

Appendix

This section discusses Burning Glass Technologies (BGT) methodology and the limitations of BGT data, and contains technical documentation of this report.

1. BGT Methodology

BGT searches more than 40,000 web sources and aggregates job advertisement information into one interactive comprehensive database. Data are parsed for specific elements (e.g., job title, education requirements, skills, etc.) and are cleaned using an algorithm designed to eliminate duplicate job ads. The data collection process consists of three stages.

1. “Spidering:” Online job ads from a fixed pool of websites are tracked and collected with pre-programmed algorithmic search engines.
2. “Extraction and Parsing:” The information in job ads are extracted, parsed, and coded into data elements. BGT relies on a contextual algorithm that is able to code data variables for each individual job ad. Semantic analyses and text mining inferences are used to contribute to the reported data elements for each job ad.
3. “De-duplication:” To clean identical job ads from its database, BGT de-duplicates job ads based on parsed data elements (e.g., location, employer, job title, etc.) with the use of several algorithms that are designed to focus on the content and sentence structure of each individual job ad. A 60-day timeframe is used to identify duplicates.

2. Limitations of BGT Data

One of the major limitations of BGT data is that online job ads are partially representative of the labor market and the demand for labor. Not all job openings are advertised online; position openings can be advertised through other means (e.g., personal connections or emails). Moreover, online job ads may not always reflect available job openings as a job position can be filled before the job ad is posted online. One online job ad may also reflect multiple job openings, as employers may use one job ad to hire multiple people for the same position.

Additionally, although BGT’s data are de-duplicated, duplicate postings could be missed for some specific employers. Some online job ads from employers such as the U.S. Air Force are created for recruitment purposes and are not indicative of individual job openings. Currently, BGT claims a 90% accuracy rate in deduplication and identification of actual online job ads.

Furthermore, BGT data cannot be used to study longitudinal changes in the online labor market for licensed psychologists. BGT continuously adds new web sources of online job ads, which renders samples of job ads from different time periods incomparable. There were also large numbers of unspecified data elements (e.g., industry, employer, employment status, etc.) that were

either 1) not advertised in the job ad, or 2) not classified by BGT algorithms. Lastly, although BGT provides a maximum of *original* job ads for each search, complete micro-level data (i.e., raw data at the level of each individual job ad, as opposed to summary data) for each search are currently not available through BGT. These limitations present difficulties in developing a complete picture of the online labor market for licensed psychologists.

3. Technical Documentation

The specific methods used to retrieve data from BGT, as well as the variable taxonomy used in this report are documented as follows:

Type of Position was defined as the basic terms of agreement outlined in a work contract with regard to the status of the advertised position. BGT categorizes “type of position” as follows:

- Temporary
- Permanent

Note: “Intern” was also considered a “type of position” but was not included in this report as none of the job ads for licensed psychologists were classified “intern” positions.

Employment Status was defined by the duration of an average work week for an advertised position. BGT categorizes “employment status” as follows:

- Full-time: more than 35 hours a week
- Part-time: at least 15 hours a week, but less than 35 hours a week

Source of job ads was defined as the medium through which employers advertise an open position online. BGT categorizes the “source” of online job ads as follows:

- Job board: “Job boards” are paid-for websites (e.g., online newspaper sites, industry associations, etc.) where job ads are posted for multiple employers, locations, and job types (e.g., Indeed, USAjobs, etc.).
- Employers Sites: “Employer sites” are websites where specific employers post their job openings (e.g., General Electric, Microsoft, etc.).
- Staffing agencies: “Staffing agencies” are staffing firms or intermediary recruiting agencies that post online job ads (e.g., Kelly staffing, Manpower staffing, etc.).

Occupations

Occupations in BGT are derived from the Occupational Information Network (O*NET) classification system used by federal statistical agencies. The following section documents the search criteria that were used to retrieve job ads data for licensed psychologists and for other occupations.

Licensed Psychologists: To identify “job ads for licensed psychologists,” the following criteria were used:

- 1) Occupation (based on O*NET codes): Broad Group 19-3030 = “Psychologists,” which includes the following detailed occupations:
 - 19-3031 = “Clinical, Counseling, and School Psychologists.”
 - 19-3031.01 = “School Psychologists;”
 - 19-3031.02 = “Clinical Psychologists;” and
 - 19-3031.03 = “Counseling Psychologists.”
 - 19-3032 = “Industrial-Organizational Psychologists.”
 - 19-3039 = “Psychologists, All other.”
 - 19-3039.01 = “Neuropsychologists and Clinical Neuropsychologists.”
- 2) Keywords: “license,” “licensed,” “licensure,” and “license-eligible.” Job ads that did not contain these words were excluded.

Note: Job ads that did not require licensure but instead “preferred” licensed psychologists were included; job ads for psychologists that required licenses other than a psychologist license (e.g., social work license) were also included. These job ads cannot be excluded from the sample of online job ads for licensed psychologists due to technical limitations in using keywords to filter online job ads data in BGT’s search query.

