SUN SAFETY:
at work, home & play!

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Conflict of Interest Declaration

- I do not have any conflicts of interest to disclose related to this presentation.

Learning Objectives

By the end of this session, participants will be able to:

- Describe the key evidence underlying the role of solar UV radiation in the development of skin cancers and heat stress
- Appreciate the importance of sun safety as both a public health and occupational health issue
- Discuss a variety of interventions and policy initiatives for improving sun safety practices and behviours in a range of settings

What is Sun Safety?

- Measures taken by a workplace, organization or individual to manage exposure to the sun (of their worker's, community or themselves), to help prevent:
  - Adverse eye and skin conditions from over-exposure to solar UV radiation (e.g. skin cancer, cataract)
  - Heat-related conditions from heat-stress associated with exposure to the sun in combination with physical activity or outdoor work

Why is Occupational Sun Safety a Concern?

"Ultraviolet radiation is one of the most significant physical risks in the working environment…14.5 million EU workers are exposed to solar radiation at least 75% of their working time, which translates to 7.4% of all employees in the EU… the risk seems to be increasing in the contemporary working and living environment…existing information is not sufficient to create a full picture of occupational exposure to UV…the implementation of legislative measures also seems to be insufficient"

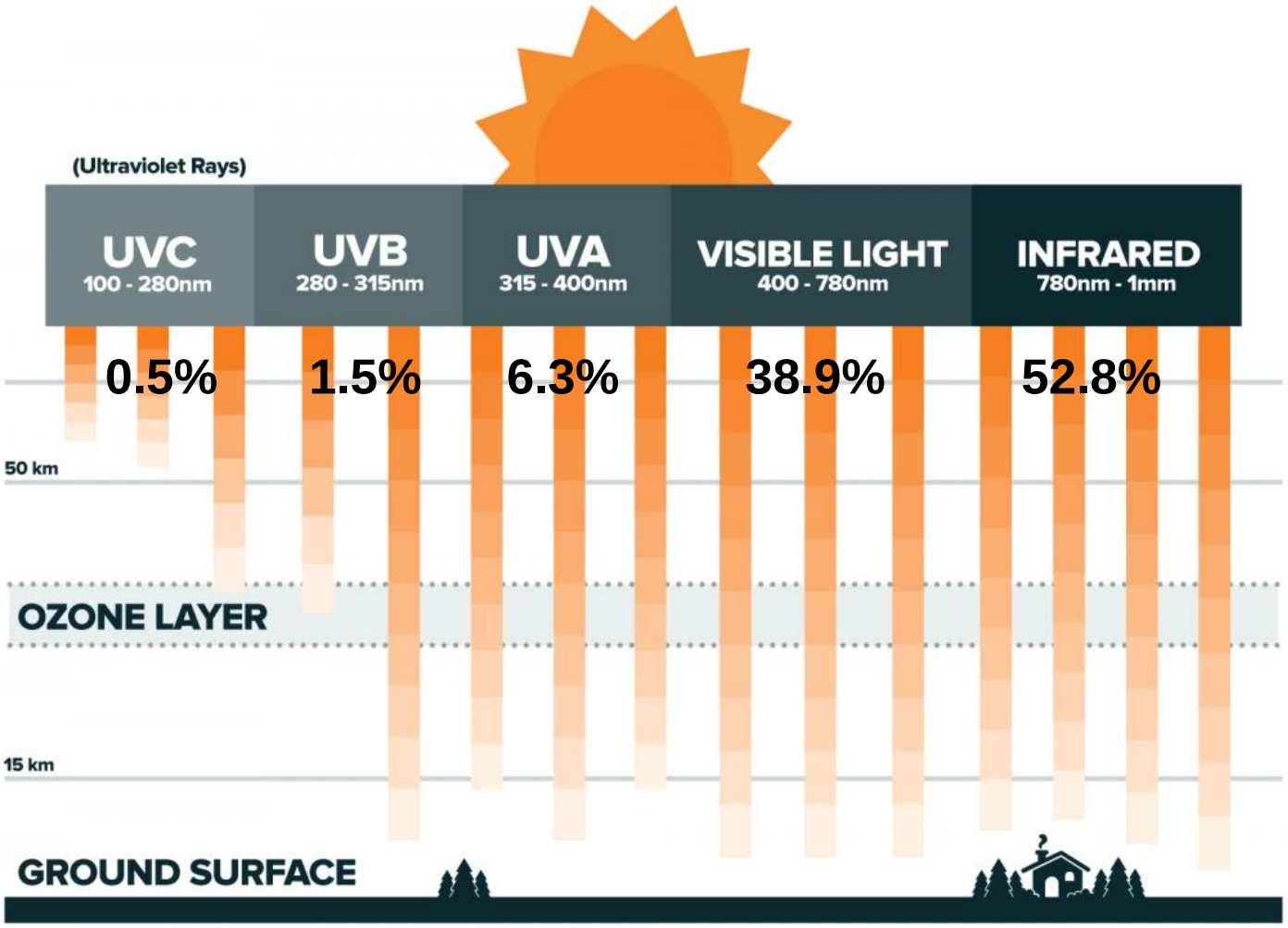
(European Agency for Safety and Health at Work: *Outlook 1 – New and Emerging Risks in Occupational Safety and Health*, 2009)

Why is Skin Cancer Prevention Important?

"Skin cancer is the most commonly diagnosed cancer in the United States, yet most cases are preventable. Every year in the Unites States, nearly **5 million people** are treated for skin cancer, at an estimated cost of **$8.1 billion**. Melanoma, the most deadly form of skin cancer, causes nearly **9,000 deaths** each year... The rates of skin cancer in our nation are increasing, creating a serious public health concern we cannot ignore".

(*US Surgeon General's Call to Action to Prevent Skin Cancer*, 2014)

