TRIAL STATISTICAL ANALYSIS PLAN

c28702727-01

BI Trial No.:	1402-0010
Title:	Relative bioavailability and food effect of a single dose of different solid formulations of BI 1358894 compared to a single dose of the reference tablet formulation of BI 1358894 following oral administration under fed and fasted conditions in healthy male subjects (an open-label, single-dose, randomised, incomplete blocks crossover design study) Including Protocol Amendment 2 [c26426667-03]
Investigational Product:	BI 1358894
Responsible trial statistician:	Phone: Fax:
Date of statistical analysis plan:	06 AUG 2019 SIGNED
Version:	Final

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2. LIST OF ABBREVIATIONS

Term	Definition / description
ADME	Absorption, Distribution, Metabolism and Excretion
AE	Adverse Event
AESI	Adverse event of special interest
ALT	Alanine aminotransferase
ANOVA	Analysis of variance
AST	Aspartate aminotransferase
AUC_{0-72}	Area under the concentration-time curve of the analyte in plasma over the time interval from 0 to 72 h
AUC_{0-tz}	Area under the concentration-time curve of the analyte in plasma over the time interval from 0 to the last quantifiable data point
$AUC_{0-\infty}$	Area under the concentration-time curve of the analyte in plasma over the time interval from 0 extrapolated to infinity
BI	Boehringer Ingelheim
BP	Blood pressure
C_{max}	Maximum measured concentration of the analyte in plasma
CTP	Clinical Trial Protocol
CTR	Clinical Trial Report
CV	Arithmetic coefficient of variation
C-SSRS	Columbia Suicidal Severity Rating scale
ECG	Electrocardiogram
gCV	geometric coefficient of variation
gMean	Geometric mean
ICH	International Conference On Harmonisation
IPD	Important protocol deviations
IQRMP	Integrated quality and risk management plan
MedDRA	Medical Dictionary For Regulatory Activities
PK	Pharmacokinetics
PKS	Pharmacokinetic parameter set
PR	Pulse rate
RAGe	Report appendix generator

Term	Definition / description
SAE	Serious adverse event
SD	Standard Deviation
SOC	System Organ Class
TS	Treated set
TSAP	Trial Statistical Analysis Plan
ULN	Upper limit of normal range

3. INTRODUCTION

As per ICH E9 (1) the purpose of this document is to provide a more technical and detailed elaboration of the principal features of the analysis described in the revised CTP, and to include detailed procedures for executing the statistical analysis of the primary variables and other data.

This TSAP assumes familiarity with the CTP and its amendments. In particular, the TSAP is based on the planned analysis specification as written in CTP Section 7 "Statistical Methods and Determination of Sample Size". Therefore, TSAP readers may consult the revised CTP for more background information on the study, e.g., on study objectives, study design and population, treatments, definition of measurements and variables, planning of sample size, randomisation.

Study data will be stored in a trial database within Medidata Rave system.

The statistical analyses will be performed within the validated working environment CARE, including SAS™ (current Version 9.4, by SAS Institute Inc., Cary, NC, USA), and a number of SAS™-based tools (e.g., macros for the analyses of AE data or laboratory data; Report Appendix Generator system (RAGe) for compilation/formatting of the CTR appendices).

PK parameters will be calculated using Phoenix WinNonlin™ software (version Phoenix 6.3, Certara USA Inc., Princeton, NJ, USA).

4. CHANGES IN THE PLANNED ANALYSIS OF THE STUDY

The CTP states in Section 7.3.4 that AEs occurring after the residual effect period but prior to next intake or end of trial termination date will be assigned to “follow-up”. As a more conservative approach, all AEs occurring after intake of trial medication and prior to next intake or end of trial termination date will be assigned to the on-treatment period of the respective trial medication. I.e., no follow-up phases will be defined in this trial, cf. Table 6.1: 2.

All other analyses described in this TSAP are in accordance with the statistical methods described in the revised CTP.

