
Fire Safety Ambassador: Content and timing of fire safety training and inspections on First Nation's communities and decision-support tool

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This report draws on data that is currently in place that was available for First Nations Populations on Reserve. There is a goal in moving beyond this current state and wherever possible by implementing new forms of data collection, drawing upon different data sources, and framing research questions that include Inuit and Metis populations and communities and First Nations residents off reserve.

Scope of work

A detailed report will be developed on the theoretical and practical aspects fire safety education delivery outlining the different technics used by peer research and policy to identify, oversee, and conduct educational treatments and then propose retreatment strategies and cycles for sustained positive fire safe behaviours within Indigenous Communities in Canada.

A decision support tool will be developed that will aid theoretical and practical aspects for the support of logistical generation for community site visits, it will consider resources required to deliver key programs and services to revisit communities to sustain positive fire safe behaviours.

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The main themes from a contemporary review of fire prevention research

The British Columbia Injury Research and Prevention Unit (BCIRPU) has published a Fire Safety Messaging Research report entitled, "Interventions for preventing residential fires in vulnerable neighbourhoods and Indigenous communities: a systematic review of the evidence" (Al-Hajj, Garis et al. 2021). This work updates and extends the 30-year old seminal work ("Global Concepts in Residential Fire Safety" series) undertaken by TriData examining the evidence base for 'what works' in fire prevention education (e.g., 2008, TriData Division 2008). In the current report, the BCIRPU reviewed and classified the contemporary literature based on the four 'E's framework: education, engineering (or environmental change), enforcement, and engagement. To avoid redundancy and maximise brevity, the remainder of this section briefly summarises the main 'themes' that emerged from the most recent BCIRPU systematic review, focusing on education (with some discussion of engagement) and engineering/environmental change (with brief mention of enforcement).

Educational interventions (focused on people)

Most of the educational interventions identified by the BCIRPU focused on the role that education can play in preventing fire (Al-Hajj, Garis et al. 2021). The logic here is that education can provide knowledge that will influence the frequency and extent of risky behaviour, which in turn will prevent fire. The commonality across these programs relates to their focus on **people** and the need to educate people in the hope of influencing their risky behaviour. The target group focused on by this body of work commonly involves vulnerable populations, as determined by combinations of elderly, highly-disadvantaged people, families with young children, and transient populations with high residential mobility. This research has also involved a variety of intervention delivery methods: ranging from dissemination of educational literature to homes (by firefighters or volunteers) through to dedicated training/interventions with small groups of residents. Engagement (in the form of hands-on training) in conjunction with education relating to fire safety and fire prevention has been demonstrated to be important. The BCIRPU report discusses evidence that fire safety comprehension and retention of information are increased in situations where people are given the opportunity to discuss what they have learned and practice the skills being discussed. The involvement of fire service personnel also increases the likelihood of people changing their decision making and improving the safety of their behaviours.

Engineering (environmental) interventions (focused on places)

The next major branch of fire-prevention interventions in the literature focus on the role that engineering and environmental interventions can play in reducing risk at places. There are three main categories of interventions: smoke alarms, residential sprinklers, and enforcement practices. The commonality across these approaches relates to their focus on **places** and the need to build-in early detection and early prevention strategies to protect people in the event of a fire. The best-practice information relating to each of these (as reviewed extensively by the BCIRPU report, Al-Hajj, Garis et al. 2021) are summarised, below.

First, with respect to smoke alarms, the logic of this intervention is based on providing an audible, early alert to residents that smoke is building up inside, meaning they should either fight or (flight) leave. There is unequivocal evidence that having a present, functioning smoke alarm reduces the risk of fire-related fatalities in the event of residential fires (but also evidence that smoke alarms can increase fire-related injuries, likely as a result of occupants remaining in place to fight fires). However, there are logistical issues associated with smoke alarms because they have a recommended product life cycle, they have to be (maintained) tested annually, and they have to be replaced when they no longer work. From a fire prevention perspective, there are separate goals related to installation/replacement (place-focused) and testing (person-focused). The methodologies used across published interventions designed to increase working smoke alarm coverage are varied. Some have used on-duty firefighters/volunteers door knocking in high-risk areas (often in partnership with a home safety visit), while others have relied on dropping alarms at houses or giving alarms away for free (on the hope that residents will install the alarms themselves). The literature on giving away alarms without installation demonstrated no effect, as the alarms were frequently uninstalled. The key to a smoke alarm being effective is that it has to be present and functioning, so interventions are best advised to ensure alarms are installed immediately and inspected regularly.