Education requirements were not included as a search criterion due to the large number of job ads with unspecified education requirements; approximately 30.4% of online job ads for licensed psychologists did not specify an education requirement. However, the keywords “license,” “licensed,” “licensure,” and “license-eligible” served as controls for education requirements because the vast majority of licensed psychologists have a doctoral degree.

Due to data limitations, the online job ads identified with the search query were only for licensed psychologists. Most job ads were for health service psychologists such as clinical, counseling, and school psychologists. Psychologists who worked as “research psychologists” or “psychology professors” may be under-represented in this sample due to BGT’s adoption of O*NET categorization. “Research psychologists” are not recognized by O*NET as an occupation, and O*NET’s categorization of “psychology professors” collapses under a different category: “Postsecondary Teachers.” BGT’s search functions do not currently permit the use of separate keywords for mutually exclusive occupations within the same search query, which would allow for a combined search of all psychologists where “license” keywords would only be used for health service psychologists. The unavailability of micro-level data also creates difficulty for conducting separate searches and then summing the job ads for different occupations together. Occupation categories can potentially overlap with each other because BGT may classify one job ad under different occupation categories.

Licensed Physicians, non-Psychiatrists: To identify “job ads for licensed physicians, non-psychiatrists,” the following criteria were used:

- 1) Occupation (based on O*NET codes): under Broad Group 29-1060 = “Physicians and Surgeons,” the following detailed occupations were included:
 - 29-1061 = “Anesthesiologists;”
 - 29-1062 = “Family and General Practitioners;”
 - 29-1063 = “Internists, General;”
 - 29-1064 = “Obstetricians and Gynecologists;”
 - 29-1065 = “Pediatricians, General;”
 - 29-1067 = “Surgeons;” and
 - 29-1069 = “Physicians and Surgeons, All Other.”
- 2) Keywords: “license,” “licensed,” “licensure,” and “license-eligible.” Job ads that did not contain these words were excluded.

Licensed Social Workers: To identify “job ads for licensed social workers,” the following criteria were used:

- 1) Occupation (based on O*NET codes): Broad Group 21-1020 = “Social Workers,” which includes the following detailed occupations:
 - 21-1021 = “Child, Family, and School Social Workers;”
 - 21-1022 = “Healthcare Social Workers;”
 - 21-1023 = “Mental Health and Substance Abuse Social Workers;” and
 - 21-1029 = “Social Workers, All Other.”
- 2) Keywords: “license,” “licensed,” “licensure,” and “license-eligible.” Job ads that did not contain these words were excluded.

Licensed Mental Health Counselors: To identify “job ads for licensed mental health counselors,” the following criteria were used:

- 1) Occupation (based on O*NET codes): under Broad Group 21-1010 = “Counselors,” the following detailed occupation was included:
 - 21-1014 = “Mental Health Counselors.”
- 2) Keywords: “license,” “licensed,” “licensure,” and “license-eligible.” Job ads that did not contain these words were excluded.

Statisticians: To identify “job ads for statisticians,” the following criterion was used:

- Occupation (based on O*NET codes): Broad Group 15-2040 = “Statisticians.”

Licensed Psychiatrists: To identify “job ads for licensed psychiatrists,” the following criteria were used:

- 1) Occupation (based on O*NET codes): under Broad Group 29-1060 = “Physicians and Surgeons,” the following detailed occupation was included:
 - 29-1066 = “Psychiatrists.”
- 2) Keywords: “license,” “licensed,” “licensure,” and “license-eligible.” Job ads that did not contain these words were excluded.

Political Scientists: To identify “job ads for political scientists,” the following criterion was used: Occupation (based on O*NET codes): under Broad Group 19-3090 = “Miscellaneous Social Scientists and Related Workers,” the following detailed occupation was included:

- 19-3094 = “Political Scientists.”

Economists: To identify “job ads for economists,” the following criterion was used:

- Occupation (based on O*NET codes): Broad Group 19-3010 = “Economists.”

Survey Researchers: To identify “job ads for survey researchers,” the following criterion was used:

- Occupation (based on O*NET codes): Broad Group 19-3020 = “Survey Researchers.”

Sociologists: To identify “job ads for sociologists,” the following criterion was used:

- Occupation (based on O*NET codes): Broad Group 19-3040 = “Sociologists.”

Mathematicians: To identify “job ads for mathematicians,” the following criterion was used:

Occupation (based on O*NET codes): Broad Group 15-2020 = “Mathematicians.”

Additional Note: Online job ads from the U.S. Air Force were excluded as they did not reflect specific job openings. Instead, these ads encouraged people to explore *possible* job openings in the U.S. Air Force. Online job ads from the U.S. Air Force were excluded from the following occupations:

- Licensed Psychologists
- Licensed Physicians, non-Psychiatrists
- Licensed Social Workers
- Licensed Mental Health Counselors
- Licensed Psychiatrists

Geography

Cities: “Cities” in this report were based on the most recent delineations of Metropolitan Statistical Areas (MSAs) released by the U.S. Census Bureau in February 2013.