5. ENDPOINTS

5.1 PRIMARY ENDPOINTS

Primary endpoints are PK endpoints of BI 1358894, as defined in Section 2.1.2 of the CTP:

- *C_{max} (maximum measured concentration of the analyte in plasma)*
- *$AUC_{0\text{-}tz}$ (area under the concentration-time curve of the analyte in plasma over the time interval from 0 to the last quantifiable data point)*

5.2 SECONDARY ENDPOINTS

5.2.1 Key secondary endpoints

Not applicable.

5.2.2 Secondary endpoints

Secondary endpoints are PK endpoints of BI 1358894, as defined in Section 2.1.3 of the CTP:

- *$AUC_{0\text{-}\infty}$ (area under the concentration-time curve of the analyte in plasma over the time interval from 0 extrapolated to infinity)*
- *$AUC_{0\text{-}72}$ (area under the concentration-time curve of the analyte in plasma over the time interval from 0 to 72 h)*

6. GENERAL ANALYSIS DEFINITIONS

6.1 TREATMENTS

For basic study information on treatments to be administered, assignment of treatment groups, and selection of doses, cf. Section 4 of the CTP.

Each subject is planned to be treated in three subsequent treatment periods, with one single dose in each treatment period. Subjects will receive three out of the five BI 1358894 treatments described in Table 6.1: 1.

Table 6.1: 1 Dosage and treatment schedule of BI 1358894

Product	Treatment	Formulation	Unit strength	Dosage	Total dose
TF2	B	Tablet	50 mg	2 tablets (50 mg), single dose, fed	100 mg
	C	Tablet	50 mg	2 tablets (50 mg), single dose, fasted	100 mg
TF2	D	Tablet	50 mg	2 tablets (50 mg), single dose, fed	100 mg
	E	Tablet	50 mg	2 tablets (50 mg), single dose, fasted	100 mg
TF1	A	Tablet	100 mg	1 tablet (100 mg), single dose, fed	100 mg

Each subject is planned to be randomly allocated to one of twelve treatment sequences.

Table 6.1: 2 shows definitions of analysis phases within each subject for statistical analyses of AEs, safety laboratory and vital signs.

Table 6.1: 2 Analysis phases for statistical analysis of AEs, safety laboratory and vital signs

Study analysis phase	Label	Start	End
Screening	**Screening**	Date of informed consent	Date/time of first administration of BI 1358894
On treatment	**TF2 fed**, **TF2 fas**, **TF2 fed**, **TF2 fas** or **TF1 fed** respectively	Date/time of administration of the respective formulation of BI 1358894	Date/time of administration of study drug in the next treatment period or 0:00 AM on day after subject's end of study participation date, whatever comes first

AE displays in CTR Section 15.3, Appendix 16.1.13.1.8.2 and Appendix 16.1.13.1.8.3 will present results for the on-treatment phase only.

In AE tables in CTR Section 15.3 (but not in Appendix 16.1.13.1.8.2 and Appendix 16.1.13.1.8.3 AE tables), the following total will be provided in addition:

- "**Total on-trt**", defined as the total over all on-treatment phases

CTR Appendix 16.1.13.1.8.1 displays will present results for the screening and on-treatment phases.

Additionally to the total defined above, the following total will be provided in AE tables in CTR Section 16.1.13.1.8.1:

- "**Total**", defined as the total over all study phases (screening + on-treatment)

Statistical analyses of safety laboratory tests and vital signs will be conducted by treatment period , with clear differentiation between baseline (cf. Section 6.7) and on-treatment measurements (as defined in Table 6.1: 2).

More details on the technical implementation of these analyses are provided in the ADS Plan of this TSAP.

6.2 IMPORTANT PROTOCOL DEVIATIONS

Consistency check listings (for identification of deviations from time windows) and a list of protocol deviations (e.g. deviations in drug administration, in blood sampling times, etc.) will be provided to be discussed at the Report Planning Meeting. At this meeting, it will be decided whether a discrepant data value can be used in analyses or whether it must be corrected in the clinical database. Each protocol deviation must be assessed to determine whether it is an IPD. For definition of IPDs, and for the process of identification of these, refer to the BI reference document "Identify and Manage Important Protocol Deviations (IPD)" (2).