SOLAR UVA,UVB&UVC RAYS

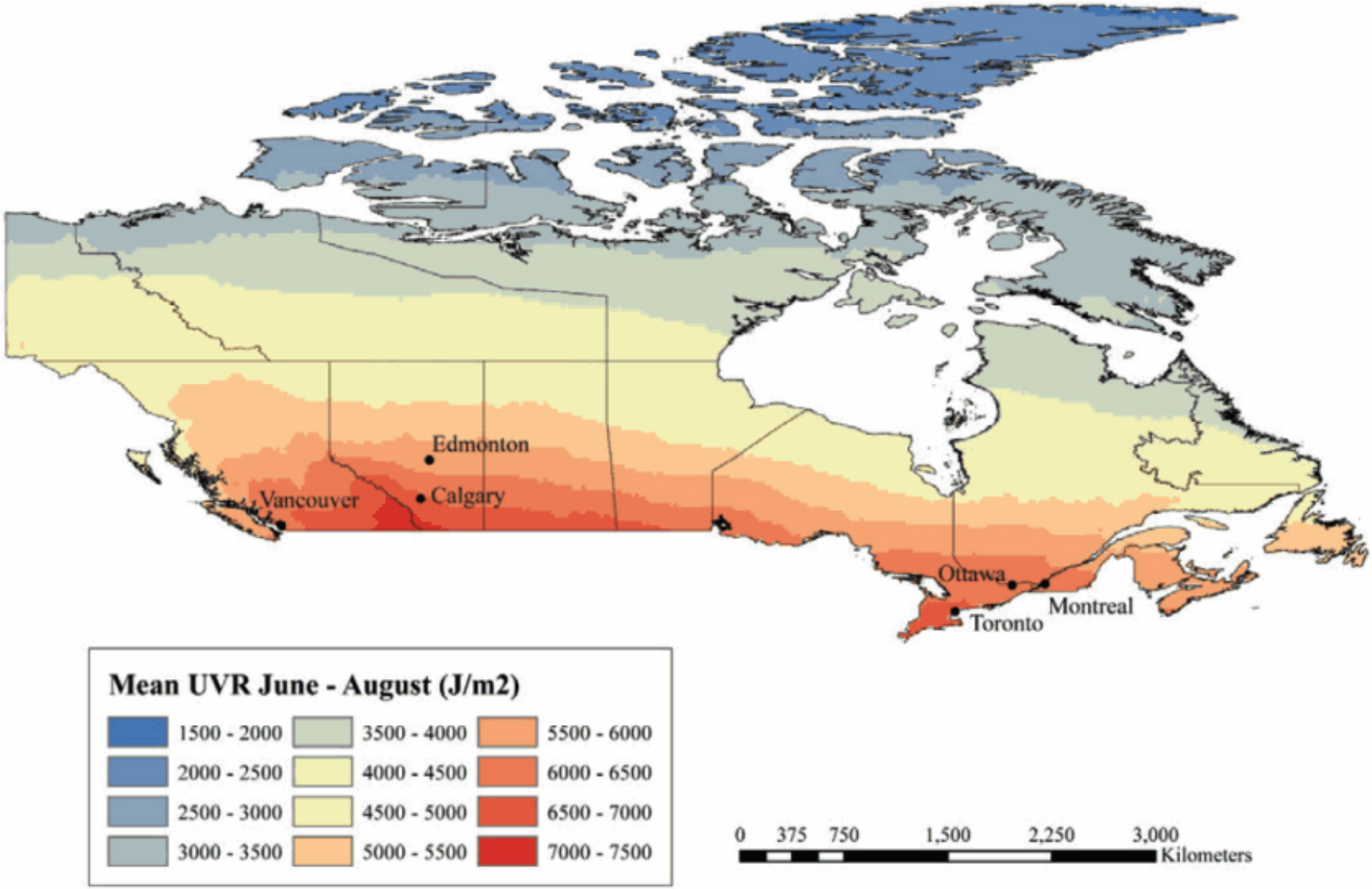


www.sunsafetyatwork.ca

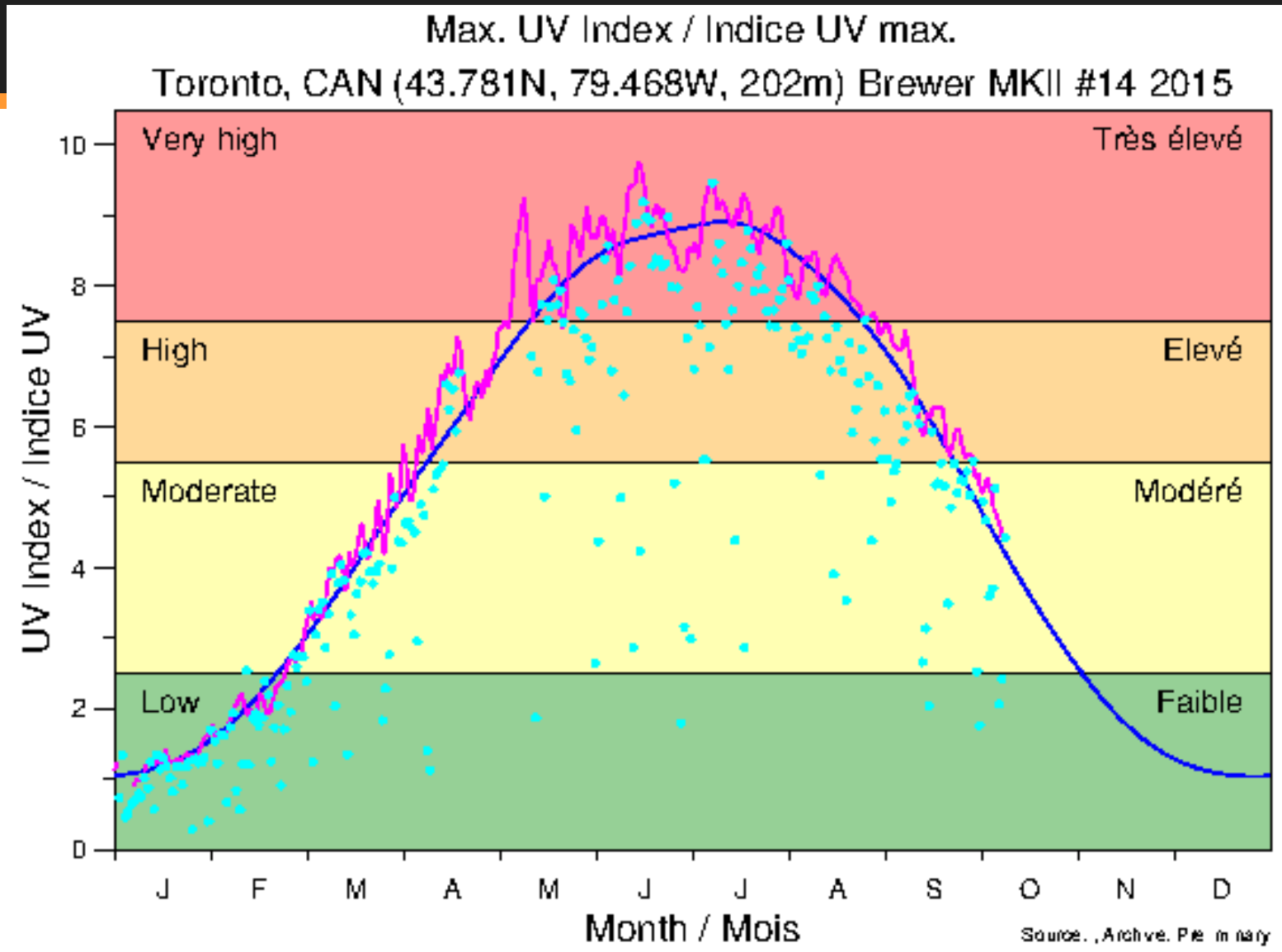
SUN SAFETY AT WORK

Map 1

Mean ultraviolet radiation (UVR) in Joules per metres squared (J/m^2) for June through August, Canada, 1980 through 1990



(Source: Pinault etal, 2017, *Health Reports* 28(5):3-11
http://www.statcan.gc.ca/pub/82-003-x/2017005/article/14790/c-g/m-c01-eng.htm



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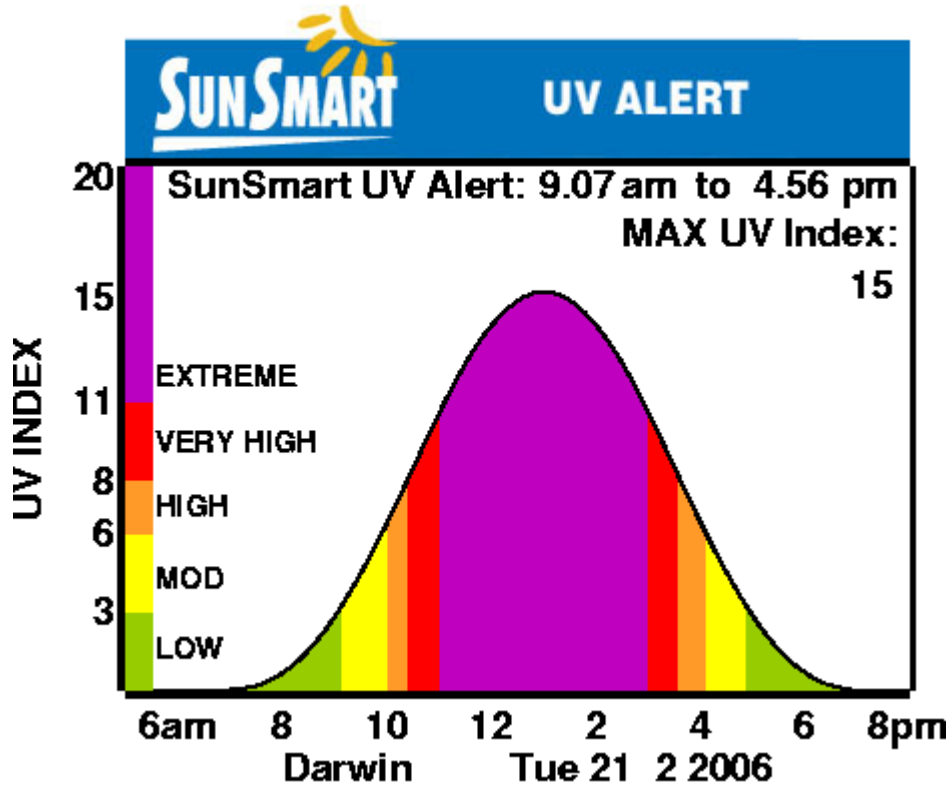

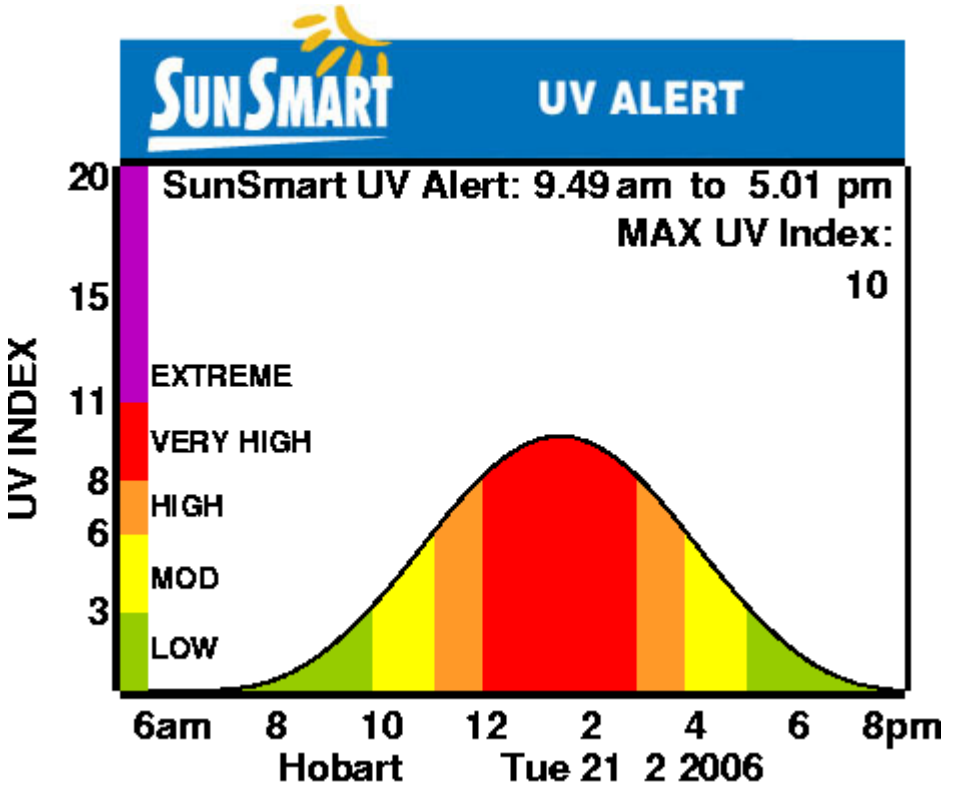

(Source: Australian Bureau of Meteorology)

Adverse Health Effects of Solar UV

Skin:

- Erythema (S)
- Chronic sun damage (V)
- Photodermatoses (S)
- Basal cell carcinoma (S)
- Squamous cell carcinoma (S)
- Malignant melanoma (S)

(Based on: Armstrong, 1994; Armstrong & Kricker, 2001; Oliva & Taylor, 2005)

Eyes:

- Climatic droplet keratopathy (L)
- Pinguecula (L)
- Pterygium (L)
- Photokeratitis (S)
- Cortical Cataract (S)
- Solar retinopathy (S)
- Uveal melanoma (S)
- AMD (I)

Weight of evidence: S = sufficient, L = limited (suggestive, not conclusive), I = inadequate, V = variable

Skin Cancer

- BCC, SCC and Melanoma account for 99% of skin cancers
- BCC and SCC together are referred to as Non-Melanoma Skin Cancer (NMSC); new preferred term is ‘keratinocyte carcinoma’
- Worldwide: 3 million cases of NMSC & 132,000 cases of melanoma occur each year (∴ 1 in 3 cancers is a skin cancer); global incidence continues to rise

