National Indigenous Fire Safety Data Collection Evaluation:

Review of Existing Practice and Recommendations for the Future

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Independent evaluation completed by

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Acknowledgements and Caveats

The National Indigenous Fire Safety Council (NIFSC) is the result of a new Indigenous developed framework designed to support Indigenous communities in the development of their internal capacity to support community safety and resiliency. The NIFSC is Indigenous inspired, designed and led in collaboration with regional and national Indigenous communities, organizations, and leaders.

This report has been developed in response to Research Area #4 (RFP #2022-04 from the 2022-23 NIFSC research agenda) to complete a National Indigenous Fire Safety Data Collection Evaluation (NIRS, HAS, FDA), with the goal of completing a review of data and collection methods and creating a template for reporting.

The authors would like to acknowledge the National Indigenous Fire Safety Council (NIFSC) for requesting this work and being committed to evidence-based decision-making in such critical areas of community health. In particular, the researcher thanks the Board of Directors, Nathan Wright, Executive Director, Blaine Wiggins, Senior Director Indigenous Fire Marshals Service, Mandy Desautels Director of Strategic Initiatives, and Len Garis, Director of Research for their vision and guidance as the project unfolded.

The presentation of data within this report cannot be considered as either endorsed by the NIFSC or an expression of their policies or views. Any errors of omission or commission are not the responsibility of the NIFSC.

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Preamble

The objective of this evaluation was to align programs with evidenced evaluated data-driven, collected from National Incident Reporting System (NIRS), Home Safety Assessments (HSA), and Fire Department Assessments (FDA) to influence development and revisions to existing programs. 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.

Analytical approach

The work presented here is comprised of five review components followed by a summary of main findings and recommendations. The review components examine: (1) contextual information from Canadian Census data relating to the relative fire-risk profile for First Nations populations; (2) the summarised content from the fire incident reports submitted to the NIRS; (3) the summarised content from the HAS records captured by the NIFSC; (4) the summarised content from the FDA programs; and (5) relevant fire safety findings from international research. Each of these components are discussed and specific recommendations are made. Following this the report conclusion overviews the main themes that emerged from this process.

Recommendations

Six high-level categories of recommendations were proposed. These were:

Recommendation 1 – Extrapolating from NIRS fire trends.

a) Implement a research-based approach to deliver a targeted strategy for increasing the coverage of working smoke alarms.
b) Use relative community risk profiles to implement targeted educational campaigns to reduce preventable fires from factors such as smoking, inappropriate use of heating equipment, and cooking.
c) Examine suspicious residential fires to determine the extent to which they are occurring in vacant/abandoned buildings, implementing a targeted prevention strategy if relevant.
d) Adopt a risk-based strategy to prioritise installation of home safety and life safety systems in high-risk First Nations communities.

Recommendation 2 – NIRS data collection and data storage improvements.

a) Align the NIRS data collection forms with those used by other fire reporting entities in Canada.
b) Increase the range of variables captured by the NIRS structure.
c) Improve NIRS reporting training to minimise the volume of missing responses.

Recommendation 3 – Increase reporting to the NIRS.

a) Develop and implement partnership-based strategies to increase fire incident reporting to NIRS, prioritising highest-risk communities in the first instance.

b) Develop and implement partnership-based strategies to increase fire casualty reporting to NIRS, prioritising highest-risk communities in the first instance.

Recommendation 4 – Increase engagement with the HSA audit process.

a) Ensure all reporting entities are using a consistent structure for the HAS reporting forms.
b) Amend the HSA data collection summary form to aggregate the local findings within each community in a timely manner that would highlight high risk, urgent intervention requirements.
c) Develop and implement partnership-based strategies to increase the coverage of this HSA process across First Nations communities.

Recommendation 5 – Increase engagement with the FDA audit process.

a) Implement a risk-based approach to prioritise FDA audits across First Nations communities.
b) Target FSA audit performance on life safety, occupational health, and document management.
c) Develop and implement sustainable, partnership-based strategies to increase the coverage of the FDA process across First Nations communities

Recommendation 6 – Commit to undertaking process and impact evaluations of changes you make.

Relevance of findings to other recent research

Building on the development and implementation of the various data collection sources (NIRS, HAS, FDA, and Census data), the report proposes ways to enhance metrics with the intention of better informing programs and services and creating better reporting templates to inform the NIFSC services. The recommendations detailed throughout this report align with recent research by Huesken et al. (2020) and other best-practice fire prevention research findings in suggesting risk-based ways to prioritize fire prevention delivery options (e.g., Clare et al., 2012) and to evaluate the (process and impact) successes of these activities.

Contextual information about relative-risk of fire-related casualty for Canadian First Nations peoples

Recent Census findings provide important context to the relative risk of fire-related casualty for First Nations Peoples in Canada (see Statistics Canada 2022a; 2022b; 2023). Important points include:

- Indigenous peoples accounted for 5.0 percent of the Canadian population in 2021;
- The Canadian Indigenous population increased by 9.4 percent between 2016 and 2021, growing at a faster rate than the non-Indigenous population;
- Looking across Census data from 2016 and 2021, fire risk-wise, relative to non-Indigenous people, Indigenous Census respondents were more likely to:
    - Live in a dwelling in need of major repair;
    - Live in crowded housing;
    - Live in low-income households;
    - Have children under the age of 6 years; and
    - Have one or more family member who is unemployed.