If any IPDs are identified, they are to be summarised into categories and will be captured in the decision log. Categories which are considered to be IPDs in this trial are defined in the integrated quality and risk management plan (IQRMP). If the data show other IPDs, the definition in the IQRMP will be supplemented accordingly by the time of the Report Planning Meeting.

IPDs will be summarized and listed. Table 6.2: 1 below specifies which kind of IPDs could potentially lead to exclusion from which analysis set. The decision on exclusion of subjects from analysis sets will be made at the latest at the Report Planning Meeting, after discussion of exceptional cases and implications for analyses. If the data show other IPDs, this table will be supplemented accordingly by the time of the Report Planning Meeting.

Table 6.2: 1 Handling of IPDs

IPD code	IPD Category & Brief Description	Excluded from which analysis set
A1	Inclusion Criteria Not Met	PKS
A2	Exclusion Criteria Violated	PKS
B1	Informed consent not available/not done	TS, PKS
B2	Informed consent too late	None
C1	Incorrect trial medication taken	PKS
C2	Randomization not followed	PKS
C3	Non-compliance	PKS
C4	Incorrect intake of trial medication	PKS
C5	Improper washout between treatments	PKS
D1	Prohibited medication use	PKS
D2	Mandatory medication not taken	PKS
D3	Improper washout of concomitant medication	PKS
E1	Certain violations of procedures used to measure primary or secondary data	PKS
F1	Certain violations of time schedule used to measure primary or secondary data	PKS
G1	Incorrect intake of meal	PKS
G2	C-SSRS not conducted at discharge and EOT	None

6.3 SUBJECT SETS ANALYSED

Subject sets will be used as defined in the CTP, Section 7.3.

Table 6.3: 1 Subject sets analyzed

	Subject set	
Class of endpoint	TS	PKS
Primary PK endpoints		X
Secondary PK endpoints		X
Safety parameters & treatment exposure	X	
Demographic/baseline endpoints	X	

6.5 POOLING OF CENTRES

This section is not applicable, because the study was performed in only one centre.

6.6 HANDLING OF MISSING DATA AND OUTLIERS

Data of screened subjects who were withdrawn from the trial prior to first administration of any study drug will not be reported in the CTR.

Data of subjects who failed to complete all periods of the study (dropouts or withdrawals) will be reported in the CTR as far as their data are available. All withdrawals will be documented and the reason for withdrawal reported in the CTR.

CTP: *It is not planned to impute missing values for safety parameters.*

One exception where imputation might be necessary for safety evaluation are AE dates. Missing or incomplete AE dates are imputed according to BI standards (3).

Missing data and outliers of PK data are handled according to BI standards (4).
CTP: *PK parameters that cannot be reasonably calculated based on the available drug concentration-time data will not be imputed.*

6.7 BASELINE, TIME WINDOWS AND CALCULATED VISITS

A separate baseline is defined for each study treatment:

- Baseline for the treatment in the first treatment period is defined as the last available off-treatment value before administration of the respective formulation of BI 1358894.

- Baseline for the treatment in the second and third treatment periods is defined as the last available pre-dose value measured on or after Day 14 of the preceding visit.

Time windows are defined in Section 6.1 of the CTP. Adherence to time windows will be checked at the Report Planning Meeting.

7. PLANNED ANALYSIS

The format of the listings and tables will follow the BI guideline "Reporting of clinical trials and project summaries" (5).

The individual values of all subjects will be listed. Listings will be sorted by treatment sequence, subject number and visit (if visit is applicable in the respective listing). AE listings will be sorted by assigned treatment (see Section 7.8.1 below for details). The listings will be contained in Appendix 16.2 (SDL) of the CTR.