Skin Cancer in Canada

- NMSC: 78,300 new cases expected in 2015, with 440 deaths in 2014 (Canadian Cancer Society, 2014 & 2015)
- Melanoma: 6,800 new cases expected and 1,170 deaths expected in 2015; rates are increasing; 8th most prominent type of cancer (Canadian Cancer Society, 2015)
- All cancer: 202,400 new cases in 2016, not including NMSC; cases of skin cancer = cases of top 4 cancers combined (lung & bronchus, colorectal, breast, prostate) (Canadian Cancer Society, 2016)

SKIN CANCER RISK FACTORS

Numerous, irregular or large moles

Fair skin, freckles, light hair and eyes

Personal and family history of skin cancer, and personal history of sunburns

(Source: www.sunsafetyatwork.ca)

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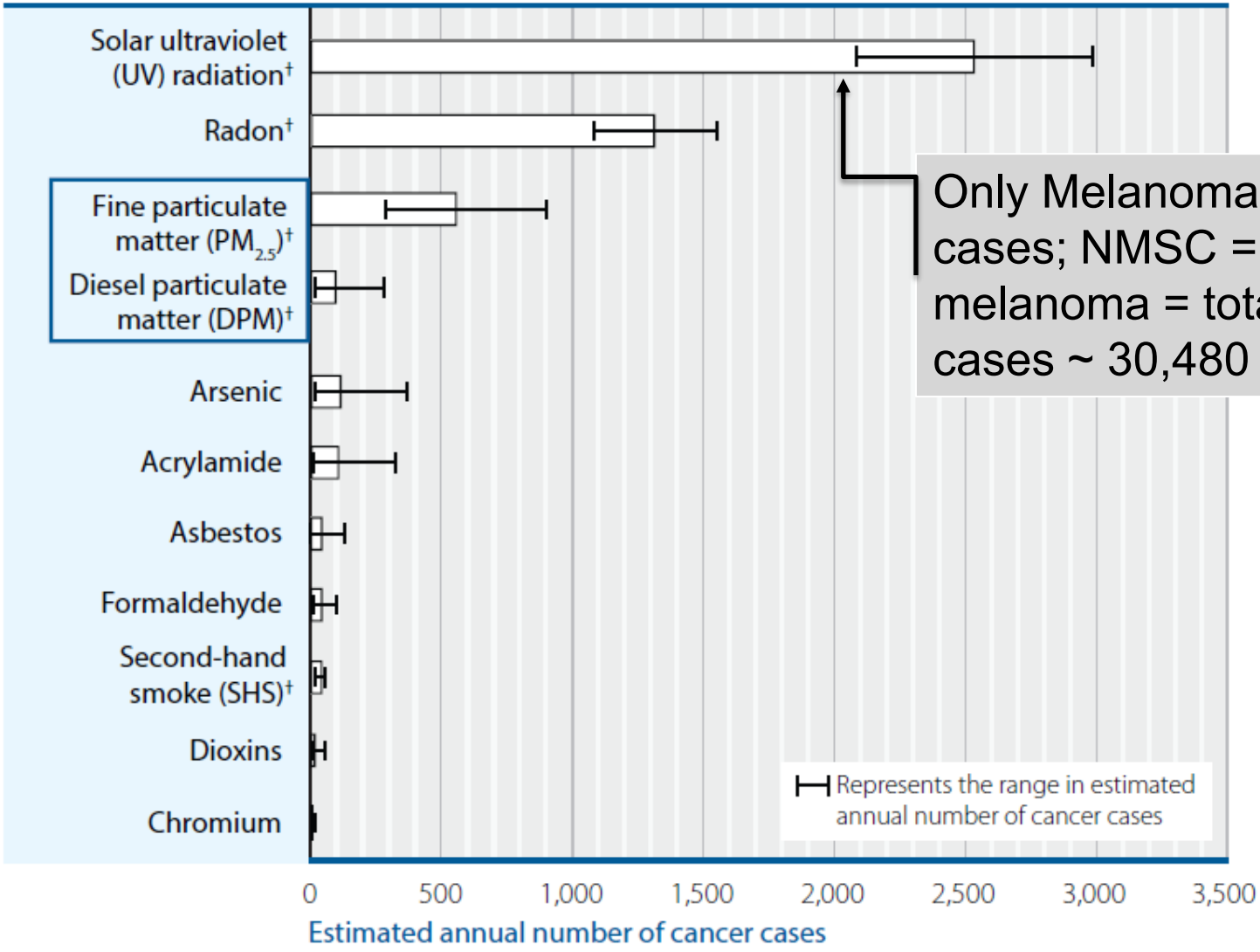
UV & Skin Cancer

- Most important risk factor is exposure to ultraviolet (UV) radiation (Elwood, 2004)
- IARC: solar radiation, UV radiation (UV-A, UV-B, UV-C) = Group 1 carcinogen (IARC, 2012)
- Most important factor in determining level of UV exposure is outdoor work (Kimlin & Tenkate, 2007)
- "UV exposure is the most preventable cause of skin cancer". Prevention focus: excessive, avoidable or unnecessary UV exposures & intentional exposure for skin tanning (US Dept. Health & Human Services, 2014)

Environmental Burden of Cancer in ON

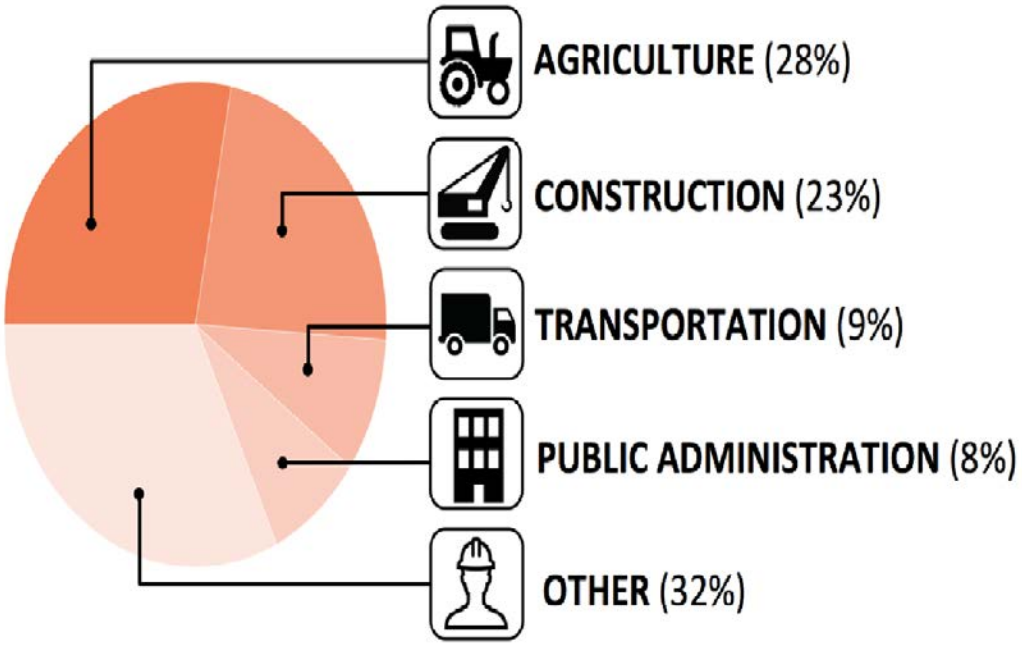


(Source: CCO & PHO, 2016: http://www.publichealthontario.ca/en/eRepository/Environmental_Burden_of_Cancer_in_Ontario_2016.pdf)

Occupational Sun Exposure & Skin Cancer

Canadian Burden of Occupational Cancer Project:

- 4560 non-melanoma skin cancers each year attributed to occupational solar radiation



Comparison:

- **Asbestos**: 1900 lung cancers & 430 mesotheliomas
- **Diesel engine exhaust**: 560 lung cancers & 200 suspected bladder cancers
- **Crystalline silica**: 570 lung cancers

(OCRC & CAREX, 2016)

Economic Burden of Skin Cancer

USA:

- Skin cancer treatment: est. $8.1 billion/year ($4.8 billion for NMSC, $3.3 billion for melanoma).
- Lost workdays + restricted activity costs: $76.8 million for NMSC, $29.4 million for melanoma
- Lost years of life/case = 20.4 years (vs 16.6 years for all malignant cancers) → annual productivity losses ~ $4.5 billion ($3.5 billion for melanoma, $1.0 billion for NMSC).

Canada:

- 2031 est: $921 million CAD/year (direct = $161.86 million, indirect = $759.94 million)
- Current estimate of occupational NMSC: $28.9M/year = $5,670 / case for BCC, $10,555 / case for SCC

(US Dept. Health & Human Services, 2014; Krueger etal, 2010; Mofidi etal, 2018)

PRIMARY FACTORS CONTRIBUTING TO HEAT STRESS

ENVIRONMENT

Air temperature, humidity, the sun

WORKER

Hydration, clothing, medical conditions, acclimatization

(how your body copes with a hot environment)

WORK

The amount of work done and how much effort it takes to complete the work

Reference: WorkSafeBC, Preventing Heat Stress at Work, 2007.

HEAT STRESS

WATCH FOR THE SIGNS

Sun exposure at work is a significant risk factor for heat stress.

Heat stress is preventable. Learn the signs and symptoms of heat stress to know when to ask for help.

Know how your workplace deals with heat stress and report all concerns to your supervisor!

Image provided by the Queensland Department of Health.

MEDIUM RISK

HEAT RASH
HEAT CRAMPS

HIGH RISK

FAINTING
HEAT EXHAUSTION
HEAT STROKE

	HEAT RASH	HEAT CRAMPS
CAUSES	Hot humid environments, plugged sweat glands.	Heavy sweating drains a person's body of fluid and salt, which cannot be replaced just by drinking water. This results in a salt imbalance in the body from a failure to replace salt lost from heavy sweating.
SYMPTOMS	Red bumpy rash with severe itching.	Painful cramps in most used muscles (arms, legs, or stomach). This can occur suddenly at work or later at home. Heat cramps are serious because they can be a warning of other more dangerous heat-related illnesses.
TREATMENT	Change into dry clothes and avoid hot environments. Rinse skin with cool water.	Move to a cool area. Loosen clothing. Gently massage and stretch cramping muscles. Drink cool salted water (1 ½ to 2 ½ ml salt in 1 L water) or an electrolyte-replacement beverage. If cramps are severe or don't go away after salt and fluid replacement, seek medical aid. Salt tablets are not recommended.

