



CONESTOGA
SCHOOL OF BUSINESS

Canadian Standard on Ergonomic Design for Ambulances and Related Equipment: CSA D500:20

NOVEMBER 2nd

Presented by:

Amin Yazdani, PhD, CSP

Director

Canadian Institute of Safety, Wellness, and Performance

School of Business

Conestoga College Institute of Technology & Advanced Learning

Canadian Standard for Paramedic Ground Emergency Response Vehicles and Equipment



Partnership:

- Center of research expertise for the prevention musculoskeletal disorders (CRE-MSD)
- CSA Group (Canadian Standards Association)
- Paramedic Association of Canada (PAC)
- Paramedic Chiefs of Canada (PCC)
- County of Frontenac
- Dessercom Inc.

Start-End: 01/2017 to 03/2021

Research team:

- CO-PIs: Amin Yazdani, Steven Fischer
- Project Manager: Bronson Du

Project Summary: Establish a Canadian Standard for Paramedic Ground Emergency Response Vehicles and Equipment.

Objective(s): Develop and promote a Canadian Standard that identifies the minimum human factors/ergonomics design and usage requirements for vehicles and equipment with consideration to paramedic and patient safety and infection control. Objectives include:

- Support manufacturers in designing and the procurement of emergency response vehicles and/or equipment in accordance with evidence-based practices;
- Direct paramedics in the safe and responsible usage of vehicles and/or equipment;
- Protect the health, safety & wellbeing of paramedics, and
- Protect public safety by improving patient safety and improving the capacity of emergency responders.

Outcome(s): This study will generate valuable information to facilitate future policy development and allow service providers to understand current methods in developing national standards.

Deliverable(s): The following deliverables signify completion of objectives:

- Environmental Scan, Literature Review and Needs Assessment Technical Reports
- Standards Development publication in both official languages
- Knowledge Transfer by way of a communications plan

Impact(s):

Public Safety and Security actors and communities have access to timely, relevant and credible information and advice. This feeds Canada's Safety and Security systems that are evidence-based, interconnected and resilient.



Prehospital Emergency Care



ISSN: 1090-3127 (Print) 1545-0066 (Online) Journal homepage: <https://www.tandfonline.com/loi/ipec20>

Existing Science on Human Factors and Ergonomics in the Design of Ambulances and EMS Equipment

Bronson Du, Michelle Boileau, Kayla Wierts, Sue Hignett, Steven Fischer & Amin Yazdani

To cite this article: Bronson Du, Michelle Boileau, Kayla Wierts, Sue Hignett, Steven Fischer & Amin Yazdani (2019) Existing Science on Human Factors and Ergonomics in the Design of Ambulances and EMS Equipment, *Prehospital Emergency Care*, 23:5, 631-646, DOI: [10.1080/10903127.2019.1568651](https://doi.org/10.1080/10903127.2019.1568651)

To link to this article: <https://doi.org/10.1080/10903127.2019.1568651>

Applied Ergonomics 88 (2020) 103144



ELSEVIER

Contents lists available at ScienceDirect

Applied Ergonomics

journal homepage: <http://www.elsevier.com/locate/apergo>



Exploring the need for and application of human factors and ergonomics in ambulance design: Overcoming the barriers with technical standards

Bronson Du^a, Michelle Boileau^{b,c}, Kayla Wierts^{b,d}, Stephanie Beatrix Karch^{b,d}, Marcus Yung^a, Steven Fischer^{b,c}, Amin Yazdani^{a,b,d,e,*}

^a Canadian Institute for Safety, Wellness, and Performance, School of Business, Conestoga College Institute of Technology and Advanced Learning, Kitchener, ON, Canada

^b Centre of Research Expertise for the Prevention of Musculoskeletal Disorders, Waterloo, ON, Canada

^c Department of Kinesiology, University of Waterloo, Waterloo, ON, Canada

^d School of Public Health and Health Systems, University of Waterloo, ON, Canada

^e School of Geography and Earth Sciences, McMaster University, Hamilton, ON, Canada

ARTICLE INFO

Keywords:
Emergency medical services
Procurement
Management systems

ABSTRACT

Ergonomic risk factors, such as excessive physical effort, awkward postures or repetitive movements, were the leading causes of injuries amongst EMS workers in the United States, of which 90% were attributed to lifting, carrying, or transferring a patient and/or equipment. Although the essential tasks of patient handling, transport, and care cannot be eliminated, the design of ambulances and associated equipment is modifiable. Our aims were to identify the extent of Human Factors and Ergonomic (HFE) considerations in existing ambulance design standards/regulations, and describe how HFE and the standards/regulations were applied in the EMS system. Through an extensive environmental scan of jurisdictionally relevant standards/regulations and key informant interviews, our findings demonstrated that existing standards/regulations had limited considerations for HFE. As a result, HFE principles continue to be considered reactively through retrofit rather than proactively in upstream design. We recommend that performance-based HFE requirements be integrated directly into ambulance design standards.



