**NATIONAL DATABASE OF CHILDCARE COSTS**

**SUPPORTING STATEMENT**

**A. JUSTIFICATION**

This request is for a new data collection.

**1. NECESSITY FOR INFORMATION COLLECTION**

The programmatic authority of the Women’s Bureau is to formulate standards and policies which shall promote the welfare of wage-earning women, improve their working conditions, increase their efficiency, and advance their opportunities for profitable employment (see Attachment A). Under the Women’s Bureau programmatic authority, the Women’s Bureau is charged with conducting research and reporting on conditions affecting the welfare of working women. Section 2 of Public Law 66-259 that established the Women’s Bureau authorizes this information collection. *See* 29 U.S.C. 13.

Access to childcare is critical to women’s employment. Because of the high cost of childcare in the United States, childcare access and availability are issues that affect most working mothers. About 65 percent of mothers of children under the age of 6 are in the labor force.[[1]](#footnote-1) Yet, in areas with high childcare prices, mothers’ employment is reduced, impacting their employment prospects and earnings in the short and long term.[[2]](#footnote-2) However, comprehensive research on the effects of childcare on women’s employment is limited due to the lack of federal data on childcare prices. Existing data sources are limited in several ways.

* **Geography.** Childcare data collected through federal data sources, including the Survey of Income and Program Participation, the Current Population Survey, and the National Survey of Early Care and Education, are restricted to national- or state-level estimates. These surveys are not large enough to provide sub-state estimates. State-level data underestimate the costs of childcare in urban areas which tend to be significantly more expensive than rural areas.[[3]](#footnote-3) County-to-county variance is also obscured, and does not allow for more localized estimates of childcare’s effects on women’s employment. Because parents must choose childcare providers that are in close proximity to their homes or workplaces, state averages are unlikely to be good estimates of the prices parents actually pay. Private sources of childcare data do not have adequate county-level data or it is unavailable for most states. The Economic Policy Institute derives county-level prices from state-level data using an inadequate approximation: all families in urban areas are assumed to use center-based care and all families in rural areas are assumed to use family-based care.[[4]](#footnote-4) Child Care Aware of America provides partial county-level data for only ten states. Local Child Care Resource and Referral agencies do not make price data available.
* **Universe.** The primary federal agency charged with collecting childcare data and reporting on availability and price is the Administration for Children and Families (ACF), Health and Human Services (HHS). However, ACF HHS primarily serves low-income families covered by Child Care and Development Funds (CCDF).[[5]](#footnote-5) As such, HHS tabulations are limited to low-income families. Because childcare is a significant cost for most working families,[[6]](#footnote-6) the Women’s Bureau seeks data on childcare prices for all working families. These data exist. Market Rate Surveys (MRS) conducted by each state assess the price of care in the paid childcare markets of childcare centers and family childcare homes.[[7]](#footnote-7) States must report selected summary MRS results in their triennial CCDF Plan to HHS and use the most recent data to establish subsidy payment rates for low-income families. However, the underlying data used in the CCDF Plan are not reported to the federal government nor consolidated across states. The Women’s Bureau would obtain the already-collected data from the states to create a consolidated database of childcare prices without income or eligibility restrictions (the National Database of Childcare Costs).
* **Time period.** To establish how childcare prices have changed over time and its association with women’s employment, we require historical childcare price data. No federal data source makes available historical trends in local area childcare prices. These data are available via MRS reports and tabulations. MRS reports became required in 1998, but not all reports are publicly available. The Women’s Bureau would request from the states unpublished reports and tabulations, or reports and tabulations that may have been published but are no longer accessible, that provide historical childcare price data as far back as 1998, to the extent that the states still have these reports and tabulations available.
* **Comparability.** To be able to conduct research on childcare prices throughout the country, the Women’s Bureau requires data that are comparable across states and counties. MRS reports from each state must be harmonized to ensure that variables and definitions are uniform across states. Currently, MRS reports are not aggregated by state and reporting metrics differ across states. Access to the underlying data and tabulations would allow for greater standardization and a higher-quality statistical product.
* **Quality and reliability.** Pursuant to the Information Quality Act[[8]](#footnote-8) (Pub.L. 106-554),[[9]](#footnote-9) federal agencies must maximize the quality, objectivity, utility, and integrity of information of disseminated statistics. Because the federal government does not have data on local area childcare costs, the government must rely on proprietary data from non-governmental entities. Private entities may cease to provide estimates without notice, may modify their methodology, or provide inadequate documentation to certify quality and reliability. Alternatively, the federal government would need to use surveys that were not designed to derive local childcare costs, yielding unacceptable margins of error and unrepresentative coverage.