SUN SAFETY AT WORK

FAINTING

CAUSES	Fluid loss, inadequate water intake and standing still.
SYMPTOMS	Sudden fainting after at least two hours of work, cool moist skin, weak pulse.
TREATMENT	GET MEDICAL ATTENTION Assess the need for CPR. Move to a cool area. Loosen clothing. Have the person lie down. If the person is conscious, offer sips of cool water. Fainting may also be due to other illnesses.

HEAT EXHAUSTION

CAUSES	Fluid loss and inadequate salt and water intake causes the body's cooling system to start to break down.
SYMPTOMS	Heavy sweating, cool moist skin, body temperature above 38°C, weak pulse, normal or low blood pressure, tired and weak and has nausea and vomiting, very thirsty, panting or breathing rapidly, vision may be blurred.
TREATMENT	GET MEDICAL ATTENTION This condition can lead to heat stroke, which can kill. Move the person to a cool shaded area. Loosen or remove excess clothing. Provide cool water to drink. Fan and spray with cool water. Do not leave the person alone.

HEAT STROKE

CAUSES	Classic heat stroke: occurs in older adults and in persons with chronic illnesses exposed to excessive heat. When the body has used up its water and salt reserves, it stops sweating causing a rise in body temperature. Exertional heat stroke: generally occurs in young persons, who engage in strenuous physical activity for a long period of time in a hot environment. The body's cooling mechanism cannot get rid of the excessive heat. Heat stroke may develop suddenly or may follow from heat exhaustion.
SYMPTOMS	High body temperature (over 40°C) and any of the following: weak, confused, upset, or acting strangely; hot, dry, red skin (classic heat stroke); profusely sweating (exertional heat stroke); fast pulse; or headache or dizziness. In later stages, a person may pass out and have convulsions.
TREATMENT	CALL AN AMBULANCE This condition can kill a person quickly. Remove excess clothing. Fan and spray the person with cool water. Offer sips of water if the person is conscious.

SUN SAFETY AT WORK

Adapted from © Queen's Printer for Ontario, 2015 and Occupational Health and Safety Council of Ontario, Heat Stress Awareness Guide, 2009.

Visit sunsafetyatwork.ca for more information.

Production of this resource has been made possible through financial support from Health Canada through the Canadian Partnership Against Cancer.

KNOW YOUR RISK

Everyone responds differently to heat. Know your personal risk factors that could increase your chance of heat stress:

- Lack of acclimatization (how your body copes with a hot environment)
- Poor physical fitness or an unhealthy weight
- Age
- Flu, lack of sleep, and other minor illnesses
- Reoccurring skin disorders (rashes, dermatitis, etc.)
- Caffeine, drugs, and alcohol can cause dehydration
- Previous heat stroke
- Pre-existing medical conditions - diabetes, heart disease, among others
- Use of some medications

Reference: WorkSafeBC, Preventing Heat Stress at Work, 2007.

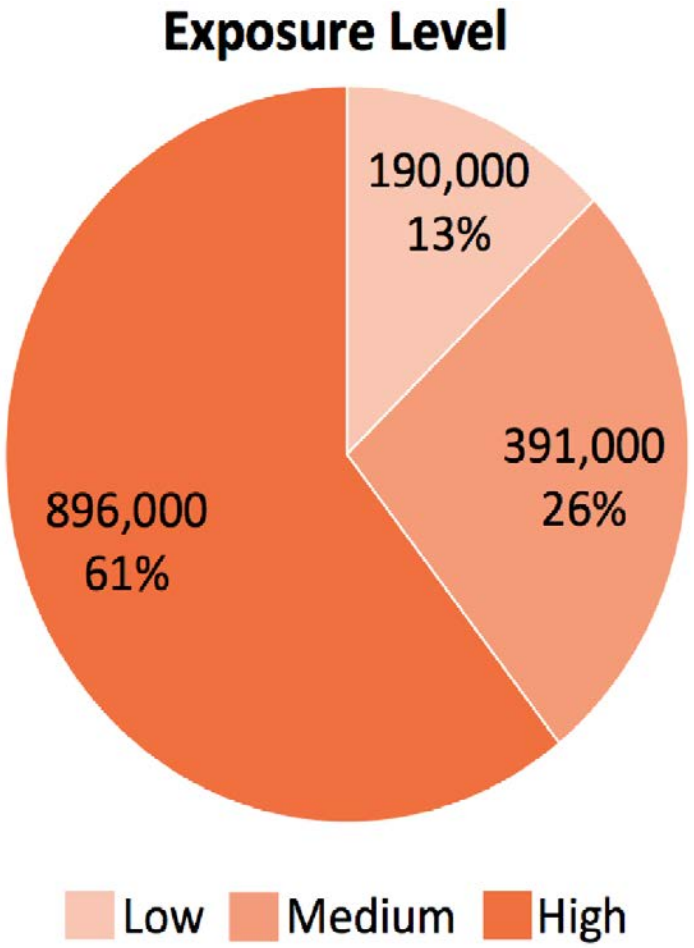
Heat illness in ON: 2004-2010 = 785 events from ED records, 612 lost-time claims; peak in summer; high risk = men, outdoor workers, manual workers, short length of employment; sectors = govt., agriculture, construction (Fortune etal, 2013)

Human Exposure to UV from the Sun

- Combination of direct + diffuse + reflected UV radiation from the sun
- Exposures to humans vary according to:
  - Time spent outdoors
  - Time of day and year (ambient UV levels)
  - Activity undertaken
  - Body posture
  - Personal behavior
  - UV protection used
  - Exposure to artificial sources
- School children: log-normal distribution, 2-fold difference in exposure based on activity/behavior (Diffey etal, 1996; Gies etal, 1998)
- Indoor vs outdoor worker

Occupational Sun Exposure in Canada

- # Outdoor workers in Canada: 1.5M(8.8%) (CAREX Canada, 2012) to 5.4M (26%) (Marrett etal, 2010)
- Canada – Levels of Exposure: (Peters etal, 2012)
  - Low: almost never exposed – truck & delivery drivers
  - Moderate: indoor/outdoor mix – crane operators, carpenters, maintenance labourers, couriers
  - High: >75% outside – farmers, construction



(OCRC & CAREX, 2016)

Exposure Time for Erythema/Sunburn

Table 2 – UV Index and various exposures times and values[14]

UV Index	Time to Exceed ACGIH TLV (t_{max}) (min)	Time to achieve erythema (min)*	Ambient UV (SEDs/hr)
3	26.4	44.4	2.7
4	19.8	33.3	3.6
6	13.2	22.2	5.4
8	9.9	16.7	7.2
10	7.9	13.3	9.0
12	6.6	11.1	10.8
14	5.7	9.5	12.6

Summer in Toronto

*for un-adapted sensitive skin (skin type I or II)

(Tenkate, 2016; based on data from Gies etal, 2009)

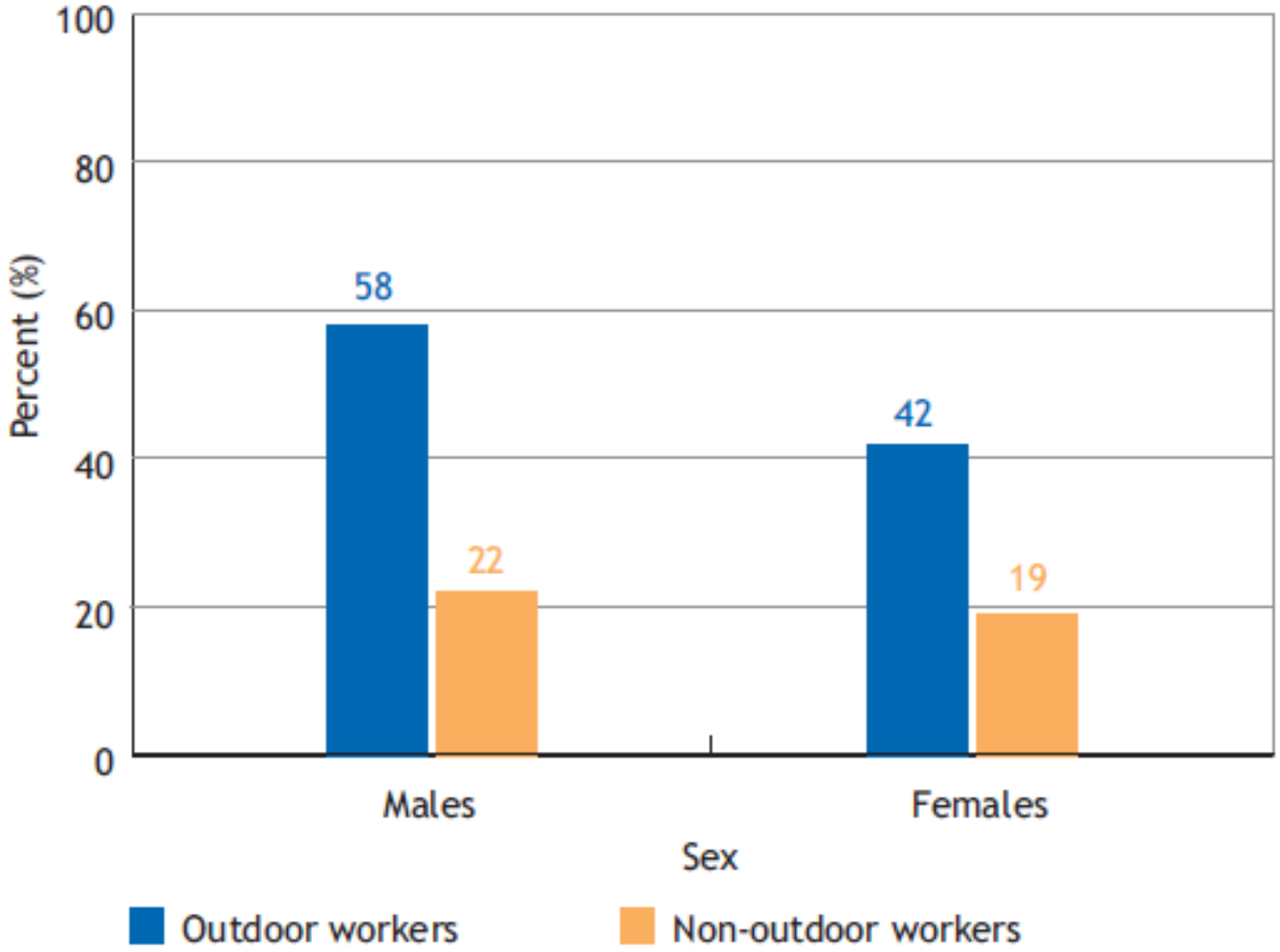
UV Exposure vs Skin Type

Table 1 – Skin Type, sensitivity to sunburn and level of exposure to produce erythema[2]