CSA Technical Committee:



Chair: Pierre Poirier (PAC)

Vice Chairs: Amin Yazdani (CISWP) & Gale Chevalier (County of Frontenac)

TC members: 40 members (30 voting members and 10 non-voting members)

CSA Project Manager: Ron Meyers

Scope:

- This Standard specifies requirements to facilitate the **application of ergonomics into ambulance design** and describes a user-centred design (UCD) process for establishing additional ergonomic requirements, as necessary.
- The objective of applying ergonomics is to **optimize overall system performance** by ensuring human performance and safety requirements are balanced with engineering and design requirements.

Ergonomic design for ambulances and related equipment



Key Requirements:

- Application of Ergonomics in Design
- General Patient Compartment and Driver Cabin Ergonomic Design
- Ergonomic Design – Patient Compartment
- Workplace Layout, Placement and Accessibility
- Driver Cabin Requirements

Annexes:

- Ergonomic Quality Control Checklist
- Task analysis methods to support user-centred design (UCD)
- Infection prevention and control (IPC) practices in ambulance design
- EMT Anthropometrics



General Patient Compartment and Driver Cabin Ergonomic Design



- Seating Requirements
 - Primary attendant seat
 - Airway attendant seat
- Storage Units
 - General
 - Pressure vessels
 - Stretcher retention
 - IV holder
 - Sharp containers
 - Stair chair
- Steps
 - Rear step design
 - Side step design
- Ingress and Egress
- Doors
 - Door Latches, Hinges, and Hardware
 - Door locks
 - Door Dimensions
 - Door-Activated Switches
 - Handholds
 - Emergency Egress
- Windows
- Labelling and Identification
- Lighting



Workplace Layout, Placement, and Accessibility



- Patient Compartment seating layout
- Waste and Sharps Disposal Layout
- Stretcher clearance
- IV Holder
- Action Wall
- Suction System
- Incubator Receptacles
- Radio Mounting Space
- Fire Extinguisher





THANK YOU!

Amin Yazdani, PhD, CSP

Director

Canadian Institute of Safety, Wellness, and Performance

School of Business

Conestoga College Institute of Technology & Advanced Learning

E: ayazdani@conestogac.on.ca



CONESTOGA
Connect Life and Learning

BUSINESS

Building Capacity for Productive and Sustainable Work.