**2. USES OF INFORMATION**

The creation of a comprehensive and publicly-available data source for childcare prices will provide a more comprehensive picture of the cost of childcare at the local level in the United States. Because data are collected within local areas, childcare prices will more accurately reflect the prices parents pay in the market, rather than estimates derived from state averages. This data source will be used to show how, who, and where childcare prices are impacting labor force participation. The combination of Market Rate Survey data with the American Community Survey will allow researchers to show how childcare prices affect women’s employment, which women are most significantly impacted by higher childcare prices, and which areas of the country have lagging participation rates associated with childcare prices. In addition to pricing data, this database will provide the number of childcare spaces available in each county by hours of operation to evaluate access to childcare in local areas, where those variables are available. This research will allow government agencies, practitioners, and policymakers to more accurately measure potential economic impacts and identify strategies for enhancing employment options and economic security for women.

**Uses by the Women’s Bureau and U.S. Department of Labor**

The Women’s Bureau intends to publish a consolidated database of county-level childcare prices based on Market Rate Surveys (MRS) and county-level characteristics obtained from the American Community Survey (ACS). This database would be used by the Women’s Bureau to develop briefs, reports, and data tools showing how the costs of childcare are associated with women’s employment in local areas.

The MRS items requested from each state are: median price of center- and family-based care by age of children, average special fees collected by childcare providers (e.g., application fees or deposits, fees for supplies), hours of operation (part-time or full-time; regular or irregular) and available spaces by hours of operation.

The Women’s Bureau would develop briefs and reports showing women’s employment rates and the changing costs of childcare over time at the county level. Reports would offer demographic and economic breakouts, including how childcare prices affect labor force participation among low-, middle-, and high-income women; how childcare prices affect labor force participation by women’s occupation group; how childcare prices affect labor force participation by the number of children in care; and how childcare prices affect labor force participation by women’s age, race and ethnicity, and other demographic characteristics.

Additional reports would focus on access to childcare by county, showing variability in available spaces by county and hours of operation. Research shows that some counties are considered childcare deserts,[[10]](#footnote-10) lacking sufficient spaces or spaces at particular hours of operation, to meet the needs of working women. Lack of full day facilities may limit employment prospects of women needing to work full-time hours. Women working irregular hours may not have access to childcare facilities. The combination of MRS data with ACS data would allow us to show how many spaces are available at irregular hours in a county, along with the share of women likely to be working irregular hours based on their occupation (e.g., service and retail).

The Women’s Bureau would develop briefs that show areas where childcare prices have increased the most and it would track women’s employment rates in those counties.

The Women’s Bureau would develop an interactive map showing childcare prices by age of children in all US counties, women’s employment rate by county, and key characteristics of the counties.

Reports, briefs, and tools produced by the Women’s Bureau would be research-based products designed to be informational to a wide audience. The Women’s Bureau would not use the information collection to develop policy proposals.

**Uses for Policy Discussion**

Childcare subsidies have positive effects on parental employment,[[11]](#footnote-11) resulting in interest in subsidies as a strong policy tool for increasing women’s employment. While there are national-level studies that inform research in this area, none of the studies assess the prices of different types of care or for different age groups using county-level data. The National Database of Childcare Costs would help close this critical research gap. This research will allow policymakers to more accurately measure potential economic impacts and identify strategies for enhancing employment options and economic security for women by expanding access to childcare.

The Child Care and Development Block Grant of 2014 requires that states examine childcare supply and demand, identify childcare deserts, and implement solutions.[[12]](#footnote-12) Childcare deserts are more prevalent in low-income areas, rural counties, areas with greater concentration of minorities, and in areas with a larger share of families working irregular or non-traditional schedules.[[13]](#footnote-13) By making the National Database of Childcare Costs (NDCC) publicly available, states would have a tool at their disposal to evaluate the presence of childcare deserts in their states, specifically affordability deserts where relatively high prices may significantly constrain access to childcare. The NDCC would include counties’ economic characteristics, enabling states to identify the characteristics of underserved areas.