As discussed by Garis and Desautels (2021a), analysis of Canadian Coroner and Medical Examiner data demonstrated that "Indigenous people in Canada are five times more likely to die from a fire than the general population, and that risk increases to 10 times if they live on reserve and 17 times if they are Inuit." Related to this work, the 2020 report by Huesken et al. (2020) entitled, "Moving from risk assessment to risk reduction: an analysis of fire-related risk factors in First Nation/Indian Band or Tribal Council Areas across Canada" examined data from Statistics Canada's 2016 Census Aboriginal Community Portraits, which represented 624 First Nation/Indian Band or Tribal Council areas. Huesken et al. (2020) used nine variables to rank relative fire risk across Canadian communities (see Garis and Desautels, 2021b, for a summary). This process estimated 166,740 Indigenous people (in 2016) were living in high-risk areas (3.4% of areas) with at least seven of the nine risk factors.[1] Based on the 2021 Census estimated population growth, a 9.4 percent increase in this at-risk population would estimate the total high-risk population to 182,414 people.

As is discussed further, below, the crucial, applied relevance of the UFV research is that it demonstrates a replicable way to quantify relative risk across First Nations communities using existing Census data that simultaneously achieves two goals: (1) highlighting the current non-random distribution of risk across places, and (2) providing a priority ranking list for where to target risk-based, prevention-focused intervention efforts.

[1] Proportion of residents who were (1) aged under 6, (2) aged over 65, (3) frequently moving house, (4) unemployed, (5) lone parent families, (6) living in houses requiring major repairs, (7) living in crowded houses (more people than rooms), (8) living in houses with high occupancy (5+ people), and (9) renting housing.

National Incident Reporting System (NIRS) data summary

Prior to overviewing the finding from the NIRS analysis, it is important to explain that there is a voluntary reporting system in place for this data. Further to this, given the highly public nature of fire-related deaths, which resulted in informal requests for NIRS reports to be filed by the relevant local authority, incidents that did not involve fatalities are likely to be under-counted in this dataset. With these caveats in mind, there were 1,270 incident reports captured in the dataset (involving 16 injuries and 71 deaths). The fire-specific reports (capturing outdoor, structure, and vehicle fires) accounted for 693 (55% of the total) incidents[2], involving 12 injuries and 70 deaths (see Table 1). This fire sub-set forms the focus of the remainder of the analysis presented here.

Table 1. All fires, incident type, frequency and percentage of fires, injury and death (counts and rates per 1,000 fires)

Report type	# incidents	% incidents	# injuries	Rate injuries per 1000 fires	# deaths	Rate deaths per 1000 fires
False Alarm	81	6.4%	0	0.0	0	0.0
Fires -Outdoor	337	26.5%	0	0.0	0	0.0
Fires -Structure	284	22.4%	11	38.7	68	239.4
Fires -Vehicle	72	5.7%	1	13.9	2	27.8
Medical	255	20.1%	3	11.8	1	3.9
Motor Vehicle Incident	65	5.1%	0	0.0	0	0.0
Other	161	12.7%	1	6.2	0	0.0
Rescue	15	1.2%	0	0.0	0	0.0
Total	**1,270**	**100.0%**	**16**	**12.6**	**71**	**55.9**

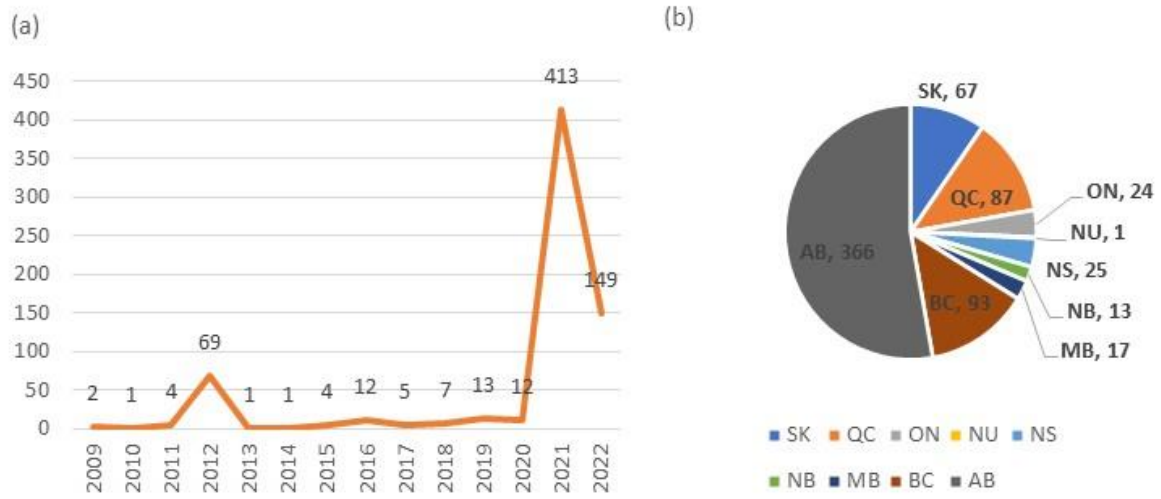

Figure 1. Panel (a) volume of reports over time between 2009 and 2022, and Panel (b) distribution of reports across Provinces and Teritories.