User centred design to advance ambulance and equipment design

11/02/2020

Presented by: Steven Fischer
Department of Kinesiology



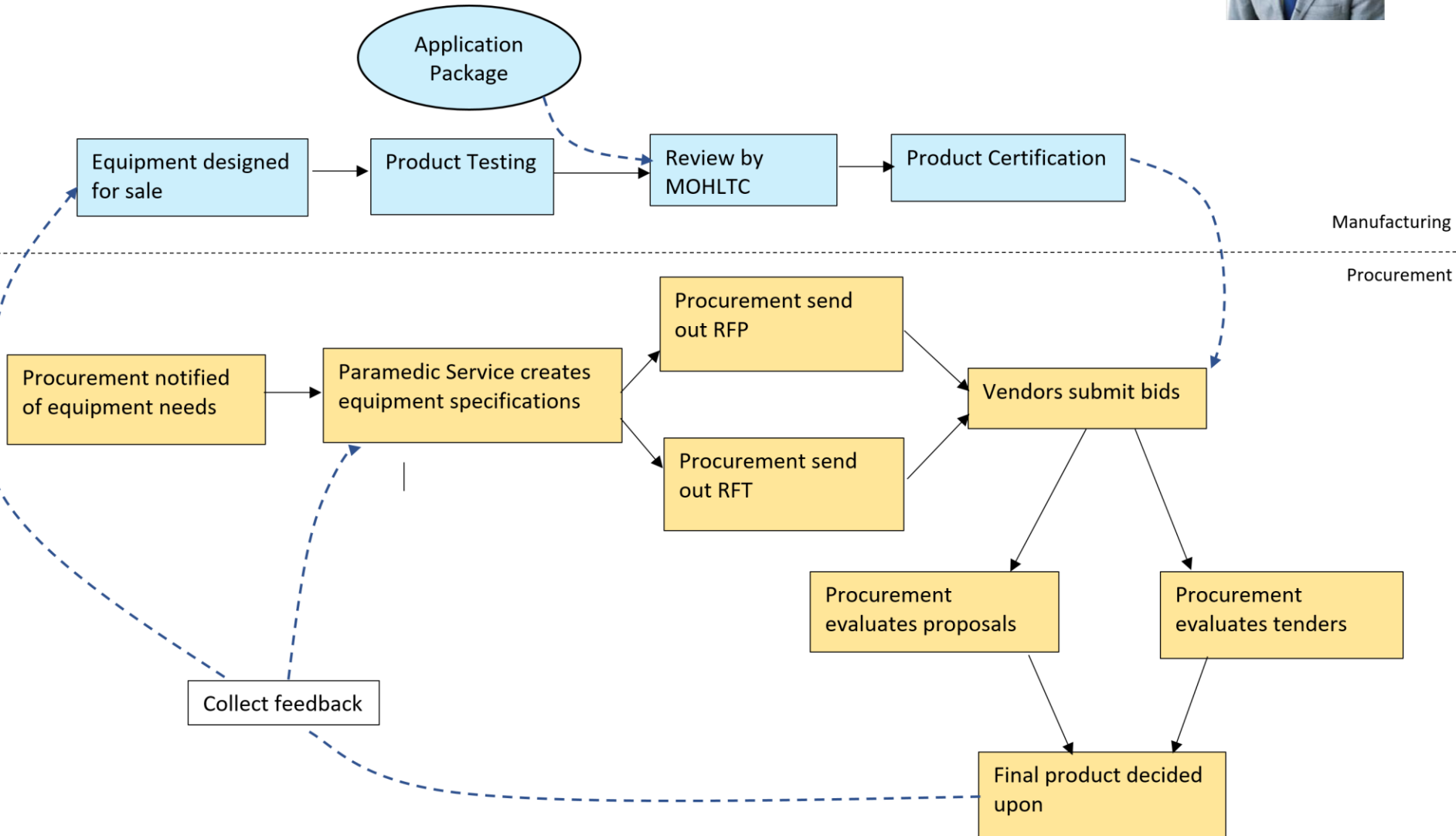
**OCCUPATIONAL
BIOMECHANICS &
ERGONOMICS LAB**
Optimizing Human Performance