The Department of Health and Human Services supports the creation of this database because it would enable them to improve their research on childcare access. This database would allow HHS to understand how well existing childcare subsidies are keeping up with childcare prices in local areas. Researchers who are funded through HHS Child Care and Development Fund grants would also be able to use the database to further their research and have access to a wide range of county-level demographic and economic characteristics linked with childcare data.

**Uses by Researchers and Analysts**

The lack of childcare data at the county level has been cited by researchers as a barrier to understanding its effects on women’s employment.[[14]](#footnote-14) We expect the public-use database would be used extensively by childcare researchers and analysts to understand variation in childcare prices and availability over time and by geography. Researchers and analysts would publish reports, journal articles, books, and other sources of information for the public.

Analysts at federal agencies would be able to cite a federal data source on childcare prices, rather than non-governmental sources, and supplement their existing data with local-level childcare price estimates.

Business analysts and childcare providers may be able to use these data to identify underserved areas to establish additional childcare centers.

**3. CONSIDERATION OF USING IMPROVED TECHNOLOGY**

The information collected will be requested via mailed letter and email follow-up. The letters and emails will explain the purpose and value of the data collection effort and also provide instructions for submitting data and reports. Each state will have the ability to upload data files and supporting documentation to a secure online portal. We expect to receive 100% of the responses electronically.

The Women’s Bureau does not expect to collect any data that include personally identifying information (PII) or business identifying information (BII). However, in limited cases, the Women’s Bureau may need to collect unpublished tabulations and additional data files. The Women’s Bureau, through its contractor, ICF, will follow best practices to avoid PII and BII disclosure. ICF has extensive experience obtaining, handling and securing PII for a range of federal clients (e.g., CDC HIV Supplemental Surveillance project, CDC National Program of Cancer Registries and Cancer Surveillance System) and will apply that experience to ensure compliance with federal and state security standards for this project, including the Federal Information Security Modernization Act of 2014 (FISMA, S.2521) and the National Institutes of Standards and Technology. For any instances in which the Women’s Bureau requests original source data from states, ICF will request that PII and BII information be removed from the file before transferring to ICF. If there are any instances in which a state indicates that it will not be feasible to remove PII and BII from the source file, ICF will provide the state with access to a secure online portal into which the files can be transferred and ICF will remove and destroy the PII and BII data before the data are entered into the database.

The final product resulting from this data collection will be a freely-available online database of county-level childcare prices linked to American Community Survey data on county-level characteristics and women’s employment. This database will be compatible for use with open source software, including open source statistical software.

**4. EFFORTS TO IDENTIFY DUPLICATION**

Childcare data at the county level are not provided by any federal agency. Furthermore, complete childcare pricing data at the county level for all counties in the United States are not available from non-federal sources (e.g., non-profits, childcare advocacy groups).

Existing data provided by the Administration for Children and Families, Department of Health and Human Services (HHS) do not meet the needs of the Women’s Bureau. Although MRS cover all eligible childcare providers in the childcare market, these data are not reported back to HHS, and existing HHS data and tabulations have incomplete coverage of families with childcare needs. Because HHS’s mandate is to provide tabulations and subsidy data on low-income families, these sources exclude many families who do not meet the criteria yet have childcare needs. The Women’s Bureau seeks to provide average childcare prices at the county level that are inclusive of all family types.

The Women’s Bureau has met with HHS to ensure that they did not already collect the data sought by the Women’s Bureau. The Women’s Bureau verified that HHS did not collect or retain Market Rate Survey (MRS) data from the states. MRS data are retained by the states and need to be requested from them directly. However, because MRS data are already collected by states, states would be reporting the information out of existing records and would not have to obtain information specifically for the Women’s Bureau. By leveraging data that have already been collected, we would not need to burden the states or childcare providers with a new survey to obtain childcare pricing data.

