10-18-2013

E-Bikes in the United States

John MacArthur
Portland State University

ELECTRIC BIKES (E-BIKES) IN THE UNITED STATES

FRIDAY PSU TRANSPORTATION SEMINAR
OCTOBER 18, 2013

John MacArthur
OTREC at Portland State University

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Presentation Outline

- Why do e-bikes matter?
- What is an e-bike?
- US e-bike user survey
- Conclusions

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WHY DO E-BIKES MATTER?

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US Transport Sector Impacts

Source: Prof. Robert Bertini

Safety

- 32,788 fatalities in 2010 (-3% from 2009)
- 1.09 fatalities per 100 MVMT (VMT +0.7% in 2010)
- 2.2 M injuries in 2009
- 5.3 M crashes in 2011
- $230 B total cost (including medical)
- Leading cause of death for ages 4 to 34

Accessibility, Reliability and Mobility

- 4.8B hours travel delay (34 hours/auto commuter)
- $121 billion cost of urban congestion

Household Expenses

- Second biggest monthly expense, after housing

Environmental

- 28% of GHG emissions (78% CO, 58% NO_x, 36% VOCs)
- 29% of energy consumed (mostly petroleum)
- 70% of petroleum consumption (60% imported)
- 3.9 billion gallons of wasted fuel

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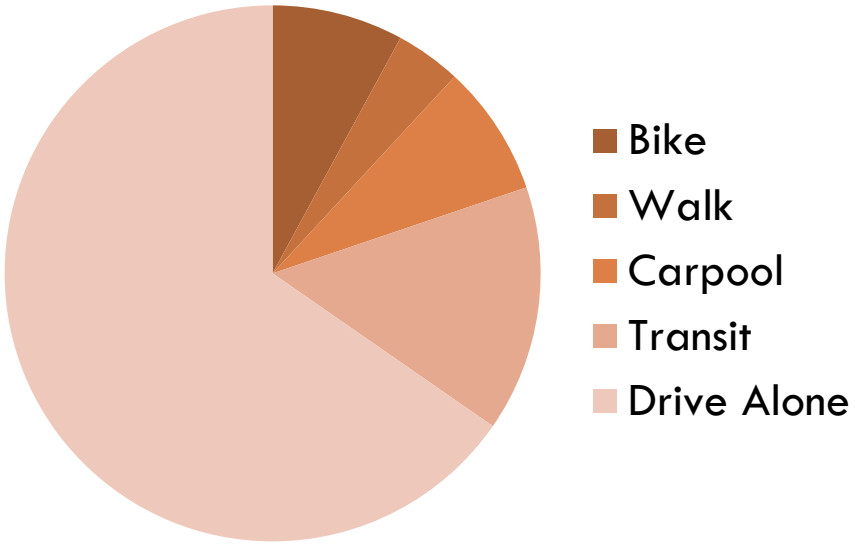
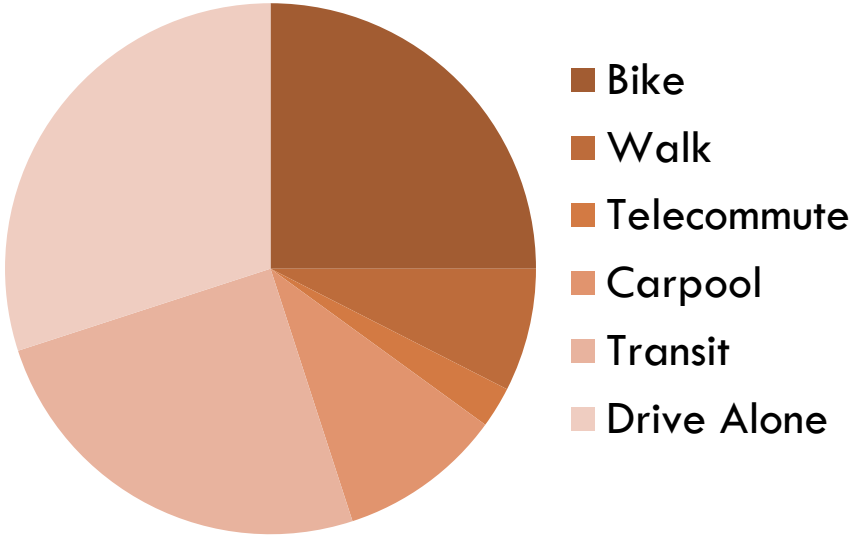
Commute Mode Share for Portland

Reduce per capita daily vehicle-miles traveled (VMT) by 30 % from 2008 levels.

2009



2030



Portland Climate Action Plan, 2009

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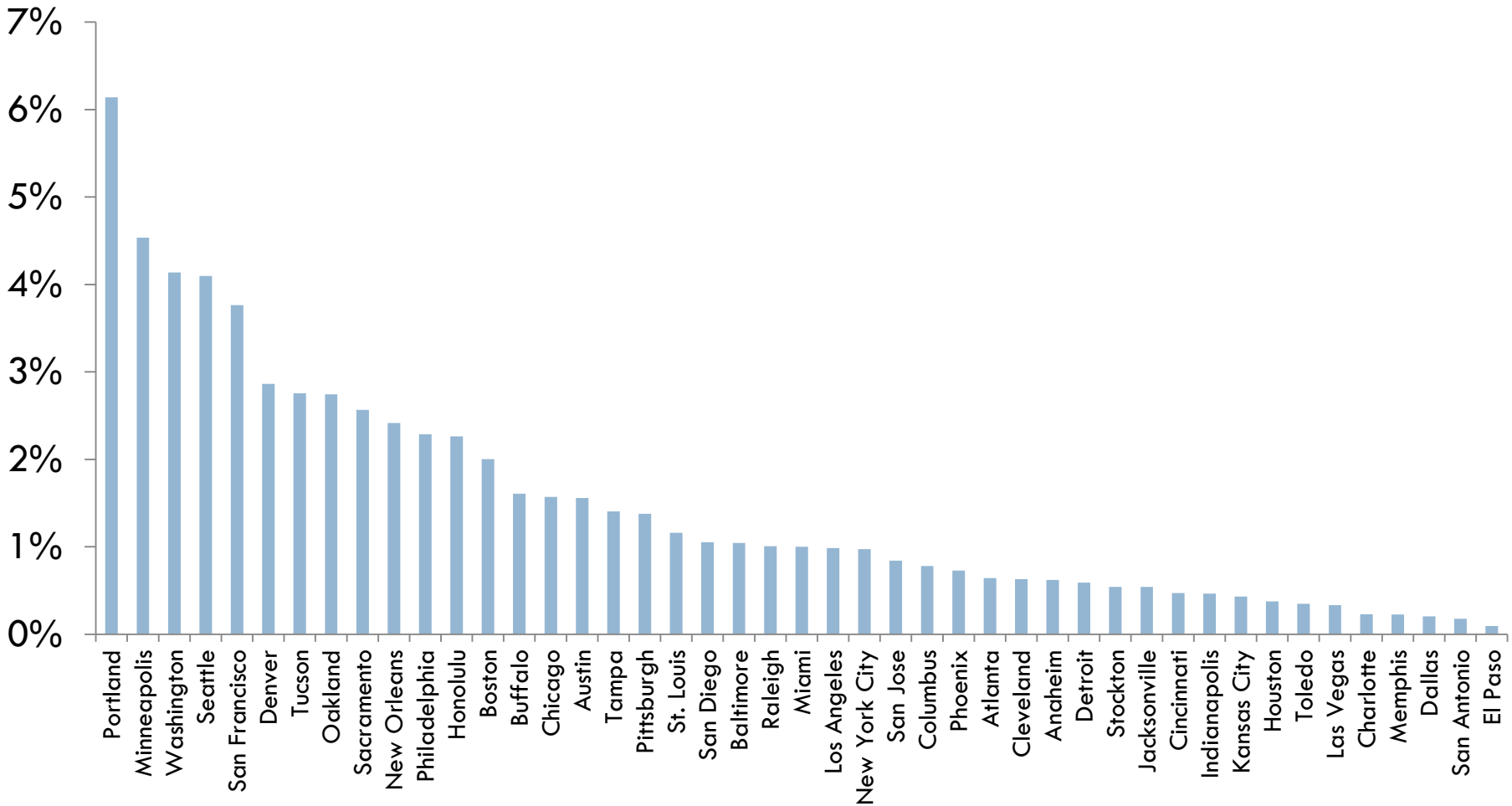
Large US Cities Ranked by % Bicycle Commuting



Source: US Census Bureau, 2012 American Community Survey

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Factors why people don't bike

- Safety
- Lack of infrastructure
- Weather
- Inconvenience
- Logistic issues
- Lack of fitness
- Lack of time
- Being tired
- Too much effort

Shifting the four types of cyclists

4% Strong & Fearless

9% Enthused & Confident

56% Interested but Concerned

31% No Way, No How

Geller, 2006 and Dill & McNeil, 2012

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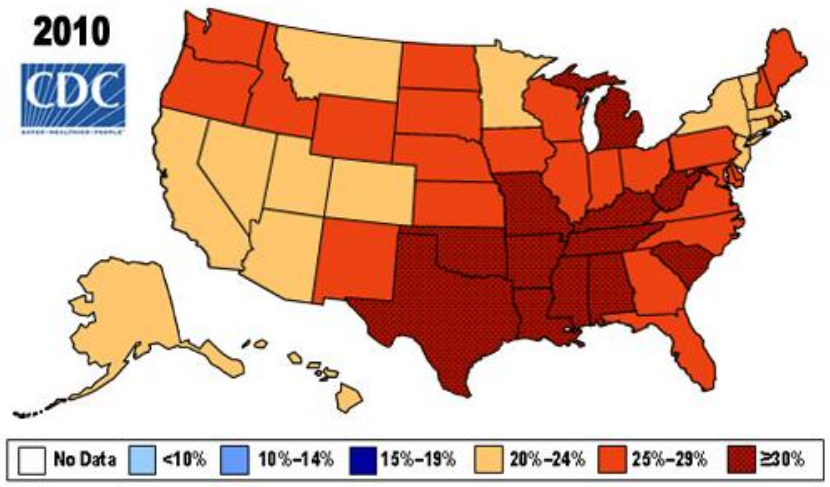
People that are older