The following standard descriptive statistical parameters will be displayed in summary tables of continuous variables:

N	number of non-missing observations
Mean	arithmetic mean
SD	standard deviation
Min	minimum
Median	median
Max	maximum

For plasma concentrations as well as for all PK parameters the following descriptive statistics will additionally be calculated:

CV	arithmetic coefficient of variation
gMean	geometric mean
gCV	geometric coefficient of variation

For PK parameters the following descriptive statistics will additionally be calculated:

P10	10^{th} percentile
Q1	1^{st} quartile
Q3	3^{rd} quartile
P90	90^{th} percentile

The data format for descriptive statistics of plasma concentrations will be identical with the data format of the respective concentrations. The descriptive statistics of PK parameters will be calculated using the individual values with the number of decimal places as provided by the evaluation program. Then the individual values as well as the descriptive statistics will be reported with three significant digits in the CTR.

Tabulations of frequencies for categorical data will include all possible categories and will display the number of observations in a category as well as the percentage (%) relative to the respective treatment group. Percentages will be rounded to one decimal place. The category missing will be displayed if and only if there actually are missing values. Percentages will be based on all subjects in the respective subject set whether they have non-missing values or not.

7.1 DEMOGRAPHIC AND OTHER BASELINE CHARACTERISTICS

Only descriptive statistics are planned for this section of the CTR.

7.2 CONCOMITANT DISEASES AND MEDICATION

Concomitant diseases will be coded according to the most recent version of MedDRA. Concomitant medication will be coded according to the most recent version of the World Health Organisation – Drug Dictionary. Concomitant non-drug therapies will be coded according to the most recent version of MedDRA.

Only descriptive statistics are planned for this section of the CTR.

7.3 TREATMENT COMPLIANCE

Treatment compliance will not be analyzed as a specific endpoint. Any deviations from complete intake will be addressed in the Report Planning Meeting (cf. Section 6.2) and described in the CTR.

7.4 PRIMARY ENDPOINTS

7.4.1 Primary analysis of the primary endpoints

Primary analysis of the primary endpoints will be performed as defined in Sections 7.3.1 of the CTP.

The statistical model for the primary analysis defined in the CTP is an analysis of variance (ANOVA) model on the logarithmic scale including "treatment", "period" and "sequence" as fixed effects and "subjects within sequences" as random effect. Relative bioavailability of the study treatments will be estimated by the ratios of the geometric means

- C/A, i.e. TF2 fas/ TF1 fed
- E/A, i.e.TF2 fas/ TF1 fed, i.e.
- B/C, i.e. TF2 fed/ TF2 fas
- D/E, i.e. TF2 fed/ TF2 fas

of the primary endpoints.

Exclusion of PK parameters

The ADS ADPP contains column variables APEXC and APEXCO indicating inclusion/exclusion (APEXC) of a PK parameter and an analysis flag comment (APEXCO). All analyses based on the PKS are based on PK parameter values which are not flagged for exclusion, i.e. with APEXC equal to "Included".

Exclusion of plasma concentrations

The ADS ADPC (PK concentrations per time-point or per time-interval) contains column variables ACEXC or ACEXCO indicating inclusion/exclusion (ACEXC) of a concentration

and an analysis flag comment (ACEXCO). Exclusion of a concentration depends on the analysis flag comment ACEXCO. For example, if ACEXCO is set to "ALL CALC", the value will be excluded for all types of analyses based on concentrations. If ACEXCO is set to "DESC STATS" the value will be excluded from descriptive evaluations per planned time point/time interval. If ACEXCO contains the addition "TIME VIOLATION" or "TIME DEVIATION", the value can be used for further analyses based on actual times. If ACEXCO is set to "HALF LIFE", the value will be excluded from half-life calculation only; the value is included for all other analyses. Excluded concentration itself will be listed in the CTR associated with an appropriate flag.

Further details are given in "Noncompartmental Pharmacokinetic / Pharmacodynamic Analyses of Clinical Studies" (4) and "Description of Analytical Transfer Files and PK/PD Data Files" (6).

7.4.2 Sensitivity analysis, subgroup analysis, exploratory analysis of the primary endpoints

The same statistical model as used for the primary analysis (Sections 7.3.1 of the CTP) will be repeated for the primary endpoints but with all sources of variation ("sequence", "subjects within sequences", "period", "treatment") considered as fixed effects.

Primary PK endpoints will be assessed descriptively. The analysis of standard PK parameters is performed according to BI standards (4).

