Analytic Error as an Important Component of Total Survey Error:

Results from a Meta-Analysis

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Outline

- Introduction
- Analytic error (defined)
- Possible consequences
- Meta-Analysis/Methods
- Results
- Conclusions/limitations
- Discussion points

Introduction

- The survey methodology literature is replete with alternative descriptions of the Total Survey Error (TSE) paradigm
  - For comprehensive overviews, see Biemer, 2010; Groves and Lyberg, 2010
- Majority of descriptions divide TSE into 4-5 parts
  - Coverage error, nonresponse error, measurement error, sampling error, processing error
- Further divisions include
  - Observation vs. nonobservation, bias vs. variance

Introduction (cont.)

- Survey organizations strive to minimize important sources of TSE
  - often at significant expense to funding agencies

- These costly efforts will be wasted if data users fail to employ appropriate estimation methods that recognize features of the sample design that gave rise to the set of respondents

Analytic Error

- Most descriptions of TSE do not recognize *analytic error* as an important error source

- Definition: The failure of a data user to employ appropriate estimation methods when analyzing the collected survey data

Considering Analytic Error as Component of TSE

- Groves et al. (2009) include analysis as a component of their "twin inferential process" description of TSE
- Biemer (2010) hints at analytic error as a form of processing error
- Smith (2011) prominently features analysis in refining the TSE perspective

Possible Consequences

- Problem can become especially serious when secondary analysts of public-use survey data submit articles for publication
- Analytic errors may be missed by otherwise well-meaning reviewers during the peer-review process
- Even the highest quality survey with all sources of TSE minimized could lead to publications that present error-prone population estimates

Proposed Study

- Aim: Quantify the prevalence of analytic errors by performing a meta-analysis of the published literature from a variety of fields that perform secondary analyses of survey data arising from complex samples

Methods

- Online search tool (Google Scholar) used to identify peer-reviewed articles from a variety of fields…
  - E.g., medicine, public health, criminology, economics, political science, demography, sociology

- …presenting analyses of survey data collected from large, nationally representative samples in the U.S.
  - E.g., National Health and Nutrition Examination Survey (NHANES), General Social Survey (GSS)

Key Word Search

- The following key words were used in search:
  - NHANES, ATUS, NCVS, GSS, NSFG, BRFSS, HRS, NCS-R

- Articles performing analyses on survey data were included

Error Indicators

- Student assistants were tasked with coding these articles on a variety of error indicators

- Examples
  - appropriate use of weights for estimation
  - appropriate use of sampling error codes
  - use of appropriate software for survey data analysis
  - Appropriate subpopulation analysis approaches
  - use of appropriate language to describe the results (e.g., weighted estimates vs. sample estimates)

Descriptive Results

Number of Articles by Survey (to date)

Survey	**Frequency**
NHANES	25
NSFG	24
GSS	13
HRS	11
BRFSS	7
NCVS	6
Multiple surveys	6
ATUS	3
NCS-R	3
NAMCS	1
NSHAP	1
TOTAL	**100**

Number of Articles by Field

Field	**Frequency**
Health	73
Population and Demography	9
Social Science	9
Criminology	6
Environment	1
Economics	1
Political Science	1
TOTAL	**100**

Journal Characteristics

% articles from journals that present analytic guidelines for survey data	11
% of articles from journals requiring a statistician on every review team or have listed statistical consultant	37
Impact factor	Avg: 6.10; Range: 0.21-47.05

Estimation Errors (%)

Does not…	**Percent**
mention use of weights in Methods section	28
mention use of sampling error codes	40
use both weights and sampling error codes in analysis	55
mention appropriate design-based tests of significance	79
adjust weights if pooling multiple years	72

Software Errors (%)

Does not mention…	**Percent**
name of software package used for analysis	30
specialized software procedure(s) in Methods	78
appropriate procedures for subpopulation analysis in the methods	91