People who live in areas that are hilly

People who commute distances greater than 5 miles



People that have a physical limitation that makes cycling difficult

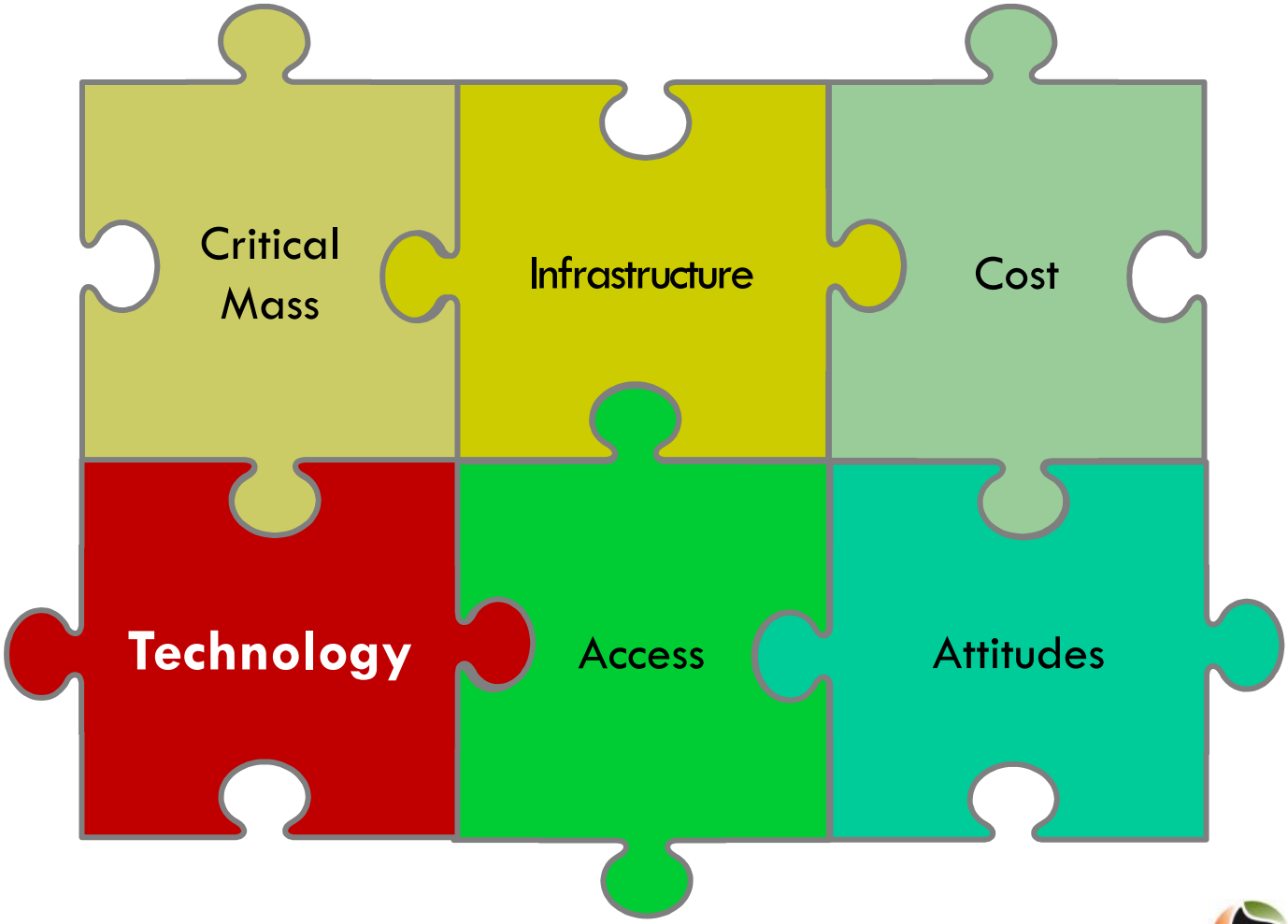
Woman tend to bike less that men. Women make up approx. 25% of all bike trips in the US.

People don’t always feel safe biking in traffic

People who don’t want to sweat or wear special clothes to commute

People who need to carry or haul items or people

What are the critical pieces to increase cycling?



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WHAT IS AN E-BIKE?

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What is an electric bike?

Come in all shapes and sizes

Different types of the e-bikes

Throttle

Pedelec

Powered bicycle (PB) versus Powered-assisted bicycle (PAB)

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Not considered “e-bikes”

Moped

Scooter

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Definition of an E-bike

- The Consumer Product Safety Act regulates the use of low-speed electric bicycles to "two-or three-wheeled vehicle with fully operable pedals and an electric motor of **less than 750 watts** (1 horse power), whose maximum speed on a paved level surface, when powered solely by such a motor while ridden by an operator who weighs 170 pounds, is **less than 20 mph**" Sec. 38 [15 U.S.C. § 2085]

- Oregon - ORS 801.258 "Has a power output of not more than **1,000 watts**" but ORS 807.020(15) "A person may operate an electric assisted bicycle without a driver license or driver permit if the person is **16 years** of age or older."

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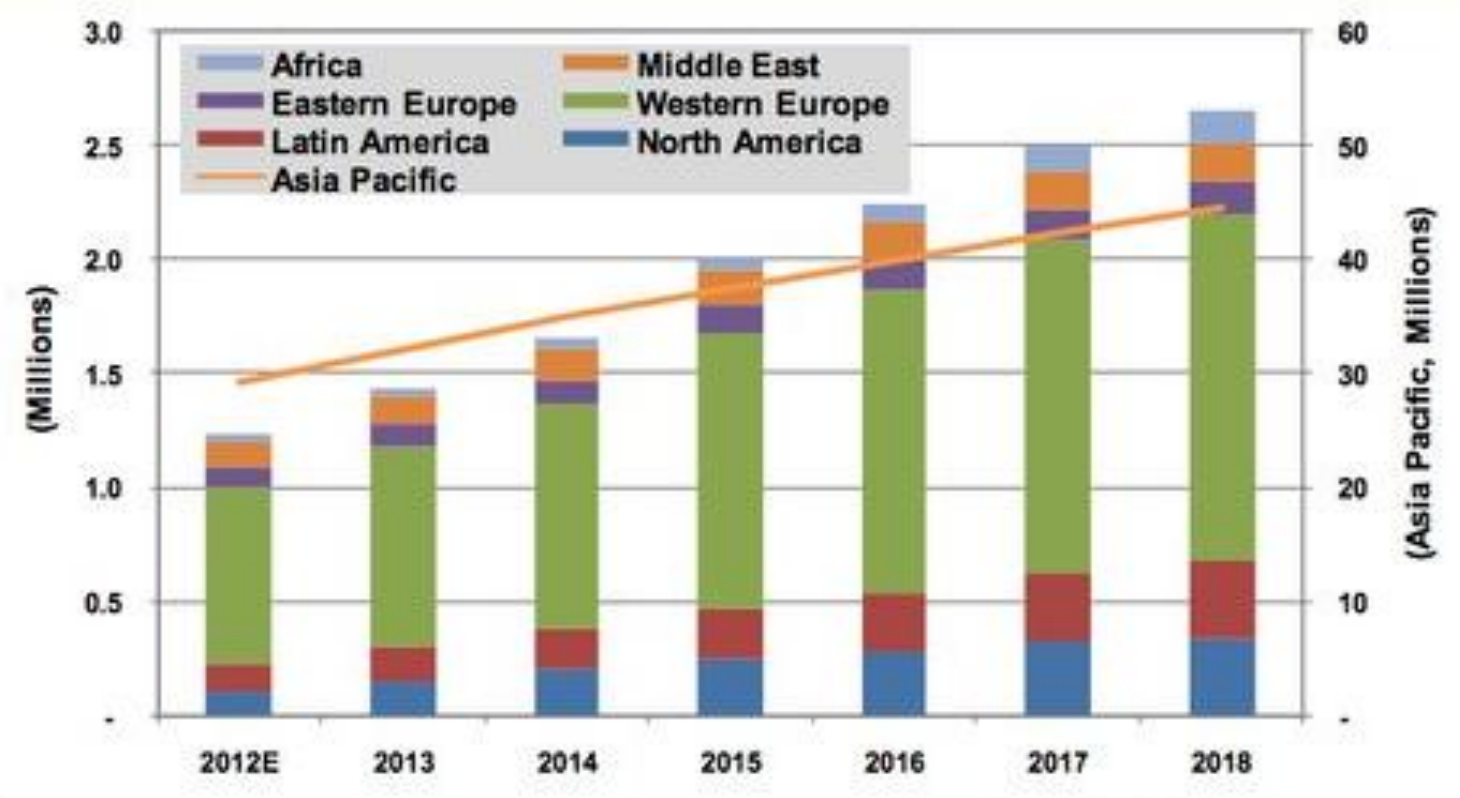
International Definitions Compared

Region	Power Limit	Top Speed	PB allowed	PAB allowed	Other
US	750W	20 mph	Yes	Yes	Has operating pedals
Canada	500W	20 mph	Yes	Yes	Has operating pedals, <265 lbs.
EU	250W	15.5 mph	No	Yes	Motor operates during pedaling only
China	No limit	12.4 mph	Yes	Yes	Has operating pedals, < 88 lbs.
Rest of Asia	250W	15 mph	No	Yes	Has operating pedals
Australia	250W	Not specified	Yes	Yes	Has operating pedals

Market for E-bikes

Electric Bicycle Sales by Region, World Markets: 2012-2018



Source: Navigant/Pike Research

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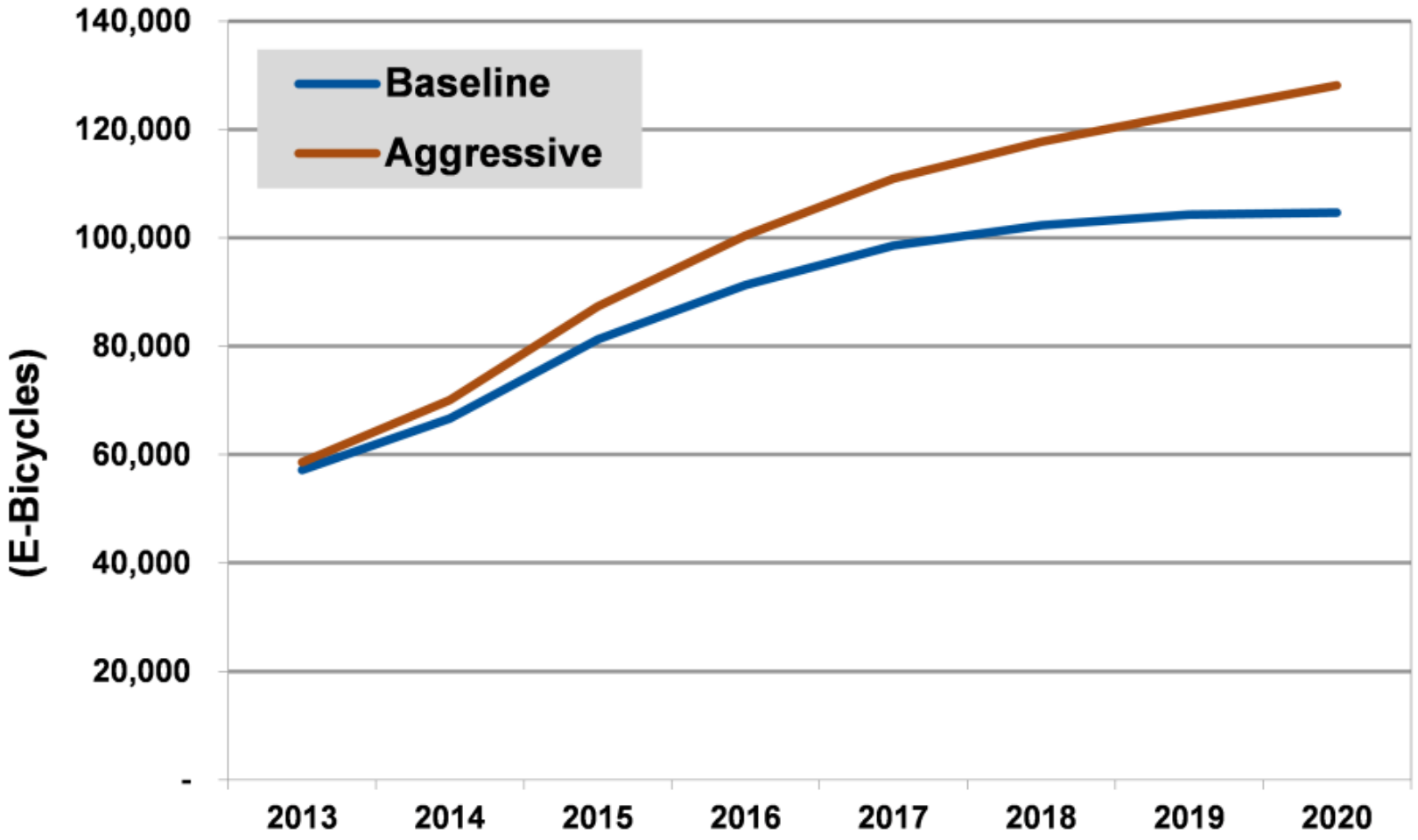
Projected US Growth



Source: Navigant/Pike Research

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U.S. E-BIKE USER SURVEY

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What Is Our Research Question?