The second place-specific environmental modification focused on reducing the risk of fire-related damage and/or casualties in the event of a fire are residential sprinklers, which operate to suppress small scale fires in their very early stages. From an installation perspective, sprinklers can be in-built during original construction or retro-fitted to existing properties – with each approach incurring an installation and maintenance cost. Neither of these approaches typically involve the fire service. Like smoke alarms, the research evidence demonstrates that sprinklers significantly reduce the risk of fire-related deaths, and they also reduce fire spread (with almost all sprinkler-controlled fires contained to the object or room of fire origin).

From an enforcement perspective, the BCIRPU report indicated this is an under-evaluated area. Areas that have been trialled relate to (a) mandatory installation of smoke alarms, (b) building standards relating to factors such as fire separations, electrical standards, and building materials, (c) legislation relating to flammability of children's nightwear, and (d) standards relating to non-reduced ignition propensity cigarettes. While some enforced fire regulations had strong impact on the reduction of fire related injuries, others reported little evidence on their success in achieving any of their intended fire prevention outcomes.

How does this relate to the current NIFSC prevention programs?

Based on the findings from this updated review of 'what works', this next section summarises the programs currently being offered by the NIFSC and classifies the relevant ones into treating people and their behaviours vs. treating places and their safety systems. In total, 77 NIFSC programs are listed within the following categories:

- Community education (20 programs);
- Governance (9 programs);
- Community infrastructure (11 programs);
- Fire department management (11 programs);
- Inspections (8 programs);
- Investigations (3 programs); and
- Fire department operations (16 programs).

With respect to the focus of this decision-support tool, the 20 community education programs are the most relevant to classify with respect to the people and place categories discussed so far.

People-focused fire education programs

The NIFSC currently offers the following community-focused programs that relate to behaviour and knowledge deficits that increase the risk of residential fire:

1. **Cooking safety:** A fire safety program designed to educate adults with safe cooking tips, dangers of cooking-related fires, and basic kitchen safety.
2. **Heating safety in the community:** Fire safety program designed to educate adults with hazards of heating sources within the home. Focus on safe use of common heating sources.
3. **Electrical safety:** Fire safety program designed to educate adults on common electrical hazards. Focus on basic prevention methods.
4. **Home escape planning:** Fire safety program designed to educate both adults and children on the awareness, planning, use, and practice of home escape plans. Intended to bring children and parents together to discuss the family plan. Developed and overseen by NFPA.
5. **Senior and elder safety:** Public education program focused on fall prevention and fire safety for seniors. Focus on senior living, common hazards and prevention, and fire-related occurrences.
6. **Multi-generational residence safety:** Fire safety program designed to educate all demographics about hazards associated with multiple generations living within one residence.
7. **Wood heat safety:** Public education program focused on wood heating appliances safety.
8. **Wood heat maintenance:** Public education program that provides wood heating appliance maintenance and awareness tips.
9. **Seasonal safety:** Season specific fire safety campaigns and education resources that focus on known and emerging issues.

Moving forward, it would be sensible to determine whether there is duplication across these programs with respect to educational content, target audience, and program administration. At first glance, it appears there is likely scope for synthesis across programs to develop fewer (perhaps a single) programs that would address the main person-focused issues likely to cause preventable residential fire.

Place-focused fire safety and prevention programs

The NIFSC also offer a smaller set of community-focused programs that are intended to reduce place-based issues that increase the risk (and severity) of residential fire:

1. **Smoke alarms and carbon monoxide safety:** Fire safety program designed to educate on the proper installation, use, and maintenance of residential smoke alarms and carbon monoxide detectors within the community.

