Safety effects of cycle track implementation on cyclist-motor vehicle collisions in Toronto, Canada

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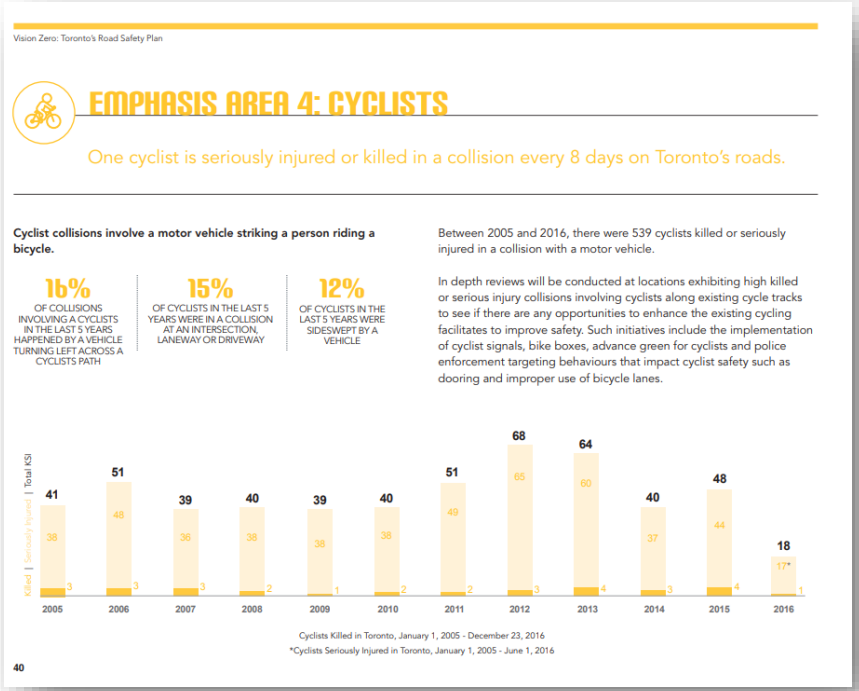
BACKGROUND

Vision Zero Road Safety Plan



Vision Zero: Toronto's Road Safety Plan

EMPHASIS AREA 4: CYCLISTS

One cyclist is seriously injured or killed in a collision every 8 days on Toronto's roads.

Cyclist collisions involve a motor vehicle striking a person riding a bicycle.

16% OF COLLISIONS INVOLVING A CYCLISTS IN THE LAST 5 YEARS HAPPENED BY A VEHICLE TURNING LEFT ACROSS A CYCLISTS PATH

15% OF CYCLISTS IN THE LAST 5 YEARS WERE IN A COLLISION AT AN INTERSECTION, LANEWAY OR DRIVEWAY

12% OF CYCLISTS IN THE LAST 5 YEARS WERE SIDESWEPT BY A VEHICLE

Between 2005 and 2016, there were 539 cyclists killed or seriously injured in a collision with a motor vehicle.

In depth reviews will be conducted at locations exhibiting high killed or serious injury collisions involving cyclists along existing cycle tracks to see if there are any opportunities to enhance the existing cycling facilitates to improve safety. Such initiatives include the implementation of cyclist signals, bike boxes, advance green for cyclists and police enforcement targeting behaviours that impact cyclist safety such as dooring and improper use of bicycle lanes.

Cyclists Killed in Toronto, January 1, 2005 - December 23, 2016
*Cyclists Seriously Injured in Toronto, January 1, 2005 - June 1, 2016

40

- Program aimed to reduce traffic-related deaths and injuries to zero

- 6 emphasis areas:
  - Pedestrians
  - School Children
  - Older Adults
  - **Cyclists**
  - Motorcyclists
  - Aggressive driving and distraction

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Cycling Infrastructure Examples in Toronto

Painted bike lane on Bay St

Google Street View at Bay St. and College St. Toronto, ON

Separated cycle track on Wellesley St West

Google Street View at Wellesley St. W and Yonge St. Toronto, ON

Background

– Literature review by Thomas and Derobertis[1]
  - Few North American studies
  - Limited reporting of “exposure data”