Skin Phototype	Sun Sensitivity	Sunburn Sensitivity	Tanning Achieved	Individual MED without Adaptation	Individual MED with Adaptation
I (Celtic)	Very sensitive	Always sunburn	No tan	2 SED	5 SED
II (Celtic)	Moderately sensitive	High	Light tan	2 SED	5 SED
III (Mediterranean)	Moderately insensitive	Moderate	Medium tan	5 SED	12 SED
IV (Mediterranean)	Insensitive	Low	Dark tan	5 SED	12 SED
V (Asian)	Insensitive	Very low	Natural brown skin	10 SED	60 SED
VI (Black)	Insensitive	Extremely low	Natural black skin	15 SED	80 SED

(Tenkate, 2016; based on data from ICNIRP, 2010)

Canadian outdoor and non-outdoor workers, ages 16-64, spending 2 or more leisure-time hours in the sun, by sex

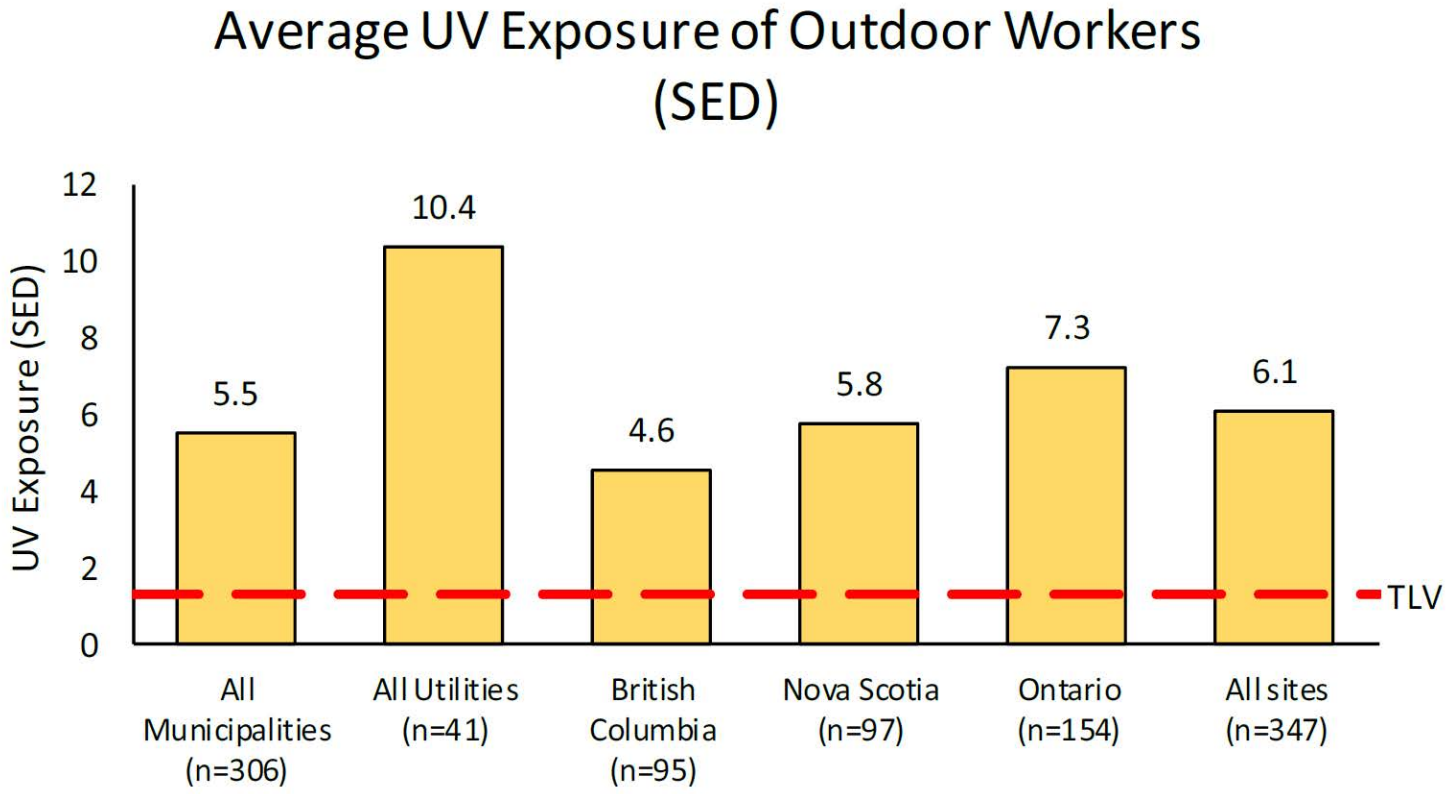


Age-standardized to the 2001 Canadian population.

(CPAC 2010 – 2006 2nd National Sun Survey)

Outdoor Workers Solar UV Exposures

- Outdoor workers in 13 workplaces in 3 provinces wore PSF badges for one work day in August/September 2016; 347 viable worker measurements (from 413 participants)



(Tenkate etal, 2017)

Heat Stress Control Measures

USE THESE SIX SIMPLE STEPS TO PROTECT YOURSELF

1. Know the signs and symptoms of heat stress
2. Watch out for symptoms in yourself and others
3. Wear sunscreen, a hat, and lightweight, loose-fitting clothing
4. Drink water often - avoid drinks with alcohol and caffeine
5. Take breaks in the shade and more often on hot days
6. Know how your workplace deals with heat stress