UNIVERSITY OF WATERLOO
FACULTY OF APPLIED HEALTH SCIENCES



Manufacturing and Procurement



If you buy it, they will use it ... or maybe not quite

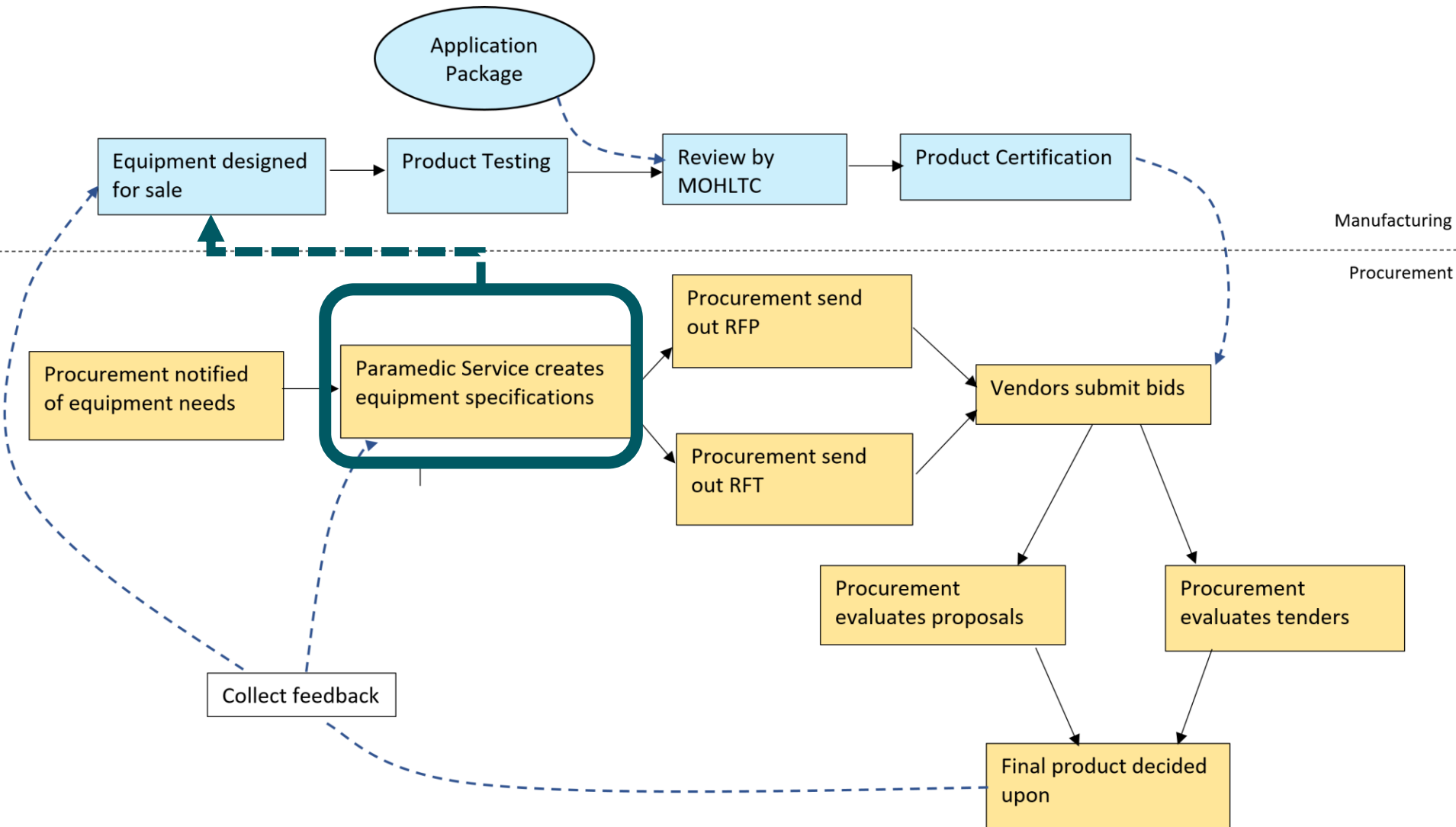


Access video at:
<https://youtu.be/BXdowbZcQ9w>



CRE-MSD Paramedics Conference (2016)
Rick Ferron, Deputy Chief of Operations; Rob Law, Primary Care Paramedic
Niagara Emergency Medical Services