7.5 SECONDARY ENDPOINTS

7.5.1 Key secondary endpoints

This section is not applicable as no key secondary endpoint has been specified in the protocol.

7.5.2 Secondary endpoints

The secondary endpoints will be statistically analysed in the same way as for the primary endpoints. The endpoints will also be assessed descriptively. The analysis of standard PK parameters is performed according to BI standards (4).

See Section 7.4 of this TSAP for details regarding exclusion of PK parameters and plasma concentrations.

7.7 EXTENT OF EXPOSURE

Descriptive statistics are planned for this section of the report, by treatment and overall.

7.8 SAFETY ANALYSIS

All safety analyses will be performed on the TS.

7.8.1 Adverse Events

AEs will be coded with the most recent version of MedDRA.

The analyses of AEs will be descriptive in nature. All analyses of AEs will be based on the number of subjects with AEs and not on the number of AEs.

For analysis, multiple AE occurrence data on the eCRF will be collapsed into one event provided that all of the following applies:

- All AE attributes are identical (lower level term, intensity, action taken, therapy required, seriousness, reason for seriousness, relationship, outcome, AESI)
- The occurrences were time-overlapping or time-adjacent (time-adjacency of two occurrences is given if the second occurrence started at most 1 hour after the first occurrence ended)

For further details on summarization of AE data, please refer to "Analysis and Presentation of Adverse Event Data from Clinical Trials" (7) and "Handling of missing and incomplete AE dates" (3).

The analysis of AEs will be based on the concept of treatment emergent AEs. That means that all AEs will be assigned to screening or on-treatment phases as defined in Section 6.1. AEs will be analysed based on actual treatments, as defined in Table 6.1: 2.

An overall summary of AEs will be presented. This overall summary will comprise summary statistics for the class of other significant AEs according to ICH E3 (8) and for the class of AESIs.

CTP: *The following are considered as AESIs:*

- *Hepatic injury*
  A hepatic injury is defined by the following alterations of hepatic laboratory parameters:
  - *An elevation of AST (aspartate transaminase) and/or ALT (alanine transaminase) ≥3-fold ULN combined with an elevation of total bilirubin ≥2-fold ULN measured in the same blood sample, or*
  - *Aminotransferase (ALT, and/or AST) elevations ≥10 fold ULN*

The investigator had to classify on the eCRF whether an observed AE was an AESI or not.

According to ICH E3 (8) AEs classified as "other significant" need to be reported and will include those non-serious and non-significant AEs
(i) which are marked haematological or other lab abnormalities, or
(ii) which were reported with "action taken = discontinuation" or "action taken = reduced", or
(iii) which lead to significant concomitant therapy as identified by the Clinical Monitor/Investigator at a Medical Quality Review Meeting.

The frequency of subjects with AEs will be summarised by treatment, primary SOC and preferred term. AEs which were considered by the investigator to be drug related will be summarised separately. Separate tables will also be provided for subjects with SAEs, subjects with AESIs and subjects with other significant AEs (according to ICH E3 (8)). The frequency of subjects with AEs and the frequency of subjects with AEs considered by the investigator to be drug related will also be summarised by maximum intensity, primary SOC and preferred term.

The SOCs and preferred terms within SOCs will be sorted by descending frequency over all treatment groups.

For disclosure of AE data on ClinicalTrials.gov, the frequency of subjects with non-serious AEs occurring with an incidence of greater than 5 % (in preferred terms) will be summarised by treatment, primary SOC and preferred term. The frequency of subjects with SAEs will also be summarised.

For disclosure of AE data in the EudraCT register, the frequency of AEs, the frequency of non-serious AEs with an incidence of greater than 5 % (in preferred terms) and the frequency of SAEs will be summarized.

For support of lay summaries, the frequency of subjects with drug-related SAEs will be summarized by treatment, primary SOC and preferred term.

If the subject reports headaches during the treatment period further information about the duration of headache, location, characteristics, and signs and symptoms were recorded. The information will be summarized with descriptive statistics.