[2] The remainder of the report types were false alarms (4.2%), medical events (21.7%), motor vehicle incidents (4.7%), rescue events (0.4%), and 'other' events (13.4%).

As is clear from Figure 1, temporal and geographic trends demonstrate an inconsistent approach to reporting over time (Figure 1(a), 60% of incidents reported in the 14-year window were related to 2021) and space (Figure 1(b), 53% of incidents were reported from Alberta, and six Bands reported over 70% of all incidents with a single Band reporting just over 50% of the whole dataset). These trends are reflective of the voluntary nature of reporting and the increased emphasis on reporting between 2020 and 2022.

Recent analysis from British Columbia Office of the Fire Commissioner (BCOFC) demonstrated that structure fires accounted for 69 percent of injuries and 61 percent of deaths that occurred in 2021 (BCOFC, 2022). Within this BCOFC subset, residential structure fires made up 79 percent of all structure fires and resulted in 94 percent of structure fire injuries and all the structure fire deaths (at a rate of 42.9 injuries per 1,000 fires and 13.1 deaths per 1,000 fires, respectively). Previous research has also found residential structure fires are the most preventable and the types of fires most positively influenced by fire safety devices like smoke alarms and sprinkler systems (Al-Hajj et al., 2022).

These findings motivated a specific residential structure fire analysis of the NIRS data. However, although there is some similarity between the reporting form used in the NIRS data and those more typically used by municipal fire services (e.g., the forms used by the BCOFC for fires and casualties) there are also important differences that limit the analysis that can be done with the current NIRS data set. Due to the lack of a Property Complex variable, "Property Use Type"[3] was selected as a proxy to identify the subset of reported fire incidents that occurred in residential buildings. Following the application of this filter, 137 fire incidents involving 10 injuries and 60 deaths were retained for analysis as the 'residential structure fires' recorded in the NIRS data (translating to 48% of structure fires, 91% of structure fire injuries, and 88% of structure fire deaths). The following analysis show patterns relating to this subset of residential fires.

Table 2. Method of fire control: frequency and percentage of fires, injury and death (counts and rates per 1,000 fires)

Method of fire control	# incidents	% incidents	# injuries	Rate injuries per 1000 fires	# deaths	Rate deaths per 1000 fires
Burned out before FD arrival	13	9.5%	1	76.9	32	2,461.5
Fire department water	87	63.5%	8	92.0	17	195.4
Hand fire extinguishers	7	5.1%	0	0.0	1	142.9
No fire detected	22	16.1%	1	45.5	0	0.0
Standpipe and hose systems	3	2.2%	0	0.0	6	2,000.0
Not stated	5	3.6%	0	0.0	4	800.0
Total	**137**	**100.0%**	**10**	**73.0**	**60**	**438.0**

Relative to the general data from BC for the most recent calendar year, this subset of fires showed a very high injury and death rate (Table 2). Partly, this is consistent with previous research that has demonstrated elevated fire-related casualties for Indigenous communities in Canada (as discussed by Garis & Desautels, 2021a). However, it is important to briefly explain the significant effect that

[3] The selected responses included: Abandoned home, abandoned dwelling, apartment (all variations), camping trailer, dwelling (all variations), house (all variations), private home, residence, RV (all variations), and residential (all variations). Also worth noting that 40.2% of the fires had no specified property use type.

under-reporting of fire events is also having on these casualty rates. The rate denominator is very likely a large underestimate of the total number of fire events that occurred across the relevant First Nations communities during the period of interest. This point will be discussed more fully at the conclusion of this section.

Table 2 also demonstrates the method of fire control involved with the 137 residential fire incidents recorded in the NIRS. From a policy and planning perspective it is crucial to emphasize the pattern showing the 13 fire events where the fire had burned out before the fire department arrived (9.5% of the incidents) resulted in 53 percent of the fatalities. When the fire department arrived and controlled the fire, the fatality rate was much lower (17 deaths in 87 fires). The lowest death rate was from fires managed by hand-held extinguishers.

Continuing to focus on the residential fire sub-set, Figure 2 analyses the coded area of fire origin for (a) fires, (b) injuries, and (c) deaths. These data demonstrate another major issue with the reporting (in addition to the under-reporting mentioned, previously). In total, 56 percent of the records show the area of fire origin as either "NA", unknown, or the field was left blank. When an area of fire origin was specified the most common rooms were the kitchen (25% of fires with an area specified) and the living room (23%), which is consistent with previous research examining this issue using larger, provincial datasets (e.g., BCOFC, 2023). This information is also absent for 65 percent of the deaths recorded in the data.