The Women’s Bureau, through its contract with ICF, has conducted a review of all 51 state childcare agency websites to locate and archive all childcare MRS reports that are already publicly available. This will minimize duplication of asking states to provide studies that are already available online. On average, states publish the last two studies online, typically covering two years each. In reviewing the most recently published studies, 10 states provide county-level estimates that can be used for the purposes of this data collection. Among states that provide complete county-level data, ICF will use the public reports as the source of data for the database and will generally not need any additional information from these states for the years covered by the studies. The remaining studies or unpublished tabulations will be requested from each state.

**5. EFFORTS TO MINIMIZE BURDEN ON SMALL BUSINESS**

This collection obtains information from state government agencies only.

**6. CONSEQUENCES OF NOT CONDUCTING THE DATA COLLECTION**

If this data collection is not conducted, the federal government will continue to lack an inclusive and complete federal source on local area childcare prices. The federal government would have to rely on incomplete or inadequate proprietary sources to estimate local childcare prices or derive estimates from surveys that were not designed to be used at the local level. Neither of these sources would provide data that reflect childcare prices parents actually pay at the local level. Because the National Database of Childcare Costs would be a new public source of information on local childcare prices and this information is not available elsewhere, studies and reports on childcare prices and change in prices over time would not be conducted. The NDCC would also be linked with American Community Survey data on women’s employment, and studies on how local area childcare prices affect women’s employment would also not be conducted. These studies would be beneficial to policymakers and state agencies as they consider changes to childcare grant programs and subsidies and consider measures to increase women’s labor force participation.

**7. SPECIAL CIRCUMSTANCES**

This data collection will be conducted once and will provide respondents with at least 30 days to submit requested documents. Respondents will not be requested to provide more than one copy of a document and will not require any retention of records. Resulting statistical results will be generalizable to the universe of the study. Proprietary information or personally identifying information and business identifying information will not be collected.

**8. FEDERAL REGISTER ANNOUNCEMENT AND CONSULTATIONS OUTSIDE THE AGENCY**

**Federal Register Announcement**

On December 26, 2018 a 60-Day Federal Register Notice was published in the Federal Register

83 FR 66309. See Attachment B.

The notice received 11 comments from businesses, childcare facilities, childcare researchers, and

state human services agencies. All comments agreed with the need to collect more childcare data

and recognized important gaps in current data availability. The proposed database collection was

noted as an essential new data collection. One state agency noted concerns with data

comparability across states. To address concerns with state differences in public tabulations, the

Women’s Bureau is requesting original data files to be able to make the database comparable

across states. The Women’s Bureau will not request that states spend additional time formatting

their data sources. The Women’s Bureau will take on all the work to make data comparable to

minimize state burden.

**Consultations Outside the Agency**

**Meetings on Data Collection Activities.**

The Women’s Bureau has conducted several meetings with representatives from the Office of

Child Care and the Office of Planning, Research, and Evaluation, Administration for Children

and Families, Health and Human Services (HHS). These meetings have been conducted to

ensure there is no duplication in data collection activities, to obtain HHS support for the data

collection, and to obtain expert input on the data collection plan. The Women’s Bureau has

verified that HHS does not have county-level childcare price data. HHS is supportive of this

data collection and would benefit from being able to do additional studies on childcare

access and the extent to which the subsidies provided cover a sufficient portion of the price

charged at the county level.

The Women’s Bureau has consulted with the Census Bureau to obtain detailed information on

the type of childcare pricing data collected, accuracy, and geographic limitations. The Women’s

Bureau verified that childcare data are not available at the county level, as childcare pricing

data are collected through surveys too small to obtain county estimates (i.e., Survey of Income

and Program Participation and the Current Population Survey).

The Women’s Bureau held several meetings with representatives from the Texas Institute for

Child & Family Wellbeing at the University of Texas at Austin. This institute conducts

the Market Rate Survey for the state of Texas. These meetings were designed to

assess the feasibility of the Women’s Bureau childcare data collection by gathering information

on the type of sub-state data collected, availability of tabulations, and state willingness to provide

this information.

**Panel on Missing Data and Imputation.**

Following data collection, the Women’s Bureau will convene a panel to review and provide input into the methodology used for standardizing and imputing the data for the database. The panel will consist of experts on childcare data from the Department of Labor, Department of Health and Human Services, Child Care Aware of America, and staff designated by the state childcare administrators in six sample states: California, Illinois, Indiana, Minnesota, Montana, and New York. These states were selected to cover a wide range of issues with missing data and imputation (e.g., large and small states, states with centralized data collection or county-based collection, states that publish county estimates and those that use zip codes or pricing zones).

