Special/Subgroup Populations.....	32
4.1 Gender, Race, and Age	32
4.2 Other Special/Subgroup Populations.....	33
4.2.1 Ethnicity	33
4.2.2 Baseline BMI	34
4.2.3 Baseline Renal Impairment Status	34
4.3 Summary Forest Plot for all Subgroup Analysis Results.....	34
5 Summary and Conclusions.....	35
5.1 Statistical Issues and Collective Evidence	35
5.2 Conclusions and Recommendations.....	35
Appendix	38
A.1 Supplementary Tables	38
A.2 Supplementary Figures	44
Signatures/Distribution List.....	48

Table of Tables

Table 1: Summary of Design Characteristics for Randomized Phase 3 Trials.....	8
Table 2: Summary of Treatment Distribution in the ITT Population by Trial	14
Table 3: Treatment Distribution in Safety Population, FAS Population, and Placebo-Controlled Subset of Safety Population.....	15
Table 4: Baseline Demographics by Treatment Group (Safety Population)	15
Table 5: Baseline CV Risk Factors and Complications by Treatment Group (Safety Population).....	17
Table 6: Baseline Framingham Risk by Study and Treatment Group (Safety Population)	18
Table 7: Premature Discontinuation of Study Medication by Study and Treatment Group (FAS Population)	20
Table 8: Summary of Events of Primary Composite Endpoint by Study and Treatment Group (Safety Population)	21
Table 9: Meta-analysis Results of Primary Composite Endpoint (Safety Population)....	22
Table 10: Sensitivity Meta-Analysis Results of Primary Composite Endpoint (Safety Population Excluding Study 1218.20)	23
Table 11: Summary of Events of Primary Composite Endpoint by Study and Treatment Group (Placebo-Controlled Subset of Safety Population)	23
Table 12: Sensitivity Meta-analysis Results of Primary Composite Endpoint (Placebo-Controlled Subset of Safety Population).....	24
Table 13: Summary of Events of MACE by Study and Treatment Group (Safety Population).....	29
Table 14: Meta-Analysis Results of Secondary Endpoints (Safety Population)	30
Table 15: Summary of Events of Primary Composite Safety Endpoint by Gender, Study and Treatment Group (Safety Population).....	38
Table 16: Summary of Events of Primary Composite Safety Endpoint by Race, Study and Treatment Group (Safety Population).....	39
Table 17: Summary of Events of Primary composite endpoint by Age Categories, Study and Treatment Group (Safety Population).....	40
Table 18: Summary of Events of Primary composite endpoint by Ethnicity, Study and Treatment Group (Safety Population).....	41
Table 19: Summary of Events of Primary composite endpoint by Baseline BMI, Study and Treatment Group (Safety Population).....	42
Table 20: Summary of Events of Primary composite endpoint by Baseline Renal Impairment Status, Study and Treatment Group (Safety Population)	43

Table of Figures

Figure 1: Percentage of Subjects with Premature Discontinuation of Study Medication by Study and Treatment Group (FAS Population)	19
Figure 2: Forest Plot of Reviewer's Analysis Results of Primary Composite Endpoint (Risk difference)	25
Figure 3: Time to Event Analysis of the Primary Composite Endpoint (Safety Population, Double-Blind Treatment Phase)	26
Figure 4: Time to Event Analysis of the Primary composite endpoint Excluding Study 1218.20 (Safety Population, Double-Blind Treatment Phase).....	27
Figure 5: Time to Event Analysis of the Primary composite endpoint (Placebo-Controlled Trials, Safety Population, Double-Blind Placebo-Controlled Phase).....	28
Figure 6: Forest Plot of Reviewer's Analysis Results of Secondary Endpoints (M-H Risk difference).....	31
Figure 7: Forest Plot of Reviewer's Analysis Results of Subgroups (M-H Risk Difference).....	35
Figure 8: Forest Plot of Reviewer's Analysis Results of Primary composite endpoint (M-H Relative Risk).....	44
Figure 9: Forest Plot of Reviewer's Analysis Results of Primary composite endpoint (Exact Odds Ratio).....	45
Figure 10: Forest Plot of Reviewer's Analysis Results of Secondary Endpoints (M-H Relative Risk).....	46
Figure 11: Forest Plot of Reviewer's Analysis Results of Subgroups (M-H Relative Risk)	47

Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.