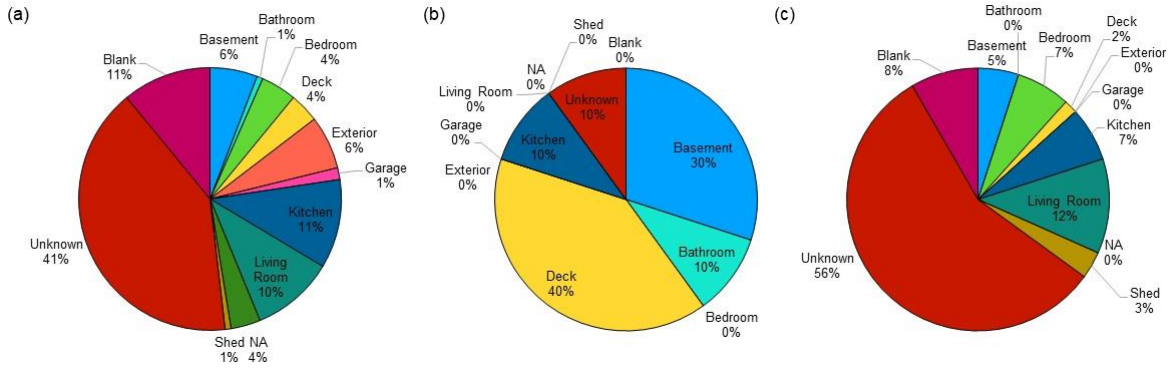

Figure 2. Area of fire origin: (a) all fires, (b) injuries, and (c) fatalities.

A similar representation of the fires, injuries, and fatalities are displayed in Figure 3, with the panels this time displaying information related to the igniting object involved. As before, a large number of the fire events have no igniting object recorded (43% missing/undetermined). When an igniting object was identified, the most frequently reported objects were matches (24%), smoker's material (22%), and electrical (16%), which once again mirrors findings from previous research (e.g., BCOFC 2023). This information was missing for 62 percent of the reported deaths.

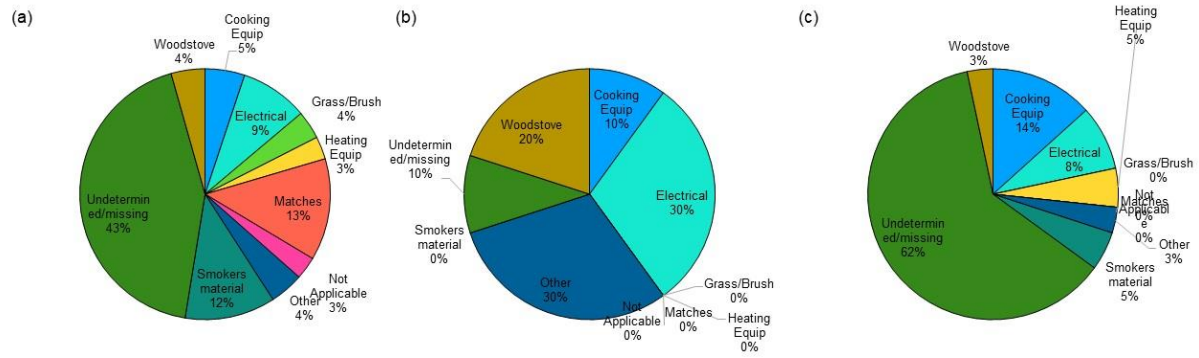

Figure 3. Igniting object: (a) all fires, (b) injuries, and (c) fatalities.

Figure 4 also uses pie charts to represent the acts or omissions captured within the dataset with respect to (a) all reported fires, (b) injuries, and (c) deaths. One-third of fires (34%) were coded as 'suspicious', one-quarter (25%) involved human error, and almost one-third (30%) had no act/omission coded in the data. What is unclear from the NIRS data is the extent to which suspicious fires were occurring in abandoned/vacant residential buildings (see Thomas et al., 2021, for a discussion of this issue). The majority of injuries were connected to human error. Human error was associated with 30 percent of fatalities, with a further 60 percent of deaths uncoded with respect to act or omission.

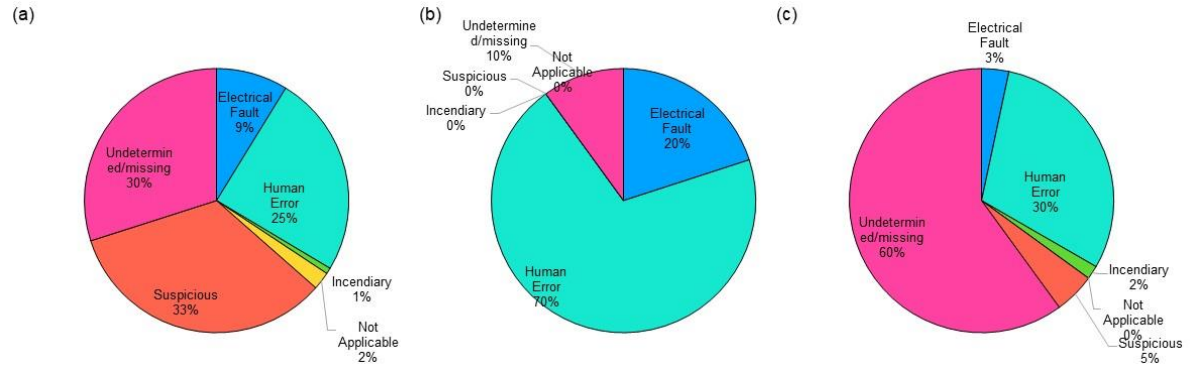

Figure 4. Act or omission: (a) all fires, (b) injuries, and (c) fatalities.