– Few studies examining area-wide effects

1. Thomas B, Derobertis M. *Accident Analysis & Prevention* (2013)

Objectives

To examine the effects of cycle track implementation on cyclist-motor vehicle collisions (CMVC) occurring:

1. On roads *treated* with cycle tracks (local effect)

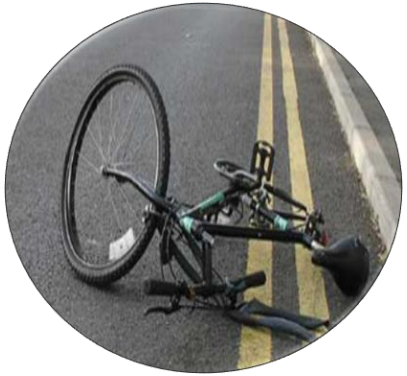
2. On roads *surrounding* cycle tracks (area wide effect)

METHODS

Data Sources

1. City of Toronto and online reports

- Cycle track location, implementation dates (month and year) and cycling volumes



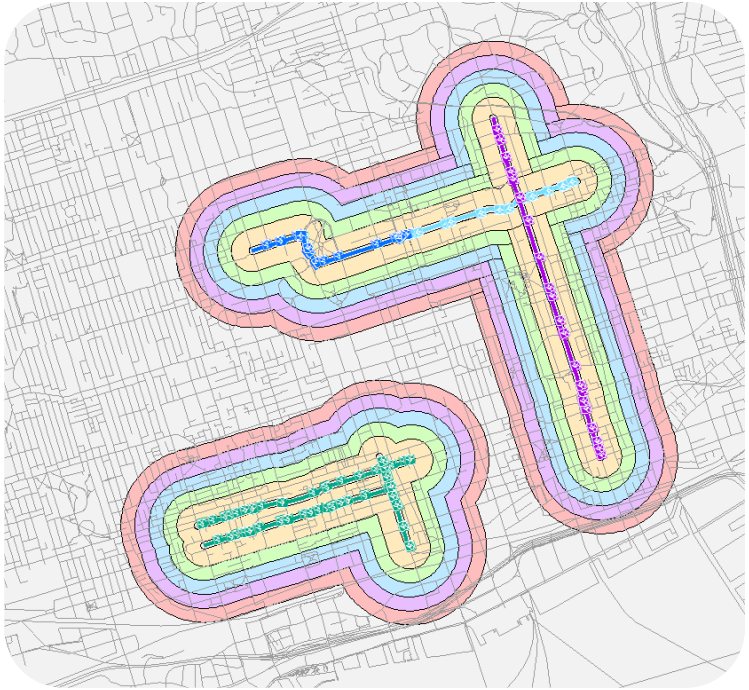
2. Toronto Police Service

- All reported cyclist-motor vehicle collisions from 2000 to 2016

CMVC Inclusion

1. CMVC on cycle tracks within 25 m

2. CVMC on surrounding roads were examined at:
   - 26 – 150 m
   - 151 – 250 m
   - 251 – 350 m
   - 351 – 450 m
   - 451 – 550 m



Statistical Analysis

- Zero-Inflated Poisson Model
  - Based on methods in previous studies[2]
  - Model includes pre-post variable, season, and cycle track
  - Conducted Vuong Test for model fit

2. Bhatia D, Richmond SA, Loo CKJ, Rothman L, Macarthur C, Howard A. *Journal of Transport & Health* (2016)

Statistical Analysis

Objective 1

CMVC on Tracks:

- Crude analysis without cyclist volume
- Adjusted analysis with cyclist volume

Objective 2

CMVC on Surrounding Streets:

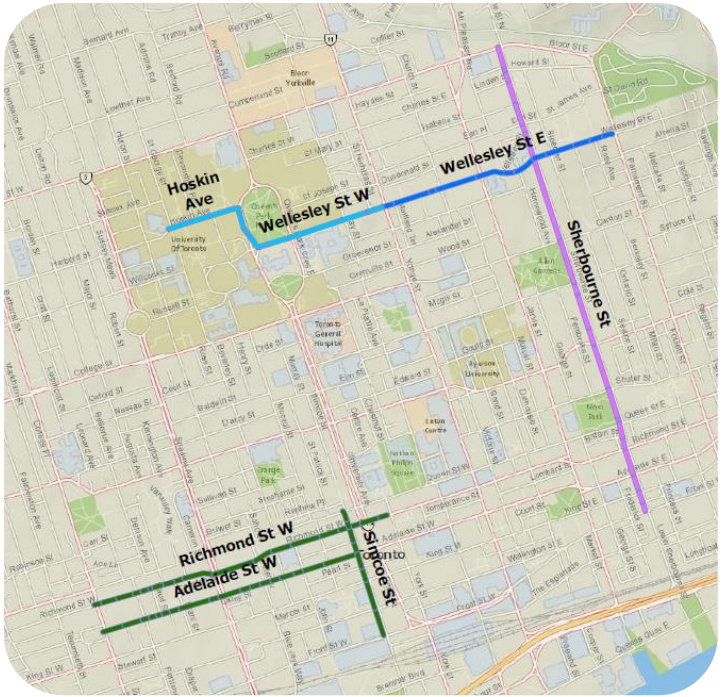
- 5 individual analysis by area
- Combined analysis for 151m – 550m distances

RESULTS

Cycle Tracks

June 2013	Sherbourne St
September 2013	Wellesley St East
June 2014	Richmond-Adelaide-Simcoe
December 2014	Wellesley St West