Leveraging procurement to engage in user centred design



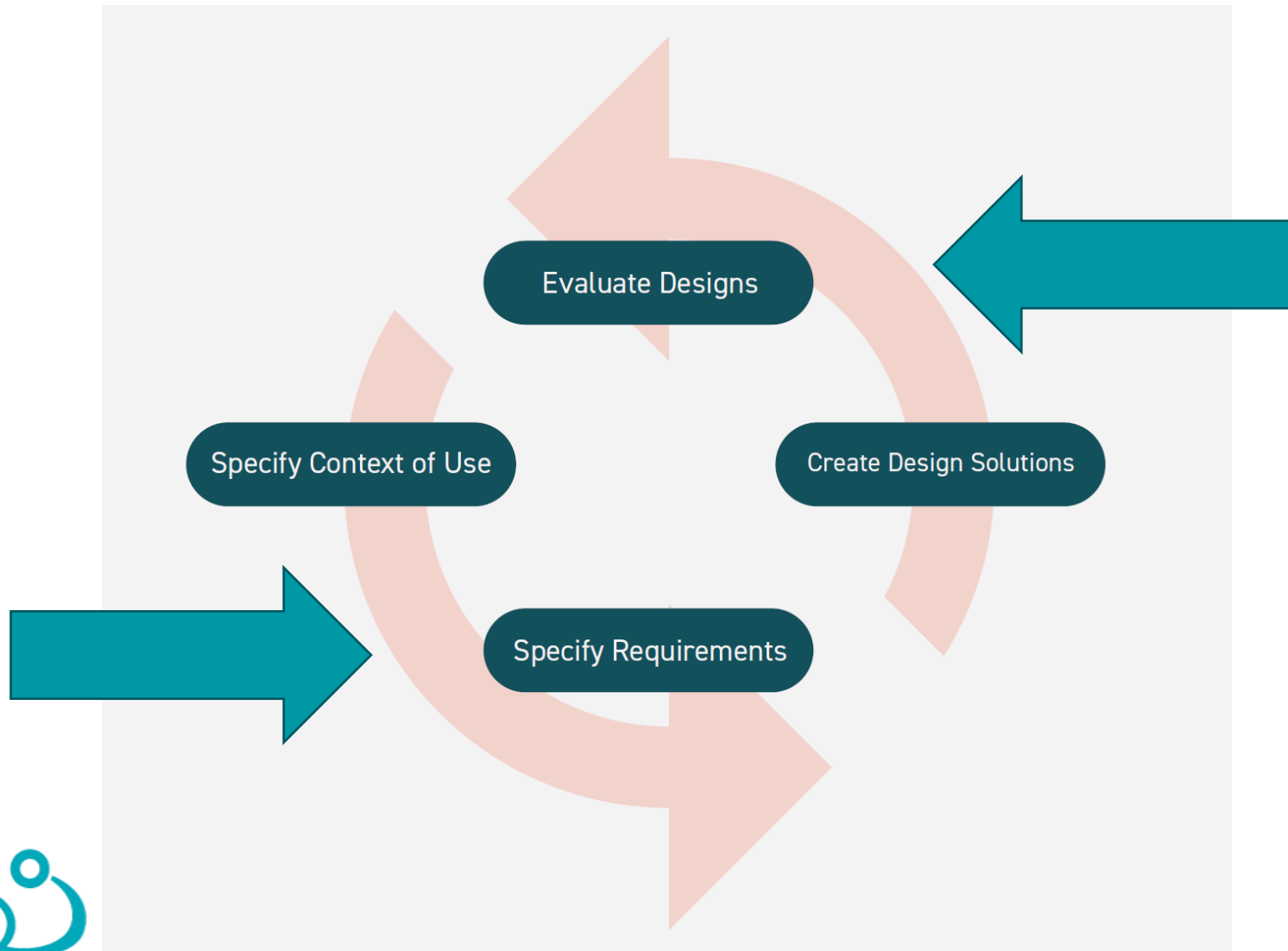
CSA D500:20 Section 4, Annex A, & B can help

Access video at:

<https://youtu.be/yII2LtPPOkA>



Techniques to help services leverage User Centred Design



Techniques for gathering paramedic input

Observation



- Record how paramedics interact with equipment, the ambulance, patients and each other (live or during simulated calls responses)
- Easy to collect and provides important visual information to communicate to non-paramedics
- Doesn't always highlight decision making



Techniques for gathering paramedic input

- Bring paramedics together in small groups
- Probe for thoughts and opinions on use
- Frame conversation to specific situations (e.g., VSA call) and to specific aspects of design (e.g., access airway bag)
- Can be time consuming to analyse

Focus Groups



Techniques for gathering paramedic input

Survey



- Closed ended questions using 5-point Likert scale
- Open ended questions to comment on the “why”
- Quick, but can require aggregation and larger data sets to be representative