There is unequivocal evidence from the literature that present, functioning smoke alarms reduce (a) the frequency of fires, (b) the extent of fire spread, and (c) the frequency of fire-related deaths (Al-Hajj et al., 2022). Table 3 provides an overview of smoke alarm presence and functionality for the subset of residential fires reported to the NIRS data portal. Consistent with the high-level trends observed for the variables reviewed, above, the smoke alarm presence was unknown/missing in over two-thirds of records (67%). Less than 10 percent of reported residential fires were recorded as having a present, functioning smoke alarm. Consistent with the findings from research in other areas (e.g., BCOFC, 2023), the rate of fire-related deaths was highest when it was clear that there was no working alarm present (with the 22 deaths from 16 fire events translating to a rate of 1,375 fatalities per 1,000 fires without smoke alarms). In combination with the previous findings relating to the huge proportion of fatalities that resulted from fires that were burned out before the fire service

arrived on-scene, it is crucial to re-emphasize the potential value of maximising working smoke alarm coverage, in addition to other fire safety strategies (discussed in later sections of this report).

Table 3. Smoke alarm presence and functionality for residential fires.

Smoke alarms - present	Smoke alarms - operated	# incidents	% incidents	# injuries	Rate injuries per 1000 fires	# deaths	Rate deaths per 1000 fires
No	NA	16	11.7%	0	0.0	22	1,375.0
Yes	No/unknown	16	11.7%	0	0.0	5	312.5
Yes	Yes	13	9.5%	8	615.4	2	153.8
Missing/Unknown		92	67.2%	2	21.7	31	337.0
Total		**137**	**100.0%**	**10**	**73.0**	**60**	**438.0**

It is also important to discuss the implications of the NIRS data structure preventing the capture of unique fire related casualty information in the event of multiple fire casualties connected to a single event. Municipal reports used more broadly allow for a one-to-many relationship between fires and casualties (in cases where multiple casualties occur as a result of a single fire). This data is collected using a separate reporting form and stored in a separate dataset, with a fire-specific unique identifier linking the fire-casualty records. The fire casualty form collects important information relating to the casualty (age, sex) and their behaviour at the time of the fire (condition of casualty, action of casualty, cause of injury, extent of injury, and cause of failure to escape). Unfortunately, due to the aggregated way that casualty data is collected and stored in the NIRS dataset, the NIRS casualty data is not directly comparable to the other national fire data sets.

Recommendations from the NIRS database analysis

The recommendations from this NIRS review can be broadly categorised into three categories. First relates to inferences that can be drawn from the patterns presented above and how these trends should inform future policy relating to fire prevention and fire safety systems. Second, potential improvements to data collection and data storage practices are proposed. Third, some broad changes are outlined relating to targeted approaches to increasing the coverage of data reporting to the NIRS.

1. Extrapolating from NIRS fire trends

a) **Implement a research-based approach to deliver a targeted strategy for increasing the coverage of working smoke alarms.** Despite the missing data, as expected based on research in other contexts, there is still good indication from the NIRS data that working smoke alarms have a preventative effect on fire-related casualties. There is a range of existing information about how to (a) identify residences with the greatest risk of not having working smoke alarms and (b) increase coverage of working smoke alarms in homes (Clare et al., 2012; Huesken et al., 2020).

b) **Use relative community risk profiles to implement targeted educational campaigns to reduce preventable fires from factors such as smoking, inappropriate use of heating equipment, and cooking.** There is indication from the NIRS patterns that previous findings from other contexts relating to area of fire origin and act/omission have relevance to preventing residential fires in First Nations communities. This suggests that educational campaigns that have targeted

preventable fires from factors such as smoking, inappropriate use of heating equipment, and cooking would be equally relevant to preventing fires in these communities (see Al-Hajj et al., 2022, for further details).

c) **Examine suspicious residential fires to determine the extent to which they are occurring in vacant/abandoned buildings, implementing a targeted prevention strategy if relevant.** There are many suspicious fires in the NIRS data (147 suspicious fires). This is worthy of additional research to understand more about what the drivers are. There is potential this is linked to vacant/abandoned buildings, which have been demonstrated in other contexts to be an elevated risk of arson (Thomas et al., 2021). Should this be the case, there are targeted intervention strategies that can be applied to try and reduce the frequency and severity of these events.

d) **Adopt a risk-based strategy to prioritise installation of home safety and life safety systems in high-risk First Nations communities.** Almost 10 percent of the total fire incidents had burned out before the fire department arrived. These events resulted in over half of the deaths. This pattern needs to be acknowledged and considered in conjunction with Recommendation 1(a). Fire departments can be important as part of a system, but given their relative cost, the remoteness involved in these communities, and the ongoing demands for training and staffing associated with fire suppression, the priority should be on home safety and life safety systems (e.g., smoke alarms, CO alarms, and residential sprinklers).

2. NIRS data collection and data storage improvements

a) **Align the NIRS data collection forms with those used by other fire reporting entities in Canada.** There would be benefits in the NIRS using the same reporting tool as the rest of the fire services in Canada. This would ensure comparability of data structures. This would also ameliorate the current NIRS issue which cannot accommodate the one-to-many relationship between fire incidents and fire casualties (where more than one casualty can result from a single fire incident). The current NIRS system does not allow separate records per casualty, which loses specificity of data relating to factors such as the extent of injury, behaviour of casualty, ages of specific casualties, etc.. This information cannot be recaptured after aggregation.

b) **Increase the range of variables captured by the NIRS structure.** If recommendation 2(a) is not possible, there needs to be consideration of including additional variables to the NIRS structure. Of particular importance would be a variable that captures residential building use.

c) **Improve NIRS reporting training to minimise the volume of missing responses.** Across all variables in the NIRS there are large percentages of incomplete responses. Without data, the report has a dramatically reduced value for strategic and planning purposes. Consider improving reporting training to minimise the 'missing' responses to the lowest level possible.

