

# Portfolio Analysis on Sex and Gender differences research in Hypertension at NHLBI



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# Background

- Women and men differ in their cardiac physiology, prevalence, manifestation and mortality associated with cardiovascular disease (CVD) <sup>1,2</sup>.
- Men and women share many risk factors for CVD, with hypertension being the major risk factor <sup>3</sup>. Some CVD risk factors are exclusive to women, e.g. preeclampsia and gestational hypertension <sup>4</sup>.
- The prevalence, awareness and control rates of hypertension differ between males and females and are age-dependent <sup>5</sup>.

**The mechanisms underlying sexual dimorphism in hypertension and CVD are poorly understood.**

# Objectives

Perform portfolio analysis of NHLBI awards related to “sex differences” in order to:

1. Examine current and historic funding trends
2. Characterize the diversity of research topics funded in the field
3. Examine the geographic distribution of funding
4. Help identify needs and opportunities in “sex differences” research in relation to “*hypertension*”

# Methods and Analysis

## Data Sources:

- NIH RePORTER <http://projectreporter.nih.gov/reporter.cfm>
- Über Research <http://www.uberresearch.com/>

## Search Keywords:

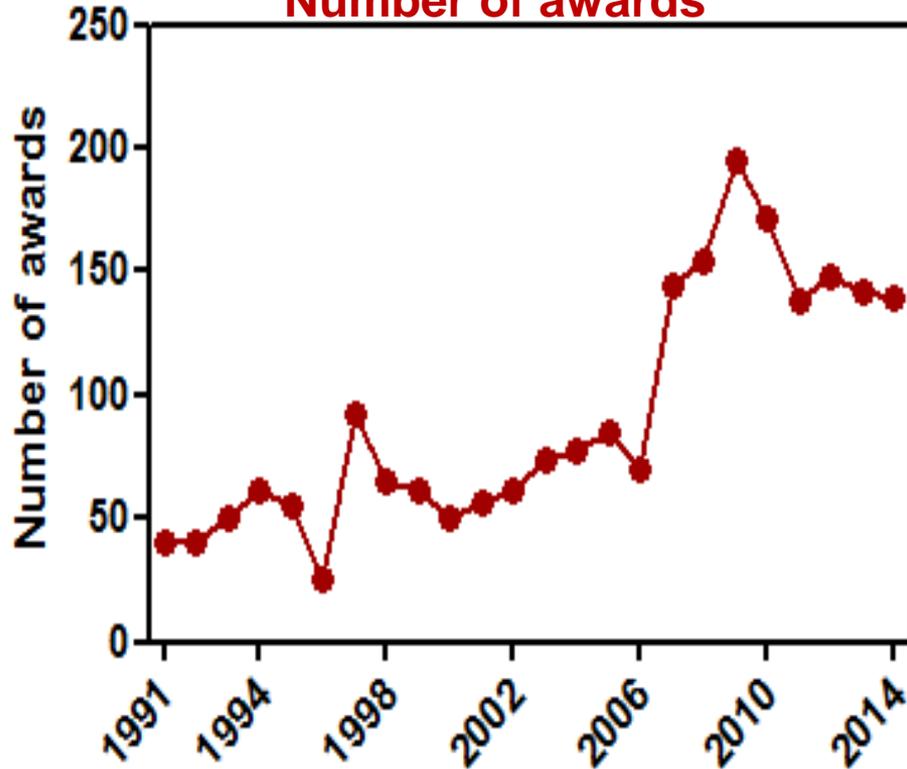
- *sex differences*
- *gender differences*
- *y chromosome*
- *x chromosome*
- *sex hormones*
- *preeclampsia*
- *pregnancy hypertension*
- *menopause*

