Incidence, Circumstances and Risk Factors of Residential Careless Cooking Fires in the City of Regina

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COMMUNITY RESEARCH UNIT

REGINA PREVENTION PROTECTION PROFESSIONALISM FIRE

<u>**RESEARCH REPORT**</u>

INCIDENCE, CIRCUMSTANCES AND RISK FACTORS OF RESIDENTIAL CARELESS COOKING FIRES IN THE CITY OF REGINA

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LIST OF ACRONYMS AND ABBREVIATIONS

CAFC: Canadian Association of Fire Chiefs

CBPR: Community-Based Participatory Research

CCFMFC: Council of Canadian Fire Marshals and Fire Commissioners

CCS: Canadian Code Structure

CRU: Community Research Unit

FDM: Flexible Data Management System

RCFRP: Residential Cooking Fires Research Project

RFPS: Regina Fire & Protective Services

EXECUTIVE SUMMARY

This research project contributes to filling current gaps in fire data by undertaking primary research into the incidence, circumstances and risk factors of careless cooking in the City of Regina, with a focus on high risk populations.

The impetus behind this research project came from Regina Fire & Protective Services (RFPS). Careless cooking has been the number one cause of residential fires in Regina for seven years, and has become a significant threat to public safety. Careless cooking incidents have been increasing each year, a growing trend the fire department is working to curtail.

A community-based participatory research partnership between RFPS and the Faculty of Arts' Community Research Unit (CRU) at the University of Regina, the *Residential Cooking Fires Research Project* (RCFRP) is providing invaluable data about residential cooking incidents, and how humans interact with cooking incidents at various stages of escalation and spread. This information is crucial to understand the human dynamics behind careless cooking. It is people who start cooking incidents, not technology. In better understanding the human dimension of careless cooking, fire services can more effectively work at preventing these incidents from occurring or mitigating their effects once these occur by addressing the various factors that define cooking fire vulnerability.

In determining what data to collect, the research partners looked at what really causes cooking fires –people. It is people who can therefore prevent these fires by changing careless cooking behaviours and habits. The *Residential Cooking Fire Data Form*, developed to meet the objectives of this collaborative research project, was designed to collect information on people – their characteristics (demographics), their influences and their behaviours. Specifically, the incident form, a one-page survey instrument, used by the on-scene Suppression & Rescue Officers collected the following information: (i) Demographic information about the host; (ii) host's cooking behaviour(s) that caused or started the incident; (iii) host's intervention behaviour in response to the incident; (iv) Firefighters' actions upon arrival; and (v) impact of the incident on the physical environment and the people in it. In gathering the data, we chose not to be influenced by the severity or extent of the cooking incident – in other words, not by whether there was an actual fire, focusing instead on the human behaviour dynamics leading to an actual, or potential, cooking fire. In other words, although the research project studied the behaviours of incidents not involving actual fire, these behaviours were studied to ultimately gain a better understanding of what causes cooking-related fires. As such, Officers were instructed to collect information on all cooking incidents, irrespective of ignition status or severity. After all, "big fires start small." Other information collected included: the incident's geographic location; time of day, day of week and month the incident occurred; occupancy type; and number of people in the occupancy at the time of the incident.

The data for the years 2014 and 2015 were analyzed for risk and vulnerability through five separate lenses:

- Incident characteristics (i.e., number of incidents; geographical location; etc.);

- Host's demographic characteristics (i.e., age; sex; etc.);
- Host's incident cause behaviours (i.e., major act or omission; location at time of incident; etc.);
- Host's behaviours following the incident start (i.e., how host was alerted; host's intervention, mitigation and extinguishment behaviours; etc.); and
- Incident impact (i.e., impact on Firefighters' actions; incident outcome; severity of incident; etc.).

Data relating to the host's behaviours were further analyzed in terms of incident start, and interaction with the cooking hazard event:

- There was no possibility of fire (e.g., toaster activated smoke alarm);
- Host was alerted and intervened – host prevented a fire (e.g., smoke alarm was activated, host removed pot from burner and turned burner off);
- Host was alerted and intervened – host mitigated fire spread (e.g., food in pot caught fire, host used lid to smother the fire and turned burner off); and
- Firefighters' actions were required (e.g., Firefighters extinguished the fire, removed burned pot and turned off stove, and extracted the smoke).

By the end of the initial two-year data collection period, the Officers had completed 884 survey forms. The Fire Department was alerted to these incidents through methods such as monitoring companies, alarm systems or callers (9-1-1). Of these, 432 cooking incidents happened in 2014 (48.9%), and 452 incidents occurred in 2015 (51.1%).

Analyses of the data showed who the hosts were, their characteristics, the risk behaviours they demonstrated in causing the incident and during its various stages, and who their behaviour affected or potentially affected. Some key findings of the study include:

- More females than males were incident hosts.

- People age 30 to 59 had the most incidents.

- Canadian born hosts had the most incidents.

- The majority of hosts were at the appliance or in the kitchen at the time of the incident.

- The majority of hosts were cooking on the stovetop (pot on stovetop or pan frying).

- Most of the hosts were distracted while cooking or forgot something was on the stovetop.

- More than half of the hosts were alerted to the incident by their smoke alarm.

- Most of the hosts attempted intervention (e.g., turning burner off, removing pot from burner, etc.).

- A quarter of the incidents required Firefighters' action.
- Most incidents occurred in the city's central neighbourhoods.
- Incidents were concentrated at the usual cooking times for lunch and dinner.
- Most incidents occurred when one or two people were in the home at the time of the incident.
- The host's acts (actions) or omissions (inactions) were relevant to every stage of a cooking fire-related incident. This human risk contributing factor was the most important predictor of:

    a. Host's intervention;
    b. Firefighters' actions;
    c. Incident outcome (e.g., whether the cooking incident became a fire); and
    d. Severity of cooking hazard.

- The findings from the multivariate analyses also highlight the important role of a working smoke alarm in predicting timely host intervention to either prevent or mitigate the effects of a cooking incident, reducing both the need for Firefighters' intervention and the severity of the incident.
- Host's demographic characteristics (e.g., age, sex and country of birth) were also found to be significant predictors of host's behaviour(s) before and during the cooking incident, Firefighters' intervention and severity of resultant outcomes of cooking incidents.
- Type of occupancy had a significant effect on host's intervention efforts, and neighbourhood of residence impacted significantly both host's intervention and severity of cooking incident.

Those most affected by the careless cooking incident outcomes were:

- Young people;
- Seniors;
- Newcomers;
- Male hosts who were intoxicated and/or sleeping while cooking;
- Residents who left the kitchen;
- Residents living in apartment buildings;
- Residents living in Central neighbourhoods; and
- Residents alerted to the incident by something other than a smoke alarm.

Analyses of these data provide crucial information that point to effective educational programming to modify the unsafe careless cooking behaviours of the identified target groups.

INCIDENCE, CIRCUMSTANCES AND RISK FACTORS OF RESIDENTIAL CARELESS COOKING FIRES IN THE CITY OF REGINA

1. REGINA'S RESIDENCES ARE BURNING: WHAT IS CAUSING OUR FIRES?

1.1. A Case Study: "Kitchen fires plague Regina fire services"

On the morning of Friday January 9 2015, a resident called 9-1-1 to report a fire in one of the upper suites in a three-storey apartment building. Arriving fire crews made their way to the fire floor, encountering heavy smoke and heat conditions in the hallway. Forcibly breaking their way into a number of suites, one crew found two male residents trapped by the smoke and rescued them by taking them out a window. Other crews found the suite where the fire started. It had already spread across the kitchen and up into the building's attic space, moving so quickly they could not get ahead of it. The Incident Commander ordered Firefighters to pull out of the building and commence operations from the outside – the fire had made its way into the building's roofline, compromising the structural integrity of the building. There was now a high risk of building collapse. To make matters worse, weather conditions were extremely difficult that morning, with the temperature at minus 24, and a wind chill of minus 33 degrees.

During firefighting operations one Firefighter was injured and two residents, while not injured, had been trapped. Twenty-three families, many of whom were Newcomer families, lost everything. The building was completely destroyed, with property damage estimated at over $4 million. Photos #1 through #5 capture the severity of this careless cooking fire.

The Fire Investigator determined this fire was caused by careless cooking. One of two occupants in the fire suite had turned on the wrong burner – one with a pot of oil on it – and had then left the kitchen.

Photos #1 through #4. Outcomes of an apartment's building careless cooking fire incident, city's south-end

Photo #1

Photo by Don Healy. Courtesy Regina Leader-Post.

Photo #2

Photo by Don Healy. Courtesy Regina Leader-Post.

Photo #3

Photo by Don Healy. Courtesy Regina Leader-Post.

Photo #4

Photo by Don Healy. Courtesy Regina Leader-Post.

Photo #5. Outcomes of an apartment's building careless cooking fire incident, city's south-end: Cont'd

Regina Fire & Protective Services

While at the height of firefighting efforts at this apartment in the south end of the city, RFPS received a call reporting another apartment fire in the city's east end. A man was in his suite with his mother, who was sleeping. He decided to make some tea, placing the stovetop kettle on the burner, then went into the living room to wait for the water to boil. While watching TV, he noticed flames in the mirror on the living room wall. He ran to the kitchen and found a fire on the stovetop. He ran to his mother's room and woke her up. She came out to the living room and started opening the patio door. Realising the severity of the situation, he got her to the front door of the apartment where they both exited, leaving the suite door open. Firefighters arrived on-scene within six minutes of the first 9-1-1 call. Heavy smoke and flames were already coming out the open patio door. As they made their way to the third-floor hallway, the Firefighters encountered flames rolling out the suite door that had been left open. They pushed the fire back into the suite and knocked it down.

The Fire Investigator determined this fire was caused by careless cooking. A number of combustible materials had been left on the stovetop, which ignited when the element was turned on to heat the kettle. Three units were impacted by the fire, with damage estimated at $50,000.

1.2. Scope of the Careless Cooking Problem

The two simultaneous fires stretched RFPS on-shift resources to capacity, leading to emergency plan activation and off-duty Firefighters being pulled in to provide additional firefighting capacity. The events of January 9, 2015 are not the outcome of isolated, one-time fire incidents. Careless cooking – the outcome of inadvertent acts, carelessness, acts of omission, inattention, and other dangerous habitual behaviours (e.g., Barillo and Goode 1996; Greene and Andres 2009; McCormick 2009; Miller 2005; Xiong, Bruck, and Ball 2014) – is the number one cause of residential fires for the seventh year in a row (RFPS Standards of Cover 2015), becoming a significant threat to public safety in the City of Regina. Between 2009 and 2015, cooking caused 39 per cent of the city's structure fires (413 of 1,046 fires) with $8,017,450 in damages (RFPS Flexible Data Management [FDM] system: Internal data). There has also been a steady rise in the number of careless cooking fires in the city, a growing trend the Fire Department is working to stop. In 2014, the rate of structure fires caused by careless cooking climbed to the highest number observed since at least 1992, causing 89 of the city's 167 structure fires, and resulting in millions of dollars in damage (RFPS FDM system: Internal data). While the impacts of residential cooking fires vary, many caused property damage ranging from the minor to the severe. A number of these fires also caused injuries and fatalities. Reducing careless cooking clearly benefits the common good.