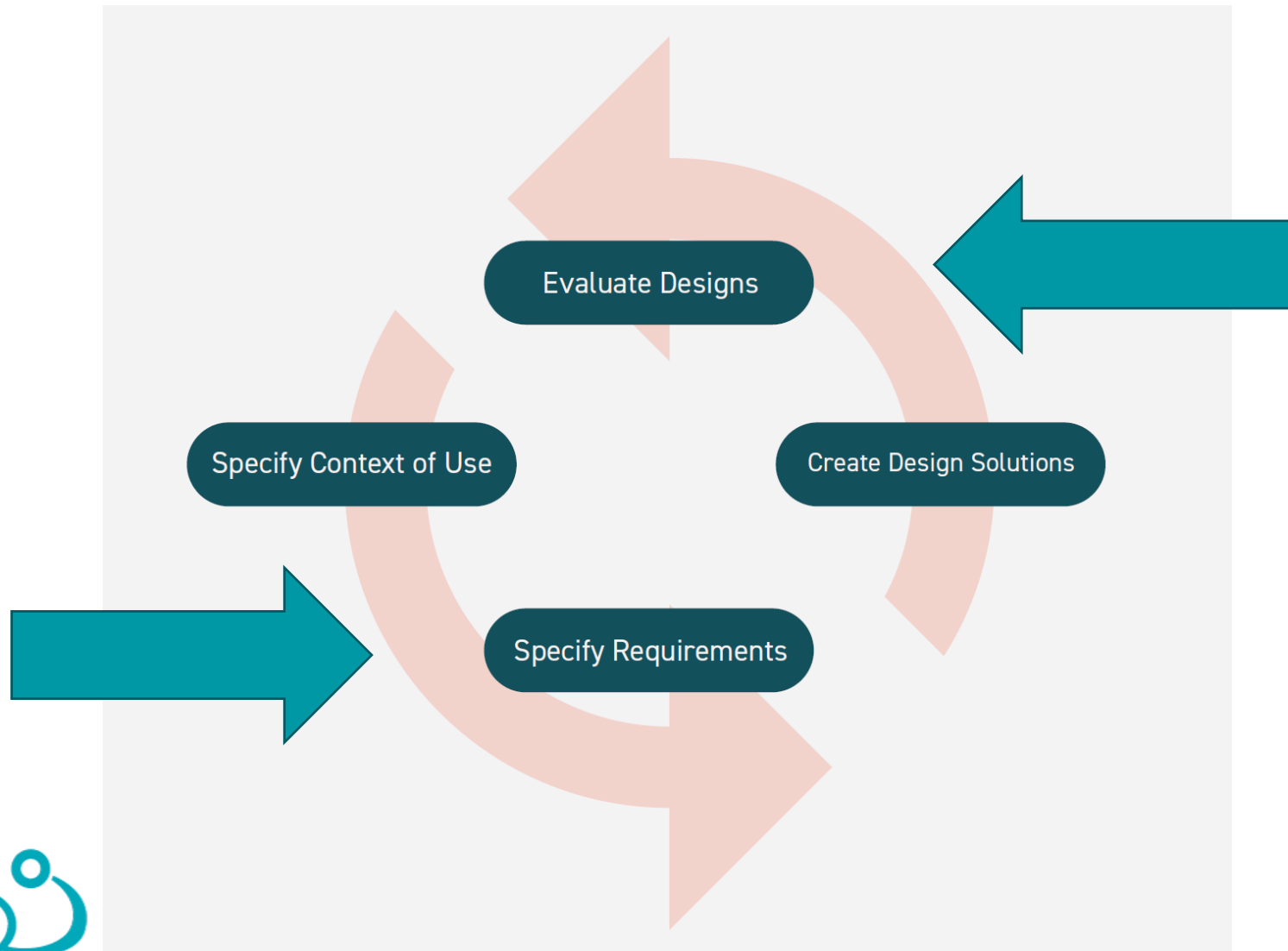
Techniques for gathering paramedic input

- Paramedics talk or walk-through specific situations or scenarios
- Audio recording is useful
- Opportunity to explain decisions / thinking