## Analysis tools:

- NIH RePORTER
- IN-SPIRE
- Über Research

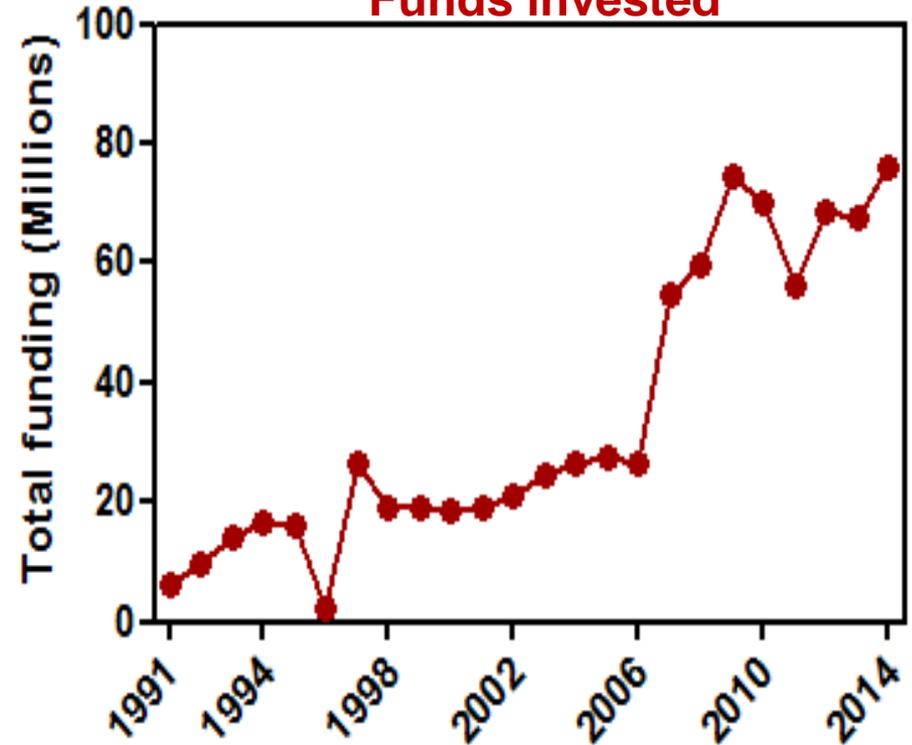
# “Sex differences” research: NHLBI funding per year (FY 1991-2014)