3. Increase reporting to the NIRS

c) **Develop and implement partnership-based strategies to increase fire incident reporting to NIRS, prioritising highest-risk communities in the first instance.** The annual reporting trends are wildly inconsistent across years. This is most likely to be a reporting issue, rather than reflecting anything about actual fire events on the ground. There are also only reports from 110 Bands (relative to the 2016 estimate of 624 used in the Huesken et al., 2020 report, 17.6%), with one power user reporting a very large percentage of all records in the dataset. To maximise the value of the NIRS for planning and strategic purposes, efforts should aim to increase the coverage and

consistency of data being entered. The current situation is reflective of the voluntary nature of reporting. Future strategies should be developed that are partnership-based and draw on other service providers who operate in these communities (e.g., police, health, child and family support, by-laws, etc.). This process could be prioritised using the risk-based tool proposed by Huesken et al. (2020).

d) **Develop and implement partnership-based strategies to increase fire casualty reporting to NIRS, prioritising highest-risk communities in the first instance.** As an extension of the under-reporting of fire events, more broadly, fire-related injuries are significantly outnumbered by deaths in the NIRS. Increased reporting as per 3(a) will improve the validity of the estimates produced from this data. It will also help expose whether the current trends are reflective of systematic differences in the types of fires that are occurring (relative to those occurring outside of First Nations communities), which is worthy of future attention as data collection improves.

Home Safety Assessment (HSA) data summary

This section presents the aggregated responses to selected variables from the voluntary HSA submissions. Given the HSA process collected data about a broad range of safety issues, only the nine variables most relevant to fire safety are presented. The selected variables present the relative percentage of households within each responding community that had: (1) visible fuel shut off valves; (2) smoke alarms installed; (3) functioning smoke alarms; (4) fire extinguishers; (5) doors and windows clear of obstructions; (6) accessible and clear electrical panels; (7) accessible and clear furnaces; (8) accessible and clear baseboards; and (9) household safety plans in place. The aggregated findings from available data are presented in Figure 5, below. It should be noted that these responses represent data from 14 locations, equating to 2.2 percent of the areas covered in the UFV report (discussed, above).

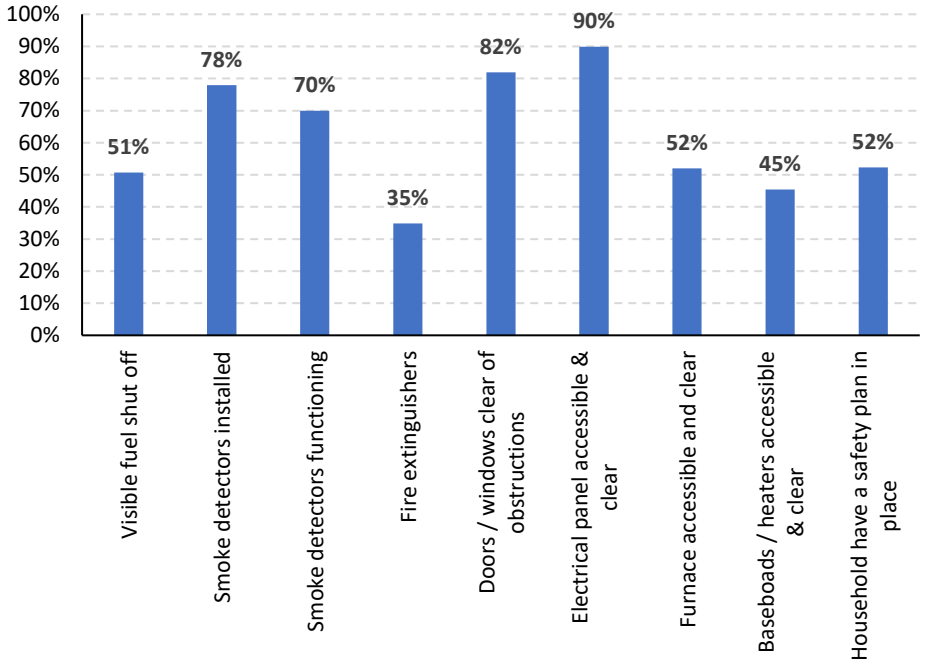

Figure 5. Average responses to the HSA summary data across nine fire-relevant assessment variables.

Keeping in mind the recommendations from above that resulted from the NIRS analysis, Figure 5 demonstrates the following relevant trends:

- In comparison to the 9.5 percent of fire incidents with a present, functioning smoke alarm, the HSA data shows a relatively higher coverage of working smoke alarms: average 78 percent of houses with alarms installed and 70 percent with working alarms;
- There is a wide range of coverage of handheld fire extinguishers (average 35%, but ranging from 3% to 89% of houses across the responding communities). Given the NIRS trends showing a large percentage of fires burn-out without fire department intervention and a smaller, but relevant percentage that are controlled by hand-held extinguishers, this is worth exploring further (discussed in the recommendations, below); and
- The 52 percent average for houses demonstrated there is room to improve the coverage of home safety plans.