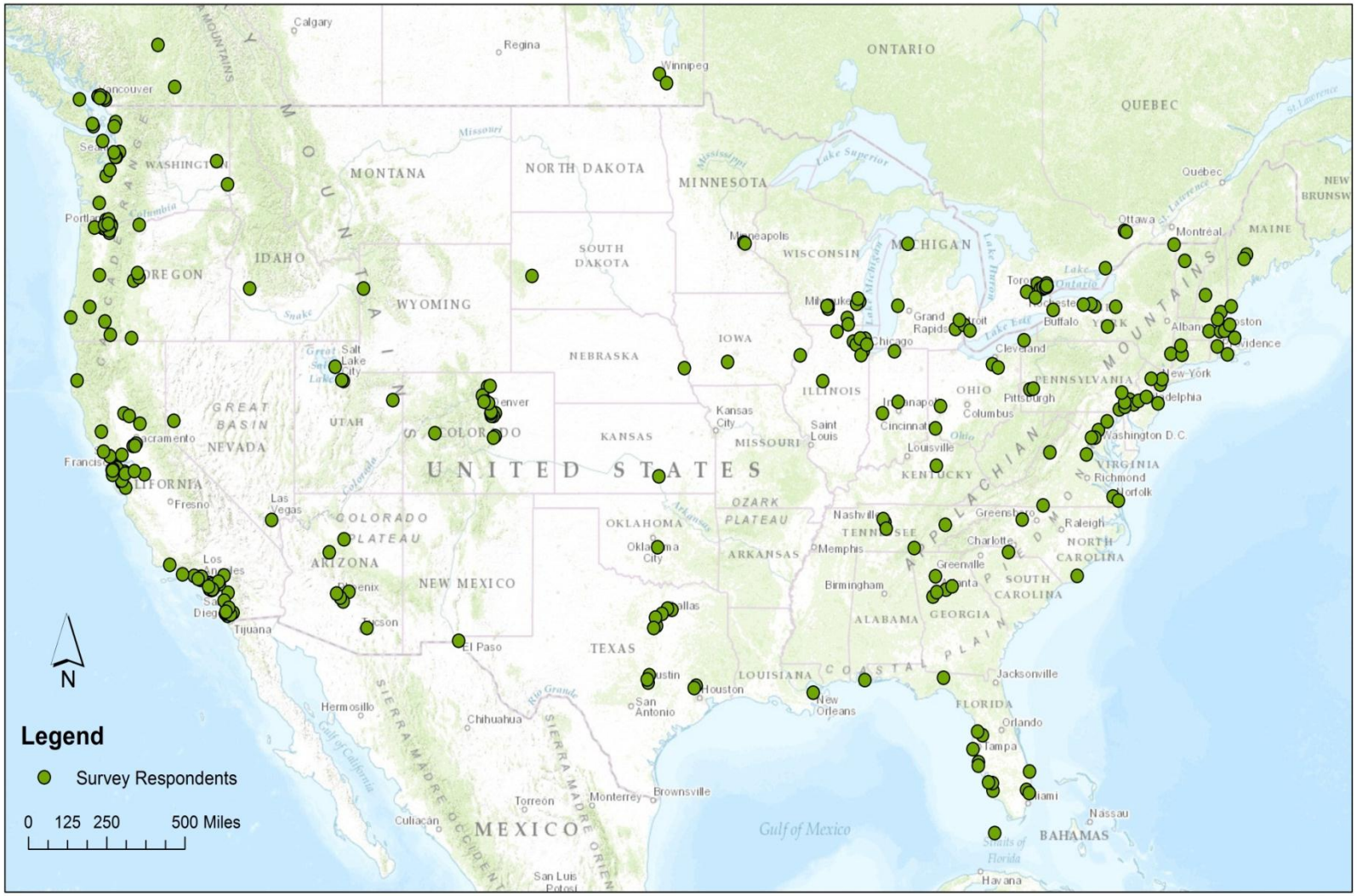
Will e-bikes…

- Get more people to bike, and
- Get people to bike more often.

Survey Methodology

- Adapted a survey instrument from the Institute of Transport Studies at Monash University
- The survey was distributed through e-bike blogs & forums, Facebook pages, Twitter accounts, e-mails to manufacturers and retailers, and via postcards to retailers in the Portland region.
- March 7 – July 1, 2013
- 553 e-bike owners responded to the survey

Geography of survey respondents



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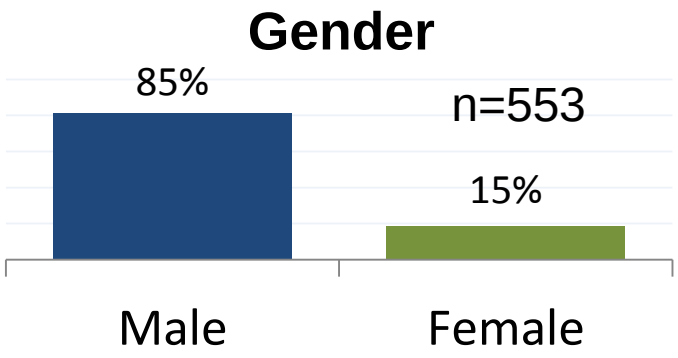
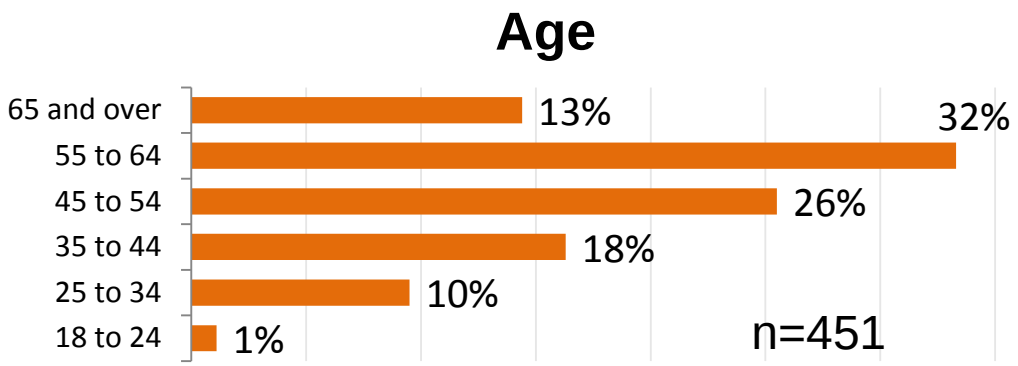
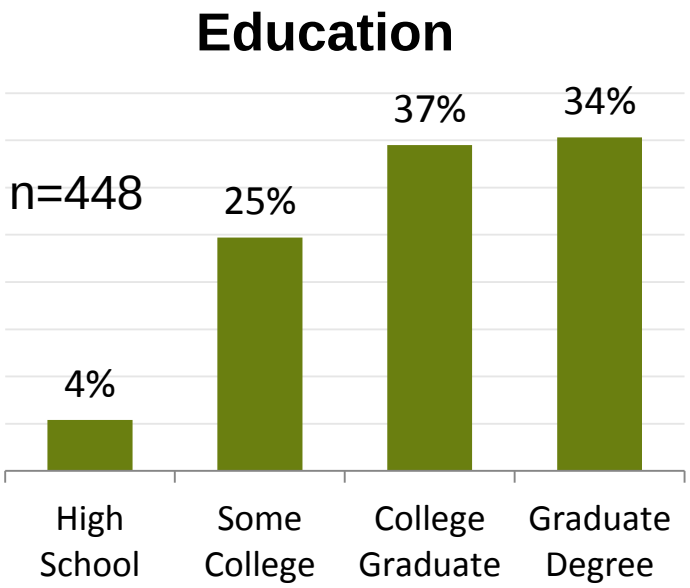
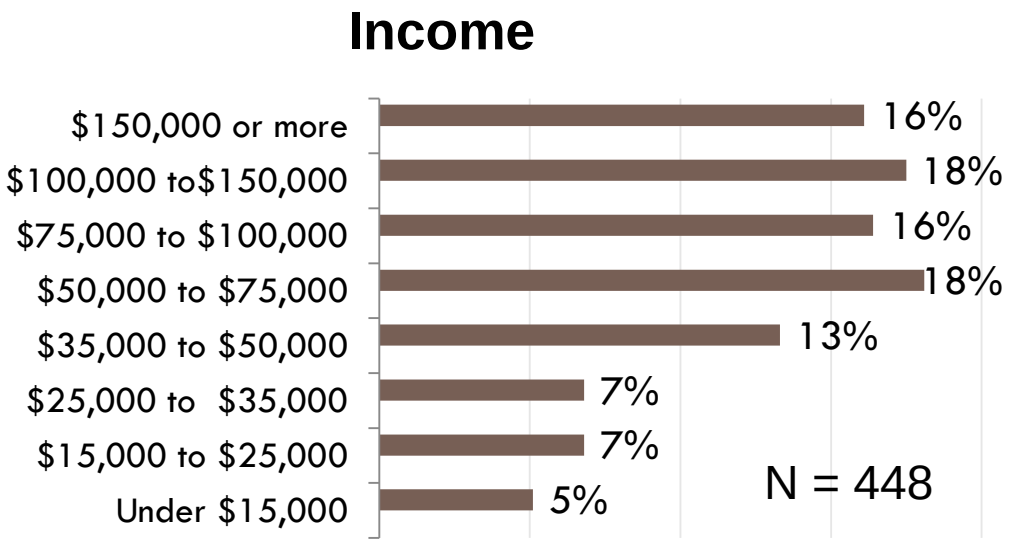
Demographics