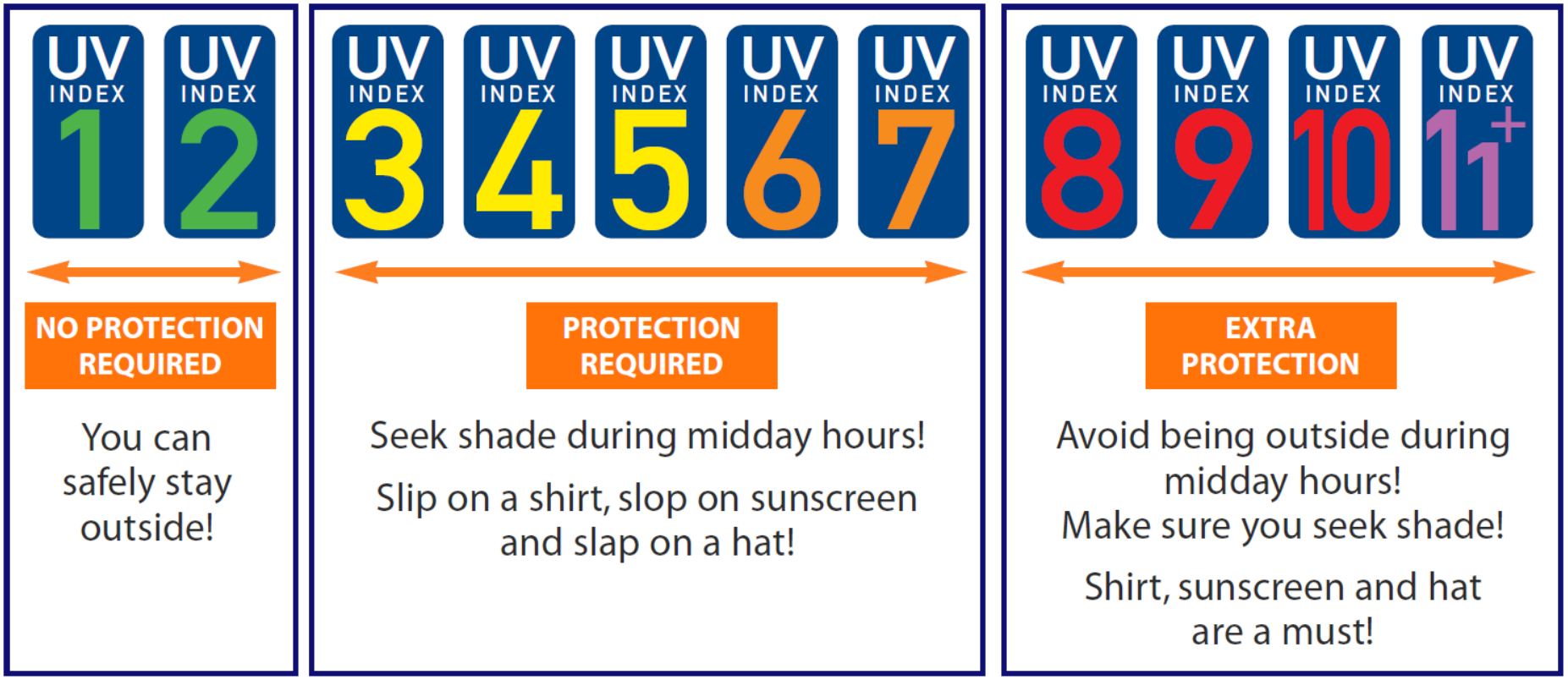
SUN SAFE

Reducing the Risk of Skin Cancer

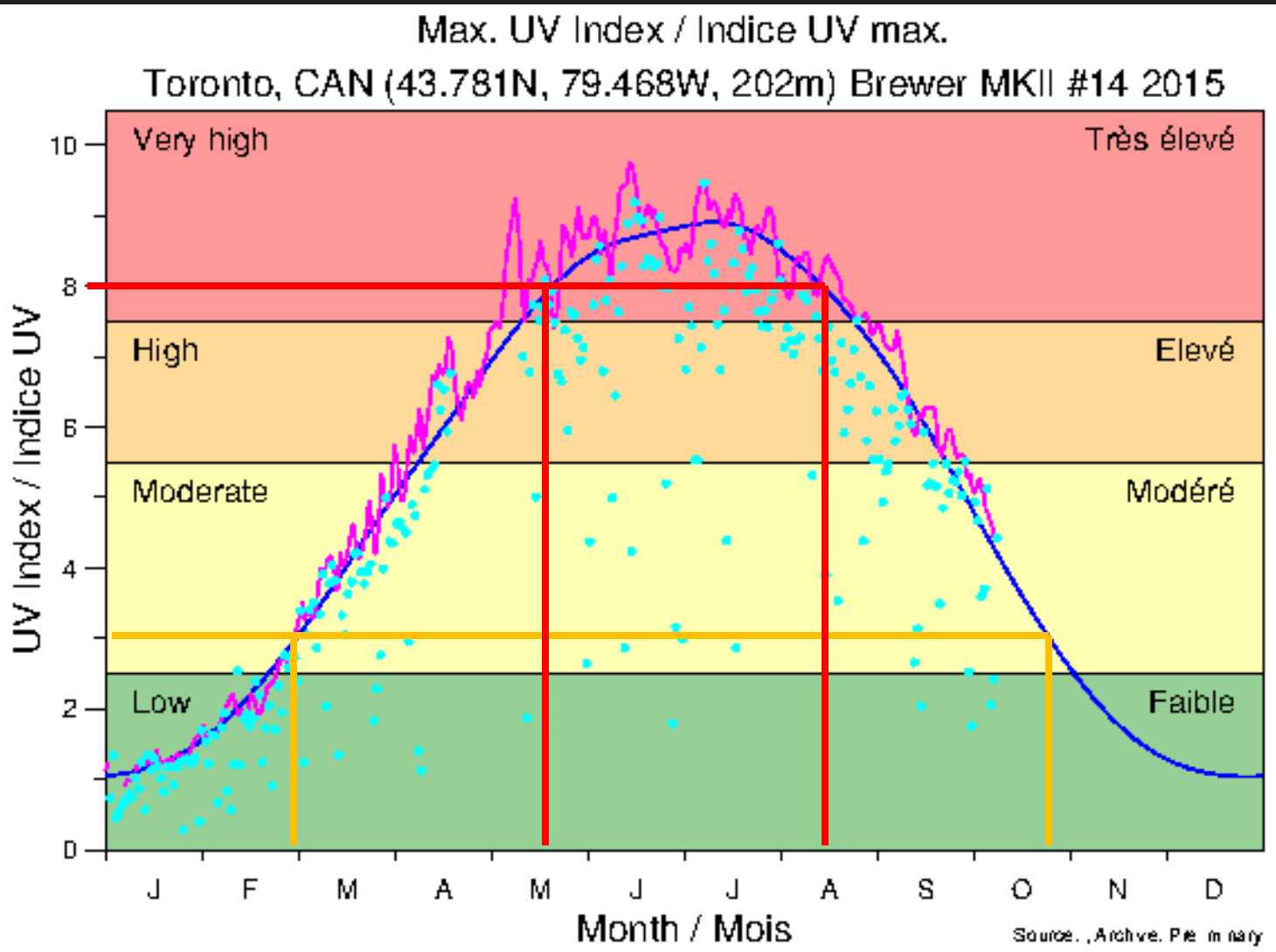
- Comprehensive suite of strategies at multiple levels:
  - Individuals
  - Clinicians
  - Communities and schools
  - Outdoor work settings
  - Local, State & National Policies, Legislation & Regulation

(US Dept. Health & Human Services, 2014)

Individual Sun Protection Measures



(WHO, 2003 – INTERSUN Guide & Compendium)



(http://exp-studies.tor.ec.gc.ca/ozone/uvgraph/Preliminary/max/STN065/uv/dailymaxuv-Brewer-014-2015.gif)

Individual Sun Protection Practices

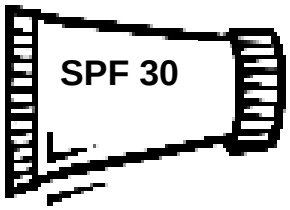
- Canadian Community Health Survey:
  - Protection measures used: sunscreen to face (45%), sought shade (41%), wore a hat (39%), sunscreen on body (38%), long pants/skirt (27%).
  - Varied by sex: women more likely to seek shade and use sunscreen; men were more likely to wear a hat and long pants
  - Varied by age: seeking shade and wearing protective clothing more common for older ages; sunscreen use more common for younger individuals.
  - Sunburn: 33% reported a sunburn in the last 12 months; men more likely to report sunburn
  - Sun avoidance and protective clothing use more associated with lower risk of sunburn, while sunscreen users had a higher risk of sunburn

(Pinault & Fioletov, 2017)

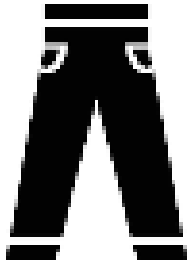
Survey of Worker Sun Protection Behaviours

Workers who reported '**Usually/Always**' using..

Tinted safety glasses or sunglasses (80%)



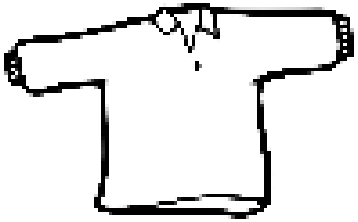
Sunscreen (35%)



Long pants (91%)

Hard hat with brim (22%)

Enclosed boots or shoes (99%)



UV rated clothing (11%)

Survey administered in 2015 as part of SSAWC project to 14 workplaces in 4 provinces (836 workers responded)

(Tenkate etal, 2016)

Barriers to Individual Use of Sun Protection

- Lack of general knowledge or awareness about the risks associated with sun exposure
- Think that they are low risk (particularly for darker skinned individuals)
- Do not perceive cancer as preventable
- Lack of understanding of the UV Index
- Costs of protective clothing & sunscreen
- Personal clothing style preferences
- Resistance to using sunscreen due to perceptions that it is messy, inconvenient, feminine

(US Dept. Health & Human Services, 2014)

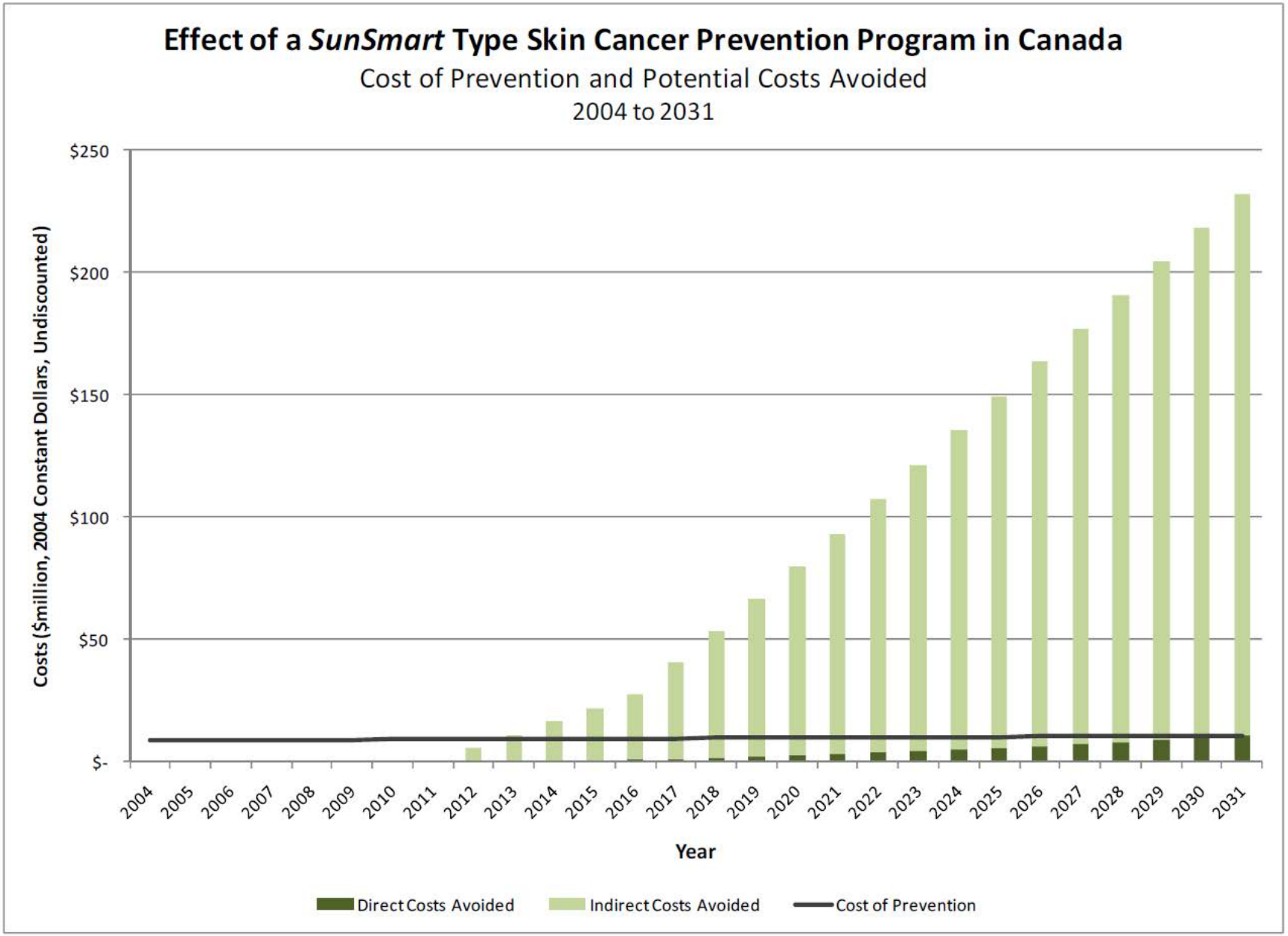
Skin Cancer Prevention – Interventions

Intervention	Recommendation
Outdoor recreational & tourism settings	Recommended
Outdoor occupational settings	Recommended
Child care centre-based interventions	Recommended
Primary & middle school-based interventions	Recommended
Multicomponent community-wide interventions	Recommended
High school and college-based interventions	Insufficient evidence
Mass media	Insufficient evidence
Interventions targeting children's parents & caregivers	Insufficient evidence
Healthcare settings and providers	Insufficient evidence
- Behavioural counseling (children & adults with fair skin)*	Recommended
- Behavioural counseling (adults >25years old)*	Recommended (depends on patient)
- Counseling about skin self-examination*	Insufficient evidence