## Number of awards



**Total number of awards: 2231**  
(including subprojects)

## Funds invested



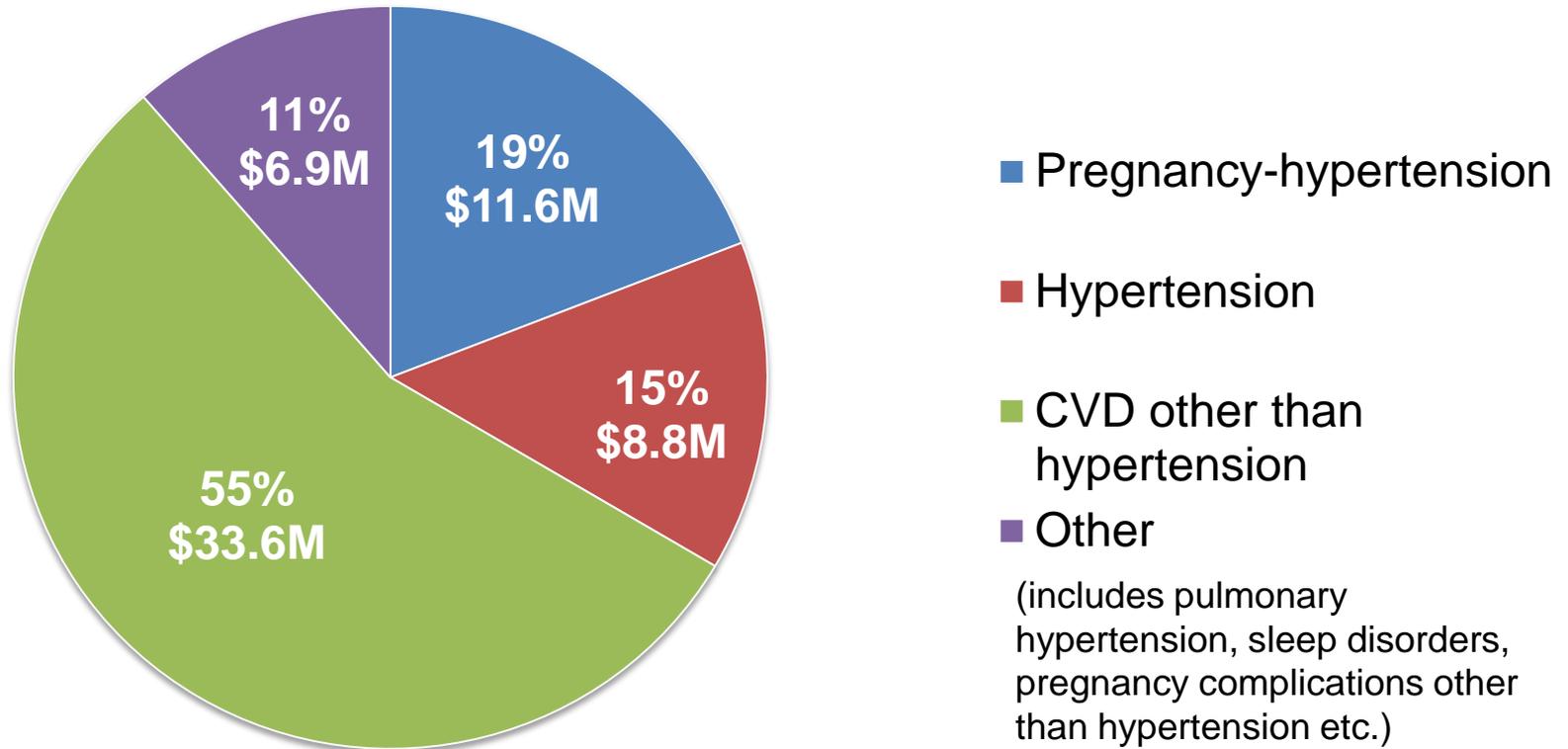
**Total investment: \$837,852 M**  
(including subprojects)

# Summary of funding trends

**Number of awards:** progressively increased from FY1991 (40 awards) to FY2014 (140 awards), for a cumulative total of 2231 awards over FY1991-2014.