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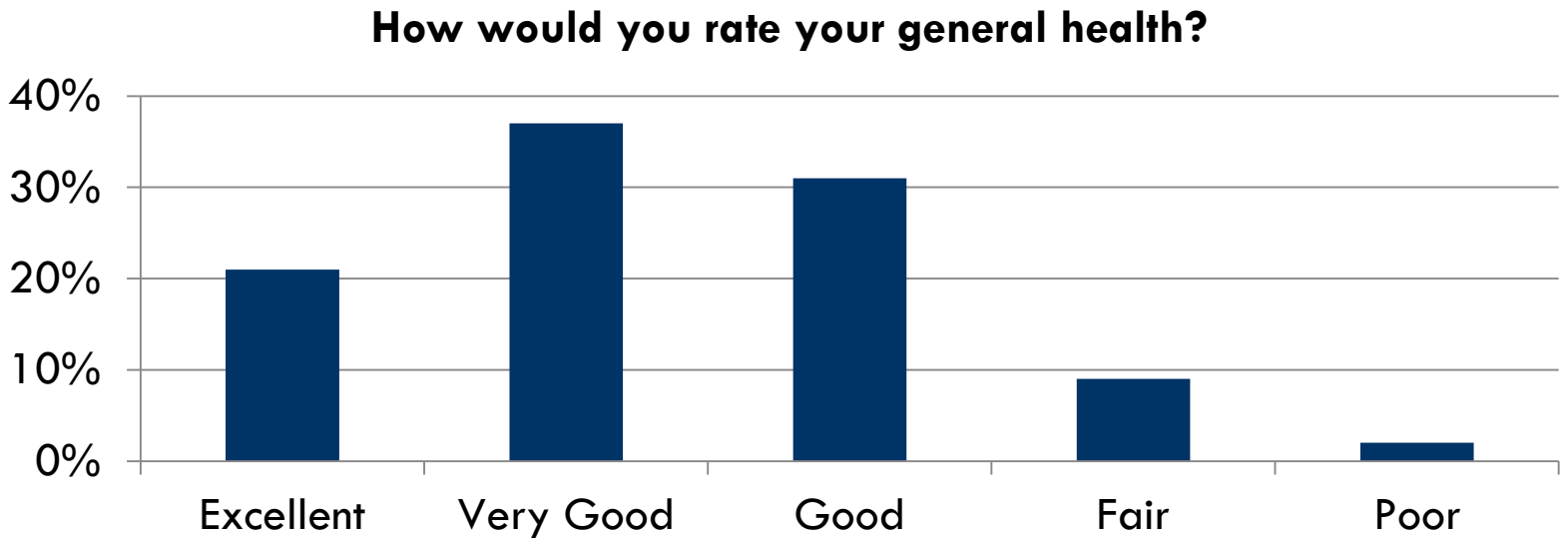
Demographic summary

- 90% White, 5% Asian, 5% other (n=428)
- 90% have access to a motor vehicle, 7% no vehicle
- 30% indicated that they have a physical condition that makes riding a standard bike difficult (n=450)



n=449

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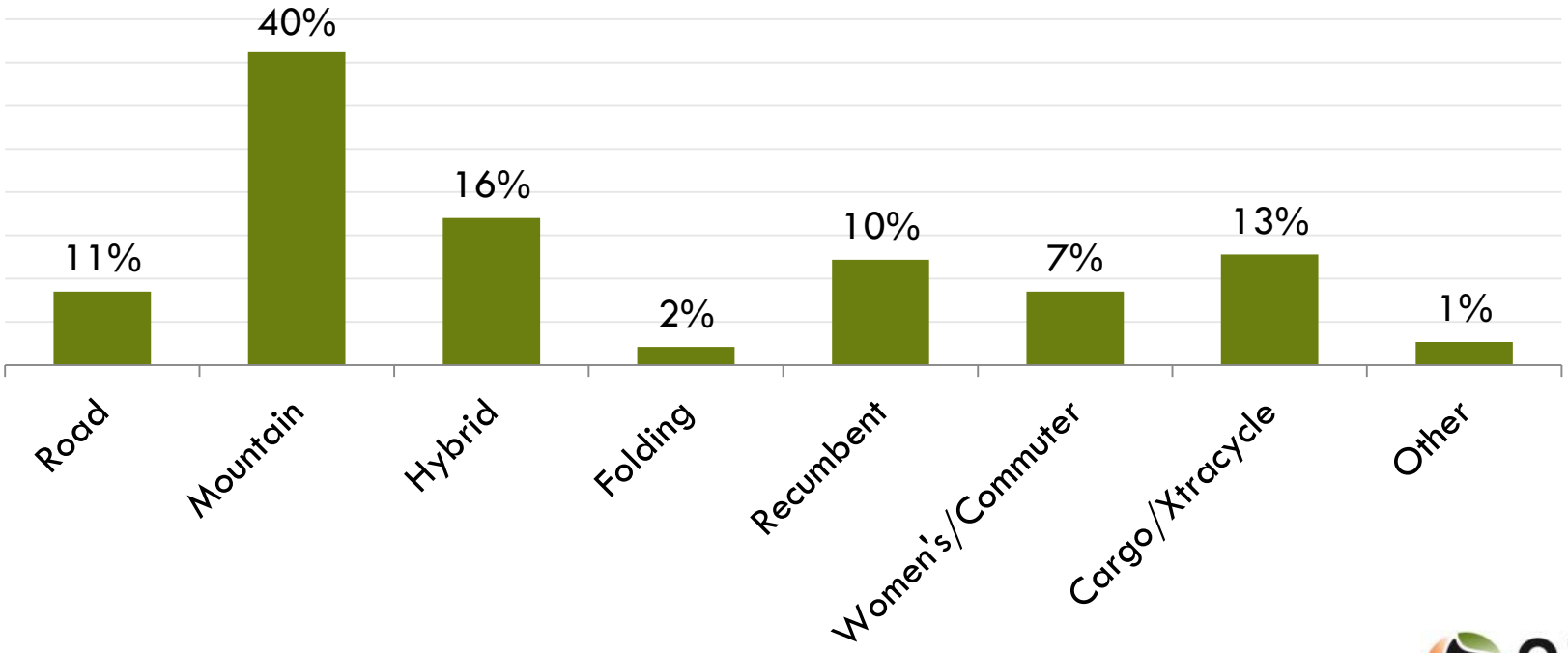
Purchase Decisions

48% purchased an e-bike,
while 52% converted a standard bike to electric-assist.

What type of bike did you convert?



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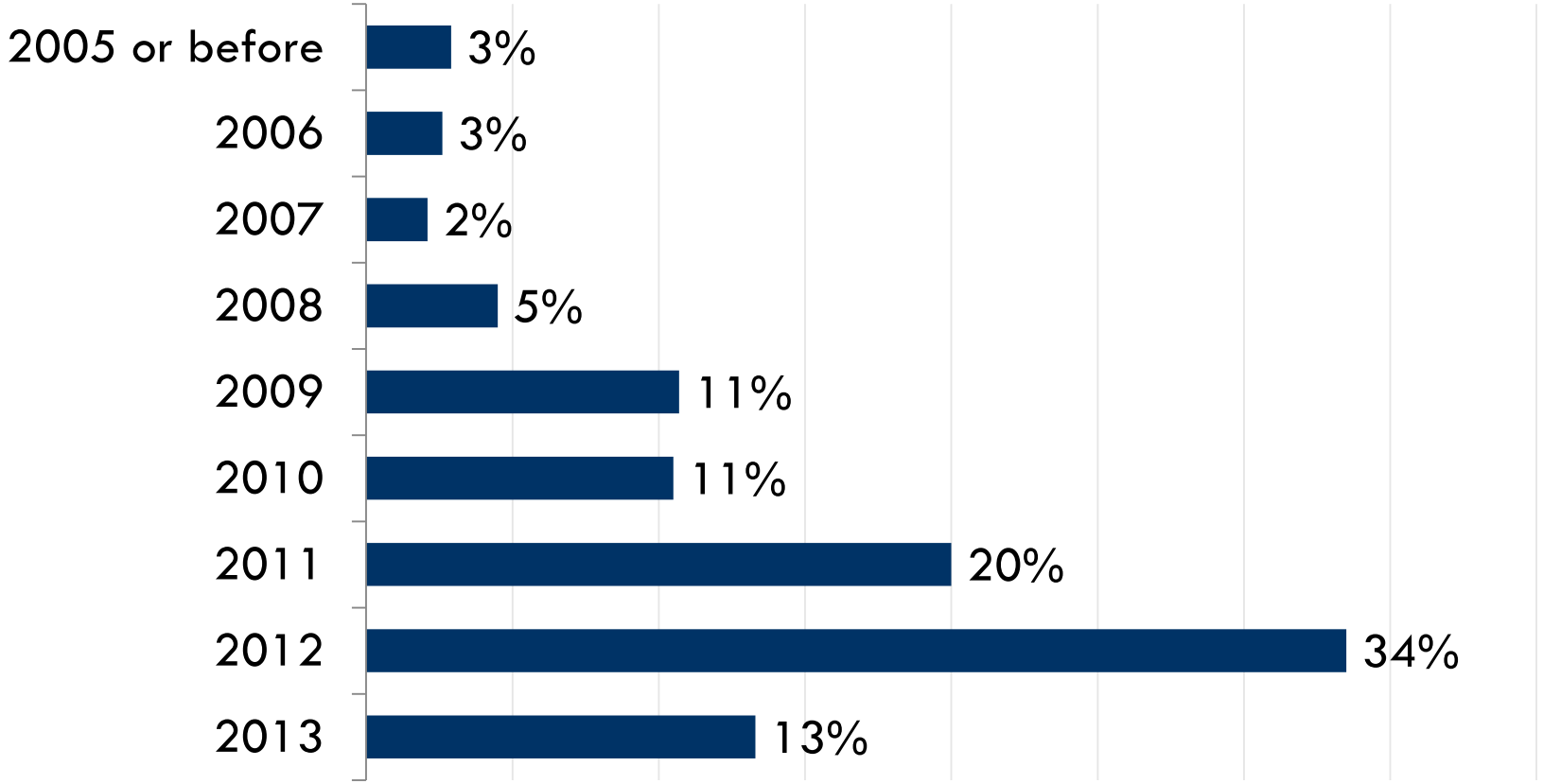
In which year did you purchase your electric bike or conversion kit?