Location Quotient: The Location Quotient for geographic location i :

$$Location\ Quotient_i = \frac{\left(\frac{Number\ of\ job\ ads\ for\ licensed\ psychologists\ in\ location\ i}{Employed\ population\ in\ location\ i} \right)}{\left(\frac{Number\ of\ job\ ads\ for\ licensed\ psychologists\ in\ the\ nation}{Employed\ population\ in\ the\ nation} \right)}$$

Industry

“Industry” was defined as a group of establishments (employers) that produce similar products or provide similar services. BGT’s industry categorization was based on the North American Industry Classification System (NAICS). NAICS is the standard industry classification used by Federal statistical agencies in classifying business establishments. NAICS uses a numbering system up to a four-digit code, from broad to specific industry groups. The industry taxonomy is documented as follows (with NAICS codes in parenthesis):

Health Care and Social Assistance (62):

- “Ambulatory Health Care Services” (621)
 - “Offices of Physicians” (6211)
 - “Offices of Dentists” (6212)
 - “Offices of Other Health Practitioners” (6213)
 - “Outpatient Care Centers” (6214)
 - “Medical and Diagnostic Laboratories” (6215)
 - “Home Health Care Services” (6216)
 - “Other Ambulatory Health Care Services” (6219)
- “Hospitals” (622)
 - “General Medical and Surgical Hospitals” (6221)
 - “Psychiatric and Substance Abuse Hospitals” (6222)
 - “Specialty (except Psychiatric and Substance Abuse) Hospitals” (6223)
- “Nursing and Residential Care Facilities” (623)
 - “Nursing Care Facilities (Skilled Nursing Facilities)” (6231)
 - “Residential Intellectual and Developmental disability, Mental Health, and Substance Abuse Facilities” (6232)
 - “Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly” (6233)
 - “Other Residential Care Facilities” (6239)
- “Social Assistance” (624)
 - “Individual and Family Services” (6241)
 - “Community Food and Housing and Emergency and Other Relief Services” (6242)
 - “Vocational Rehabilitation Services” (6243)
 - “Child Day Care Services” (6244)

Public Administration (92):

- “Executive, Legislative, and Other General Government Support” (921)
 - “Executive, Legislative, and Other General Government Support” (9211)
- “Justice, Public Order, and Safety Activities” (922)

- “Justice, Public Order, and Safety Activities” (9221)
- “Administration of Human Resource Programs” (923)
 - “Administration of Human Resource Programs” (9231)
- “Administration of Economic Programs” (926)
 - “Administration of Economic Programs” (9261)
- “Space Research and Technology” (927)
 - “Space Research and Technology” (9271)
- “National Security and International Affairs” (928)
 - “National Security and International Affairs” (9281)

Educational Services (61):

- “Educational Services” (611)
 - “Elementary and Secondary Schools” (6111)
 - “Junior Colleges” (6112)
 - “Colleges, Universities, and Professional Schools” (6113)
 - “Technical and Trade Schools” (6115)
 - “Educational Support Services” (6117)

Other Industry Sectors: other industry sectors with employers posting job ads for licensed psychologists are:

- “Agriculture, Forestry, Fishing, and Hunting” (11)
- “Mining, Quarrying, and Oil and Gas Extraction” (21)
- “Utilities “ (22)
- “Construction” (23)
- “Manufacturing” (31-33)
- “Wholesale Trade” (42)
- “Retail Trade” (44-45)
- “Transportation and Warehousing” (48-49)
- “Information” (51)
- “Finance and Insurance” (52)
- “Real Estate and Rental and Leasing” (53)
- “Professional, Scientific, and Technical Services” (54)
- “Management of Companies and Enterprises” (55)
- “Administrative and Support and Waste Management and Remediation Services” (56)
- “Arts, Entertainment, and Recreation” (71)
- “Accommodation and Food Services” (72)
- “Other Services (except Public Administration)” (81)

Qualifications

Education Qualification was defined as the highest degree an individual has completed as *required* for a candidate to qualify for the advertised position. BGT categorizes levels of minimum education requirements as follows:

- High school or vocational training
- Associate's degree
- Bachelor's degree
- Graduate or professional degree

Experience Qualification was defined as the minimum number of years prospective employees have spent working in a related area that are *desired or required* for a candidate to qualify for the advertised position. This particular data element does not specify the kinds of experiences (e.g., post-doctoral, pre-doctoral, internship, etc.) that may be required for licensed psychologists to qualify for certain positions. BGT categorizes levels of minimum education requirements as follows:

- Less than 2 years
- 2 to 5 years
- 5 to 8 years
- 8+ years

Skill Qualification was defined as the expertise *desired or required* for a candidate to qualify for the advertised position. The top skills in demand are those that were most frequently specified in the online job ads.