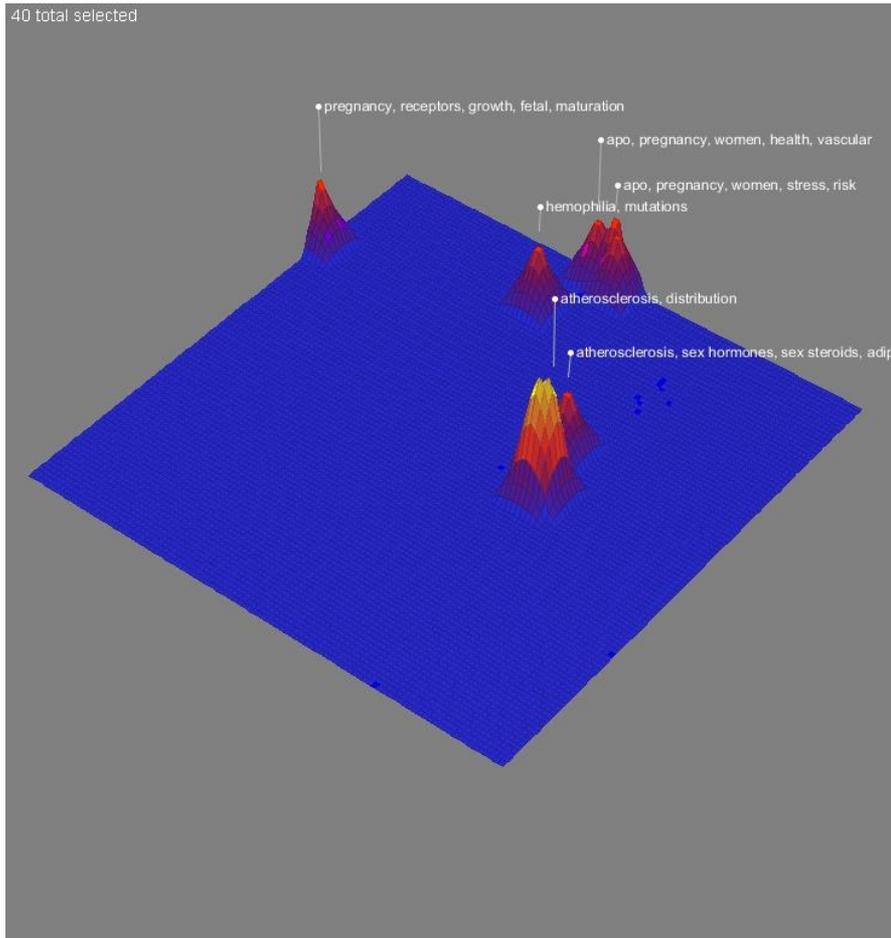
**Funds invested:** overall dollar investment has also progressively increased from \$6.1 million (FY1991) to \$76.3 million (FY2014), for a cumulative total of \$837 million over FY1991-2014.