**9. PAYMENT OR GIFTS TO RESPONDENTS**

This information collection will not provide any payment or gifts to respondents.

**10. ASSURANCE OF CONFIDENTIALITY**

The Women’s Bureau does not expect to collect any data that include personally identifying

information (PII) or business identifying information (BII) and provides no express privacy assurance of confidentiality to respondents. In limited cases where data transfers may inadvertently include PII or BII, data will be provided via a password-protected secure portal. The Women’s Bureau, through its contractor, ICF, will follow best practices to avoid PII disclosure. ICF has extensive experience obtaining, handling and securing PII for a range of federal clients (e.g., CDC HIV Supplemental Surveillance project, CDC National Program of

Cancer Registries and Cancer Surveillance System) and will apply that experience to ensure

compliance with federal and state security standards, including the Federal Information Security

Modernization Act of 2014 (FISMA, S.2521) and the National Institutes of Standards and

Technology. For any instances in which the Women’s Bureau requests original source data from

states, ICF will request that PII and BII be removed from the file before transferring to ICF. If

there are any instances in which a state indicates that it will not be feasible to remove PII and BII

from the source file, ICF will provide the state with access to a secure online portal into which

the can be transferred and ICF will remove and destroy the PII and BII data before the data are

entered into the database. All files will be secured with access granted only to individuals

developing the childcare database. Any printed copies of files will be secured via locked

cabinets and offices.

To ensure no individuals or business are identified in the public use database, the Women’s

Bureau, through its contractor, ICF, will use imputation and other disclosure avoidance

methodologies to avoid identification. Counties with few eligible providers will be imputed to

avoid disclosure. ICF will complete an assessment of the final database to ensure no

entities are identifiable.

**11. JUSTIFICATION FOR SENSITIVE QUESTIONS**

No questions of a sensitive nature are asked in this information collection.

**12. ESTIMATE OF RESPONDENT BURDEN**

The estimated burden to the states and the District of Columbia is 153 total hours to respond to the request. The following table outlines the burden.

**Burden Table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Collection Activity | Number of Respondents | Number of Responses  | Average Burden perResponse(in hours) | Total AnnualBurden (in hours) | Average Hourly Wage Rate[[15]](#footnote-15) | Total Annual Respondent Cost |
| National Childcare Database | 51 | 1 | 3 hours | 153 | $92 | $276 |
| Total | 51 | 1 | 3 hours | 153 | $92 | $14,076 |

**13. COST BURDEN TO RESPONDENTS**

This information collection will not require respondents to purchase equipment,

Software.

**14. COST BURDEN TO THE FEDERAL GOVERNMENT**

The estimated cost burden to the federal government is $345,000. This estimate was derived

from the cost of the contract with ICF to conduct the information collection and staff hours of

five employees assigned to oversee the project. No additional operational expenses are expected

outside of normal labor and operations costs.

The cost of the contract with ICF is $164,834.

The cost of staff hours to oversee the project, obtain OMB clearance, coordinate with the

contractor, and review and provide input on all deliverables is $345,000. Staff hours are based on

$115,000 annual salary of 1.5 FTE for 2 years. The staff hours are estimated based on the share

of time five employees will devote to the project: 0.5 (senior researcher), 0.3 (contracting officer

representative), 0.3 (senior economist), 0.3 (policy analyst), 0.1 (contracting officer) = 1.5 FTE.

**15. REASON FOR CHANGE IN BURDEN**

This is a new information collection.

**16. SCHEDULE FOR INFORMATION COLLECTION AND PUBLICATION**

The Women’s Bureau contracted with ICF to obtain Market Rate Survey (MRS) data at the

county level from each state in April 2018. Data collection of publicly available data from the

American Community Survey and published MRS reports began in June 2018. Pending OMB

approval, ICF will begin data collection of unpublished reports and tabulations in January 2020.

Data standardization and disclosure avoidance is scheduled to begin in May 2020 and

conclude in June 2020. Imputation of missing data is scheduled for May 2020. Preparations for

the publication of the National Database of Childcare Costs will begin March 2020, concluding

with the published database in December 2020. A detailed schedule of data collection,

standardization, disclosure avoidance, imputation, and publication is available in Attachment C.