n=421

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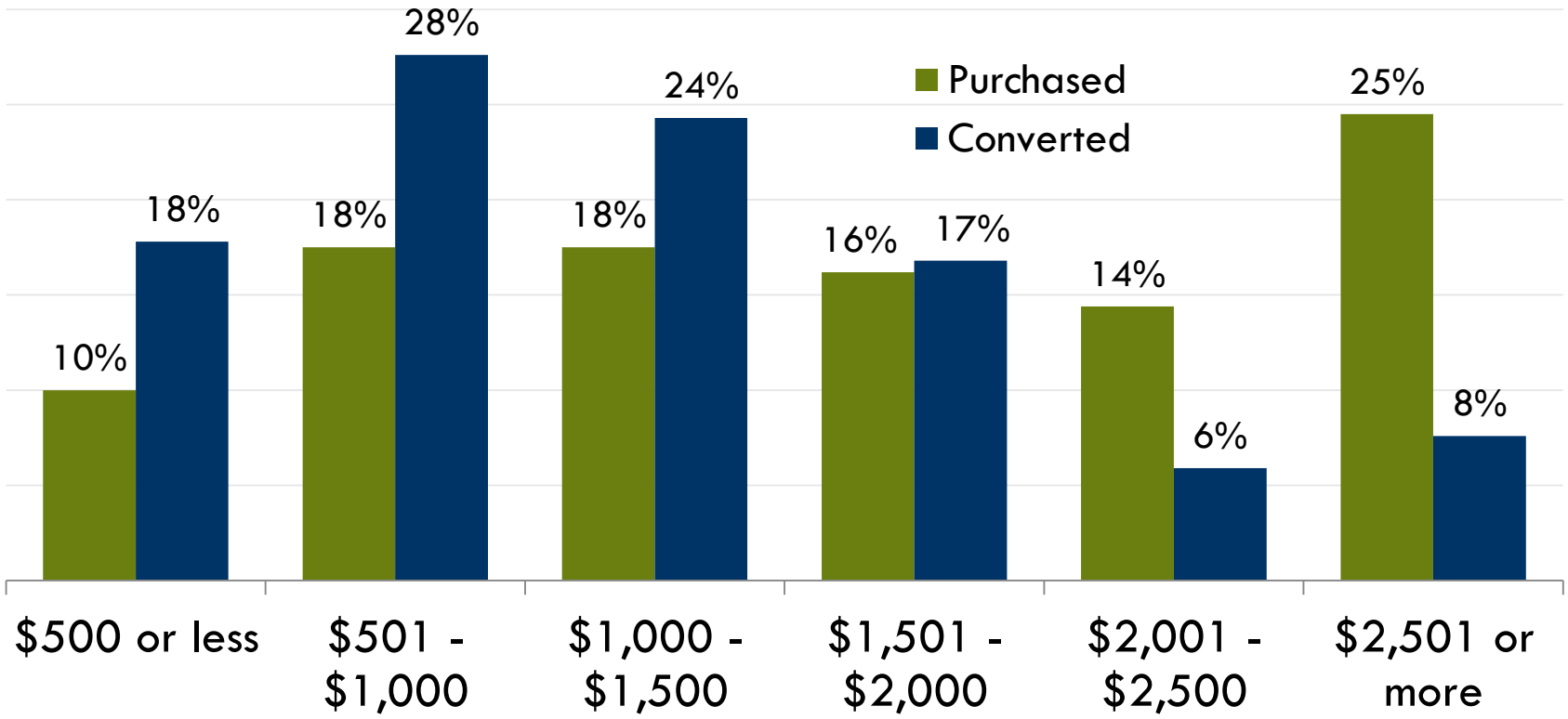
How much did your electric bike or conversion kit cost to purchase?



n=414

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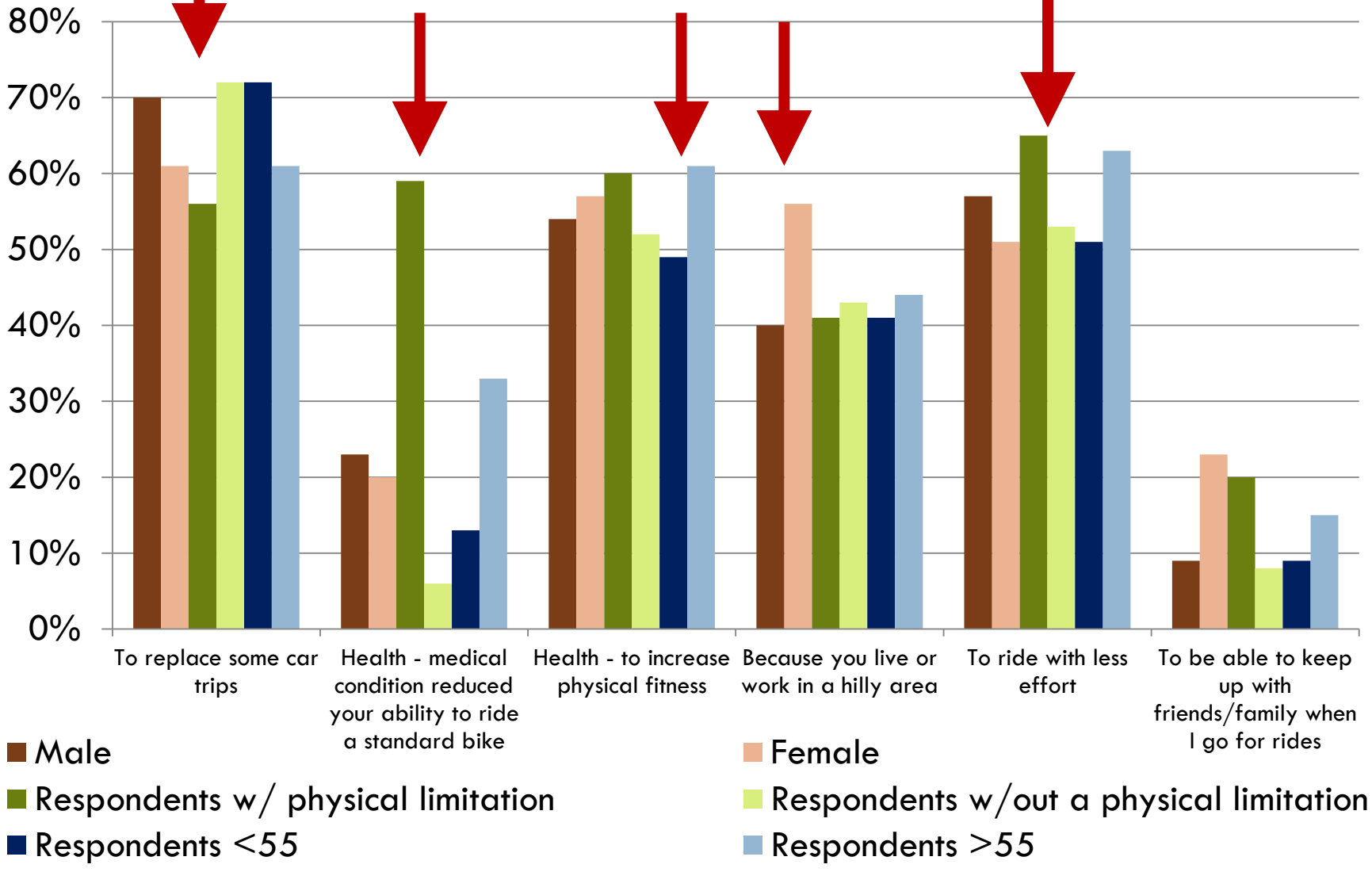
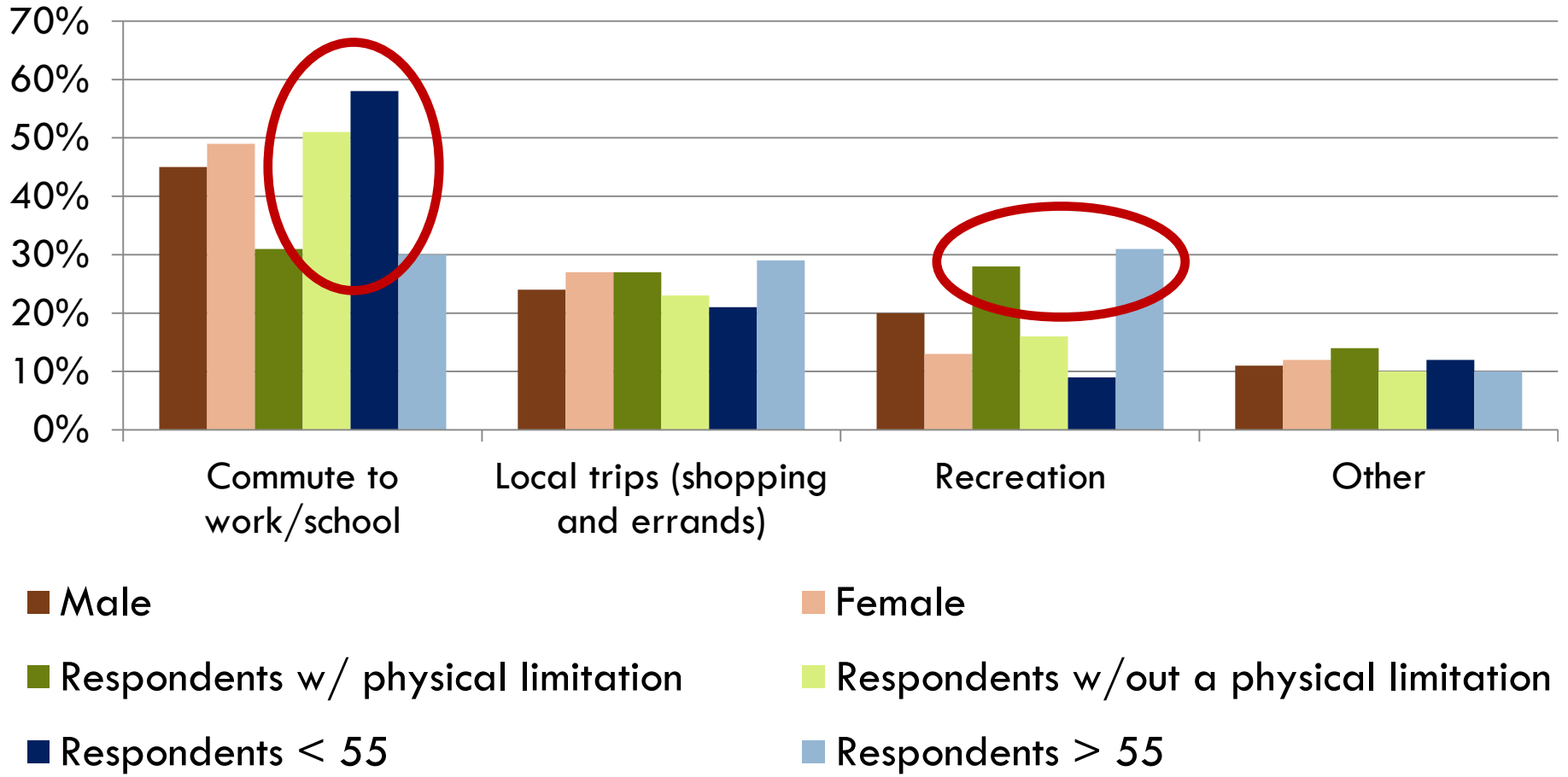
What were the main reasons you bought an electric bike, or converted a standard bicycle?



What is the main reason that you use your electric bike (purpose of trips)?