# “Sex differences” NHLBI research in FY2014: by main disease conditions

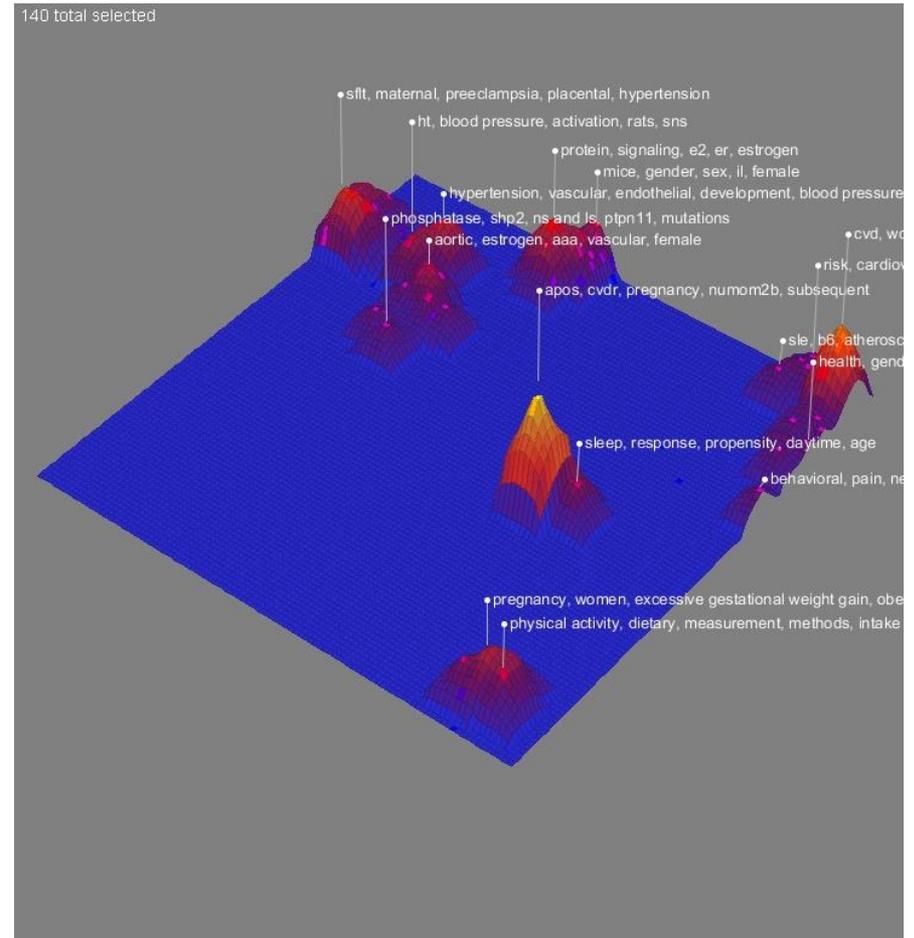


# “Sex differences” research FY1991-2014: by research topics

FY1991



FY2014



Data Source: NIH RePORTER; Data analysis: IN-SPIRE

# Change in Research topics over FY 1991-2014

## Top 5 research topic clusters in FY1991

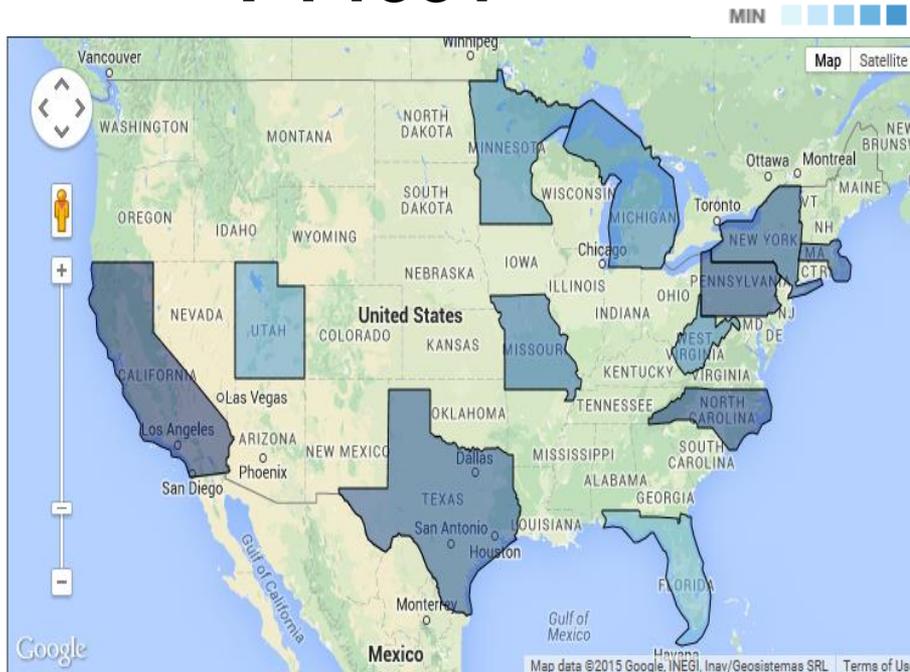
- **Atherosclerosis, sex hormones, sex steroids**
- **Pregnancy, receptors, growth**
- **Apolipoprotein, pregnancy, vascular**
- **Apo, pregnancy, stress**
- **Hemophilia, mutations**

## Top 5 research topic clusters in FY2014

- **CVD, pregnancy, Numom2b**
- **CVD, women, health**
- **Sflt (splice variant of VEGFR 1), preeclampsia, hypertension**
- **Protein, signaling, estradiol**
- **Hypertension, vascular, endothelial**