2. **Home safety assessment:** Public education program utilizing a standardized safety assessment and provides occupants with recommendations to mitigate identified and potential hazards.

On a related note, from the 'community infrastructure' category (above), there are also existing support services aimed at community fire protection planning and fixed systems/sprinkler protection support services.

It is also likely that these program goals could be combined into a single, place-focused program that would maximise the likelihood of building-in and sustaining early detection and early prevention strategies designed to protect people in the event of a fire.

Cognitive factors: the 'knowing-doing gap' and the 'wear-off' effect

As explained, above, there is a substantial body of evidence demonstrating person- and place-focused interventions can increase fire safety knowledge and reduce the risk of fire, fire damage, and fire casualty. However, for methodological reasons, there is a lack of clarity about the extent to which the efficacy of these person-focused training/education-based fire prevention interventions diminishes over time. As a result, we need to look outside of fire safety research when considering what the best-practice timeframes of training and re-training should be.

Looking to cognitive psychology and what is known from research into the durability and efficacy of training in other contexts, at least two main factors need consideration when evaluating the long-term effectiveness of fire safety interventions (for an extensive summary of issues, see Wenzel and Cordery 2014). These are the 'knowing-doing gap' (e.g., Joyner 2015) and the 'wear-off effect' (aka 'knowledge retention problem', e.g., Compton and Chein 2008). In an ideal context, effective training should convert into more optimal behaviours of some sort. The knowing-doing gap defines situations where people learn new knowledge, but this knowledge does not influence how they act. In parallel, there is also an issue of the extent to which information is retained without being refreshed – how long before the benefits of training 'wear-off'?

It is reasonable to expect that both of these factors will influence the long-term efficacy of community-focused, residential fire safety training. Translating these issues to a fire context, pre-training, trainees can be classified into the following categories:

- Lacking safety knowledge and behaving unsafely,
- Possessing safety knowledge and behaving unsafely (knowing-doing gap), or
- Possessing safety knowledge and behaving safely.

Post-training, (assuming training is effective, providing knowledge AND influencing behaviour), trainees can be classified into the following categories:

- Possessing safety knowledge and behaving unsafely (knowing-doing gap), or
- Possessing safety knowledge and behaving safely (with the retention-related risk of the training benefits wearing-off over time and behaviours relapsing into unsafe habits)

With these categories in mind and acknowledging that learning-related outcomes may be cognitive, affective, attitudinal, and/or behavioural, it is important to be explicit about the goals of person-focused, community-based, fire safety training. Whilst sustainable, long-term increases in the implementation safety knowledge that increase safety behaviour is the ultimate goal, it is also important to monitor the extent to which training produces a knowing-doing gap and the duration

over which there is a wear-off effect meaning trainees have forgotten content, shifted attitudes, and ultimately returned to their old, unsafe behaviours. These issues are revisited, below, when considering the methodology for delivering and evaluating person- and place-focused fire-safety training.

Proposed methodology for the training and evaluation schedule

With respect to the proposal methodology for the training and evaluation schedule, summarising the information discussed above, the NIFSC logistics tool should plan on implementation of at least two programs: one focused on educating people with a view to changing their behaviour and one focused on reducing the fire risk at places by increasing the likelihood of having effective fire prevention systems in place.

Based on available evidence and considering the high-risk and transient population of trainees involved, a conservative approach should be taken to the frequency of the person-focused training. This would involve a **2-year rotation through communities** in the first instance, with the potential to adjust this frequency (up or down) as better evaluation data becomes available.

Based on manufacturer's recommendations relating to smoke alarms and the general requirements for inspecting in-built safety systems like sprinklers (where present), in addition to training residents to conduct their own annual audits, a conservative approach to place-focused fire safety inspections and alarm installations inspection should occur **every 4 years for buildings** in the first instance (also with the potential to adjust up/down based on evaluation outcomes). In addition to this full place-focused inspection, residents should also be able to request additional alarms from the NIFSC between inspections should they identify a problem with an existing fire safety device.