In the past, RFPS has been successful in reducing other leading causes of fire with specific and targeted public education programs aimed at changing unsafe behaviours. To prevent careless cooking, it is necessary to know who is cooking and who is at risk. Social, environmental, and personal factors such as the presence of distractions when cooking, age, use of alcohol, drugs or medication, and mobility or agility can increase or decrease the risk for, and consequences of, residential careless cooking. Evidence-based research is needed to form the foundation for educational programming that targets high-risk/high-impact populations with appropriate cooking safety messages. RFPS, like many other local fire departments in Canada, does not have a data analysis section or an analyst position. While a great deal of data is collected through the dispatch, response and investigation personnel, no one is tasked to ensure that data collection is consistent, accurate or analyzed. For RFPS to more effectively allocate resources, increased attention to data standardization, completeness, accuracy and analysis is necessary to assess "where the problems are, whom they affect, and where programmatic and prevention activities should be directed" (Teutsch and Churchill 2000:6). Systematic collection and analysis of cooking incident data is required to understand careless cooking dynamics and actual and potential threats to public safety. This will help inform public education programs to modify behaviour, and identify key areas requiring attention.

This report details the theoretical and methodological approaches and empirical findings of a community-based participatory research (CBPR) case study that illustrates the importance of a community/university collaborative partnership to better understand a community safety issue. The goal is to change unsafe cooking behaviours through evidence-based research. Arising from a Memorandum of Understanding between RFPS and the Faculty of Arts' Community Research Unit (CRU) at the University of Regina, and in line with community situated, action-oriented research traditions, the *Residential Cooking Fires Research Project* (RCFRP) grew from this context. It was fostered by a deeply held conviction, shared by both the community and university partners, that development of effective public education strategies to mitigate residential careless cooking and their resultant consequences requires a better understanding of the circumstances behind these incidents. This can be accomplished through the collection of standardized data examining the circumstances and risk factors contributing to careless cooking in the city.

The RCFRP provides invaluable data about the circumstances, risk factors and outcomes of residential careless cooking incidents, and how hosts interacted with the cooking hazard at its various stages. The data collected includes information on how incidents started, host's intervention efforts (or lack thereof), and incidents' resulting effects or outcomes. The research project also provides demographic and behavioural information about the hosts involved – those who started or caused the cooking incidents. It also provides information about the impact of the incident on the physical environment and the people in it, including persons not cooking but potentially affected by the host's actions. This information is key to understanding the human dynamics behind careless cooking. After all, it is people who start these incidents, not technology. In better understanding the human dimension of careless cooking, fire services can more effectively work at preventing them from occurring.

Adhering to the principles of CBPR including co-learning, mutual benefit, and long-term commitment (e.g., Minkler et al. 2011; O'Fallon and Dearry 2002), the research project was co-developed and co-led by the community and university partners. The CRU, which fostered and facilitated this community engaged research, brought together faculty research expertise and community experience. This research partnership embodies the University of Regina's 2015-2020 strategic plan priorities of *Research Impact and Commitment to our Communities*, and RFPS' mandate to protect lives and property, by generating evidence-based public education recommendations and programs. The scarcity of Canadian fire research and the lack of reliable, on-going and up-to-date fire incident data and statistics were challenging. The framework adopted here was developed from the ground up, and uses a data-driven approach. It does this by incorporating a survey methodology to collect primary data on the types of behaviours and sequence of events that lead to residential careless fire incidents in the city. The community and university partners equitably share control of the research agenda through active and reciprocal involvement in the research design and implementation of the survey instrument. Ultimately, the research project seeks to support the development and implementation of evidence-based education strategies designed to reduce careless cooking in the city. It also supports RFPS' continued systematic collection and analysis of valid, reliable and on-going careless cooking incident data to inform and evaluate future public education programs. The longer-term implication for data collection includes integration of the data collection survey form into the RFPS Flexible Data Management (FDM) system.

As the results of the research illustrate, the RCFRP provides an example of the community safety benefits that are possible when academics, fire department public educators, and Suppression & Rescue Officers and Firefighters work in partnership to expand service levels into novel areas. In line with this type of community situated, action-oriented and collaborative partnership, the findings of the current study have the power to effect positive change in public fire-safety by generating evidence-based public education recommendations and programs to reduce careless cooking occurrences and minimize their consequences when these do occur. These findings will be used to design and deliver educational programming to targeted audiences identified through the design and implementation of the survey methodology. The data shed light on the demographics and behavioural patterns associated with residential careless cooking, enhancing the applied research aspect of this project. Members of the fire service are tasked with the responsibility of protecting lives and property from the effects of fire. Analyses of these data will help those tasked with that responsibility to more effectively allocate limited resources, crucial given today's economic climate and the fiscal constraints facing the fire service industry. This partnership is also meaningful in fostering a relationship between these two institutions to share research expertise and opportunities.

2. THE NATIONAL DATA GAP AND ITS IMPLICATIONS FOR CANADIAN FIRE RESEARCH

With weighty negative impacts on society, the economy and the environment, fires are a significant public safety threat in terms of potential death, injury, and financial costs associated with burn treatment and property damage (e.g., Asgary et al. 2010; Banfield et al. 2015; Barnett 2008; Bounagui and Bénichou 2005; Chhetri et al. 2010; DiGuiseppi et al. 2000; Frattaroli et al. 2012; McCormick 2009; Parmer et al. 2006). Despite important advances in fire prevention, structural fires, especially residential fires, remain a critical concern (e.g., Frattaroli et al. 2012; Jennings 2013). Home fires and losses dominate the North American fire problem (e.g., Ahrens 2015; Council of Canadian Fire Marshals and Fire Commissioners [CCFMFC] 2007; International Association of Fire Chiefs 2013; Wijayasinghe 2012). Mainly unintentional in causation yet arising from a variety of factors which can be averted (e.g., Miller and Beever 2005), fires beginning with cooking equipment and appliances account for the largest shares of home structure fires and associated fire injuries in the United States (e.g., Ahrens 2015, 2013, 2012, 2009; Ahrens et al. 2007; Federal Emergency Management Agency 2011; Greene 2009; Hall 2006, 2008) and Canada (e.g., Bounagui and Bénichou 2005, 2007; Canadian Association of Fire Chiefs [CAFC] 2012; McCormick 2009; Office of the Fire Marshal [Ontario] 2009, 2013; Wijayasinghe 2011, 2012). Responsible for fatalities, injuries, and significant property losses, careless cooking is a growing concern in Canada (e.g., McCormick 2009; Wijayasinghe 2011, 2012), particularly since most of these incidents and their resultant negative outcomes are caused by human errors, and are thus entirely avoidable. To address these concerns, more research needs to be done to better understand the main causes and outcomes of residential careless cooking to effectively address the various factors that define cooking fire risk and vulnerability.

Fire research is still in its infancy in Canada, with the limited empirical research and funding opportunities available often being tailored towards engineering solutions that study the management of fire effects rather than identification of its causes. The disparate vulnerability to fire reported in the international literature (e.g., Jennings 2013; Warda et al. 1999) highlights the fact that, while technological advances are a partial solution to fires, “much wider issues of social equity are raised by these fire[s]” (Brennan 1999:310). Attempts to truly remedy the situation must go beyond suppression and must address systemic inequalities. The sparse available data shows that fires involving cooking equipment account for the largest share of home fires and associated fire losses in Canada (e.g., Bounagui and Bénichou 2007; CAFC 2012; Emergency Management BC Office of the Fire Commissioner 2013; McCormick 2009; Office of the Fire Marshal [Ontario] 2013; Wijayasinghe 2011, 2012), warranting continued and, if possible, increased attention to these types of fires as a fire-safety priority.

Development of evidence-based interventions and educational programming requires an understanding of not only the nature of these cooking fire incidents, but also the types of behaviours and circumstances most likely to result in a fire, and its escalation and spread. This information is fundamental to the development of sound recommendations for behavioural mitigation strategies that will reduce such fires and their resultant outcomes, as most cooking fires are preventable, and often precipitated, directly or indirectly, by some human action (something is done) or omission (something which has not been done). Conceptualized this way, careless cooking is not an imposed, external event, but rather a human[1], hazard agent[2] and environment[3] interaction in which the actions (or inactions) of individuals (for example, the inadvertent contribution to incident causation through carelessness) directly contribute to the

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[1] The ‘human agent’ covers host-related sociodemographic characteristics and a number of behaviours and conditions that precipitated careless cooking incident’s causation and spread (e.g., Xiong et al. 2014).

[2] The ‘hazard agent’ refers to heat source and fuel or factors that took an active role in a cooking incident or produced a specified effect, for example ignition factor (ibid).

[3] The ‘environment’ includes information regarding the broader physical and social context of residential structures where the cooking incident occurred (ibid).

hazard, its severity, and its outcomes (e.g., Miller and Beever 2005). In relation to this, Bounagui and Bénichou (2005:1) argued that, "[t]he collection of fire incident data is an important task as the fire statistics can be used to assess how life safety is being affected year after year in Canada. It also motivates corrective actions to be taken and identifies key areas requiring further research".

However, due to general federal funding cutbacks and the lack of a legislated federal mandate for the collection and reporting of fire statistics, Canada does not have an ongoing national fire information database (for a recent review see, Maxim, Plecas, and Garis 2010), leading to important gaps in the state of Canadian fire research (Bounagui and Bénichou 2005; Garis and Mark 2011, 2015; TriData 2009). While many industrialized nations have up-to-date, nationally-representative information on fires, Canada has no such reliable, standardized and constant source of information with which to inform resource allocation, prevention efforts, and fire education programs (ibid). Instead, provinces play a key role in developing fire legislation, collecting data, and developing prevention strategies, resulting in significant variations in the amount and type of data collected by and within local departments (Maxim et al. 2010).

Developing a national fire data gathering mechanism poses challenges as fire departments are funded by and report to local municipalities. One of the major differences in the organization of fire response data in Canada from many other countries is that it is highly decentralized. Rather than being governed federally, Canada's fire service is operated at municipal and provincial levels (Garis 2014; TriData 2009). Decisions regarding fire-related legislation, data collection, resource allocation, and strategies for fire prevention are made at the provincial level. While some provinces have adopted legislation supportive of the collection of detailed fire statistics, other provinces record only a minimum amount of information (TriData

2009). Consequently, there are variations in the amount and type of data collected by local departments. In some localities, the amount of data collected is extensive while in others, it is very limited. The lack of cohesiveness across provinces in terms of data collection and recording methods, policies, and data-keeping rigorousness makes inter-provincial comparisons extremely difficult, and renders the generation of a meaningful national picture on fires impossible (e.g., Garis and Mark 2011; Maxim et al. 2010; TriData 2009).