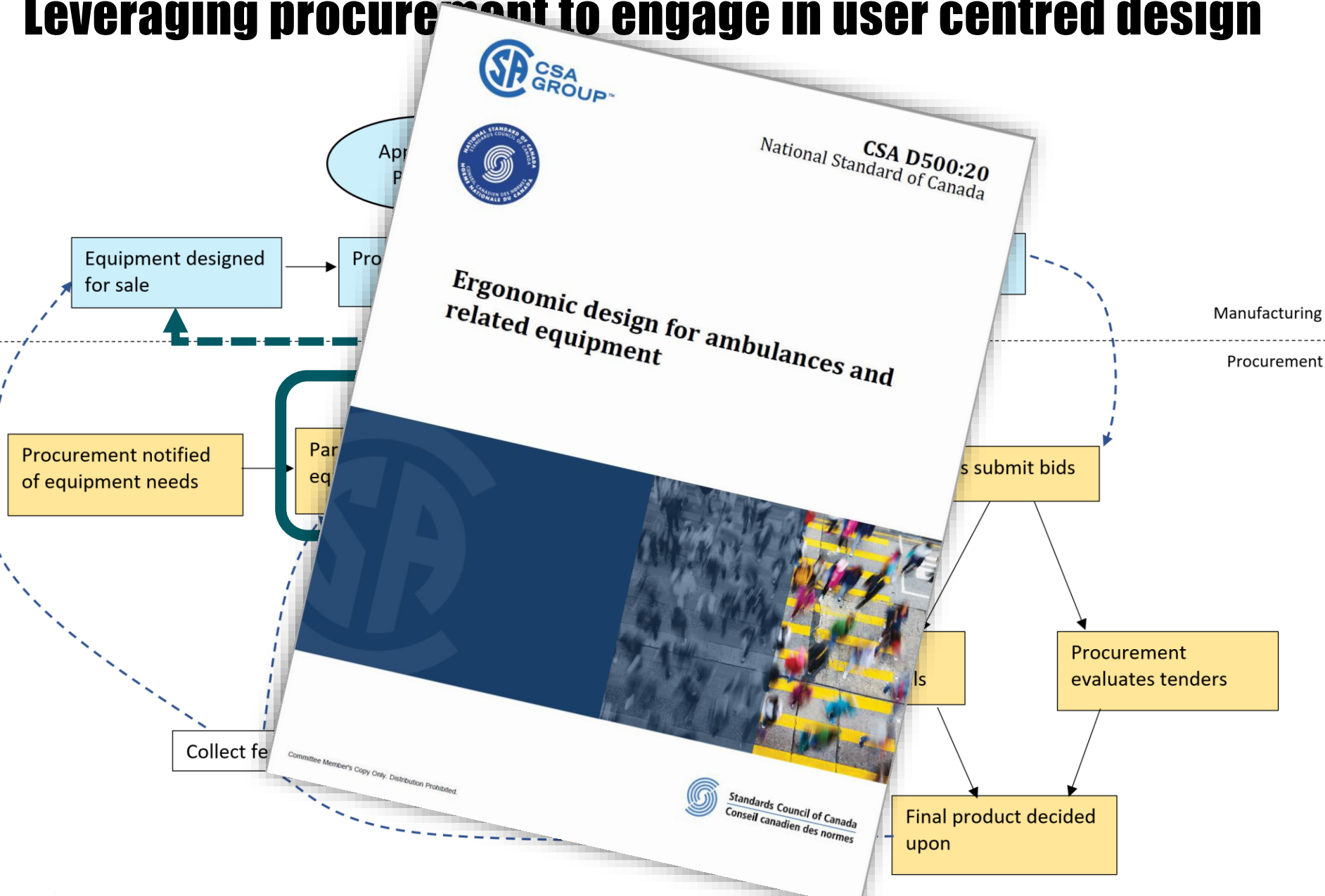
Walk- / talk throughs



How services can leverage User Centred Design



Leveraging procurement to engage in user centred design





**OCCUPATIONAL
BIOMECHANICS &
ERGONOMICS LAB**
Optimizing Human Performance

steven.fischer@uwaterloo.ca
www.uwaterloo.ca/obel
[@BiomechErgoLab](https://twitter.com/BiomechErgoLab)



CSA D500:20

Annex C: Infection Prevention and Control Practices in Ambulance Design

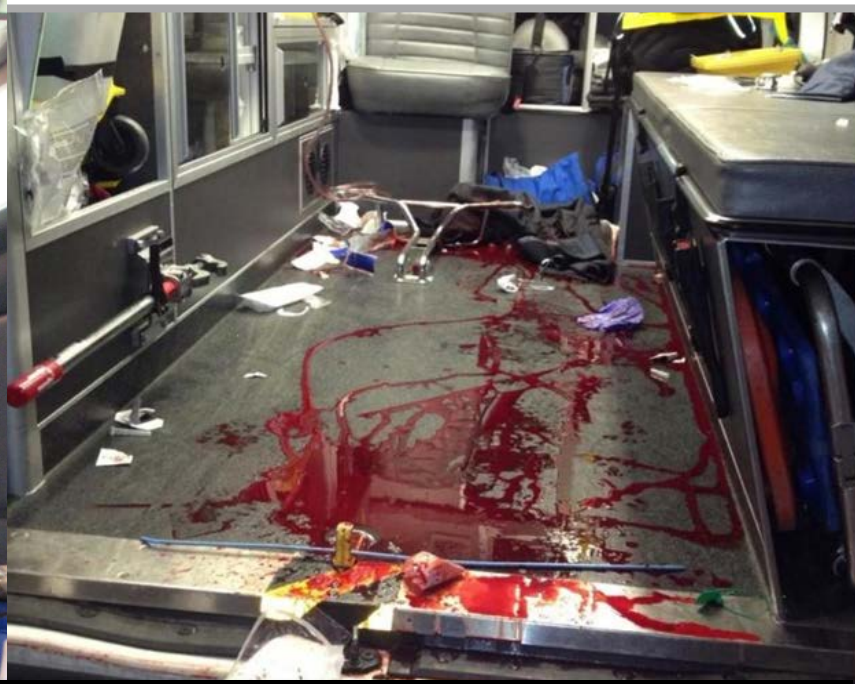
Prepared By:
Greg Bruce, Platoon Supervisor/ICP
County of Simcoe Paramedic Services