7.8.2 Laboratory data

The analyses of laboratory data will be descriptive in nature and will be based on BI standards "Display and Analysis of Laboratory Data" (9).

Analyses will be based on normalised values, which means transforming to a standard unit and a standard reference range. The original values will be analysed if the transformation into standard unit is not possible for a parameter.

Descriptive statistics of laboratory values over time and for the difference from baseline (see Section 6.7) will be provided. Frequency tables of changes between baseline and last value on treatment with respect to the reference range will be presented.

Possibly clinically significant abnormal laboratory values are only those identified either in the Investigator's comments or at the Report Planning Meeting at the latest. It is the Investigator's responsibility to decide whether a lab value is clinically significant abnormal or not. Standard or project-specific rules for flagging clinically significant values in an automated manner will not be applied in this study.

Clinically relevant findings in laboratory data will be reported as baseline conditions (prior to first administration of study treatment) or as AEs (after first administration of study treatment) if judged clinically relevant by the investigator, and will be analyzed as such.

7.8.3 Vital signs

The analyses of vital signs (blood pressure and pulse rate) will be descriptive in nature. Descriptive statistics of vital signs over time (baseline and on-treatment measurements, cf. Table 6.1: 2, only) and for the difference from baseline (see Section 6.7) will be provided.

Clinically relevant findings in vital signs data will be reported as baseline conditions (prior to first administration of study treatment) or as AEs (after first administration of study treatment) if judged clinically relevant by the investigator, and will be analyzed as such.

7.8.4 ECG

Relevant ECG findings will be reported as relevant medical history/baseline condition (if a condition already exists before first administration of study treatment) or as AE (if condition emerges after first administration of study treatment) and will be summarized as such. No separate listing or analysis of ECG findings will be prepared.

7.8.5 Others

Physical examination findings will be reported as relevant medical history/baseline condition (if a condition already exists before first administration of study treatment) or as AE (if condition emerges after first administration of study treatment) and will be summarized as such. No separate listing or analysis of physical examination findings will be prepared.

Reports of C-SSRS will be reported as AEs as described in CTP Section 5.2.6.1.7 and will be summarized as such. Results of the C-SSRS will only be listed. No further analysis will be prepared.

Clinically relevant findings of the neurological examination will be reported as relevant medical history/baseline condition (if a condition already exists before first administration of study treatment) or as AE (if condition emerges after first administration of study treatment) and will be summarized as such. No separate listing or analysis of neurological examinations will be prepared.

8. REFERENCES

1	*CPMP/ICH/363/96*: "Statistical Principles for Clinical Trials", ICH Guideline Topic E9; Note For Guidance on Design, Conduct, Analysis and Evaluation of Clinical Trialss, current version
2	*001-MCS-40-413_1.0:* "Identify and Manage Important Protocol Deviations (iPD)", current version; IDEA for CON
3	*KM Asset BI-KMED-BDS-HTG-0035:* "Handling of missing and incomplete AE dates", current version; KMED
4	*001-MCS-36-472_RD-01*: "Noncompartmental Pharmacokinetic / Pharmacodynamic Analyses of Clinical Studies", current version; IDEA for CON
5	*KM Asset BI-KMED-BDS-HTG-0045:* "Reporting of Clinical Trials and Project Summaries", current version; KMED
6	*001-MCS-36-472_RD-03*: "Description of Analytical Transfer Files and PK/PD Data Files", current version; IDEA for CON
7	*KM Asset BI-KMED-BDS-HTG-0041:* "Analysis and Presentation of Adverse Event Data from Clinical Trials", current version; KMED
8	*CPMP/ICH/137/95*: "Structure and Content of Clinical Study Reports", ICH Guideline Topic E3; Note For Guidance on Structure and Content of Clinical Study Reports, current version
9	*KM Asset BI-KMED-BDS-HTG-0042:* "Display and Analysis of Laboratory Data", current version; KMED

10. HISTORY TABLE

Table 10: 1 History table

Version	Date (DD-MMM-YY)	Author	Sections changed	Brief description of change
Final	**06-AUG-2019**		None	This is the final TSAP