Recommendations from the HSA database analysis

4. Increase engagement with the HSA audit process

d) **Ensure all reporting entities are using a consistent structure for the HAS reporting forms.** There are inconsistencies across completed forms with data structures. It is not clear if these changes have been made at the local level, or if there are multiple versions of the HSA data collection tool in use. Either way, for ease of analysis and aggregation, a single form should be used moving forward.

e) Amend the HSA data collection summary form to aggregate the local findings within each community in a timely manner that would highlight high risk, urgent intervention requirements. The data collection tool could be used to provide an early warning to the data collection administrator of the need for immediate action around issues such as smoke alarm coverage and fire safety plan implementation.

f) **Develop and implement partnership-based strategies to increase the coverage of this HSA process across First Nations communities.** This could be achieved in a targeted manner, prioritising coverage by combining this process with the risk assessment tool proposed in the UFV report for prioritising fire prevention action more broadly. There is also scope to utilise local, partnership-based strategies for conducting HSA audits, working with other government and non-government agencies operating in First Nations communities (as discussed in 3(a), above).

Fire Department Assessment (FDA) data summary

This section displays the aggregated FDA audit scores across seven aspects of operational and administrative service. Each of these service areas are scored on a number of different audit components and then this compliance rate is converted to a within-service area audit percentage. The seven service areas (with corresponding maximum within-component audit scores displayed in brackets are: (1) fire service management (maximum score 18, where the highest score demonstrates the greatest audit compliance), (2) fire service operations (maximum 21), (3) documentation management (maximum 9), (4) occupational health programs (maximum 15), (5) fire life safety and public education programs (maximum 12), (6) equipment management and maintenance programs (maximum 33), and (7) training programs (maximum 33). The summary data presented in Figure 6 display the aggregated audit outputs from 55 locations (8.8% of the locations included in the UFV risk report). Caution on extrapolation and representativeness of findings.

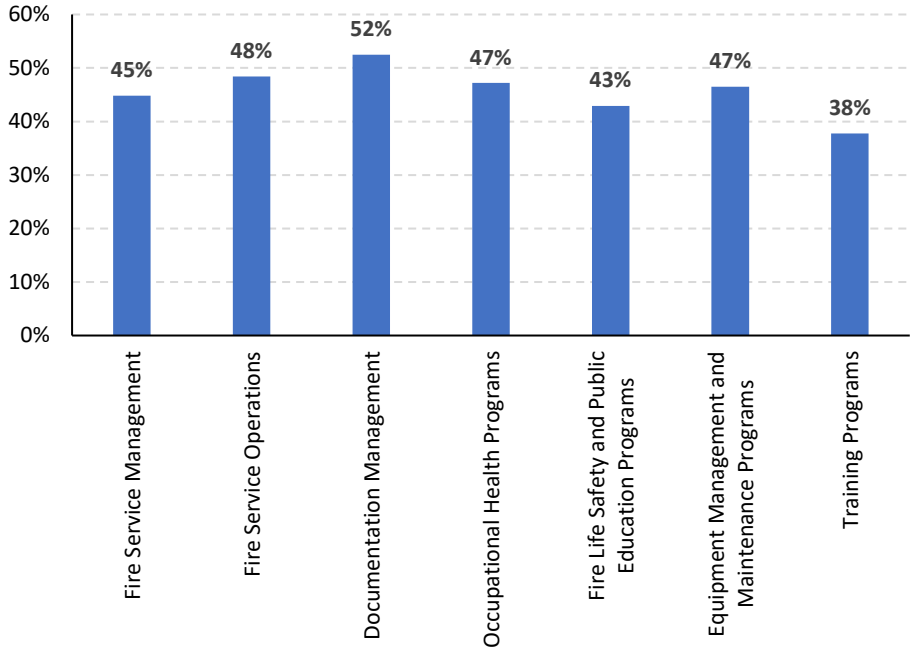

Figure 6. Average responses to the FDA summary data across the seven FDA audit assessment categories.

Keeping in mind the recommendations from above that resulted from the NIRS analysis, Figure 6 demonstrates the following relevant trends:

- The average audit compliance for the areas that participated is ranges from a low of 38 percent for training up to a high of 52 percent for documentation management;
- Across all of the responses on each program there were respondents who scored 0 percent and those who scored 100 percent, covering the whole spectrum of possible compliance; and
- Fire life safety and public education programs, which incorporate fire prevention plans, public education plans, home safety programs (including smoke alarms and CO alarms), and seasonal fire safety programs had a low average response compliance across respondents (scoring 43%).

Recommendations from the FDA database analysis

5. Increase engagement with the FDA audit process

d) **Implement a risk-based approach to prioritise FDA audits across First Nations communities.** Look into the feasibility of combining the FDA process with the risk assessment tool proposed in the UFV report for prioritising fire safety action across First Nations communities.

e) **Target FSA audit performance on life safety, occupational health, and document management.** Life safety systems, occupational health processes, and document management processes should be prioritised as these are most likely to have the more immediate impact on preventing fire-related casualty and the least dependent on fire suppression infrastructure and equipment.

f) **Develop and implement sustainable, partnership-based strategies to increase the coverage of the FDA process across First Nations communities.** Explore the feasibility of a sustainable, partnership-based approach to FDA data collection with other relevant agencies (as discussed in 3(a) and 4(c), above).