"I have bad knees(I'm retired, 68 years old). If I pedal a bike my range is limited by pain to about 5 to 6 miles. The e-bikes has a range per charge of 30 to 35 miles." – Survey Respondent

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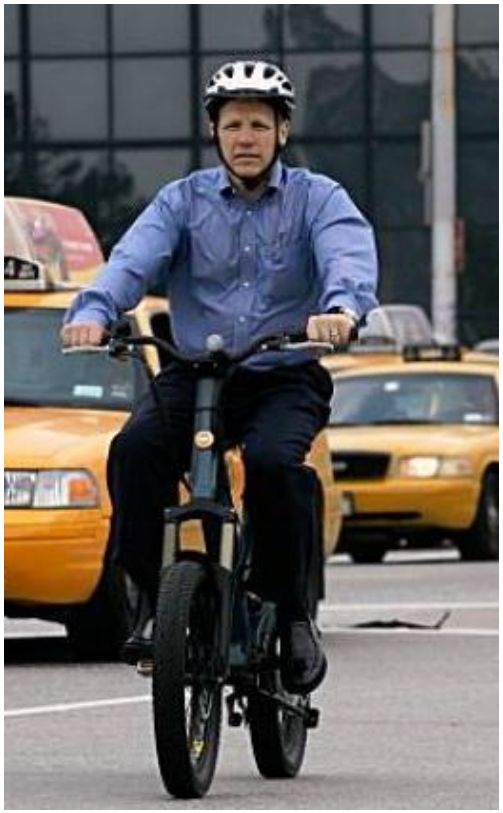
Bike Use

- 94% indicated they had rode a standard bike as an adult
- 55% rode their standard bike weekly or daily prior to e-bike purchase --this went up to 93% after purchase
- Of the 6% that hadn't rode a bike as an adult, of those 89% ride their e-bike daily or weekly
- Over 90% use their e-bikes weekly or daily



"To replace 95% of car trips and make commuting fun" – Survey Respondent

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Getting around

- 45% indicated that they take a different route on their e-bike than a standard bike
- 35% don't avoid hills on e-bike and 31% will take more direct or higher traffic route on e-bike but 30% say they take lower traffic or less direct route
- Three quarters (73%) ride to different destinations on their e-bikes than they did on a standard bike

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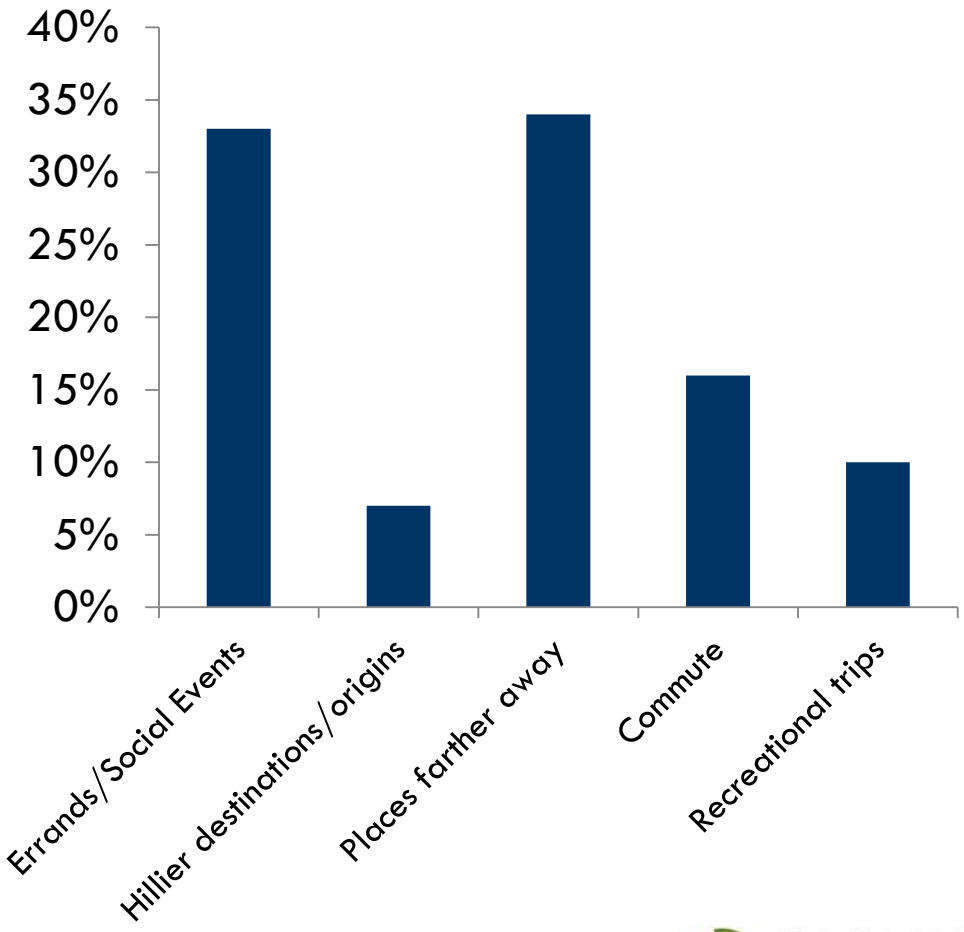
What are the different destinations you ride to on your electric bike?

- 52% of women responded that they take a different route on their electric bike than they did on their standard bike as compared to 42 percent of men.
- 82% of women responded that they ride to different destinations on their electric bike than they did on their standard bike compared to 73 percent of men.



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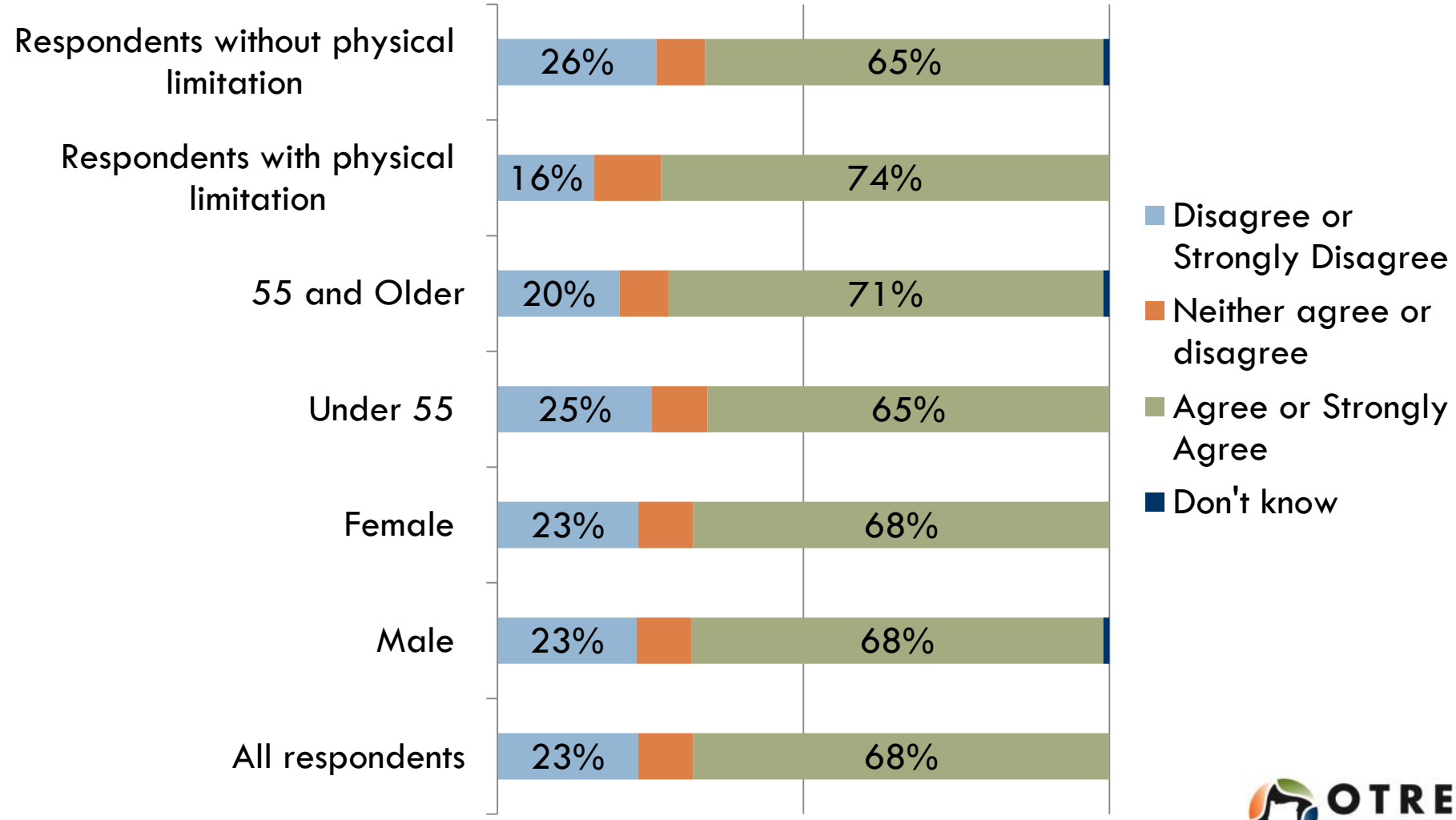
My top speed is higher than when I rode a standard bike



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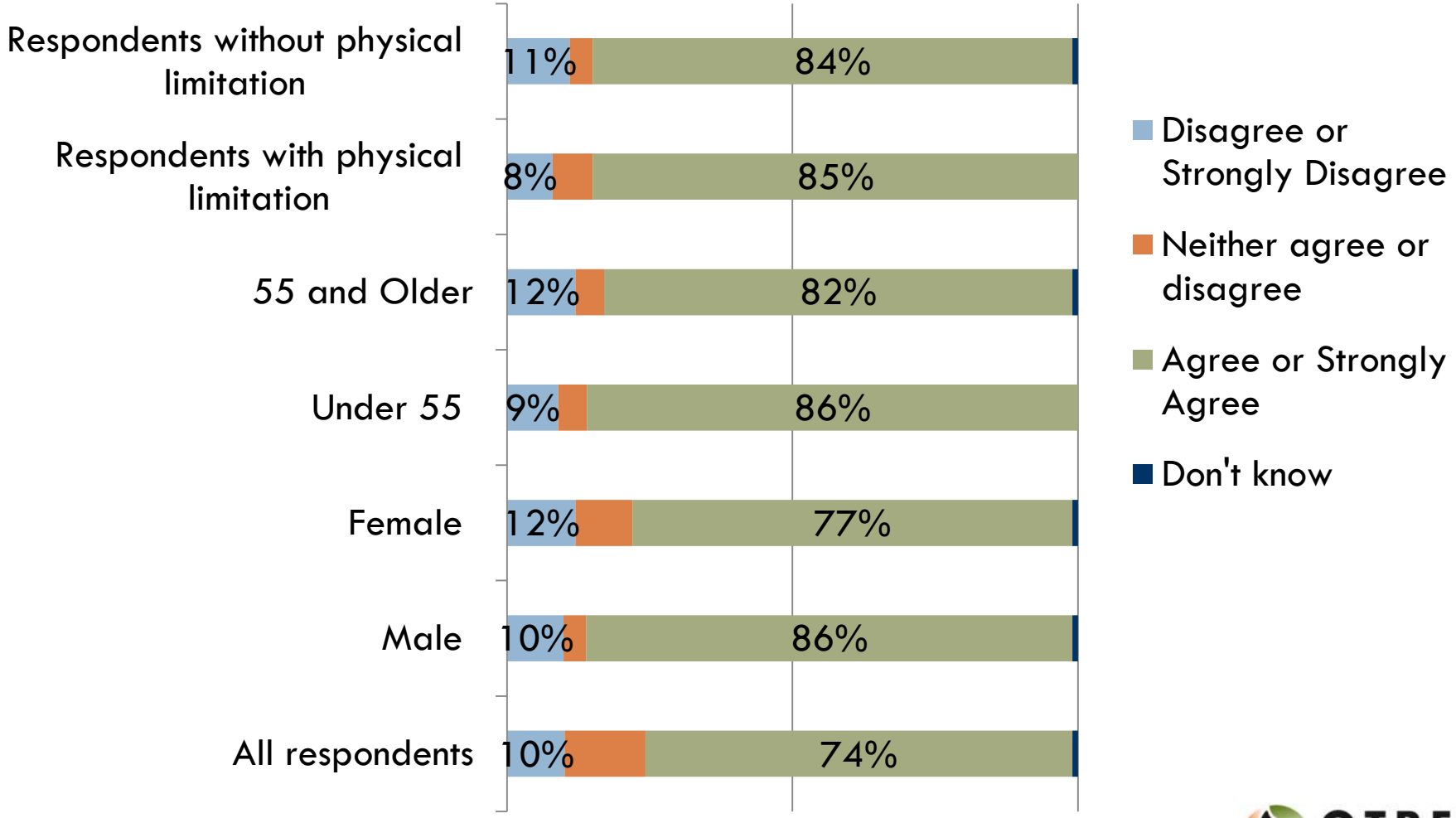
My average speed is higher than when I rode a standard bike