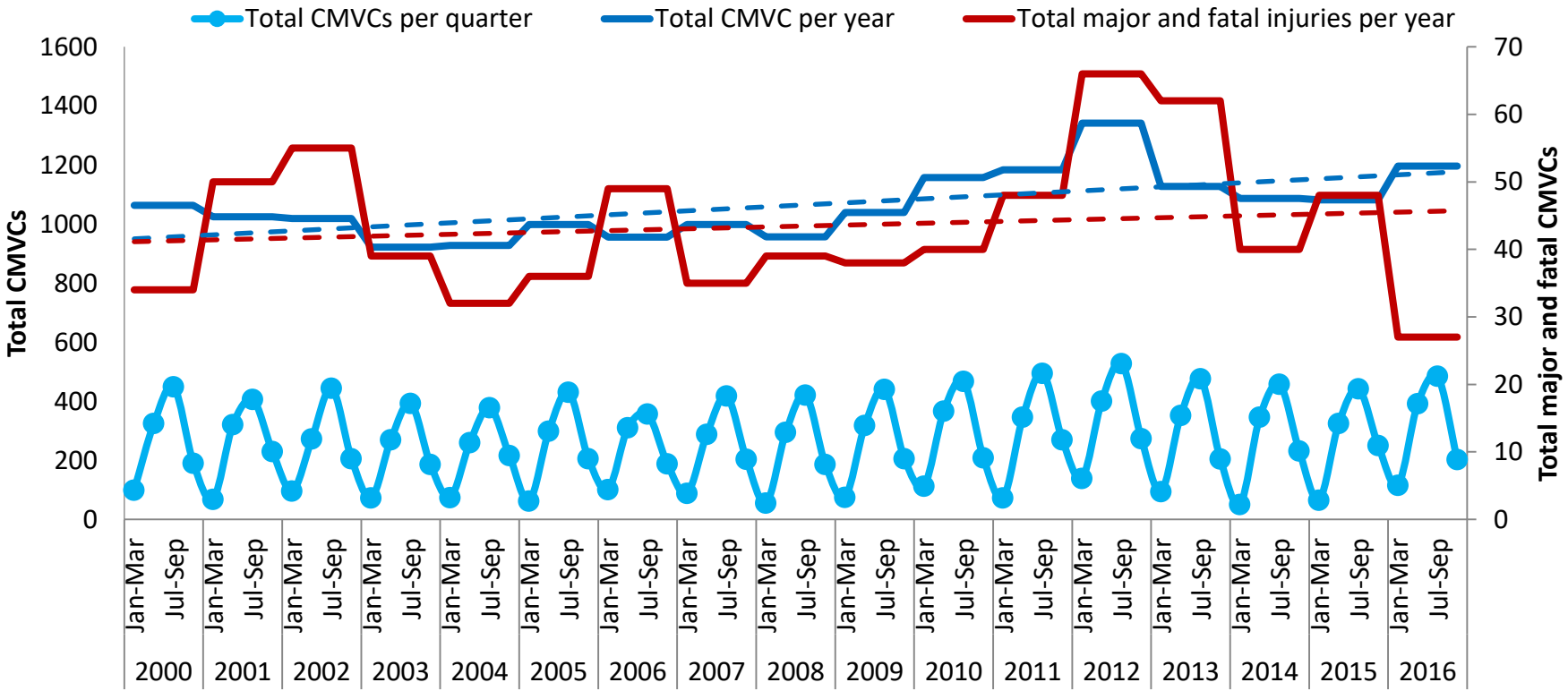
Map of Cycle Tracks in Toronto



Wellesley St East

- Two way cycle track
- Mixed use of bollards, raised tracks, and raised curb

Quarterly and Yearly Trends in CMVC Counts on All Roads, 2000 to 2016 (n=20 632)

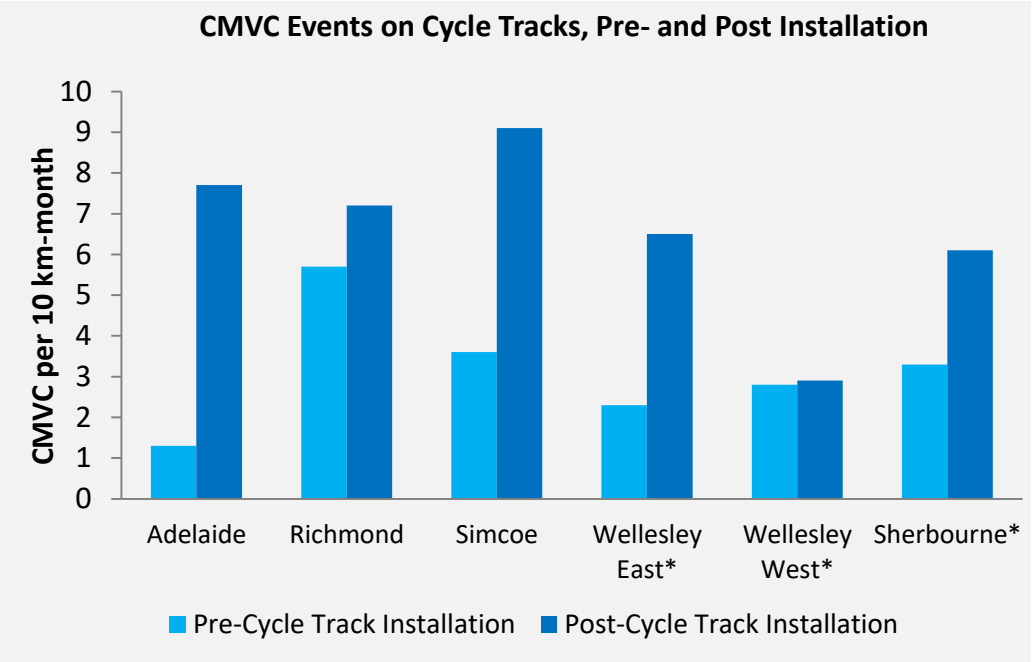


Overall trends of total CVMC and Major & Fatal CMVCs are shown in dotted lines

Analysis 1 (no cyclist volume)

194 CMVC on cycle tracks

CMVCs significantly increased by 2 times following cycle track implementation (IRR= 2.06, 95% CI: 1.51–2.81)