**17. DISPLAY OF OMB EXPIRATION DATE**

The OMB information collection number and expiration date will be displayed on the outreach

Letters and emails to each state and on the secure portal that would collect confidential

information.

**18. EXCEPTION TO THE CERTIFICATION STATEMENT**

 There are no exceptions to the certification statement.

1. Women’s Bureau. 2018. “Labor Force Participation Rate of Mothers by Age of Youngest Child: 1975-2016.” Available online: <https://www.dol.gov/wb/stats/NEWSTATS/facts/women_lf.htm#three>. [↑](#footnote-ref-1)
2. Mathur, Aparna and Abby McCloskey. 2014. *How to Improve Economic Opportunity for Women*.American Enterprise Institute.

<http://www.aei.org/publication/how-to-improve-economic-opportunity-for-women/> [↑](#footnote-ref-2)
3. Swenson, Kendall. 2008. “Child Care Arrangements in Urban and Rural Areas.” U.S. Department of Health and Human Services. Washington, DC. [↑](#footnote-ref-3)
4. https://www.epi.org/publication/family-budget-calculator-documentation/ [↑](#footnote-ref-4)
5. https://www.acf.hhs.gov/occ/about/what-we-do [↑](#footnote-ref-5)
6. Child Care Aware of America. 2017. *Parents and the High Cost of Care: 2017 Report.* https://usa.childcareaware.org/wp-content/uploads/2017/12/2017\_CCA\_High\_Cost\_Report\_FINAL.pdf. [↑](#footnote-ref-6)
7. Davis, Elizabeth, Lynn A. Karoly, Bobbie Weber, Pia Caronongan, Kathryn Tout, Patti Banghart, Sara Shaw, and Anne Partika. 2017. “Market Rate Surveys and Alternative Methods of Data Collection and Analysis to Inform Subsidy Payment Rates.” OPRE Report #2017-115. Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available online: <https://www.acf.hhs.gov/opre/resource/market-rate-surveys-and-alternative-methods-of-data-collection-and-analysis-to-inform-subsidy-payment-rates>. [↑](#footnote-ref-7)
8. Office of Management and Budget Information Quality Guidelines. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/assets/OMB/inforeg/iqg\_oct2002.pdf. [↑](#footnote-ref-8)
9. Copeland, Curtis W. and Michael Simpson, Congressional Research Service. 2004. “The Information Quality Act: OMB’s Guidance and Initial Implementation.” CRS Report for Congress. [↑](#footnote-ref-9)
10. Child Care Deserts, Child Care Aware of America. 2016. <http://usa.childcareaware.org/wp-content/uploads/2016/09/Child-Care-Deserts-report-FINAL2.pdf>. [↑](#footnote-ref-10)
11. Forry, Nicole, Paula Daneri, and Grace Howarth. 2013. “Child Care Subsidy Literature Review.” OPRE Brief 2013-60. Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available online: https://www.acf.hhs.gov/sites/default/files/opre/subsidy\_literature\_review.pdf. [↑](#footnote-ref-11)
12. Child Care and Development Block Grant Act of 2014. <https://www.congress.gov/bill/113th-congress/senate-bill/1086>. [↑](#footnote-ref-12)
13. Child Care Deserts, Child Care Aware of America. 2016. <http://usa.childcareaware.org/wp-content/uploads/2016/09/Child-Care-Deserts-report-FINAL2.pdf>. [↑](#footnote-ref-13)
14. Gonalons-Pons, Pilar. 2018. “When Does It Pay Off to Work? Childcare Costs and Employment after Birth, 1984-2014.” Work and Family Researchers Network conference presentation. June 21.; Strader, Eiko Kiraoka, 2018. “Do Race and Marriage Matter? The Motherhood Wage Penalty in the Military.” Work and Family Researchers Network conference presentation. June 21. [↑](#footnote-ref-14)
15. Average hourly wage rate was obtained from the Contract-Awarded Labor Category (CALC) tool. Wage rates based on costs for a program analyst with a bachelor’s degree and less than 10 years of experience. <https://calc.gsa.gov/> [↑](#footnote-ref-15)