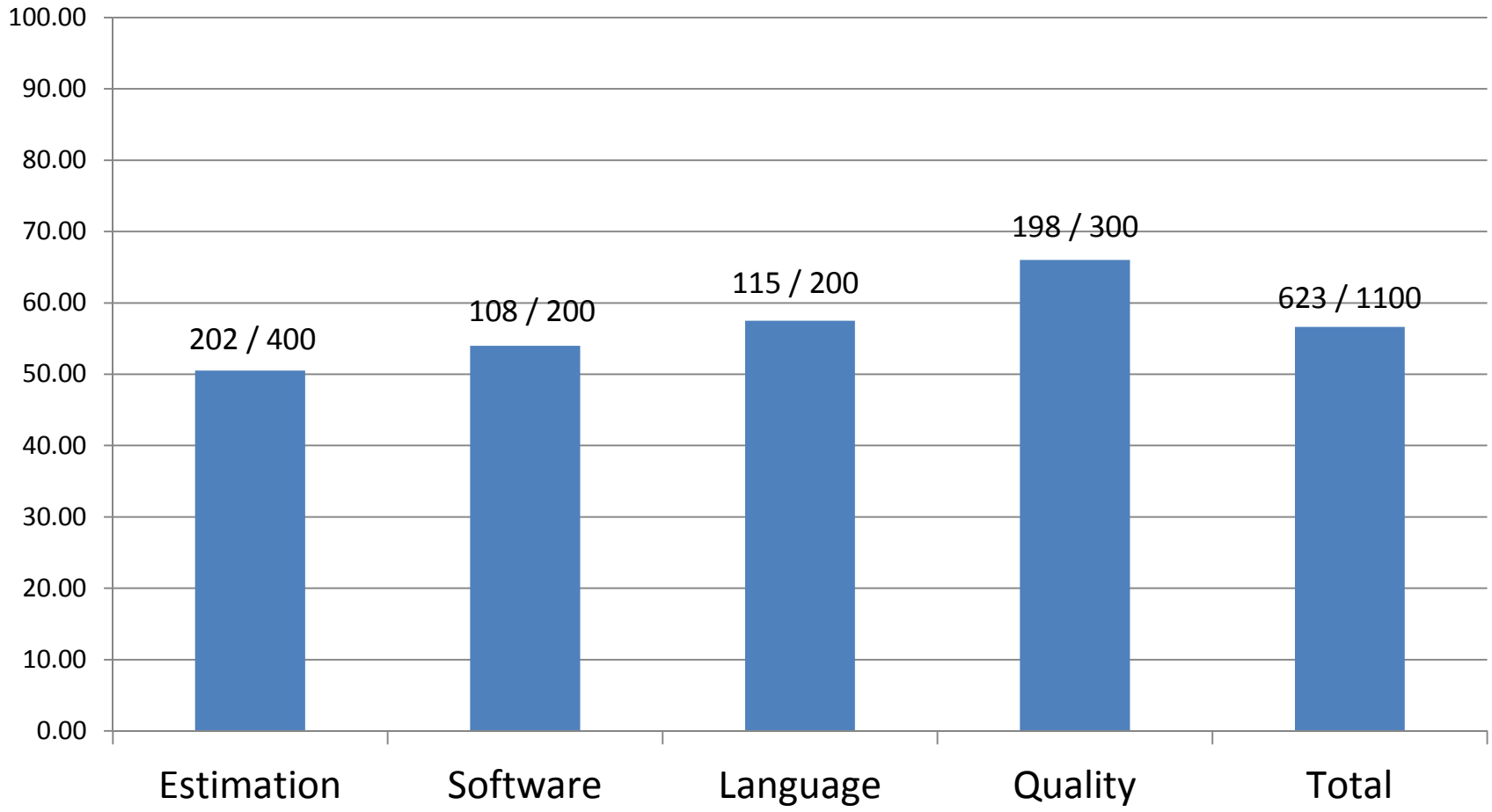
Language Errors (%)

Does not use appropriate language…	**Percent**
to describe estimates (e.g., weighted estimates of population totals)	59
to describe tables (e.g., Table 1 presents weighted estimates)	56
to describe figures (e.g., Figure 1 presents weighted estimates)	84

Quality Errors (%)