(Community Preventive Services Task Force; *US Preventive Services Task Force 2018)

Economic Evaluation of Skin Cancer Prevention

- Studies consistently show that skin cancer prevention represents 'excellent value for money' (Carter etal, 1999) and are considered to have substantial impact on population health (Vos etal, 2010).
- Return-On-Investment: Australia's *SunSmart* program = $2.30 for every $1 invested (Shih etal, 2009); *SunWise* School Program (USA) = $4 for every $1 invested (Kyle etal 2008)
- If a *SunSmart* type program was implemented in Canada (2004 to 2031), the cumulative cost would be $270 million, but would result in 2,500 avoided deaths and the avoided costs would be $2.1 billion = 7.8 x cost of prevention (Krueger etal, 2010)



(Krueger etal, 2010)

Sun Safety Programs – our approach

- Workplaces should consider sun exposure like any other workplace hazard and manage it the same way as other hazards, i.e. through an OHSMS
- For workplaces with outdoor workers, a Sun Safety Program (SSP) should be part of an organization's OSHMS.
- The SSP is focused on prevention and management of health risks associated with sun exposure within the workplace.
- OHSMS is based on the Plan-Do-Check-Act model of improvement

Model Sun Safety Program

OHS Management System

3. Responsibility, accountability, authority

21. Management review & continual improvement
22. Off-the-job sun safety

17. Incident reporting & investigation
18. Workplace inspections
19. Documentation, records & statistics
20. Auditing & Evaluation

on or Substitution
ring controls
that increase
ss
uministrative controls (incl.
raining)
Personal protection
Control verification &
alidation

First aid & incident notification
14. Return to work
15. Preventive maintenance
16. Procurement

Do – Control measures

Do – Support

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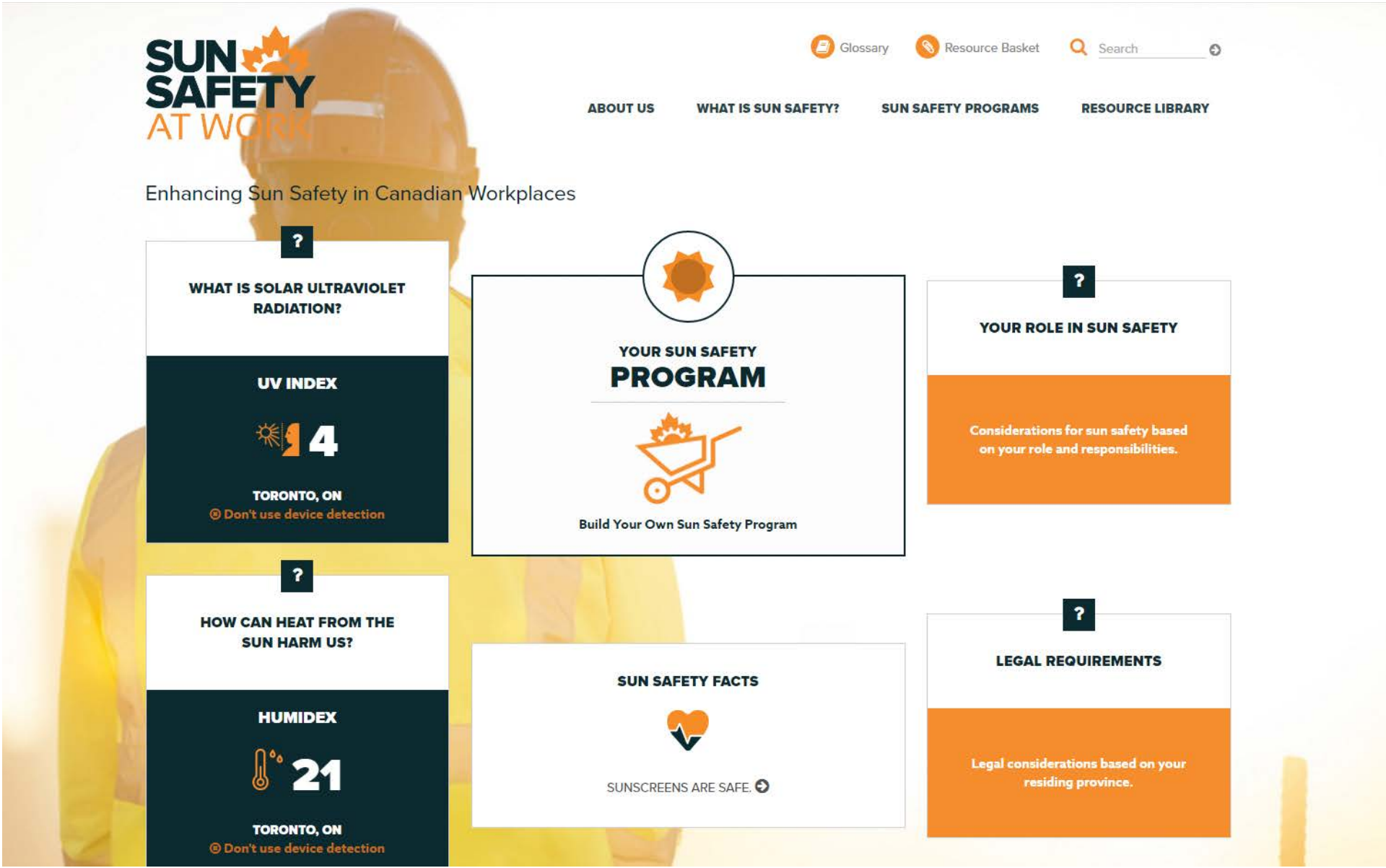
Sun Safety Program & OHS Legislative Requirements

Common Elements of a Health & Safety Program[1]	Model Sun Safety Program Elements
OHS Policy/Policy Statement	Policy
Assign responsibilities, accountabilities and authorities for OHS matters and the program	Responsibility, Accountability & Authority
Responsibilities of and support for the health and safety representative/officer or committee	Role of the health and safety committee Legal and other requirements
Identification and assessment of workplace hazards	Risk assessment
Control measures to eliminate or reduce the risks from the hazards identified	Do-Control Measures Do-Support
Inspection program	Workplace Inspections
Worker training and education	Administrative Controls (including training & education)
Emergency preparedness, including first aid requirements	First Aid and Incident Notification
Incident reporting and investigation	Incident reporting and investigation