That there is some commonality across jurisdictions is a consequence of the Council of Canadian Fire Marshals and Fire Commissioners' (CCFMFC 2002) Canadian Code Structure (CCS), a general unified flexible framework for fire data collection and categorization that identifies a comprehensive list of variables widely recognized as crucial for fire incident analysis developed to standardize the reporting system if implemented adequately. However, the last report published by the CCFMFC revealed that some provincial data was incomplete or unavailable and that there were only a few common fire variables among participating jurisdictions (e.g., Bounagui and Bénichou 2005; Wijayasinghe 2011). This underscores the limited availability of fire incident data to undertake annual national analysis. For example, in 2011, based on an analysis of fire incident data from eight Canadian provinces representing approximately 75 per cent of the Canadian population, Wijayasinghe (2011) showed that no Canadian fire jurisdiction conforms fully to the guidelines of the CCS. While using the CCS as a guide to recording fire data, each Canadian firefighting jurisdiction has developed its own unique method of recording fire incident data, with the result that, while there are some core variables captured by the majority of jurisdictions (for example, fire ignition source, property loss, and fire fatalities), how these details are captured varies significantly inter-provincially (e.g., Bounagui and Bénichou 2005; Maxim et al 2010; Wijayasinghe 2011).

The lack of unity across fire jurisdictions in Canada regarding fire data collection precludes the discovery of emerging national trends, patterns and issues that may initially appear random, ambiguous, or unique at municipal and provincial levels, preventing the identification of particularly fire-vulnerable populations at a national level (Bounagui and Bénichou 2005; Garis 2014; Garis and Mark 2011, 2015). The Canadian Association of Fire Chiefs (CAFC), in their successful proposal to Public Works and Government Services Canada on the possibility of creating and maintaining a national fire-incident database, reflects on this by succinctly noting that, "the ability to gather and analyze fire-incident statistics on a national basis [i]s an important tool for optimizing effective delivery of fire services; particularly, to substantiate improvement in policy, preventive measures and operational response methodologies" (*cited in* Garis 2014). Funding remains the biggest challenge. While a step in the right direction, the recent three-year funding of a pilot National Fire Information Database remains a one-time funding opportunity for collecting and standardizing a decade of Canadian fire records (Garis and Mark 2015). The challenge is finding ongoing, sustainable, long-term funding for the creation and maintenance of a cohesive national data set of fire statistics (Garis 2014).

3. RESIDENTIAL COOKING FIRES IN CANADA AND INTERNATIONALLY: GAPS AND RESEARCH OPPORTUNITIES

Although it is difficult to capture a national picture of the severity of the problem due to the lack of nationally-representative, up-to-date fire statistics in Canada, available data indicates that careless cooking is a serious problem. The *2002 Fire Losses in Canada* annual report published by the CCFMFC, the last available analysis of nationwide fire losses, revealed that, in 2002 alone, approximately 54,000 fires were reported in Canada, resulting in over 300 fatalities, 2,500 fire injuries, and billions of dollars in property losses. Residential fires accounted for the largest proportion of these fires, accounting for over 22,000 fires or 41 per cent of the Canadian total, and resulting in 250 deaths, fully 82 per cent of the entire national fire fatality rate in 2002 (CCFMFC 2007:1). In 2002, residential fires incurred over seven hundred million dollars in property damages, almost half of the nation's total loss (ibid). In a 2011 review of international fire fatality trends, Canada ranked 12th among the 24 industrialized nations studied, with a fire fatality rate of 10.7 fatalities per million population (Federal Emergency Management Agency 2011:2). This rate was five times that of Switzerland, the country with the lowest fatality rate among the nations considered (ibid:2).

Research consistently points to careless cooking as one of, if not the, leading factor contributing to residential fire ignition in Canada (see, for examples, CAFC 2012; McCormick 2009; Wijayasinghe 2011, 2012). In 2002, the CCFMFC identified cooking equipment as one of the leading ignition sources of fires nationally, falling behind only "smokers' material and open flame" (CCFMFC 2007:26). Based on comparable data collected from British Columbia, Alberta and Ontario for the period 1995 to 2003, Bounagui and Bénichou (2007) found that residential fires occurred most frequently in the kitchen and cooking areas, often from stovetop fires in which cooking oil or fat was the first material ignited (1, 3). In turn, an analysis of 4,758 structure fires that occurred between 1988 and 2007 in the City of Surrey, British Columbia showed that residential house fires account for 75 per cent of all fires in the city, and regardless of community, cooking equipment consistently appeared as the leading cause of fires accounting for more than one-third of residential fires (McCormick 2009:20, 54). Paralleling these findings, analysis of fire incidents for 2012 showed that cooking was the leading cause of the “determined” residential fires and fire related injuries in BC (Emergency Management BC Office of the Fire Commissioner 2013).

Similarly, the Office of the Fire Marshal identified cooking equipment as the number one cause of residential fires in Ontario, reporting that cooking accounted for fully 25 per cent of all Ontario’s home fires, was the leading cause of home fire injuries, and was the second most common cause of home fire fatalities (Office of the Fire Marshal 2009). Analysis of the fire incident data for the year 2011 in Ontario revealed paralleling findings, with cooking found to be the number one cause of residential fires in the province (Office of the Fire Marshal 2013). A recent comparative study of seven Canadian provinces and one territory, representing about three-quarters of the Canadian population, showed that cooking fires accounted for the largest percentage of residential fires and home-fire injuries, with the kitchen being the leading area of origin for home fires (22%) and civilian home fire injuries (29%) (Wijayasinghe 2011, 2012).

The same study presented information regarding risk of residential fires separately for each participating province. Specifically, fire data collected in Saskatchewan indicated that in 2008, of the 3,245 reported fires that year, 920 were residential fires, and of these, 131 were kitchen fires that resulted in three fatalities, one injury, and millions of dollars in property losses (Wijayasinghe 2011:22). Considering that about two-thirds (n = 586) of the 920 fire incidents analyzed were not coded, it is safe to assume that this estimate provides a very crude picture of the extent of the cooking fire problem in Saskatchewan. As noted in the previous section, the caveats in data collection, and the quality of the data collected, including consistency, accuracy and detailedness, are not unique to Saskatchewan. The fact that Canada does not have a unified national reporting system for fire incident data has resulted in marked variations in both the amount and type of data collected by and within local departments countrywide. While Canadian fire statistics are elusive, the sparse available data suggest that the cooking fire problem's share of total home fires, related injuries and property damage in Canada suffice to make the case that careless cooking warrants continued or increased attention as a fire-safety priority.

Similar findings are reported in research conducted in other nations. Cooking equipment is the leading ignition source for residential fires in the United Kingdom, the United States, New Zealand and Australia (e.g., Ahrens 2015, 2013; Barnett 2008; Hall 2006; Miller 2005). Recently, the Department for Communities and Local Government reported that the misuse of cooking appliances was the ignition source in more than half of all residential fires in the United Kingdom (Department for Communities and Local Government 2014). A similar situation exists in the United States, with American research consistently identifying careless cooking as a leading ignition source of residential fires (see, for examples, Ahrens 2015, 2013; Ahrens et al. 2007; Federal Emergency Management Agency 2013; Greene 2009; Hall 2006, 2008). Similarly, in New Zealand, nearly one-third of classified structural fires were caused by cooking equipment (New Zealand Fire Service 2010:Table 14), and almost 45 per cent of Australian domestic fires started in the kitchen (Kobes and MIFireE 2009:15).

In the United States, as is the case in most industrialized nations, most fire fatalities and a significant proportion of fire injuries occurred because of residential fire incidents. In 2005, cooking equipment was involved in approximately 146,000 residential fires in the United States, accounting for 40 per cent of all residential fires, and resulting in an estimated 4,700 civilian injuries, 480 fire fatalities, and almost $880 million dollars in property losses (Hall 2008:i). More recent American national estimates for the five-year period of 2009 to 2013 corroborated past trends, revealing that careless cooking continued to be the leading cause of reported home structure fires and home structure fire injuries, and the third leading cause of home fire deaths (Ahrens 2015:ix).

Referring to the insidious and pervasive nature of residential fires as the "quiet disasters", Ward (2004) highlights the serious human cost of residential fires as being responsible for the death of more Americans annually than result from all natural disasters each year combined. Despite their many detrimental impacts, residential fire fatalities have not received the attention they deserve (e.g., Jennings 2013), possibly because the fatalities associated with them represent what Rhodes and Reinholtd (1998) call a "diffuse disaster", that is, a public safety hazard that, due to its ongoing and pervasive nature as well as its "small-scale" day-to-day fatality rate, is not widely recognized as serious. What makes the losses associated with cooking fires more egregious is the fact that, when "cooking equipment" is noted as the ignition source of a fire, it simply means that cooking equipment provided the heat that resulted in fire ignition, not necessarily that the equipment malfunctioned. Indeed, in most cases, residential fires in which "cooking equipment" is noted as the cause are not the result of equipment malfunction, but human error, including: neglecting equipment maintenance; misusing cooking equipment due to intoxication, sleepiness or being distracted; or deliberately leaving cooking unattended due to a lack of appreciation of fire risks (e.g. Ahrens 2015, 2013; Ahrens et al. 2007; McCormick 2009; Rhodes and Reinholtd 1998; Wijayasinghe 2011; Xiong et al. 2014). It is important to understand the nature and circumstances of residential careless cooking, particularly because these incidents are often avoidable, and almost always caused by human failings.

Further compounding the seriousness of the careless cooking problem is the fact that, since many cooking incidents are unreported, available careless cooking statistics represent only the smallest fraction of cooking incidents that occur (e.g., Ahrens 2012, 2013, 2015; Ahrens et al. 2007; Dinaburg and Gottuck 2014; Greene and Andres 2009; Office of the Fire Marshal 2009). In addition, changing human behaviours that result in residential careless cooking incidents and fires can be difficult due to the widespread acceptance of the notion that “a person’s home is his/her castle”, a notion that is largely antithetic to external scrutiny of at-home behaviours, even if these behaviours are dangerous (for example, consuming alcohol while cooking). This notion stands in sharp contrast to some Asian cultures where the belief system is that any behaviours that could hurt others – even behaviours in private homes – are frowned upon (Miller and Beever 2005:851).

Residential careless cooking is a serious concern in Canada and internationally. What makes careless cooking of particular concern in Canada is the fact that, while the majority of industrialized nations – including the United States, Australia, France, Germany, and the United Kingdom – have nationally unified and coordinated fire incident databases, Canada does not have (yet) a cohesive national database of fire statistics, with existing data being incomplete, inconsistent and not comparable (e.g., Maxim et al. 2010; Garis 2014). In other words, while many industrialized nations have up-to-date, nationally-representative information on fire incidents, Canada has no such reliable information with which to inform resource allocation, prevention efforts, and civilian fire education programs. This research project will contribute to filling the current gaps in fire data by undertaking primary research into the incidence, circumstances and risk factors of careless cooking in the City of Regina, with a focus on high risk populations.