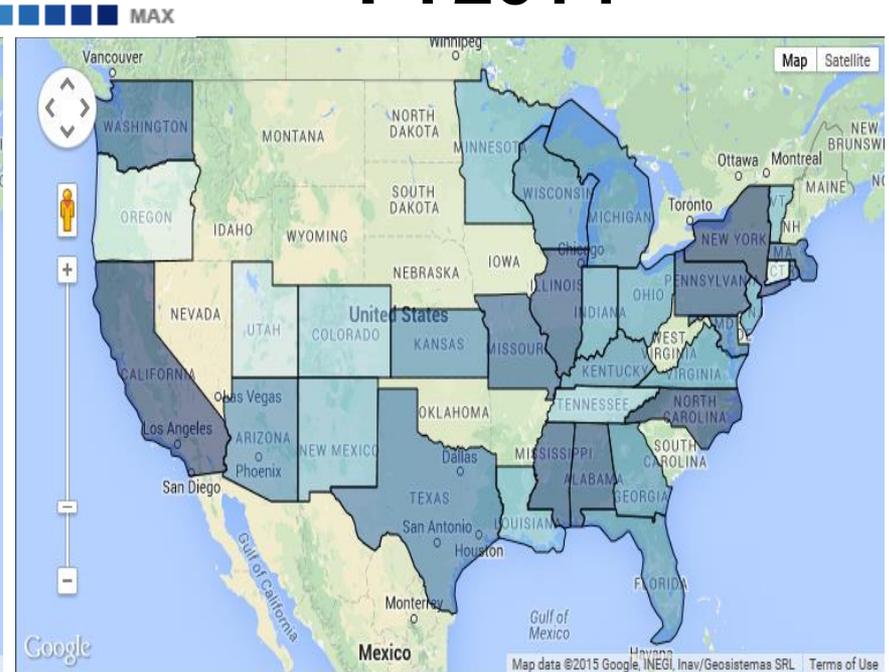
# Evolution of US geographic distribution of NHLBI-funded “sex differences” research

## FY1991



**Total number of states funded: 14**

## FY2014



**Total number of states funded: 35**

# Distribution of total NHLBI awards related to “sex differences” by State

## FY1991

Institution	Total awards
CA	6
PA	5
NC	3
DC	3
TX	3
NY	2
MA	2
WV	1
MI	1
MO	1

## FY2014

Institution	Total awards
CA	19
PA	12
NC	10
IL	10
MS	10
NY	9
MA	8
WA	4
TX	4
MD	3

Data source: NIH RePORTER; Data analysis: manually curated & classified data

# Distribution of total NHLBI funding related to “sex differences” by State

## FY1991

Institution	Total funding
CA	\$1.80M
PA	\$0.99M
DC	\$0.65M
NC	\$0.59M
NY	\$0.48M
TX	\$0.47M
MA	\$0.37M
MO	\$0.22M
MI	\$0.14M
WV	\$0.14M

## FY2014

Institution	Total funding
NC	\$11.0M
CA	\$9.7M
NY	\$8.1M
IL	\$5.1M
PA	\$3.5M
MS	\$3.4M
AL	\$3.3M
MA	\$3.1M
RI	\$2.5M
WA	\$2.3M

Data source: NIH RePORTER; Data analysis: manually curated & classified data

# Change in geographic distribution of funding (FY1991-FY2014)

- The top 3 states by number of awards have not changed since FY1991 (CA, PA, NC).
- Since FY1991, 4 states have fallen off the “top 10 list” by number of awards and 5 by total funding (differences between FY1991 and FY 2014 in states being funded are highlighted in red)
- Overall funding per state has increased from FY 1991-2014.

# Distribution of total NHLBI awards related to “sex differences” by Institution

## FY1991

Institution	Total awards
Georgetown Univ.	7
Wake Forest Univ.	6
Univ. of Pittsburgh	4
Baylor College of Med.	2
UCSD	2
Univ. of Utah	1
Univ. of NC Chapel Hill	1
Univ. of Miami	1
UC Berkley	1
Tufts Med. Center	1

## FY2014

Institution	Total awards
Univ. of MS Med. Center	10
Brigham and Women’s	5
Univ. of NC Chapel Hill	5
Northwestern Univ.	4
Case Western	4
UCLA	4
Johns Hopkins	3
Univ. of Arizona	3
NHLBI	3
RBHS-New Jersey	3