In addition to using the logistics tool to monitor the frequency of training/inspection delivery, it is also strongly recommended that the NIFSC commence an ongoing program of evaluation to monitor the effectiveness of this fire safety strategy. It is recommended that the NISFC commit to ongoing **process** (ensuring programs are delivered) and **impact** (seeing how effective the programs are) evaluations. At a minimum, the person-focused training should be evaluated in two ways. From a process perspective, records should be kept about how many trainees are involved in each community and how many have completed related training in the past. From an 'impact' perspective, ongoing evaluation should measure (at a minimum) information about:

1. Pre- and post-training fire safety knowledge/beliefs/attitudes/behaviours,
2. Knowledge gain,
3. Knowledge retention,
4. Behavioural change (knowing-doing gap), and
5. Knowledge retention (wear-off effect)

We know from research in other contexts that increasing awareness can change attitudes, which can influence behaviours, but these are all different thresholds of success. Then there is an additional issue relating to the extent and duration of knowledge retention before (non-clinical) behavioural relapse into previous habits. Ongoing monitoring of the training effectiveness will ensure more is understood about these patterns for community-based fire safety training, which, in turn, will ensure the maximum benefit is being gained from these safety interventions.

Similarly, the place-based interventions should be evaluated with respect to process (how many dwellings have been inspected, how many alarms have been checked/installed, etc.) and impact (how many houses have present/functioning alarms, how many fires have occurred, how many fires have

extended beyond the room of origin, etc.). The overarching objective of these combined strategies is to influence behaviour and safety systems in a way that will reduce fire-related casualties (injuries and deaths) and reduce fire-related loss.

The following section explains how the NIFSC program delivery logistics tool brings together data sources to augment the existing program delivery mechanisms to prioritize efforts for more impactful and measured outcomes.

4. Scheduling task – scheduling entry form:

Province 1	<input type="text"/>	Action 4	<input type="text"/>	<input type="button" value="SUBMIT"/>	<input type="button" value="CLEAR"/>
Program 2	<input type="text"/>	Date (mm/dd/yyyy) 5	<input type="text"/>		
Entered By 3	<input type="text"/>	13			
Band # 6	<input type="text"/>				
Location	<input type="text"/>				
Closest Service Location	<input type="text"/>				
Population	<input type="text"/>				
Households	<input type="text"/>				
At Risk Population	<input type="text"/>				
Band Name	<input type="text"/>				
Most Recent Treatment Completed & Date	<input type="text"/>				
Next Treatment Scheduled & Date	<input type="text"/>				
Program Term (Years)	<input type="text"/>	Required Staff per Treatment Team per Program Policy	<input type="text"/>		
Scheduled Date 7	<input type="text"/>	Teams Scheduled for Location (Insert Minimum of 1)	<input type="text"/>		
Treatment Per	<input type="text"/>	Treatment Delivery Time Required (hours)	<input type="text"/>		
Number of Sessions(Default=1) 8	<input type="text"/>	Travel Time Required (hours)	<input type="text"/>		
Current Status	<input type="text"/>	Current Condition	<input type="text"/>		
Change Status to: 10	<input type="text"/>	Change Condition to: 11	<input type="text"/>		
Notes 12					
<input type="text"/>					

Role: Data entry using controlled inputs to be completed so that scheduling can be generated for each program for each of the active bands. This activity generates records for the database once record is complete, so that Staff know where to travel to deliver the scheduled program.

Instructions (Every yellow box **MUST** be completed prior to completing record. Light Blue boxes are useful to the process but are not mandatory fields):

1. Select Province from Dropdown – this choice refines the Band Numbers shown in Step 6
2. Select the Program from Dropdown
3. Enter Initials or name of person recording the entry for data auditing purposes
4. Select "Schedule" from Dropdown