4. IMPORTANCE OF THE PRESENT STUDY AND RESEARCH QUESTIONS

Growing from the context of the persistent residential careless cooking problem in the City of Regina, the present investigation contributes to a small, yet theoretically and methodologically informed approach to what is hopefully a growing literature on residential fires in Canada. Careless cooking has been the leading cause of unintentional residential fires in the city since 2004, currently accounting for half of all unintentional structure fire incidents. Careless cooking incidents have been increasing each year, a growing trend the Fire Department is working to curtail. They are the cause of significant property damage, compounding housing issues already affecting the city and placing residents and Firefighters at risk of injury and death. RFPS identified the cause (cooking) and origin (kitchen) of these incidents but the human dimensions of these fires – that is, the socio-demographic and behavioural characteristics of hosts –had neither been determined nor studied. To be effective, cooking fire prevention strategies need to target those populations at highest risk, and the circumstances that are most likely to result in the escalation and spread of these fire incidents.

Against this backdrop, the research project intends to highlight the human dimension of residential cooking incidents. In particular, it aims to identify high risk populations by applying key concepts of Brennan and Thomas' *Revised Paradigm of Human Behaviour in Fires* (Brennan and Thomas 2001a,b; Brennan 1999) and the Haddon Matrix (e.g., Rhodes and Reinholtd 1998; Xiong et al. 2014). These applications will facilitate a more "holistic" understanding of the complex circumstances surrounding such cooking incidents, and allow the organization of a variety of factors (human/host, hazard agent, and environment) before, during, and after the cooking hazard. With an over-emphasis on the role of hazard agents in incident causation and spread, this research contribution responds to recent calls (e.g., Xiong, Bruck, and

Ball 2014, 2016) for a paradigmatic shift within firefighting away from incident suppression and toward incident prevention and host mitigation by highlighting the role of the host involved in careless cooking, and underscoring the higher vulnerability of certain sub-groups of the population (e.g., the elderly, the young, males, recent immigrants, etc.) (e.g., Jennings 2013; Warda, Tenenbein, and Moffatt 1999). This research project is one of few empirical studies to examine the simultaneous contribution of several theoretically important factors associated with the outbreak, spread and negative outcomes of residential cooking incidents to develop sound recommendations for behavioural prevention and mitigation strategies to reduce careless cooking.

The research project analyzes primary survey data collected in 2014 and 2015 using the *Residential Cooking Fire Data Form* to describe careless cooking in the City of Regina by examining:

i. incidence, circumstances and risk factors of careless cooking causation;
ii. location of host at time of incident and initial detection or means by which the careless cooking incident was first detected;
iii. smoke alarm status in careless cooking incidents;
iv. prevalence and correlates of hosts' interventions utilized in residential careless cooking incidents and how these relate to effective safety strategies;
v. nature and correlates of Firefighters' actions taken in response to careless cooking incidents;
vi. interplay between different stages or phases of a careless cooking incident time scale;
vii. relative contribution of human, hazard agent and environment-related risk factors to host and Firefighters' actions taken in response to the residential cooking incident;

viii. outcomes and severity of careless cooking incidents; and

ix. relative contribution of human factors vis-à-vis technological and engineering detection solutions (e.g., presence of operating smoke alarms) in the extent of careless cooking incident outcome and severity, and relating these findings to theoretical formulations to develop improved fire-safety and public education initiatives.

5. THEORETICAL FRAMEWORK: ACHIEVING A PARADIGMATIC SHIFT IN CANADIAN FIREFIGHTING – MOVING BEYOND SUPPRESSION

While the fire service's traditional focus on technological solutions aimed at improving fire suppression offers a partial solution to the problem of fires, focusing solely on suppression ignores the role of human agency in the causation, spread and severity of fires. The role of humans in incident causation, escalation and severity of fire outcomes cannot be ignored, since many fires – and particularly residential careless cooking incidents – are caused directly or indirectly by people's actions or inactions. Effectively and sustainably addressing the careless cooking problem requires a major shift in focus, in that effective fire prevention and mitigation strategies must examine a variety of systemic social issues to adequately address the various factors that define vulnerability to such incidents. As Shields and Proulx (1999) noted:

> The development of human behaviour in fire into an area of scholarly study of vital importance has been extremely rapid. ... Hard fire science alone cannot solve the 'fire problem'. With increasing international emphasis on community fire-safety policy initiatives, knowledge of occupant behavioural characteristics associated with fire is essential (*cited in* Miller and Beever 2005:846).

The human dimensions of fire are further elaborated below. First, the socio-demographic factors which define vulnerability are presented. Second, the various ways in which people contribute to fire ignition and spread are reviewed. Following these, Canada's gradual movement toward a risk-management, prevention-first firefighting paradigm is discussed in greater detail.

5.1. When Suppression Is Not Enough: Vulnerable Populations

Particular populations (e.g., the elderly, children, or new immigrants) are at greater risk in relation to careless cooking than the general population. Fire victim profiles indicate that in Canada (e.g., BC Coroners Service Ministry of Justice 2012; CCFMFC 2007; Statistics Canada 2015), as in many western industrialized nations (for literature reviews, see Ballard et al. 1992; Jennings 2013; Harpur et al. 2014; Miller and Beever 2005; Rhodes and Reinholtd 1998; Warda et al. 1999), senior citizens, young children, males, low-income individuals, and new immigrants are particularly vulnerable to residential fires. Increased vulnerability to fire causation, spread and severity of outcomes is determined by a variety of demographic, economic, and social factors which intersect and have a direct and negative impact on the ability of vulnerable groups to access the resources necessary for fire prevention, mitigation and recovery (e.g., Taylor-Butts 2015).

A recent Statistics Canada study found that seniors, immigrants, and individuals who lived in low-income households were less likely to have large social support networks they could rely on in an emergency, which impacted event and post-event hazard mitigation. These high fire-risk populations were less likely to engage in emergency-preparedness behaviours. This impacted their vulnerability to fire ignition and severity outcomes (Taylor-Butts 2015). For example, while 21 per cent of all Canadians reported having a "high degree of social support" (defined as having more than five people on which to rely on in an emergency), this number dropped to 13 per cent for seniors, 15 per cent for recent immigrants, and 13 per cent for individuals who lived in households with combined annual income of less than $20,000 (ibid:20-

21). Less than three of ten (27%) individuals in households with a total annual income of less than $20,000 had a smoke detector, carbon monoxide detector, and a fire extinguisher, rising to four of ten for individuals in households with earnings of $60,000 to $80,000, and to more than half (54%) for individuals in households with a total income $150,000 or more annually (ibid:11). While these fire-safety measures may not affect fire prevention efforts, they do factor in early incident discovery efforts and incident mitigation and survival.

Seniors aged 75 and older are one of the most fire-vulnerable segments of the Canadian population (Wijayasinghe 2012). The fire fatality rate of Canadian seniors aged 75 to 89 was found to be 2.5 times that of the national average, while seniors aged 90 and older were five times more likely than the average Canadian to die because of fire-related outcomes (ibid). The vulnerability of seniors to fire is due to various factors unique to aging – for example, limited mobility and mental or physical disability – many of which commonly exist in combination and compound each other's effects (e.g., Barnett 2008; Brennan 1999; Bruck, Thomas, and Kritikos 2006; McCormick 2009; Miller 2005; Harpur et al. 2014; Warda et al. 1999; Wijayasinghe 2012). Factors such as limited mobility, vision or hearing loss, and mental disabilities contribute to incident causation, spread and its resultant outcomes and negatively impact seniors' ability to be aware of, and respond appropriately to, a fire incident (e.g., Bruck et al. 2006; McCormick 2009). In addition to physical vulnerabilities, many seniors face high fire-risk because they live alone. Living alone, in conjunction with a physical or mental disability, can prove fatal in the event of fire, as a living alone senior cannot rely on assistance from other individuals to detect fire or respond appropriately (e.g., Barnett 2008; Warda et al. 1999). In Canada, approximately one-quarter (24.6%) of seniors aged 65 and older live alone (Statistics Canada 2012).

Seniors are not the only age group in the Canadian population particularly vulnerable to fires. Children also have higher death rates when compared to the national average (e.g., British Columbia Coroner's Service 2016). Children's vulnerability is a result of their physical and emotional immaturity. For example, children are more likely than adults to engage in fire-play as they often underestimate or fail to appreciate the danger of fire. Very young children are also often physically incapable of escaping dangerous situations without adult assistance (e.g., British Columbia Coroner's Service 2016; Byard, Lipsett, and Gilbert 2000; Warda et al. 1999).

Socioeconomic status is another key determinant of fire vulnerability. Individuals with the least social and economic capital are most vulnerable to fire injuries and fatalities (e.g., Barnett 2008; Duncanson et al. 2002; Jennings 2013; Miller 2005; Miller and Beever 2005). Factors that contribute to the vulnerability of low-income populations include: increased likelihood of occupying residences that are of poor quality; lack of information about fire risk and fire-safety because of physical or social isolation; and limited resources with which to ensure the safety of their homes (e.g., Chhetri et al. 2010; Duncanson et al. 2002; Rhodes and Reinholtd 1998). In Canada, the incidence of fires is higher in Aboriginal communities as compared to the Canadian average (e.g., BC Coroners Service 2012; Canada Mortgage and Housing Corporation 2004). For example, between 2007 and 2011 in B.C, Aboriginal people were found to have four times the rate of residential fire death and were 20 years younger on average than non-Aboriginal victims (BC Coroners Service 2012:5), something that is no doubt related to the fact that, "Aboriginal people face significant earnings and income disparities compared to non-Aboriginal people in Canada" (Aboriginal Affairs and Northern Development Canada 2013:1).

In addition to age and socioeconomic status, sex is a significant predictor of fire vulnerability, with males being more vulnerable to fire fatality than females. This is likely due to gender socialization that encourages men toward risk-taking behaviours (e.g., Barnett 2008; Duncanson 2000; Miller 2005). Based on analysis of Canadian fire data collected in 2002, 174 males died because of fire-related incidents, accounting for over half (57%) of the total fire fatalities that year (CCFMFC 2007). Men's socialization into risk-taking behaviours not only impacts their actions during a fire – for example, they are more likely to try to fight the fire, and thus risk injury and death – but it also impacts their vulnerability to fire ignition. In a review of fire fatalities, Karter and Miller (1990) found male victims were more often intoxicated compared to their female counterparts, and being intoxicated is a well-established predictor of fire vulnerability (e.g., Ahrens et al. 2007; Barillo and Goode 1996; Hall 2006; Howland and Hingson 1987; Miller 2005).