Data source: NIH RePORTER; Data analysis: manually curated & classified data

# Distribution of total NHLBI funding related to “sex differences” by Institution

## FY1991

Institution	Total funding
Univ. of Pittsburgh	\$0.90M
Stanford Univ.	\$0.72M
Georgetown Univ.	\$0.65M
UCSD	\$0.52M
Wake Forest Univ.	\$0.52M
Kaiser Foundation	\$0.35M
Baylor College of Med.	\$0.31M
Tufts Med Center	\$0.27M
Cornell Univ.	\$0.26M
St.Luke-Roosevelt Inst.	\$0.22M

## FY2014

Institution	Total funding
Univ. of NC Chapel Hill	\$5.9M
Univ. of MS Med. Center	\$5.0M
Univ. of Alabama	\$3.1M
Research Triangle Inst.	\$2.8M
Univ. of Illinois	\$2.7M
New York Med College	\$2.7M
Yeshiva Univ.	\$2.6M
Brigham and Women’s	\$2.6M
San Diego State Univ.	\$2.3M
Wake Forest Univ.	\$2.1M

Data source: NIH RePORTER; Data analysis: manually curated & classified data

# Change in Institutional distribution of funding (FY1991-FY2014)

- Since FY1991, there has been a dramatic shift in the Institutions that receive funding for research in “sex differences in hypertension”:
  - Only 1 Institution (Univ. of NC Chapel Hill) remains on “top 10 list” by number of awards.
  - Only 1 Institution (Wake Forest Univ.) remains on “top 10 list” by total funding.

differences between FY1991 and FY 2014 in Institutions being funded are highlighted in red

# World-wide funding and topics for all “sex differences” and “hypertension” research

Q Sex differences × Hypertension RCDC ×

See the matrix for the chosen indicator for the entities defined for rows and columns.  
As bigger the value is, as darker the color for a given cell. You might see the values by selecting "Show indicator value", and you can change the sorting.

Chart | Table

Aggregated funding amount ▾



Columns

Funders ▾

sort by

Indicator default ▾

Rows

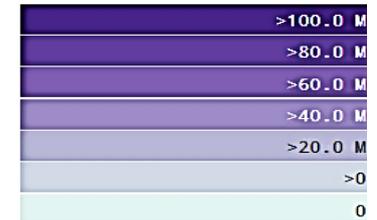
RCDC Categories ▾

sort by

Indicator default ▾

Show Indicator Values

Aggregated funding amount



Data source and analysis: Über Research

# Global funding distribution

- NHLBI is the top world-wide granting agency for all “sex differences” and “hypertension”-related research.
- In addition to NHLBI, other Institutes at the NIH fund research related to “sex differences” and “hypertension”, (e.g. NICHD and NIDDK).
- Other international agencies dedicated to supporting “sex differences” in “hypertension” research are CIHR (Canada) and MRC (UK).

# Conclusions

- NHLBI is one of the top organizations conducting and funding research related to sex differences in hypertension and CVD worldwide.
- NHLBI is funding an increasing number of awards related to sex/gender differences in hypertension and CVD.
- Despite the growing number of awards in the field, the fact that the mechanisms underlying sexual dimorphism in hypertension and CVD are poorly understood, suggests that further research is needed in this important field
- The NHLBI is collaborating with the extramural community to identify specific scientific gaps in the field.

# References

1. Appelman Y, van Rijn BB., Ten Haaf ME, Boersma E, Peters SA. *Atherosclerosis* 241: 211-218, 2015.
2. Fuster V. *Nature Rev Cardiol* 11: 671–683, 2014.
3. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, *et al.* *Lancet* 380: 2224-60, 2012.
4. Sattar N, Greer I.A. *BMJ* 325: 157-160, 2002.
5. Doumas M, Papademetriou V, Faselis C, Kokkinokis P. *Curr Hypertens Rep* 15: 321-330, 2013.