History

- Summer 2017
- CSA is planning D 500 standard
- Intention to incorporate IPC considerations
- CSA commissions pan-global literature review on IPC and ambulance design







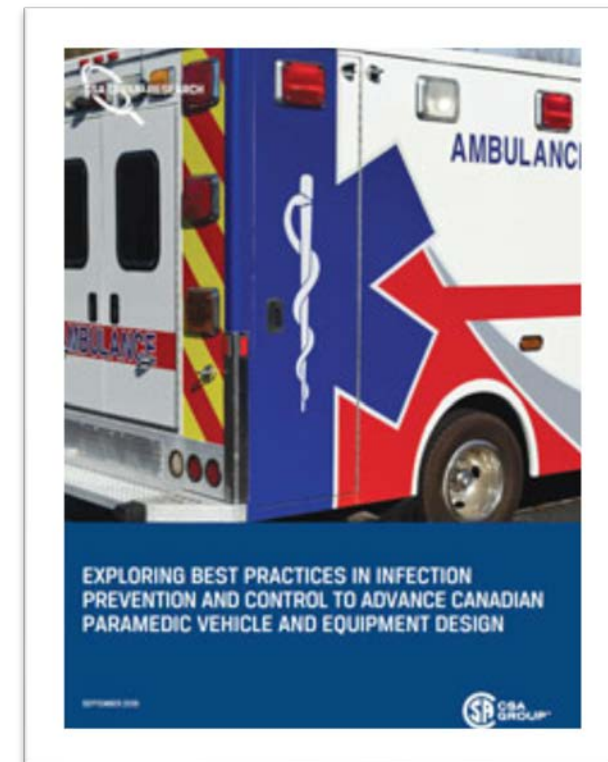


Considerations

- Uncontrolled, dynamic and confined setting
- Paramedics scope of practice
- Evolving practice
- New and emerging pathogens
- Diverse geography and demographics
- Level of contamination is high
- Lack of Prehospital IPC guidelines

History

- September 2018 releases document https://www.csagroup.org/wp-content/uploads/CSA_Group_Ambulance_Design_Research_Paper.pdf
- IPC Recommendations included in D500:20 Annex C





Recommendations

In Annex C the recommendations are consolidated into three categories

- Surfaces
- Storage, Access, Layout
- Training, Education and Competencies

Surfaces

- Durable surfaces
- Disinfectant compatible
- Smooth, seamless, non textured
- Eliminate nooks and crannies, debris traps
- Non porous materials
- No touch technology
- Sealed conveyance equipment



Storage, Access, Layout

- Ease of access
- Adequate space
- Sealed patient compartment
- Separated clean, dirty, biohazard
- Point of care access
- Modular storage
- Ventilation





Training, Education and Competencies

- Organizational and professional culture
- Standardized IPC curriculum
- Standardized Paramedic competencies
- Expanded training
- Standardized cleaning and disinfection checklist
- Quality improvement practice



Summary

- Current knowledge from other Healthcare sectors
- Adapt to design of ambulance and equipment
- Incorporate into Paramedic practice
- Provide a tool that will lead to better design for IPC
- Improve Paramedic and patient safety

Questions



Greg Bruce greg.bruce@Simcoe.ca



Credits

- Trainsmartinc.com
- Recoilweb.com
- Diamedicalusa.com
- Medixbc.ca
- Physio-control.com
- Laerdal.com
- Fernoems.com
- Theleadertheteacher.wordpress.com