Finally, while the evidence is still limited, new immigrant status also seems to determine fire vulnerability, such that immigrants are significantly more vulnerable to fire than their nationally-born counterparts. The high risk of fire causation, spread and severity outcomes among various immigrant populations is related to a number of factors, including: language barriers; cultural differences between origin and host countries; unfamiliarity with electric stovetops and a lack of understanding of the potential dangers associated with them; likelihood of living in poor-quality housing; differences in building construction between country of origin and host country; and lack of knowledge about existent fire-safety information or inability to access it due to social isolation or language and cultural barriers (e.g., National Fire Protection Association 2016; Taylor-Butts 2015). A recent Statistics Canada study found that recent immigrants, due to their social and economic marginalization, were less likely than the majority of Canadians to live in houses with fire-safety measures (Taylor-Butts 2015). While less than one-quarter (24%) of newcomers lived in households equipped with a smoke alarm, a carbon monoxide detector, and a fire extinguisher, 44 per cent of Canadian born individuals lived in houses with all three fire-safety measures (ibid:12).

Before concluding this section, it is important to echo other scholars in the field who highlighted the difficulty of extrapolating the risk factors of careless cooking from previous empirical studies, especially since most past studies focused exclusively on residential fire death or serious injury risks (for thorough reviews see, Xiong, Ball and Bruck 2016, 2015, 2014). Yet, “survived residential fires with no death … [or] injuries are the most prevalent fire incidents and are an important public safety issue” (Xiong et al. 2014:1049), most of which are the outcome of careless cooking that in most cases were mitigated or supressed without fire department assistance. Despite this, there has been very little research done in this area, which is problematic because there may be significant differences between small and large incidents. As will be discussed further below, the RCFRP’s data overcomes this limitation by collecting information on all careless cooking incidents, irrespective of ignition status, spread or severity. If the incident had the potential to become serious if left unchecked, then we need to study that incident as it can inform us of the sequence of events between cases that were promptly contained thus effectively preventing a fire or mitigating its effects once it started and those that were not. Certain types of cooking incidents are more likely to be severe, and these generally result from the interaction between certain human actions (or inactions) and a range of hazard agents. It is also clear that there are factors which increase the level of risk for some people more than others. Comparing careless cooking incidents in various ignition, spread and severity continuums will help us form a more comprehensive picture of how some incidents remain contained while others escalate and spread to produce significant negative outcomes.

5.2. Human Dimensions of Careless Cooking: Understanding the Role of the "Host"

Purely engineering solutions to fire safety are insufficient to achieve effective outcomes. Following the seminal First Seminar on Human Behaviour in Fire at Surrey University in 1977, Canter (1980) captured the limits of a sole focus on technological advances to the study of fires:

> Study of the causes of fire is surprisingly scarce. Engineering tradition of dealing with the management of effects rather than the identification of causes seems to have an influence here. But the view that human agency is totally 'accidental' which has, until recently, overshadowed consideration of causes due to human 'error' led people to focus on prevention as a mechanical engineering consideration rather than as an aspect of management and training (*cited in* Miller 2005:13).

The disparate vulnerability to fire highlighted in the Canadian and international literature illustrates the fact that, while technological and engineering answers are partial solutions to fires, attempts to truly remedy the situation must go beyond simple suppression and must address systemic inequalities (Brennan 1999), with education seen as the first line of defense against fires and their resultant outcomes (e.g., Sheridan 2011, 2012; Tennant 2014). Education is a 'universal access' response to fire prevention. Education can be made available to any vulnerable group and can be effective if the right messages are provided by trusted individuals or providers (see also, Tennant 2014). Engineering changes are not universally accessible (i.e., stovetop upgrades). And, while fire-safety laws or regulations pertain to everyone, they are not universally enforced.

Fire service industry acceptance of risk management principles that require a thorough and detailed understanding of the nature of risks facing the community, strategies to reduce the likelihood of these occurrences, and minimizing consequences when they do occur, is growing. A great deal of literature points to the significance of human agency in fire causation, escalation and spread (e.g., Ballard et al. 1992; Barillo and Goode 1996; Brennan 1999; Brennan and Thomas 2001a,b; Miller and Beever 2005; Thompson and Wales 2015; Wales and Thompson

2013; Xiong et al. 2014, 2015, 2016). Most residential fire incidents are caused by a set of circumstances precipitated by "human acts" (something is done) or "human omissions to act" (something which has not been done) (McCormick 2009; Rhodes and Reinholtd 1998). Humans contribute to fire ignition in a variety of ways, many of which are inadvertent or are a result of a lack of knowledge about the real dangers of fire, such as failure to supervise children who have access to flammable materials; intoxication; interacting with flammables carelessly; and neglecting to maintain cooking equipment and safety systems, such as smoke alarms (e.g., Brennan 1999; McCormick 2009; Miller and Beever 2005; Rhodes and Reinholtd 1998). Based on a six-year study of fire fatalities in New Jersey, Barillo and Goode (1996) concluded:

> Many fires, and most fire-related injuries, are preventable. Fire requires the interaction of fuel, oxygen and a source of ignition, and the union of these elements is frequently a result of human behaviour. [P]revention can be achieved by … altering the human behaviour that brings the fuel and ignition source together … [A]nalysis of human behaviour resulting in fire and fire-related injury is hampered by a paucity of data (85).

5.3. Firefighting in Canada: A Changing Paradigm?

Traditionally, fire services focused their attention on the suppression component of fire control (for a recent example, see Levin 2013), allocating fewer resources to fire prevention, and focusing on technological and engineering solutions to fire (for a review on the need for a more 'holistic' approach, see Rhodes and Reinholtd 1998). Two related trends contributed to this: i) Protecting hosts from fire-related liability or the "victim-blaming assertion" (Gielen and Sleet 2003), which in turn resulted in dejection of individuals' accountability for fires; and ii) the incorrect assumption that "it is [fire services'] responsibility to deal with fire, usually … through the application of technological approaches to improving suppression capability" (Rhodes and Reinholtd 1998:43), because people are thought of as "passive victims", who need help from fire services or engineering solutions to prevent and suppress fires. That is, human behaviour is modelled as "purely reactive". Combined, these assumptions led to the notion that preventing the fire to begin with is not possible – certainly not possible by changing human behaviour. Fire can be controlled or mitigated only once it is started. This notion is in line with what Brennan and Thomas (2001) characterize as a "reactive" model, grounded on the underlying assumptions that fire is an "externally imposed event", "independent of occupants", who are, in turn, "subjected to fire" (Figure 1). That is, it discourages people from taking an "active role" in protecting themselves (Gielen and Sleet 2003).

Figure 1. Brennan and Thomas' (2001) revised paradigm of human behaviour in fires

TRADITIONAL MODEL	REVISED MODEL
▪ **Assumptions:** Individuals **REACT TO** fire cues (smoke, safety warnings, flames).	▪ **Assumptions: Individuals INTERACT WITH fires and may be involved with fire ignition.**
✓ Fire ignition, growth and cue generation are independent of occupants.	✓ **Occupant may have role in ignition.**
✓ Fire is **externally** imposed event.	✓ **Occupant may facilitate fire growth or spread by inadvertent actions.**
✓ Occupants are **subjected** to fire.	✓ **Acknowledges primitive attachment between fires and humans, including attempts to fight fires.**

Source: Brennan and Thomas (2001); Figure Adapted from Miller (2005:14)

Even common words used by the fire service underline these erroneous assumptions, which in turn inform the fire service on how to deal with fires, i.e., suppression instead of fire prevention. For example, noting that 'cooking equipment' caused fires is misleading. While the cooking equipment provided the heat source, it is rarely the cooking equipment that is not working properly. It is the person using the cooking equipment who uses it carelessly, or continues using it despite its showing previous signs of malfunction. Using terminology in this way forms a commonly-accepted mindset that it is the equipment that causes fires, not humans. Therefore, the logical conclusion is that there is no point in developing programming to change human behaviour, which undermines human-based public safety initiatives. This practice is manifested through the usage of terms like "accidental", taken from investigation terminology applied to public information, supporting the mindset that if the incident was "accidental", then the individual could not have done anything differently to avoid its imminent occurrence.

We join scholars like Brennan and Thomas (2001) and Rhodes and Reinholtd (1998), among many others (e.g., Thompson and Wales 2015; Wales and Thompson 2013), regarding the need of a firefighting paradigm shift from a narrow "reactive" model for fire safety to an "interactive" model that acknowledges the important role of human involvement in fire causation, escalation and spread, and addresses the high vulnerability of particular groups to fire hazards. For example, based on qualitative data collected through semi-structured interviews with 10 individuals who had experienced an injury as a result an unintentional residential fire in Kent, UK, Thompson and Wales (2015) findings' regarding individuals' desire to tackle or mitigate the fires in their homes led them to conclude:

> Indeed, one is presented with a strong impression of just how active people are during a fire [...] This is important as it provides further evidence to undermine the still frequently held assumptions (certainly within the fire service) that during a dwelling fire, those in the property are either simply helpless agents, passive in the face of a developing fire, or irrational beings that become consumed by and victim to (the equally misunderstood) phenomena of 'panic' (461).

Due to this suppression focus, less attention has been given to the causes of fire incidents, and the strategic examination of community vulnerability (e.g., Rhodes and Reinholtd 1998;

TriData 2009; Xiong et al. 2014). However, there is currently an increasing recognition that incident suppression is only one feature of the fire service, prompting greater interest in the study of the demographic and social predictors of fire causation and severity (e.g., Chhetri et al. 2010; Duncanson et al. 2002; Jennings 2013; Miller and Beever 2005; Miller 2005). This increasing recognition of the role of human agency in fire causation, escalation, spread and severity is leading to a shift toward a risk management approach, which requires: implementation of strategies aimed at reducing fire incidence; comprehensive knowledge of community-specific risks; and minimization of human, physical, and environmental fire losses (Rhodes and Reinholtd 1998). Based on the tenets of a risk management approach, it follows then that to be effective, careless cooking prevention strategies must target the most vulnerable populations, based on a thorough understanding of the circumstances in which careless cooking incidents are most likely to occur and escalate (ibid). This research project highlights the human dimension of residential careless cooking and identifies high risk populations.

Studies on the fire-safety impact of increased spending or resource allocation by fire services on prevention measures show how those countries (e.g., Australia, England and New Zealand) that provide more resourcing to prevention have better community safety outcomes (for thorough reviews, see TriData 2007, 2008). In Canada, a gradual shift away from a technological, suppression-focused approach has taken place in the past decade (TriData 2009). To date, a number of Canadian provinces have passed legislation supporting a risk management approach to community fire control (TriData 2009). In Ontario, the Office of the Fire Marshal and Emergency Management is encouraging fire departments to allocate more resources toward fire prevention, public education and code enforcement, rather than solely on fire suppression operations (e.g., D'Orazio 2014; Sheridan 2011, 2012; Tennant 2014). For example, Margo

Tennant, an Education Officer at the Brampton Fire and Emergency Services in Ontario, reflects on the importance and lasting implications of this movement by noting, “We know that learning is for life and that if we get the right messages to the right people in the right formats, the lessons will have meaning.” Also, exemplifying the paradigmatic shift in Canadian firefighting from suppression toward prevention and public education are the actions of the Ottawa Fire Chief and the Ottawa Prevention Chief, who “no longer display in their offices pictures of big fires the department fought” because these images are no longer “the[ir] major points of pride” (TriData 2009:7). Similarly, Ken Sheridan, Captain of Fire Prevention in Norfolk County Ontario, makes a strong case for promoting and funding fire prevention and public education efforts in the face of recent cuts to operations by arguing:

> The cost of running a fire department is astronomical. Pumper trucks cost $350,000 (and up), aerial trucks cost more than $1 million. [...] [Y]et dollar losses due to fire continue to increase. Of all the measures we’ve taken and money that has been spent, our fire death rate is almost the worst in the western world. Does this add up? If we are really in this business to save lives and property, why are we fighting change? […] We must continue to be creative and accept the fact that life in the fire service is an evolution. I really believe that more fire prevention and public education is the key to our communities’ best chance against fire. […] We have come a long way […] in this area of emergency preparedness through education from a global perspective; however, we must see the future with fewer fires through the same approach (2011:6).