* Upgraded cycle tracks which previously had painted bike lanes

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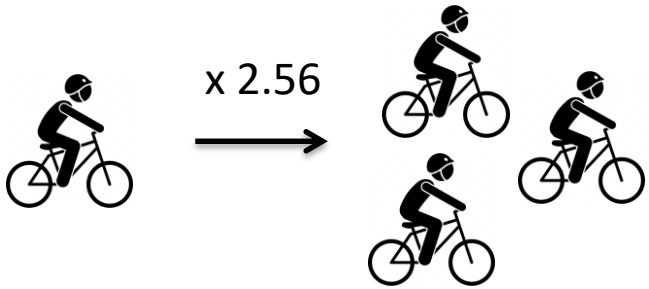

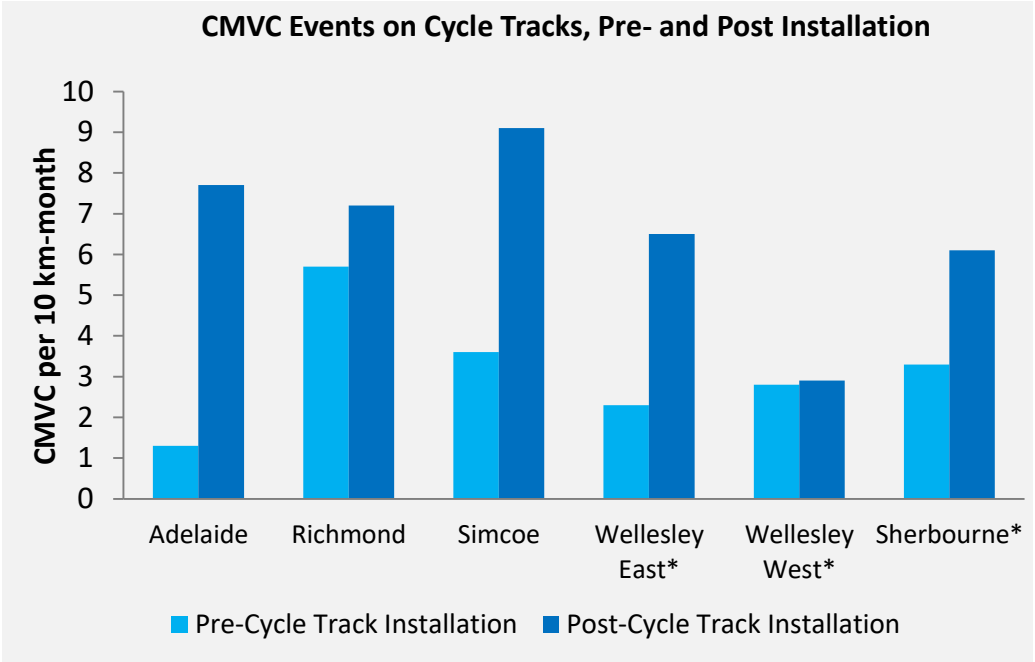

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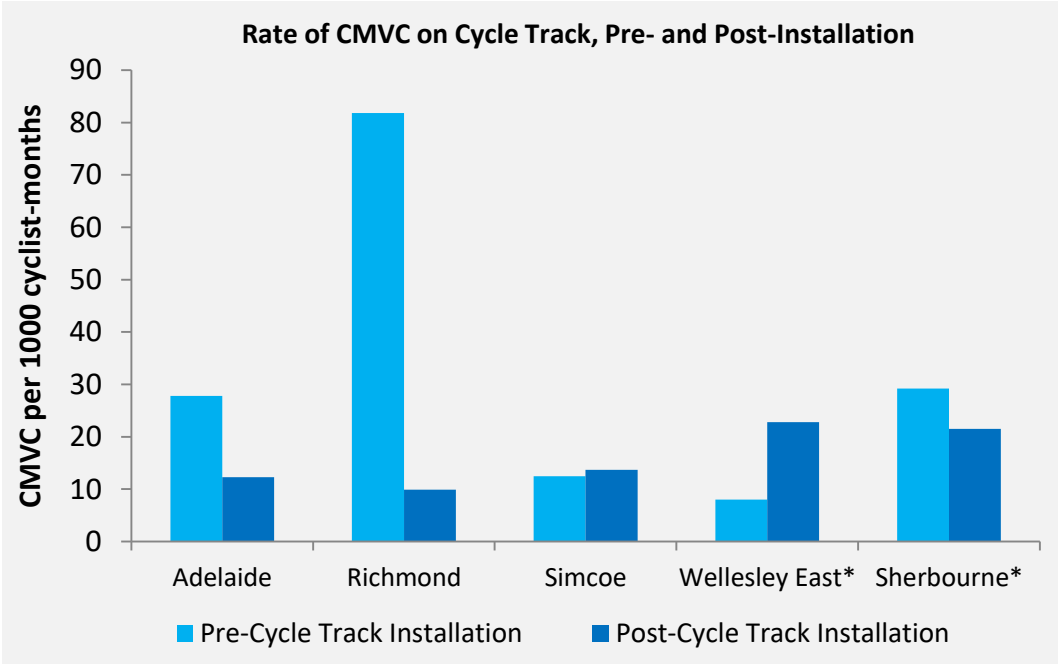
Analysis 2 (with cyclist volume)