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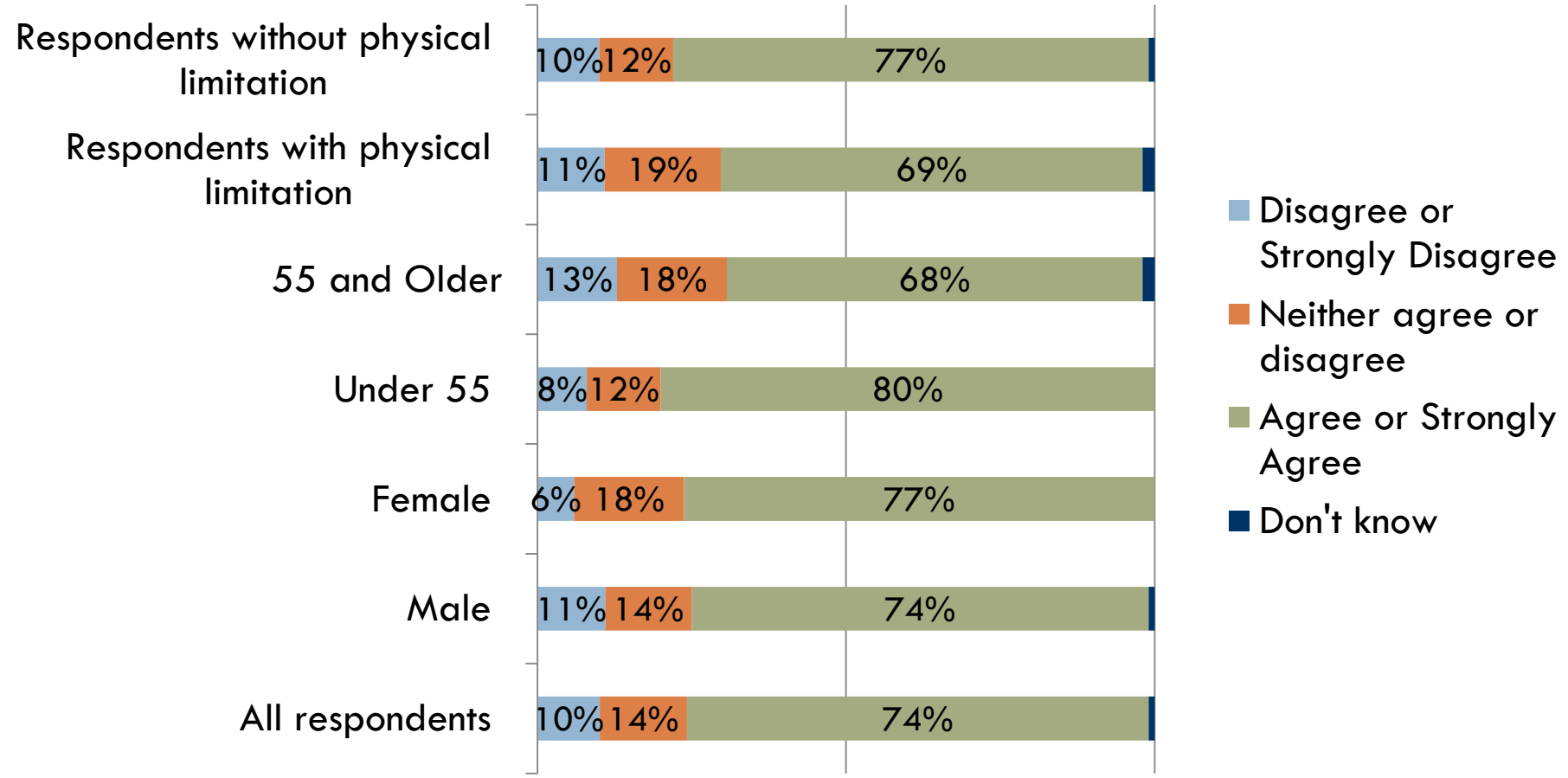
I don't need to shower at the end of the trip



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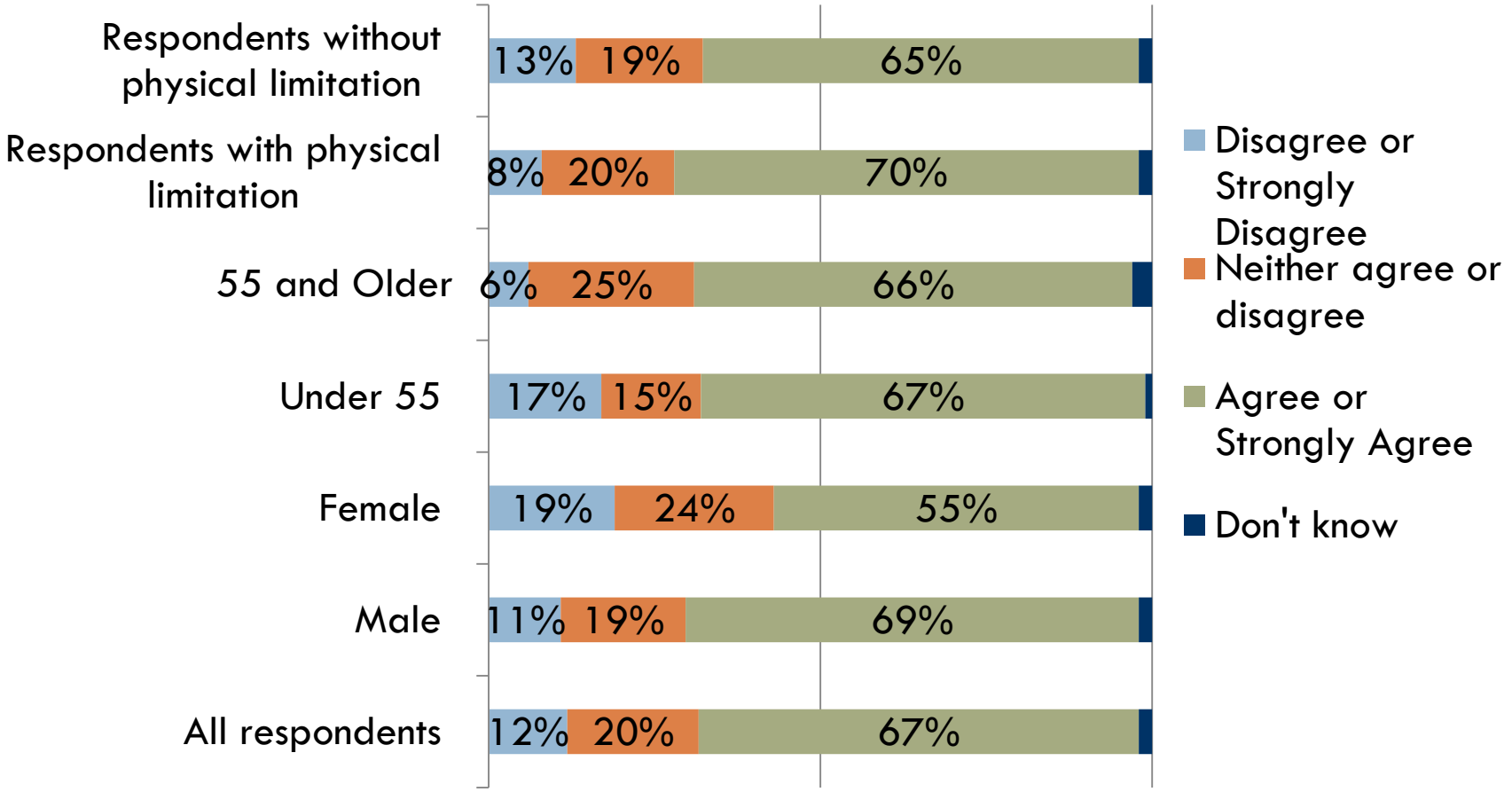
To ride the same trip by standard bike I would need a shower



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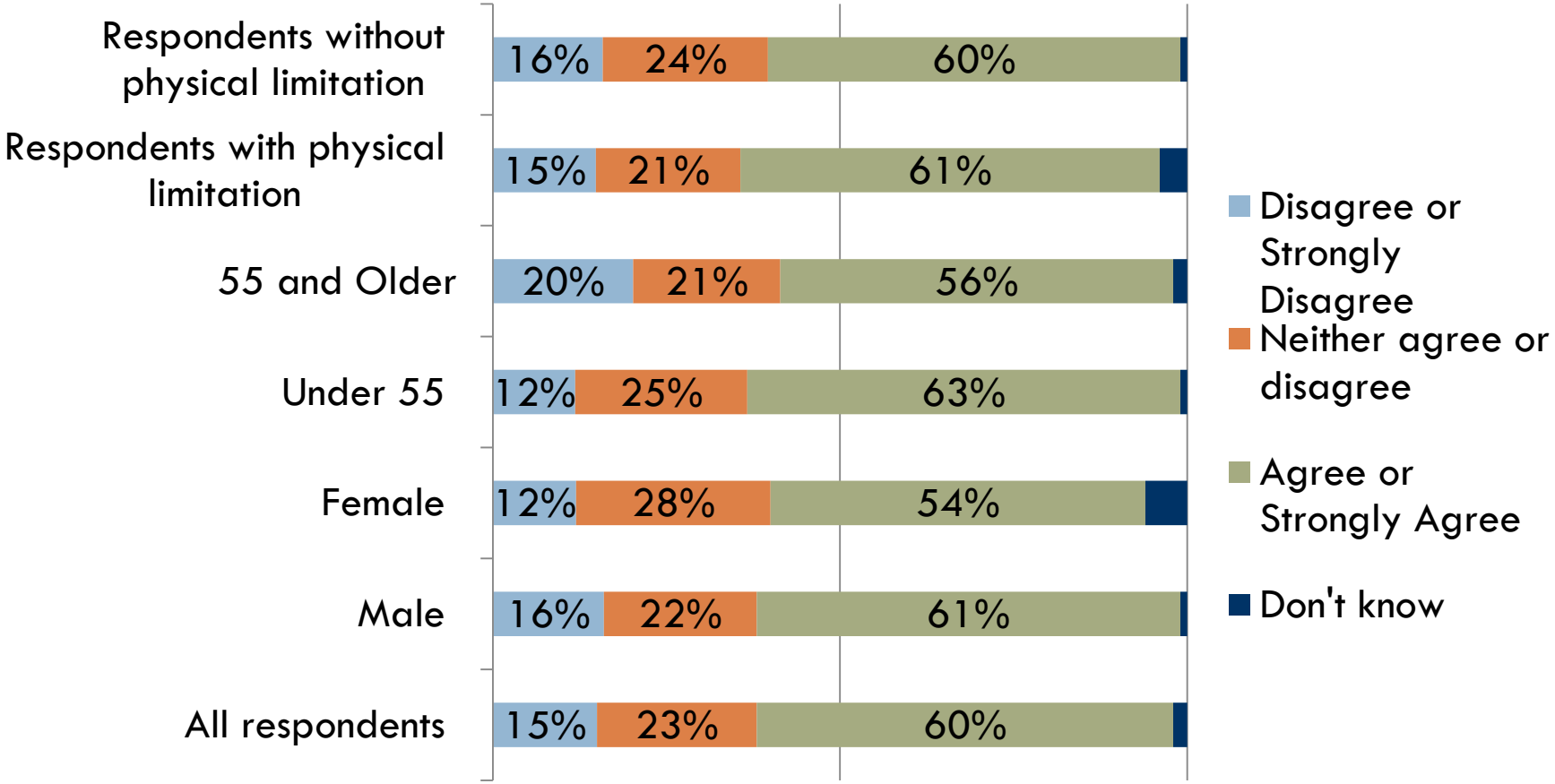
I feel safer on the e-bike than on a standard bike