The research project also underscores this attitude shift. Careless cooking has been the leading factor associated with unintentional residential fires for the tenth year in a row in Regina. RFPS partnered with the Faculty of Arts’ CRU at the University of Regina to identify the behaviours and the sequence of events which lead to careless cooking fires. An important contribution of this collaborative partnership is the development of sound recommendations for behavioural mitigation strategies that will reduce such cooking incidents and their resultant negative outcomes by examining the interaction between host involved, hazard agent, and environment in more detail. While there has been progress in prioritizing prevention and public education in the Canadian fire service, the collection of ongoing, reliable and comprehensive national fire data is still under contention.

6. METHODOLOGY AND METHODS

6.1. Community-Based Participatory Research and its Use in the Current Research

Defined as research that is "conducted by, for or with the participation of community members" (Loka Institute 2002), community based participatory research (CBPR) is an approach to research that has origins in two distinct research traditions, namely "action research" and "participatory research" (Flicker et al. 2007). Together, these emphasize the meaningful inclusion of community stakeholders' representatives in applied social research, and support the building of strong partnerships between academics and communities, with the goal of fostering positive change (ibid). As a collaborative approach to research, CBPR promotes equitable involvement of all partners in the research process and recognizes the unique strengths that community partners and academics bring to applied research (Minkler, Garcia, Rubin and Wallerstein 2012; Wallerstein and Duran 2006). CBPR represents a systematic effort to incorporate community members and leaders in research decision making to create practical community changes that are sustainable, community-supported, and data-grounded (Wallerstein and Duran 2006). Ideally, CBPR provides all participants with a sense of ownership over the research and agency in the determination of practical research outcomes (The Examining Community-Institutional Partnerships for Prevention Research Group 2006; O'Fallon and Dearry 2002).

In following the CBPR approach in addressing the careless cooking issue in the City of Regina, the research project began with a research problem identified by the community partners with the aim of combining knowledge and action for social change to improve an outcome. In examining residential structure fires in the city, RFPS identified careless cooking as an area of concern and suggested the need to develop key community partnerships to reduce the incidence and magnitude of these fires. RFPS management approved the application for a research partnership with the University of Regina. The research proposal was written in consultation with the former Coordinator of the Faculty of Arts' CRU, Yolanda Hansen. The research proposal was successful with an Associate Professor in Sociology & Social Studies signing on to lead the research project. Meetings were held to establish the research goals and methodology, to discuss any ethical concerns and to establish final report parameters. In the fall of 2013, RFPS Deputy Chief issued a departmental memo introducing the research project and the expectation for participation.

The community and academic partners contributed their respective expertise and learned from one another. Community partners acquired new skills in conducting research, and researchers learned about community concerns. Clear terms of reference were developed early on (e.g., Flicker et al. 2007), explicitly laying out each partner's roles and responsibilities (e.g., Macaulay et al. 1998; Minkler and Wallerstein 2003). The community partner was engaged at every stage of the research process, including: background research; choosing research methodology; designing survey questions and pilot testing of the measurement instrument; consulting with Fire Department management; consulting and training Officers; collecting primary data; managing the data; interpreting study findings; and writing up and disseminating research results. In addition to conducting station visits to introduce the survey form and supplying forms to front-line Officers, the community partner also introduced a wide consultation and feedback process with Suppression & Rescue Officers and Firefighters. This included a focus group methodology a year after implementation of the survey, and periodic dissemination of preliminary results. During these discussions, Officers shared that one of their primary concerns regarding data collection was the occasional absence of occupants at the scene affecting their ability to gather information. A category was added to the final version of the survey that reflected these situations but still allowed Officers to report their observations of the incident upon arrival.

Firefighters and Public Educators regularly work together in the development and delivery of the fire department's public education programming. While Firefighters form the main delivery arm of the program, community development and program design responsibilities rest largely with public education staff. The Public Education Program's success, both internally and within the community, is dependent on the strong working relationship between the department's Firefighters and Public Educators (see also, Tennant 2014). This research project provides these members another opportunity for collaboration, bringing together a wide array of fire service experience, strengths and skills.

The university partners involved in the project acted as co-research investigators to RFPS, and assisted with the development of the survey instrument, processed and analyzed data, wrote up and disseminated research results, and made recommendations to assist RPFS with the development of public education programs. The Faculty of Arts' CRU acted as a facilitator of the project, supporting both community and university partners for the duration of the research.

6.2. Survey Instrument

To address the increasing careless cooking incidence in the City of Regina, the research partners took as one of their primary objectives the identification of demographic, behavioural, and social factors causing this community risk. The *Residential Cooking Fire Data Form*, completed by Suppression & Rescue Officers at the scene of every careless cooking incident, was implemented on January 1, 2014 and continues to be used for comparative data collection. The Officers were provided with training and their support was enlisted. Using both original and adopted questions (e.g., Ontario Stovetop Fire Survey), the survey form was limited to one page to ensure it was fast and easy to fill out by Officers gathering data on the scene, yet comprehensive in the data being gathered. This method of incorporating specific data collection into the Officers' emergency response is ground breaking for the fire service in Canada, and can potentially provide direction and guidance to other communities wishing to embark on similar evidence-based research.

In determining what data to collect, the research partners looked at what really causes careless cooking – people. The survey form was designed to collect information on people – their characteristics (demographics), their influences and their behaviours. The survey form has three distinct components, including: information regarding the host's characteristics and behaviour; information regarding the careless cooking incident; and information regarding damage and loss. A copy of the survey is provided in Appendix A. The Officer completing the form can also provide a brief narrative on each careless cooking incident. These narratives – and where applicable the Fire Investigator's detailed report –provided rich supporting insights. Selected case studies were drawn upon in this study to help illustrate more fully the human factors behind careless cooking causation, escalation and spread.

6.3. Firefighters' Commitment

Suppression & Rescue Officers are best positioned to collect data about the actual circumstances of residents experiencing these careless cooking incidents. Consequently, from the beginning of this research project, the Officers were tasked with the responsibility of collecting the data. These Officers and the Firefighters they lead are the responders who are on-scene, know the circumstances, and have contact with the residents. Officers and Firefighters understand the importance of preventing fires because they are the ones who see when the fire service fails in its fire prevention efforts. They are the ones who see families in crisis when fire destroys their homes. They are the ones who put their own lives at risk when someone was not careful. Firefighters truly are committed to protecting the people they serve, whether through emergency response, or fire prevention and mitigation efforts.

In addition to tasking Officers with data collection, this research project gave Officers and Firefighters the opportunity to provide input into how to best collect information that could be used to positively and proactively impact careless cooking incidents and their effects. They provided feedback to the research partners on both the data being collected and the survey tool used in two ways: informally to the department's Public Education Officers involved in the research project, and more formally during focus group discussions. During these discussions, they shared areas of concern and suggested changes to improve the survey form. The focus groups provided both the Officers and research partners an opportunity to communicate and exchange information. The Officers, for example, could appreciate why the data collection was so important and how it would be applied to future programming. They were enthusiastic about their participation, concerned only that the information they were providing would not be used or applied. The discussions with the research partners, particularly the academic partner, reassured them that their work and input were vital. Fire industry publications often speak to the issue of Firefighters and the fire culture as being resistant to this type of proactive work (e.g., Berard-Reed and Vastis 2015; Sheridan 2011, 2012). The experience with this research project showed the opposite – Suppression & Rescue Officers and Firefighters were fully supportive and engaged.

6.4. Quality Assurance Checks

RFPS Public Education Officers ensured accuracy and completeness of the data through various quality assurance checks. Thus, we are confident the surveys represent all the cooking incidents reported to the Fire Department during the study period. All emergency incidents were audited to ensure no cooking-related incidents were missed. Each form was compared with the incident notes written by Emergency Communications Centre personnel during the incident, and notes written by Officers in the immediate aftermath for the department's FDM system, showing clearly that the forms were being filled out thoroughly and completely. Officers even used spaces in the margins to provide further details they felt were important and relevant. Completed incident forms, along with supplementary contextual data collected for each incident (e.g., time of day, day of week and month of incident occurrence; geographic information; occupancy type; etc.), were forwarded to the academic research partner on a month-by-month basis for data processing (e.g., data entry, coding, editing, checking, and update or correction), analysis, and dissemination. The processed data for the years 2014 and 2015 were used here to meet the objectives of the present study.

RFPS does not have an analyst position; no one is tasked to ensure data collection is consistent, accurate or analysed. Indeed, one of the major goals of the present partnership was to review and update existing methods of record collection and maintenance. Prior to implementation of the survey form, many Officers categorised cooking-related incidents that did not result in an actual fire as a false alarm. As a result, many of these incidents were unaccounted for, making it difficult for the research partners to identify the scope of the problem. Problematic for performance measurement, monitoring and research, the team found low correspondence in careless cooking incidents recorded on-scene in the *Residential Cooking Fire Data Form* compared with incidents entered in the RFPS FDM system due to differences in definitions, classifications, and record maintenance systems. The number of residential careless cooking incidents in the City of Regina for 2014 and 2015 was much larger than what was recorded in the RFPS FDM system.

The query for 'investigated fires' in structures in the RFPS FDM system underestimates the number of careless cooking incidents because of a tendency to input and collect supplementary information only for cooking incidents that are large and thus requiring more serious actions by the Suppression & Rescue crews to put the fire out. Fire Investigators are informed of such fires by a call from the Incident Commander at the time of a cooking incident (this would be a significant fire) or by the Suppression & Rescue Officer putting an "X" in a box in the FDM system, requesting an Investigator to follow up during regular working hours if the incident is somewhat less serious. Fires getting an "X" are at the discretion of the Suppression & Rescue Officer who responded to the emergency, and this process or task appears to be very inconsistent. Given the caveats in data collection, estimates based on Incident Reporting obtained from the department's FDM system may generate a higher rate of resultant negative outcomes (e.g., property damage, injury and death) on a per fire basis because only the more severe fire incidents are fully reported, investigated and documented. The absence of these less severe types of incidents from the RFPS FDM system likely affects the department's ability to fully evaluate prevention measures such as smoke alarms or host's intervention efforts because by definition, when prevention or intervention efforts work, there is no (severe) incident to report. There is a need to review and update existing methods of record collection and maintenance to ensure systematic and on-going collection and analysis of valid, complete and accurate incident data.