https://sunsafetyatwork.ca



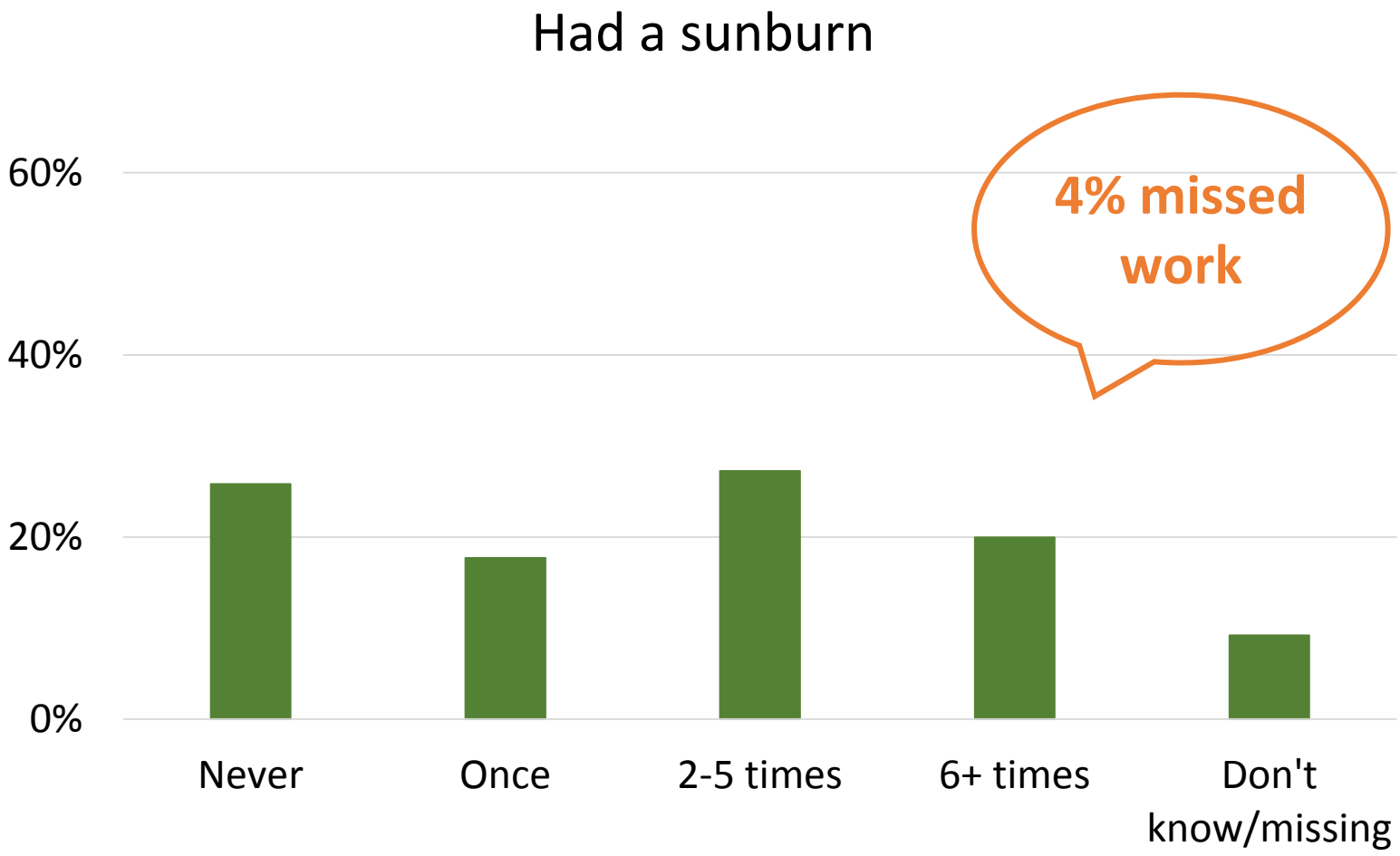
Workplace Intervention - Evaluation

Evaluation Activity	T1 (Summer/Fall 2015)	T2 (Spring 2016)	T3 (Fall 2016)
Worker Survey	16 workplaces 1133 workers	-	14 workplaces 885 workers
OHS Lead Interview	16 interviews 19 participants	12 interviews; 12 participants	16 interviews 21 participants
Key Informant Interview	30 interviews 72 participants	-	22 interviews 34 participants
Document Analysis	17 workplaces	-	-
Site Observation	6 workplaces 10 observation days	-	-
UV Dosimetry	-	-	13 workplaces 413 participants 347 viable measurements
OHS Lead Survey	-	-	12 workplaces
Workplace Commitments	-	-	14 workplaces
Sun Safety Advisor Reflections	-	-	16 workplaces

Workplace Intervention – Results

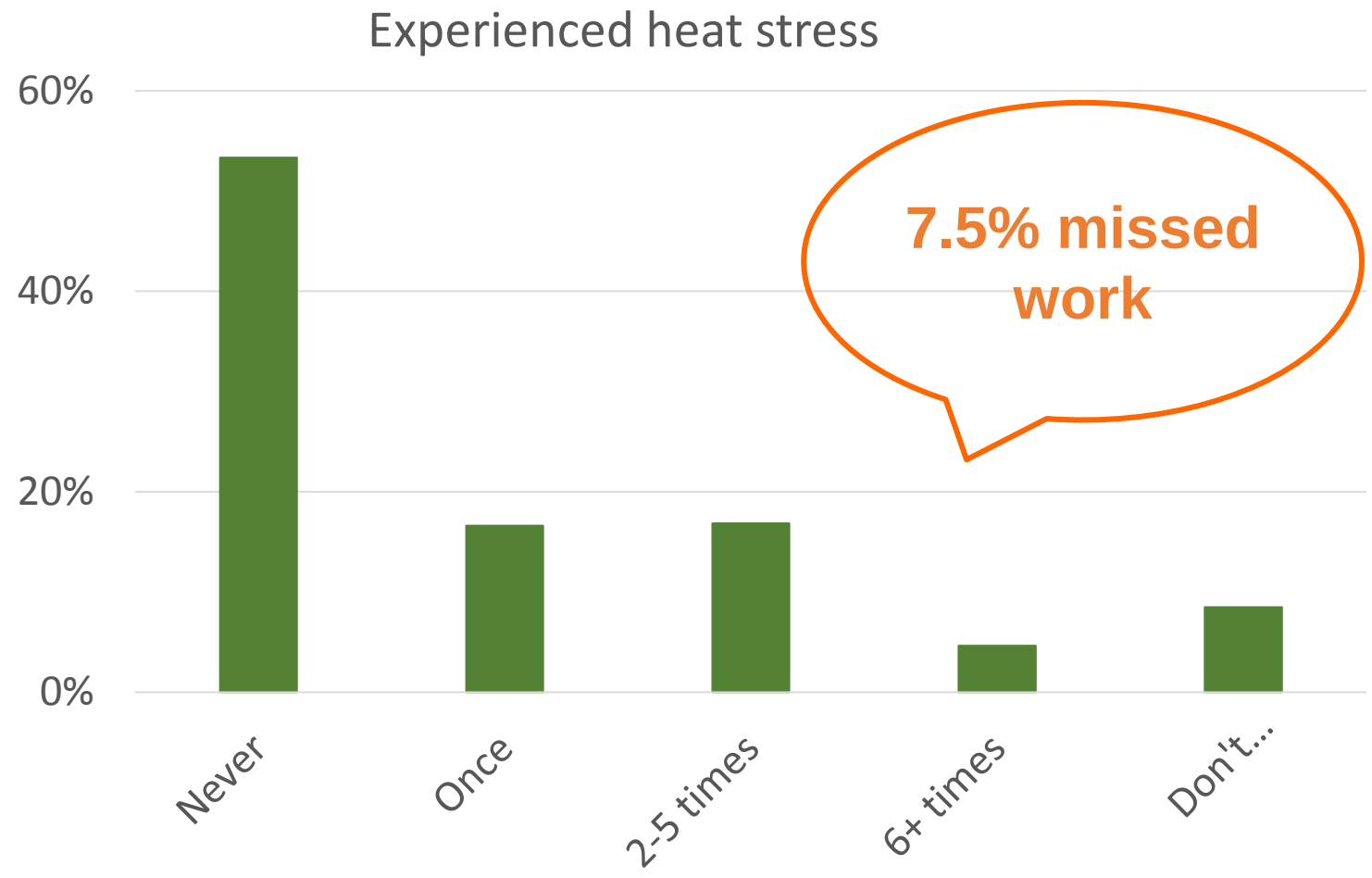
- **Interviews:** barriers and facilitators for sun safety:
  - The workplace context:
    - Available resources
    - The engagement of key supervisors and workers
    - The nature of the hazard and its importance
  - The intervention:
    - The intervention delivery
    - Role of sun safety advisor
  - Outer factors:
    - Provincial OHS legislation
    - Regional climate

Worker Survey – Incidents



1% completed an incident form related to sun exposure at work

Worker Survey – Incidents



1% completed an incident form related to sun exposure at work

Workplace Intervention – Results

- **Worker Surveys** (T1 vs T3)**:**
  - ↑ use of shade for breaks (↑25%)
  - ↑ training of workers (85→93%)
  - No change in use of shade during peak UV times
  - Limited use of PPE:
    - Hat/cap: Usually/Always 42%→57%;
    - Long sleeved shirt: Usually/Always 22→16%
    - Sunglasses: Usually/Always 57→52%
    - Sunscreen: Usually/Always 34→34%
  - Few workers having regular skin checks (23→10%)
  - 15% of workers reported having had skin cancer

Workplace Intervention – Results

- **Measures Implemented by Workplaces:**
  - 23 policy changes
    - 8 heat stress policy; 6 solar UV exposure policy; 9 sun safety policy
    - E.g.: solar UV policies/procedures developed or revised; incorporation of sun safety into workplace's OSHMS; linking solar UV policy with heat stress policy
  - 137 practice changes:
    - Training (crew talks, sun awareness campaigns, etc): 34
    - Information/awareness (resources, posters, daily advice): 16
    - Sun safety messaging into employee handbooks: 11
    - Supply of new PPE (wide-brimmed hats): 34
    - Sun safe work procedures (rescheduling of work tasks): 20
    - Risk assessment process (sun safety included): 10

Lesson Learnt

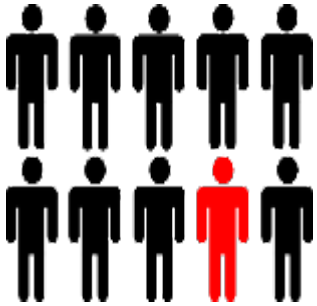
- Outdoor workers had very high personal UV exposures (Mean = 6xTLV); exposures varied substantially between individuals & work tasks
- Worker behavior/sun safety practices were hard to change, e.g. use of shade and PPE
- High rate of work-related sunburns, but few workers have regular skin checks
- Policy change:
  - Takes time to change/implement
  - Example policies & evidence summaries assist to make-the-case
  - Smaller workplaces tended to be more successful

Lesson Learnt

- Practice changes:
  - Workplaces tended to implement initiatives which were 'low hanging fruit'
  - Gaining worker support early is key for future success
  - Multi-year action plans enabled longer-term commitment by workplaces, e.g. plan in late fall/winter for spring/summer
  - Workplace champion was critical to success of OHS initiatives
  - Workplace culture, systems and process determine extent & timeliness of development & implementation of policy or practice changes
  - Workplaces viewed 'sun safety programs' as 'best practice'

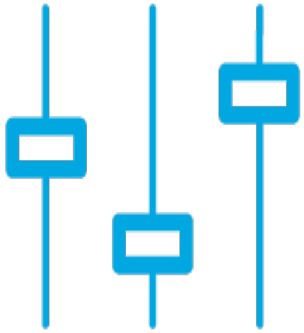
Effective Sun Safety Programs

Individual + Organizational



Active engagement

Customizable



Workplace champion

Embedded

Management support

SUN SAFETY AT WORK

A ‘Call to Action’

- The evidence is clear...
  - –Skin cancer is a significant burden on Canada’s public health system
  - –The levels of sun exposure and current sun safety practices within the community and specific settings are unacceptable if we wish to address skin cancer in a meaningful way
  - –Broad range of prevention initiatives are known to be effective, but need a comprehensive approach
  - –Skin cancer prevention initiatives provide a good ROI
- Its time to ‘turn-up the heat’ on sun safety…

Thank you!

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https://sunsafetyatwork.ca

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