General recommendations about fire safety from previous research

Previously, this consultant completed a report for the NIFSC entitled, "Fire Safety Ambassador: Content and timing of fire safety training and inspections on First Nation's communities and decision-support tool" (January 2022). The recommendations from this previous report should be considered in parallel with the current work. The 2022 report summarised the main themes from the recent contemporary review of fire prevention research conducted by the British Columbia Injury Research and Prevention Unit (BCIRPU) entitled, "Interventions for preventing residential fires in vulnerable neighbourhoods and Indigenous communities: a systematic review of the evidence" (Al-Hajj, Garis et al. 2021). The January 2022 review summarised the main findings relating to education/engagement and engineering/environmental change. To avoid redundancy, these points are only briefly restated here and interested readers should consult the previous report and the published journal article.

The importance of fire-safety educational interventions

Fire safety education can provide knowledge that influences the frequency and extent of risky behaviour, which in turn prevents fire (Al-Hajj, Garis et al. 2021). Fire safety education programs typically focus on vulnerable populations, as determined by combinations of elderly, highly-disadvantaged people, families with young children, and transient populations with high residential mobility. These are the same types of risks that First Nations communities are over-represented in (as discussed in the Census section, above) and that were used to develop the Huesken et al. (2020) risk-based tool for prioritising fire safety interventions across communities. A range of strategies have been used to delivery fire safety education to communities, ranging from dissemination of educational literature to homes (by firefighters or volunteers) through to dedicated training/interventions with small groups of residents. The previous summary reports discuss a range of factors relating to the uptake, retention, and wear-off effects of these types of strategies.

The importance of engineering (environmental) fire-prevention interventions

The Al-Hajj et al. (2021) article also discusses a range of place-based engineering/environmental fire-prevention interventions intended to reduce fire risk at places. The three main categories of these interventions are smoke alarms, residential sprinklers, and enforcement practices. The common focus across these approaches is the need to build-in early detection and early prevention strategies to protect people in the event of a fire. The summarised best practice information relating to each of these areas is as follows:

- **Smoke alarms.** Alarms are intended to alert internal building residents about smoke build-up, providing them with time to make a fight or flight decision. 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). Maintaining a present, functioning smoke alarm protection requires maintenance, with annual testing to ensure alarms have not expired (as per the manufacturer's life-cycle recommendations). This means there are two, parallel goals for programs targeting smoke alarm coverage: ensuring (1) all houses have alarms installed, and (2) all installed alarms are working. Al-Hajj et al. (2021) summarise a range of strategies that have been evaluated to achieve these place-based and person-based safety goals.

- **Residential sprinklers.** With the potential to operate in parallel or separately from smoke alarms, residential sprinklers are another place-specific environmental modification intended to operate to suppress small-scale fires in their very early stages, thus reducing the risk of fire-related damage/casualties. These systems can be included in new construction or retrospectively installed in existing properties. These systems operate independently from the fire service. The research evidence shows sprinkler systems 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).
- **Enforcement of safety regulations.** The objective of this strategy is to ensure safety regulations (relating to things like mandatory smoke alarm installation, fire safety building standards, non-reduced ignition propensity cigarettes, etc.) are being adhered to. The effectiveness of these strategies is under-evaluated (Al-Hajj et al., 2021). 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.

Summary of relevance to the current study

Both main areas of evidence (relating to education and engineering) lend further support to the recommendations, above, focused on ensuring (a) there are present, functioning smoke alarms in all residential buildings, (b) residents have fire safety plans in place, (c) regular, targeted safety education refresher programs are conducted, particular focused on high-risk sections of the population (at an individual and community level), and (d) regular audits are undertaken relating to safety system maintenance.

Discussion

This report concludes by discussing a few general points about implementing and evaluating evidence-based change.

1. Be clear about what problems you want to address. The clearer you are, the more targeted you can be, meaning the greater likelihood you have of achieving your goal. Based on the summary, above, major issues relate to (a) data – reporting and records management, and (b) fire safety in the event of fires. Use the recommendations outlined, above, to develop targeted, problem-specific intervention strategies.
2. As suggested in a number of the recommendations, above, try to develop sustainable strategies that increase partnerships with other service providers (e.g., police, health, child and family support services) to increase data coverage and reporting. For example, these partners could be involved in checking the presence and functionality of smoke alarms, with a reporting process to advise when alarms are absent and the residents want one installed. Think broadly about partnership opportunities and leverage as much support as you can to achieve your goals.
3. Evaluate the effectiveness of what you are trying to do. This is such an important component of any change, but is so often missed out or not thought about until it is too late to do well. At a high level, evaluation should monitor the effectiveness of the process (did you implement the plan that you developed?) and the impact (did your plan have an effect on the problem(s) you were trying to fix?).

Additional general recommendations

6. Commit to undertaking process and impact evaluations of changes you make

The Al-Hajj et al. (2022) work discusses the importance of evaluation to measure the process and impact of changes that are made. Moving forward, the recommendations outlined, above, should be implemented and appropriate process and impact evaluations conducted to ensure (a) changes are actually implemented as intended, and (b) subsequent improvements have been made to the problems being targeted.

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