6.5. Data Requirements and Units of Analysis

Several variables from the various sections of the survey were used to meet the research objectives, including: demographic information about the host involved in the cooking incident; information on human or host activities before an incident which caused or triggered the incident, activities during an incident including how hosts were first alerted to the presence of the incident and host's intervention behaviour; Firefighters' actions upon arrival; outcome and severity of the incident; and the impact of the incident on the physical environment and the people in it.

Compared to mortality and morbidity databases, the survey instrument collects information on more aspects of a careless cooking incident, allowing richer examination of the types of behaviours and sequences of events surrounding careless cooking risk and outcomes of such incidents. To enrich understanding of residential careless cooking dynamics, the present study focused on all cooking incidents attended by RFPS, irrespective of ignition status, severity of the cooking incident or extent of fire or whether there were deaths, serious injuries or significant property damage, an area that has been largely ignored in the past (e.g., Xiong et al. 2014, 2015, 2016). RFPS Suppression & Rescue Officers were requested to gather information on all residential incidents involving cooking equipment in the kitchen or cooking area, that is, all cases where a cooking incident originated in a house, apartment or other residence where the occupant or host lives. These selective criteria are in line with the definition used in previous, published empirical research on residential careless cooking, in which incidents involving cooking equipment are defined as any occurrence large or small that resulted in unwanted flames or smoke, and could have caused damage to life or property if left unchecked (e.g., Ahrens 2015, 2013; Ahrens et al. 2007). One of the reasons for studying all incidents irrespective of ignitability and severity is to try to understand the process of how residents became aware of an unwanted, potentially risky if left unattended incident and ultimately bring it under control without requiring fire department involvement. After all, “big fires start small.”

Although the research project studied the behaviours of incidents not involving actual fire, these behaviours were studied to ultimately gain a better understanding of what causes cooking-related fires. To reiterate, focussing on all incidents can contribute knowledge of residential careless cooking risk dynamics and the sequence of events contributing to causation, escalation and spread of fire, providing additional insights into these incidents, especially those that were promptly controlled by residents before escalating. It is important to note that without exception, all careless cooking fires in the present study started as small, preventable incidents, caused by a set of circumstances precipitated by human acts (something is done) or human omissions to act (something which has not been done). In other words, all incidents began small from contact between a heat source and a fuel. Some incidents were promptly controlled by hosts, preventing a fire or mitigating the effects of one if started, while other incidents grew, causing injury and property damage.

Whether careless cooking behaviours resulted in small, non-serious cooking incidents where no Firefighter intervention was needed, or in ignition and severe fire outcomes, depended mainly on certain circumstances such as: the host’s activities leading to the incident; early detection (e.g., a monitored alarm); and/or the host, other household resident(s) or Firefighters’ timely and effective intervention in response to the incident. The survey instrument can reveal the role of these various circumstances on the outcome of the cooking incident by considering such issues as location of host at time of incident, how host became aware of the presence of an incident, role of smoke alarms in alerting people, and host or other occupant’s intervention behaviour to prevent a fire or mitigate the incident as it develops. In line with the focus on the human dimension of careless cooking, examination of the population of cooking incidents attended by RFPS will, therefore, allow us to more comprehensively evaluate how host's behaviour(s) before and during a cooking incident affected the hazard outcome as defined by the actions taken by Firefighters and the incident's resulting severity. This is an important research contribution. While the existing fire research has tended to over-emphasize the role of hazard agents in fire ignition and spread, the present study instead highlights the role of the "host", or the human agent, involved in residential careless cooking incidents as these are often the outcome of some human action, either directly or indirectly, bringing together a heat source and fuel. Thus, the units of analysis are the careless cooking incidents. At the end of the two-year study period, 884 surveys were completed by Suppression & Rescue Officers.

6.6. Analytical Modelling Techniques Used to Answer the Research Questions

To analyze the survey data, we applied a range of univariate, bivariate and multivariate statistical tools, based on the outcome variables' level of measurement. IBM SPSS Statistics 23 and Stata 12.1 were used to analyze the data. To investigate the interaction between host involved, hazard agent, and environment in more detail at the individual level, we adapted the Haddon Matrix to the study of careless cooking. Originally developed by Dr. William Haddon for the study of traffic accident injuries, the Haddon Matrix has now been widely adopted as a tool to identify risks related to injuries or fatalities in a variety of hazard contexts (e.g., Rhodes and Reinholtd 1998; Runyan 1998; Xiong et al. 2014). The usability of the model for understanding the origins of injuries and fatalities in hazard situations, as well as for stimulating countermeasures to address those origins, has resulted in the wide and continued use of the framework (Runyan 1998). Calling for a holistic approach to reducing residential fire fatalities, Rhodes and Reinholtd (1998) adapted Haddon's concept of host-agent-environment interaction to highlight the necessity of a paradigmatic shift within firefighting away from incident suppression and toward incident prevention and mitigation. A greater focus on the human dimension of fires – that is, the socio-demographic and behavioural characteristics of hosts – was necessary to begin to understand fire incidents in a meaningful way, and to highlight the vulnerability of certain sub-groups of the population.

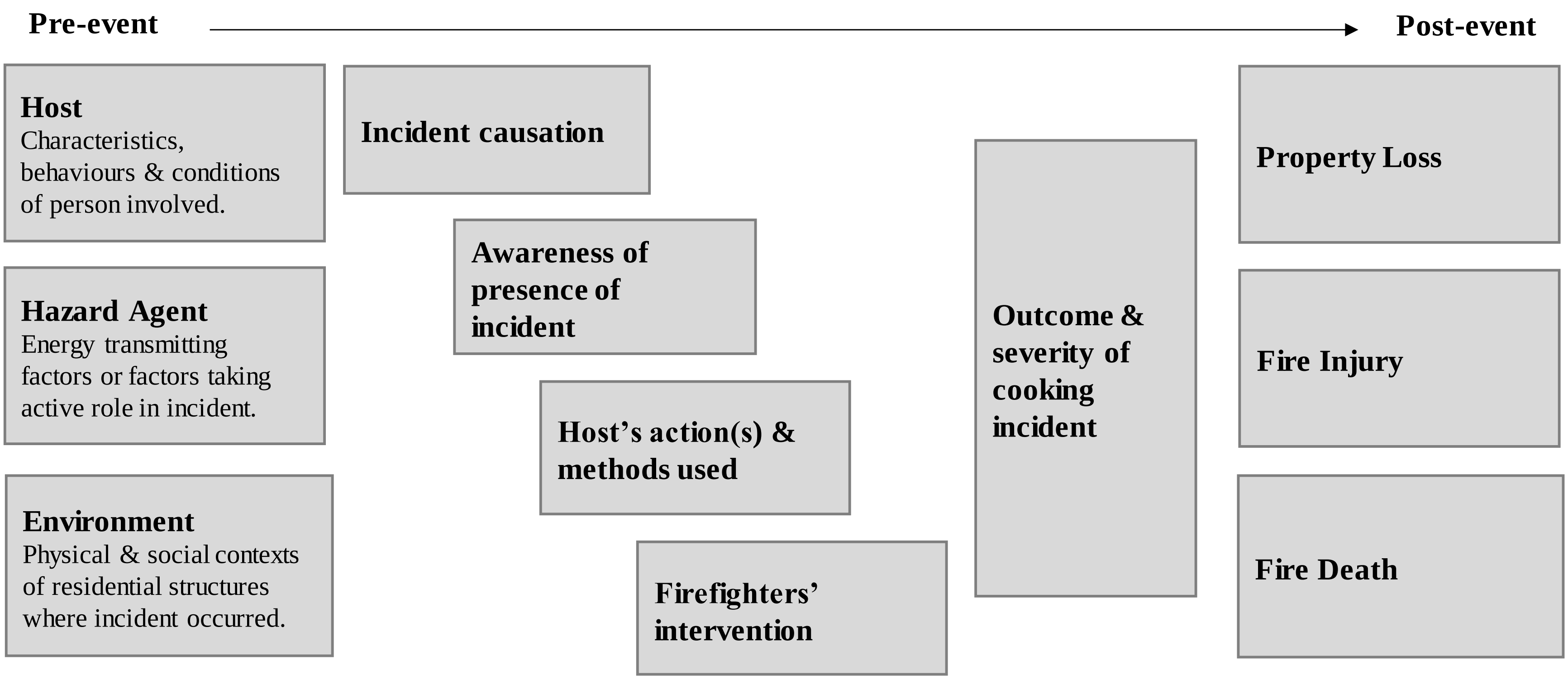
Like Haddon's model, Brennan and Thomas' (2001a,b) conceptualization highlights the human dimension of fires, bringing to the front how humans interact with the environment, with hazard agents, and with the broader social environment to create particular hazards and hazard outcomes. That is, human behaviour affects incident causation, escalation, spread and negative outcomes. Surprisingly, however, Brennan and Thomas (2001b) reflected on this by noting:

> One critical aspect of fires … largely ignor[ed] is occupant involvement with ignition. A second is role of occupants in facilitating or encouraging fire growth and smoke spread, even if inadvertently, by their actions before and during a fire. Together, these behaviours are major contributors in fire[s], …, overlooked when human behaviour is modelled as purely reactive (124).

In careless cooking, particularly, hosts are more likely to be intimately involved in interactions with the incident in its causation, escalation, and spread through a set of circumstances precipitated by acts or omissions. In highlighting human involvement in hazard situations, Brennan and Thomas (2001a,b) argued that injuries and other negative hazard outcomes do not simply "happen" to passive receptors (see Figure 1). Rather, individuals involved in hazard situations often have an agentic and interactive role in hazard creation. Conceptualized this way, careless cooking is not an imposed, external event, but rather is a human-agent-environment interaction in which the actions of individuals (for example, the inadvertent contribution to fire ignition through carelessness) directly contribute to the hazard, its severity, and outcomes (e.g., Gielen and Sleet 2003; Miller and Beever 2005). This means that public education strategies can be applied to each of these three stages of the host-agent-environment interaction to prevent or mitigate the effects and outcomes of careless cooking behaviour.

Since careless cooking is the result of some human action(s) or inaction(s), directly or indirectly bringing together a heat source and fuel, we extend the existing knowledge of human behaviour in residential fires by investigating the interaction between host involved, hazard agent, and environment in more detail. We also consider hosts' awareness of the presence of the cooking hazard and their intervention efforts in response to the incident. To do that, both Brennan and Thomas' (2001a,b) *Revised Paradigm of Human Behaviour in Fires* and the *Haddon Matrix* will be adapted to the study of residential careless cooking by: researching the types of behaviours and sequence of events leading to causation, outbreak and spread of careless cooking incidents; and classifying relevant risk factors across an incident time scale to facilitate understanding of the circumstances surrounding careless cooking risk and outcomes of such incidents (Figure 2). In line with the relevant literature (e.g., Rhodes and Reinholtd 1998), we expect the factors that increase the likelihood of a severe careless cooking incident to define vulnerability of host to the fire hazard. For instance, hosts heavily intoxicated are less likely to become aware of an incident and are therefore less able to respond appropriately to incident cues.