5. Enter date of record being entered into database
6. Select Band number from Dropdown – note that if an inactive or “Out of Scope” Band is selected it will show by design. Band related information populates once Band number chosen, so that Band name can be referenced to validate choice.
7. Enter date for program to be delivered
8. If program selected in Step 2, is provided to “Community” or “Facility” instead of “Household”, then dropdown must be used to confirm number of Treatments/inspections/ presentations. If program is provided to “Household”, then skip this step as the field will not show.
9. Insert number using Dropdown. This field allows for additional flexibility for number of teams to reduce on site time where preferred.
10. In the event that a band showing on the Band Reference table is showing as “Out of Scope” but a program needs to be delivered the program can be scheduled and the status of the Band changed to show as Active going forward. NOTE. The Band information should also still be updated on the “Band Ref” tab.
11. If a grading of conditions becomes useful for tracking trends over time, this feature is available.
12. A note field may be of use where staff providing delivery of scheduled programs can see notes provided by person performing Scheduling.
13. Once record complete and reviewed for accuracy, one can choose to click “Clear” button to start over, or “Submit” to add record to database listing.
14. Enter next record using the same steps from 1-13 above.

5. Updating scheduled records in database – all activities database

Role: After Staff have completed program delivery results of program delivery must be sent to Scheduler or other appropriate staff member to update the following fields highlighted in yellow

Notes	Lifespan	Next Treatment Date	Treatment Time	Travel Time (hours)	Number of Staff	Total Staff Time	Completion Date (MM-DD-YYYY)	Completion Status	Actual Travel Time	Actual Treatment Delivery Duration on Location	Actual Quantity Treated	Actual Quantity Declined	Treatment 1	Treatment 2
Speak to Jim	5	10/20/2026	200.00	2.00			10/31/2021	Completed	3.00	200.00	200.00	-	10/20/2026	10/1
Notes are awesome	4	10/31/2025	62.50	1.33	2.00	127.67		Schedule					10/31/2025	10/3
	4	11/29/2025	35.00	0.73	2.00	71.47		Schedule					11/29/2025	11/2
Headsup	2	11/24/2023	6.00	1.12	4.00	28.47		Schedule					11/24/2023	11/2

2. The remaining 4 fields all provide valuable information so that original data can be updated if needed. Examples:
 - a. If actual travel time is significantly different from time contained in “Band Ref” tab then it should be updated
 - b. If actual treatment time for a particular program is often significantly different to estimated treatment time that provides an opportunity to either refine the assumptions contained “Program Ref” tab or seek clarification on the process being performed on location.

6. Planning Reporting - Resource Allocation Tool

Role: This report provides the appropriate program management user functionality to build and analyse alternative scenarios for programs already scheduled and not yet completed.

1. Program parameters such as Program Term, Treatment Time per Unit and Staff members assigned per team, can be altered using the provided instructions to shift timing for years when next delivery date is due and how many staff hours will be required by program and province.
2. Changes can also be made to parameters related to the annual hours estimated for the full time equivalent of the average program delivery team member.
3. The combination of the above sets of parameters provides an output by year of how many staff members are required to keep the program delivery on schedule.

Assumptions: 1 - Program Scenarios			Status Quo (per REF Program tab)			ALTERNATIVE SCENARIO		
Program Description	Delivery Mode	Basis	Years to Expiry	Treatment Time Per Unit	Staff per Team	ALT Years to Expiry	ALT Treatment Time Per Unit	ALT Staff per Team
Home Safe	Inspection	Household	4	30	2	2		
Senior Safety	Community Presentation	Community	2	180	2			0
Youth Fire Safety	Community Presentation	Community	2	120	2			0
Program D	Inspection	Facility	4	180	2			0
Program E	Door to door with Follow up	Household	4	20	2			0

Assumptions: 2 - Calculation of annual Full time equivalent hours for 1 staff member

Calculated Number of Full Time Equivalent (FTE) Hours

Number of Annual hours for a FTE (Weeks x Hours/week) 50 x 35 = 1,750

Planning 10 Year Outlook Report: based on Actual Treatments Scheduled Within/From Chosen Year below

START YEAR 2021 Step 3: Insert Start year for 10 Year Outlook.