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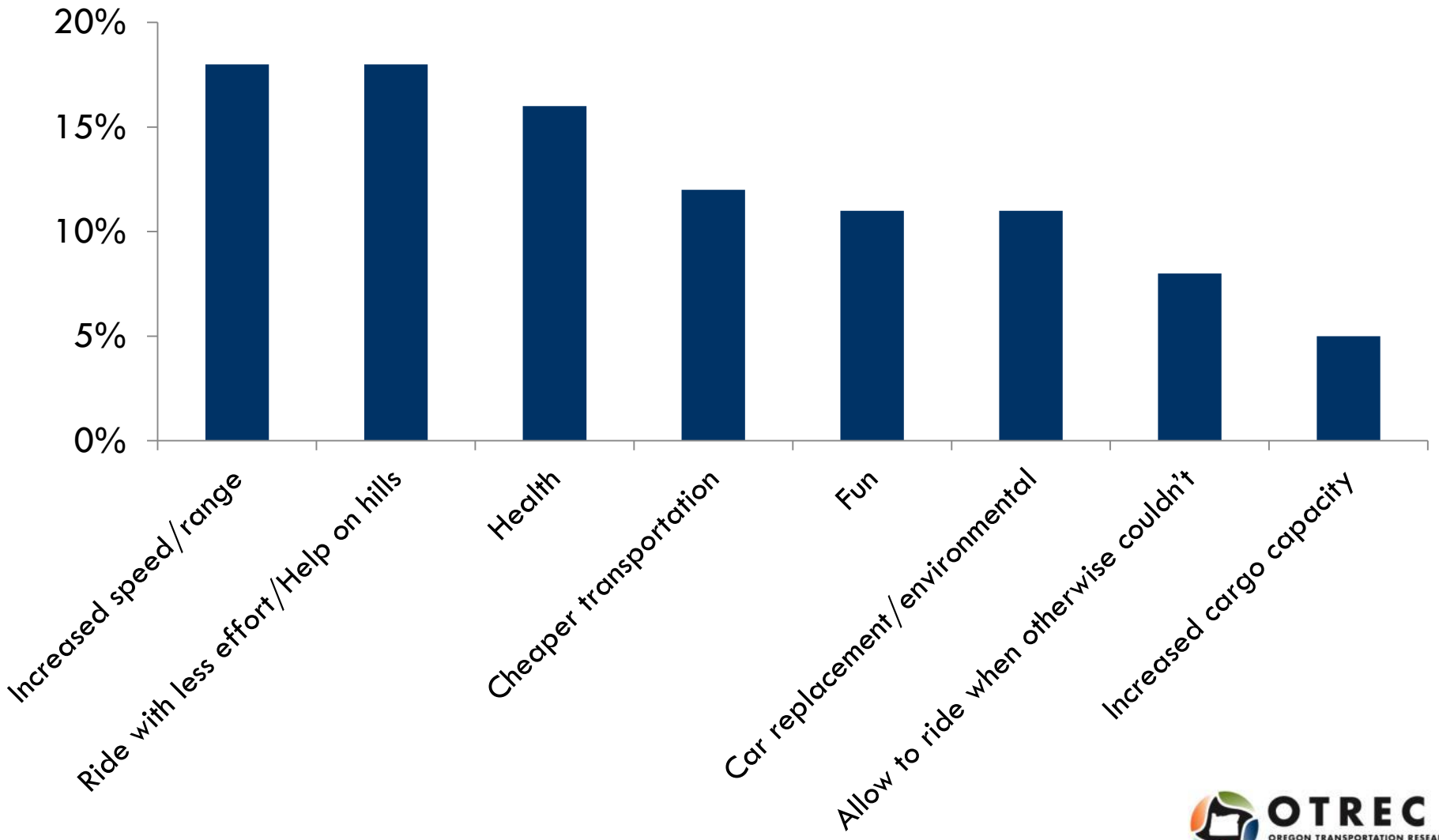
What are the main advantages to riding an e-bike?



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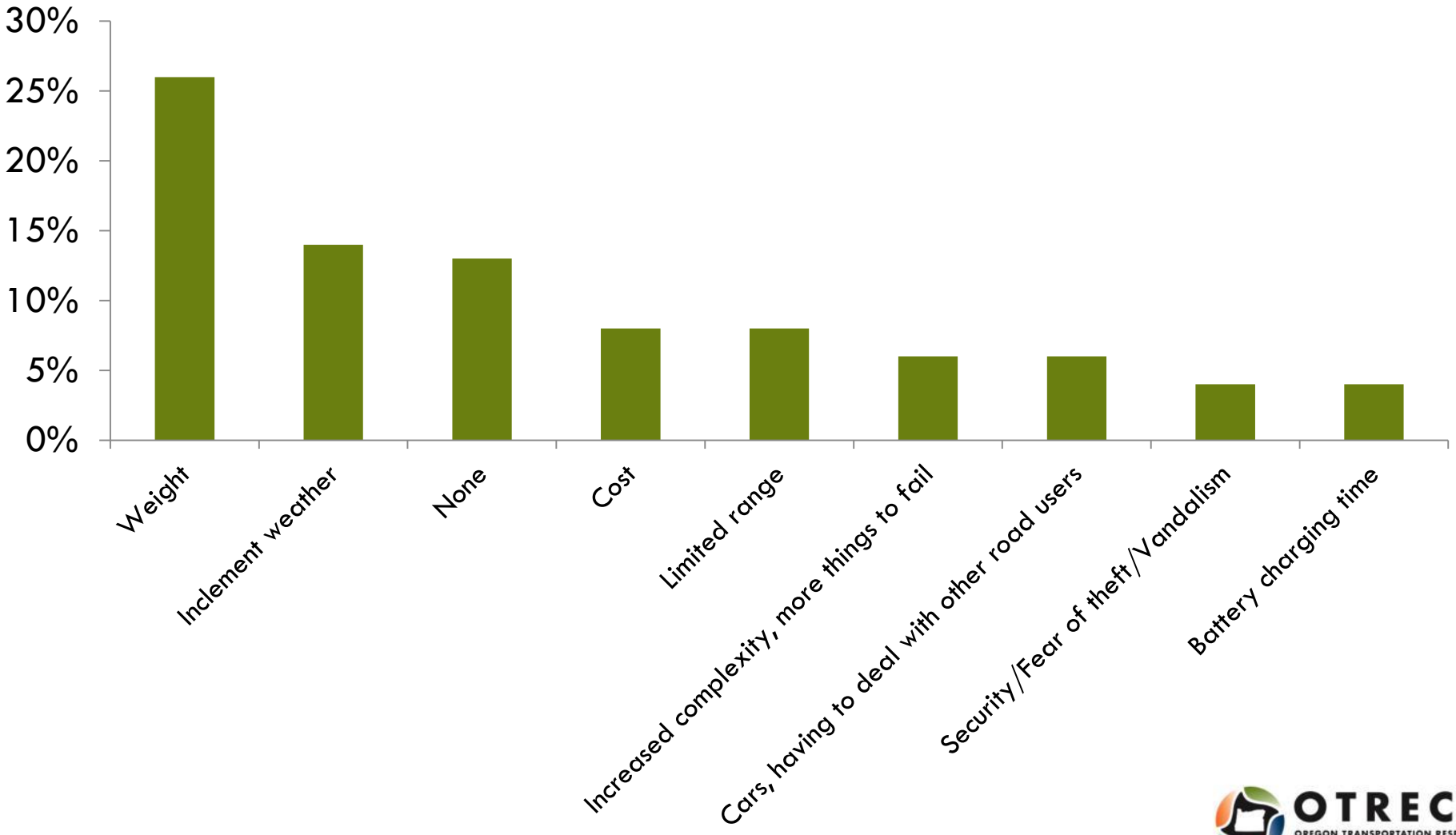
What are the main disadvantage to riding an e-bike?



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Conclusions

- Have a potential to get more people on bikes
  - Older adults
  - People with physical limitations
  - Women (?)

I cannot drive due to epilepsy. I cannot bus due to severe motion sickness. Biking is my only way to work other than getting a ride. Bike commuting maintains my fitness level. I can ride even when I don't feel physically well or am overtired. I get to work faster than it takes when I get a car ride. I love the time outdoors, seeing the city and feeling like part of the bike community.

Conclusions

- Encourages more people to bike more often & to more distant locations
  - Commuters
    - Less sweaty, not strenuous
    - Not avoiding trips or locations
    - Enjoy biking!
  - Reported increase in bike usage

I use the e-bike primarily as a substitute for the car where I would have otherwise would have driven a car.

I can carry my son and a week's worth of groceries.

I can ride to and from work without needing to shower at my destination.

Limitations

- No response rate
- Method of delivery
- Online survey and self reporting use
- Not random and potential basis

Additional Research Needs

- Comparative analysis with different regions (e.g., Australia)
- Infrastructure planning
- More evaluations of existing users
- Studies of potential e-bike users, especially women and older adults
- Safety
- Impacts on physical activity
- Interactions with other road users (perceptions & attitudes)
- Policy and legal

Kaiser Permanente E-bike Project

- Currie iZip E3 Compact
  - Top Speed: 18 mph
  - Range: 15-22 miles
  - Weight: 42 lbs
  - Folding
- Kaiser Employees at 3 campuses (1st/last mile commuting)
- 18 month trail & 180 people

Drive Oregon
Innovation in Electric Mobility

KAISER PERMANENTE®

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