176 CMVC on cycle tracks

CMVCs significantly decreased by **38%** following cycle track implementation (IRR=0.62, 95% CI: 0.44–0.89)



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Analysis 1 & 2: Results

Area	Pre-CMVC per 10 km-month (total)	Post-CMVC per 10 km-month (total)	Adjusted IRR	95% CI
Analysis 1				
26 – 150m (cycle track access)	1.07 (99)	0.99 (92)	0.95	0.71 – 1.28
151 – 250m	0.60 (47)	0.33 (26)	**0.55**	**0.34 – 0.89**
251 – 350m	1.07 (89)	0.64 (53)	**0.60**	**0.42 – 0.86**
351 – 450m	1.20 (110)	0.93 (85)	0.75	0.55 – 1.02
451 – 550m	0.95 (116)	0.62 (76)	**0.65**	**0.48 – 0.88**
Analysis 2				
151 – 550m (safety halos)	0.97 (362)	0.64 (240)	**0.65**	**0.54 – 0.76**

IRR: Incidence Rate Ratio, CI: Confidence Interval, CMVC: Cyclist-Motor Vehicle Collision
Bolded at significance of 0.05

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DISCUSSION

Areas of Impact

Cycle Track = 38% reduction in CMVC per cyclist

- Physical separation[3,4] and “safety in numbers” effect[5]

Cycle Track Access Areas (26 to 150m) = no change

- -5% decrease in cyclists on parallel streets[6]

Safety Halo (151 to 550m) = 35% reduction in CMVC events

3. Lusk AC, Furth PG, Morency P, Miranda-Moreno LF, Willet WC, Dennerlein JT. *Injury Prevention* (2011)
4. Teschke K, Harris MA, Reynolds CCO, Winters M. *American Journal of Public Health* (2012)
5. Jacobsen PL. *Injury Prevention* (2003)
6. City of Toronto, 2019.

Safety Halos

- Preferences toward dedicated cycling infrastructure

  - Cyclists rode 277m longer distances for cycling infrastructure[7]
  - Vancouver study saw regions with increase and decrease in cycling incident intensity following new cycle tracks[8]

7. Krenn PJ, Oja P, Titze S. *International Journal of Behavioural Nutrition and Physical Activity* (2014)
8. Boss D, Nelson T, Winters M. *Accident Analysis & Prevention* (2018)

Strengths

- Study looks at safety effects of collisions in surrounding areas near cycle tracks
  - Observed net reduction (-63 CMVC)

Limitations

- Small sample of collision data
  - Extend study period
- Cycling counts provided crude estimate of exposure
  - Adjusted for seasonal cycling rates, results remained the same
- No cyclist volumes available for neighborhood roads
  - Use crowdsourced data

Conclusion

- Cycle tracks are important in promoting cycling
- Cycle tracks are associated with reduced CMVC risk per cyclist
- Safety halos seen on nearby streets at 151m to 550m distances of cycle tracks
- Intersection treatments to further safety

Thank you! Questions?

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