Calculated FTE's Required by Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	44.6	0.0	44.6	0.0	44.6	0.0	44.6	0.0	44.6	0.0

Program		Province	Treatment Unit Type	Travel Time	Treatment Units	Prog Years	Treatment Time (minutes)	Staff per Team	NUMBER OF STAFF HOURS BY YEAR BY PROGRAM BY PROVINCE									
									2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Home Safe		AB	Household	84.00	12620	2	30	2	25,240		25,240		25,240		25,240		25,240	
Home Safe		BC	Household	344.07	18725	2	30	2	37,450		37,450		37,450		37,450		37,450	
Home Safe		NB	Household	30.00	3095	2	30	2	6,190		6,190		6,190		6,190		6,190	
Home Safe		NL	Household	4.00	545	2	30	2	1,090		1,090		1,090		1,090		1,090	
Home Safe		NT	Household	42.00	2745	2	30	2	5,490		5,490		5,490		5,490		5,490	
Home Safe		EI	Household	4.00	200	2	30	2	400		400		400		400		400	
Home Safe		YT	Household	24.00	1090	2	30	2	2,180		2,180		2,180		2,180		2,180	
Senior Safety		BC	Community	1.12	1	2	180	2	12		12		12		12		12	
Youth Fire Safety		BC	Community	1.07	1	2	120	2	8		8		8		8		8	
Youth Fire Safety		MB	Community	8.13	2	2	120	2		16		16		16		16		16

Report below uses Status Quo parameters unless alternative parameter provided.

Step 1: Insert alternative into Yellow cells in respective field.

To reset to Status quo, remove data inserted into Yellow filled cells.

Note Staff member per team applies across all programs.

Step 2: Insert Number of weeks and hours per week to approximate annual hours for typical FTE.

7. Reporting Example – Ad Hoc Reporting Tool

Role: As familiarity of the logistics tool develops and new insight is sought this sample pivot table provides the appropriate program management user functionality to build new reporting on an as needed basis.

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Author Biographies

Professor Joseph Clare has a PhD in applied cognitive psychology and a Master of Criminology and Criminal Justice. He is the Deputy Head, Research, at the University of Western Australia (UWA, 2020 ranking 85th in Academic Ranking of World Universities), working within the School of Law (2019 ranking 75th in Times Higher Education World Subject Rankings). Joseph's is a social scientist who is capable of thinking and researching across disciplines, with a strong commitment to the nexus between theory, applied research, and practice. The variety of research roles he has undertaken have enabled him to develop a diverse range of research interests. The common focus across these areas is the use of available data to help criminal justice agencies develop problem-specific solutions. Joseph has excellent quantitative skills and applied experience in a range of criminal justice (and emergency first-responder) areas that provide him with the knowledge and capacity to undertake complex, highly-applied research and to work with practitioners to implement and evaluate data-driven prevention strategies.

Mr Pierre Robinson is the Director of Brighart Analytics Inc., which develops logistics and analytics tools designed to meet the operational challenges unique to each organization. Leveraging over 24 years of business analytics experience in the telecommunications, energy, transportation logistics, and fire safety industries, the focus is to build sustainable informative decision-making tools that can easily be maintained by clients.

References

Al-Hajj, S., L. Garis, C. Pawliuk, E. Desapriya and I. Pike (2021). Interventions for Preventing Residential Fires in Vulnerable Neighbourhoods and Indigenous Communities: A Systematic Review of the Evidence. Vancouver, BC, Prepared by the BC Injury Research and Prevention Unit for the National Indigenous Fire Safety Council Project.

Compton, M. T. and V. H. Chein (2008). "Factors related to knowledge retention after crisis intervention team training for police officers." *Psychiatric Services* **59**(9): 1049-1051.

Joyner, F. F. (2015). "Bridging the knowing/doing gap to create high engagement work cultures." *The Journal of Applied Business Research* **31**(3): 1131-1148.

TriData Division (2008). Global concepts in residential fire safety: Part 1 - Best practices from England, Scotland, Sweden and Norway.

TriData Division (2008). Global concepts in residential fire safety: Part 2 - Best practices from Australia, New Zealand, and Japan.

Wenzel, R. and J. L. Cordery (2014). *Training transfer research: a manager's guide and bibliography*, Australian Institute of Management.