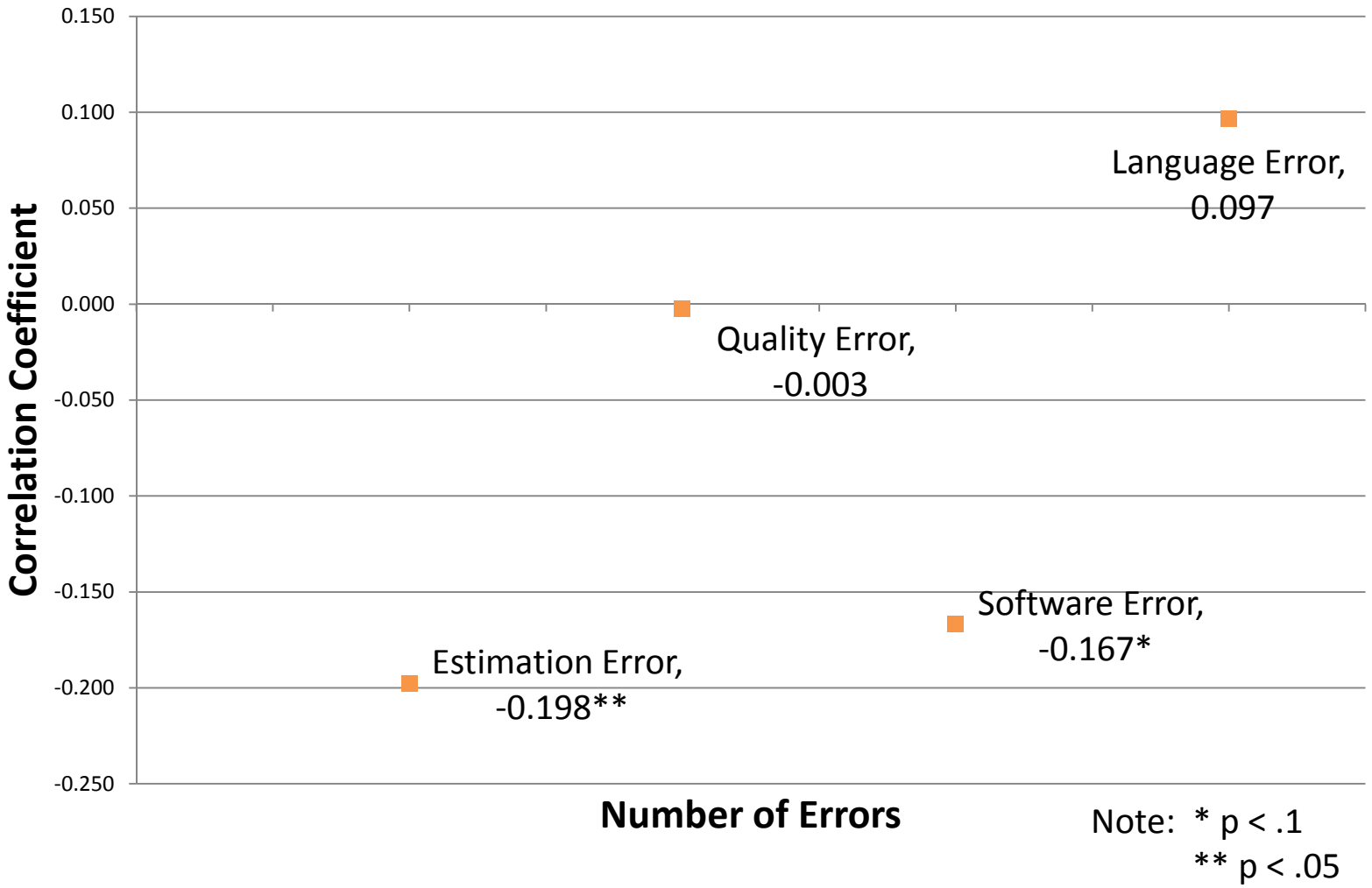
Does not…	**Percent**
mention an overall survey quality indicator (e.g., response rate)	60
mention item-missing data	61
use appropriate methods to adjust for item-missing data	77

Percentage of Errors by Group
(out of all possible errors)



Bivariate Analyses

Correlation Coefficient of # of errors and Impact factor



Note: * p < .1
** p < .05

Conclusion

- Estimation (and other types of) errors prevalent in peer-reviewed literature

- Need for academic journals accepting articles presenting secondary analyses to
  - have strict guidelines for analyses of survey data and;
  - clear communication of analytic methods

Limitations

- Articles selected based on online search; results may not be generalizable to all published articles
- Do not have access to code used in analyses
  - Appropriate methods may have been used, but not mentioned in article
- Work is still ongoing…

Discussion Points

- Additional analyses that we could perform as we keep growing this database?

- Other indicators of analytic error that we can capture?