Figure 2. Types of behaviours and sequence of events in residential careless cooking hazard



7. FINDINGS

Drawing upon surveys of 884 residential incidents involving cooking equipment, the research project adopted the basic concepts (host, hazard agent, and environment) of the Haddon Matrix to organize factors associated with residential careless cooking incidents occurring between January 1, 2014 and December 31, 2015 in the City of Regina (e.g., Xiong et al. 2014). Key univariate, bivariate and multivariate findings are presented both thematically and across a cooking incident time scale. First, we present results displaying the human or "host" factors – both demographic and behavioural – identified as predictive of cooking incident causation, host and Firefighters' intervention behaviours, and severity of cooking incidents. Second, we present results of the various hazard agents implicated in the cooking incident, including materials involved and appliance providing heat source. Third, we present findings pertaining to the environment in which careless cooking incidents most commonly occur. This section concludes with a presentation of the general findings regarding host and Firefighters' intervention in response to the cooking incident, the outcome of the incident, and the severity of the residential careless cooking problem in the city, and their most important predictors.

7.1. Incidence, Circumstances and Risk Factors of Careless Cooking Causation

By the end of the initial two-year data collection period, the Officers had responded to and completed survey forms for 884 cooking incidents. Of these, 432 cooking incidents occurred in 2014 (48.9%), and 452 incidents occurred in 2015 (51.1%). The Fire Department had been notified of these incidents by monitoring companies, alarm systems or 9-1-1 callers. In 640 cases, a monitoring alarm alerted the Fire Department of the incident.

7.1.1. Human Risk Factors of Careless Cooking: Demographic and Behavioural Characteristics of Hosts

Human-related risk factors cover information associated with the demographic characteristics of the host responsible for the cooking incident, including age, sex and country of birth. These are often referred to as “nonmodifiable risk factors” (for a review see, Warda et al. 1999). Table 1 shows the frequencies of these variables.

Age. In the overwhelming majority of cooking incidents, the hosts (96.3%) were adults (over 18 years of age). Almost two-thirds (62.6%) were between the ages of 25 and 59, while seniors (adults 65 and older) were hosts to about 15 per cent of reported cooking incidents. Children (ages 0-11), youth (ages 12-17) and emerging adults (ages 18-24) were implicated in roughly 12 per cent of all incidents.

Sex. In roughly 6 out of 10 (58%) cooking incidents, the host was female. While the percentage of Canadians who reported cooking decreased nationally from 74 per cent in 1998 to 65 per cent in 2010 (Statistics Canada 2011:7), according to Statistics Canada’s 2010 General Social Survey, female respondents were still more likely than their male counterparts (75% versus 54%) to report having cooked on the diary-day, and they reported spending on average 24 minutes longer cooking (74 vs. 50 minutes, respectively) (ibid:10). Considering that women on average spend more time daily than men on food preparation, this finding is not surprising.

Canadian versus non-Canadian born status. In seven out of ten (69%) cooking incidents, the host was Canadian born. Comparison with census data suggests overseas-born hosts (19.5%) face a disproportionate risk of cooking incidents relative to their proportion in the general population. The 2011 Canadian National Household Survey reports that as of June 2011, 10.5 per cent of the estimated Regina resident population was born overseas (Statistics Canada,

Table 1. Distribution of residential cooking incidents by selected demographic characteristics of host, RFPS Residential Cooking Fire Data Form 2014-2015

Human risk factors	Freq.	Percent
Demographic characteristics: Non-modifiable		
Age (n= 884)		
Number of Children (11 and Under)	2	0.2
Number of Youth (12 – 17 Years)	31	3.5
Emerging Adults (18 – 24 Years)	70	7.9
Adults (25 – 64 Years)		
25 – 29	90	10.2
30 – 59	463	52.4
60 – 64	37	4.2
Approximated	62	7.0
Senior Citizens (65 Years of Age and Older)		
65 – 79	82	9.3
80 & over	32	3.6
Approximated	15	1.7
Sex (n = 884)		
Female	517	58.5
Male	367	41.5
Country born (n = 884)		
Canadian born	610	69.0
Overseas		
Non-Canadian born - U.S.A and Europe	20	2.3
Non-Canadian born -Africa	19	2.1
Non-Canadian born -Middle East	8	0.9
Non-Canadian born -South Asia	35	4.0
Non-Canadian born -East Asia	16	1.8
Non-Canadian born -Southeast Asia	48	5.4
Non-Canadian born -Other Asian	2	0.2
Non-Canadian born -Other	5	0.6
Non-Canadian born -Unclassified	19	2.1
Unspecified	102	11.5

National Household Survey 2011), representing 7.4 per cent of the total population in private households (Statistics Canada 2013). Hosts born overseas had a relative risk that was 1.8 times that of the Canadian born population residing in Regina as a whole, and had a risk 2.6 times that of the Regina general population residing in private households. The high risk of careless cooking incident causation among non-Canadian born hosts could be related to many unmeasured socioeconomic factors and cultural variations in cooking. For example, it may be plausible that the higher risk of careless cooking causation among non-Canadian hosts is the artifact of differences in building construction materials between countries of origin and Canada, making it unsafe to transfer previous cooking behaviours and practices to Canadian kitchens. Careful assessment of country of birth and length of residence in Canada, and their inclusion in future research, will help establish the extent to which these independently affect careless cooking causation. Such information is necessary to develop intervention strategies that are relevant to at risk populations.

One of the goals of this study is to identify the behavioural features affecting residential careless cooking incidents. As the relevant literature shows, leaving cooking unattended is the leading factor contributing to careless cooking fires (e.g., Ahrens 2015; Greene and Andres 2009; International Association of Fire Chiefs 2013; McCormick 2009; Miller 2005), and can arise in a variety ways, including “not being home at all, forgetting that cooking is still going on, being distracted by household interruptions, mistakenly believing cooking has been turned down or off when it has not been, and deliberately choosing to leave cooking unattended, presumably because of a lack of appreciation of the risks involved” (Ahrens et al. 2007:41). Some of these contributing human risk factors emphasize the behaviour or “oversight” that failed to keep the cooking equipment properly controlled (e.g., equipment was unintentionally turned on, set in wrong setting or not turned off), whereas other human risk factors behind causation emphasize the failure to keep combustibles separate from cooking heat sources (e.g., combustible too close to heat source) (ibid: 33). To further clarify the role of these acts of carelessness or omissions and irresponsible habitual behaviours, among the human-related risk factors, we also examined information regarding behaviours and involvement of the host in the start of the residential cooking incident. These are often referred to as “modifiable risk factors” being more amenable to public safety education programs (for a review see, Warda et al. 1999).

Acts or omissions. The data support the important role of the host in precipitating the cooking incident, and that many of these behavioural contributing factors are indeed related to unattended or careless cooking. As Table 2 shows, most of the hosts were distracted while cooking or forgot that cooking was still going on, with the “distracted/forgot” category accounting for 44 per cent of residential cooking incidents. High heat cooking – that is, cooking in which hosts turned a cooking device to a high heat setting – was a contributing factor in 22 per cent of the cooking incidents observed in the two-year study period. Suspected impairment by alcohol or drugs use was a contributing factor to ignition in 3.5 per cent of cooking incidents, while “person asleep” was behind 3.6 per cent of the incidents. As further illustrated from the Fire Investigator’s Reports into house fire incidents (Box 1 – Cases #1 and #2), there is a strong correlation between excessive drinking and cooking incidents which confirms a pattern reported in a number of previous studies (e.g., Ahrens 2015, 2012, 2013; Ahrens et al. 2007; Miller 2005; International Association of Fire Chiefs 2013; Miller and Beever 2005; Warda et al. 1999), especially of intoxicated individuals attempting to cook a meal but falling asleep or becoming insensible. In turn, Cases #3 through #7 (Box 2) contextualize some of the circumstances

Table 2. Major human act or omission contributing to residential cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015

Major act or omission	Frequency	Percent
Away from home	64	7.2
Possibly impaired by alcohol or drugs	31	3.5
Person asleep	32	3.6
Appliance malfunction	12	1.4
Combustibles placed too close to heat	8	0.9
Unattended or unsupervised person	13	1.5
Equipment was unintentionally turned on, set in wrong settings or not turned off	19	2.1
Distracted/forgot	390	44.1
Failure to clean	39	4.4
High heat cooking	191	21.6
Other factors	85	9.6
Total	**884**	**100.0**

surrounding cooking incidents associated with hosts falling asleep while cooking was still going on.

Other reasons for diminished ability to control cooking safely, including physical or mental disability and the limitations of age, were also reported as factors in residential cooking incidents in this study. For instance, in 1.5 per cent of cooking incidents, an “unattended or unsupervised person” was a contributing human factor, a category intended to describe incidents started by a person with unreliable judgment or a person with limited mobility, such as a young child or a person with a severe physical or cognitive disability, whose access to or contact with a heat source led to the start of the cooking incident. Hosts who begin cooking when drowsy, impaired by alcohol or drugs, or otherwise limited may be more likely to stop paying attention to

Box 1. Host cooking while impaired

Case Study #1. An adult resident and his visiting mother had been drinking when the mother decided to cook using oil on the stovetop, resulting in a large fire. When the two occupants became aware of the fire, they ran outside to a neighbour, who called 9-1-1. Firefighters arrived to heavy smoke coming out the front door, and a large fire in the kitchen. While extinguishing the fire Firefighters also checked the two bedrooms and all other rooms in the house to ensure no one else was inside. Fire damage, although significant, was contained mainly to the kitchen area. The rest of the house sustained heavy smoke damage, and was uninhabitable. The fire and smoke destroyed the home, which was a total loss. Damage to the structure alone is estimated at over $130,000.

Case Study #2. Two female occupants had been drinking and began cooking with oil, when they left the kitchen unattended. A neighbour taking out his garbage noticed smoke coming out the back window. He ran into the house, where he found one woman asleep on the living room couch, and the second woman asleep in an upstairs bedroom. He rescued both occupants from the burning home. As this was happening, another neighbour called 9-1-1. Upon arrival, Firefighters found smoke showing from the front of the house, then went around to the back where they could see fire in the kitchen window. The responding Firefighters had received reports of a person possibly still inside as one of the occupants thought her boyfriend was still in the house. When interviewing the occupants, the Fire Investigator found them to be heavily intoxicated. The Fire Investigator determined this fire was caused by careless cooking, specifically a pot of oil was left unattended on the back burner of the stove. Photos #6 through #8 capture the severity of this careless cooking fire.

Photos #6 through #7. Outcomes of a careless cooking fire caused by intoxicated hosts

(Case Study #2)

Photo #6

Regina Fire & Protective Services

Photo #7

Regina Fire & Protective Services

Photo #8. Outcomes of a careless cooking fire caused by intoxicated hosts (Case Study #2): Cont'd

Regina Fire & Protective Services

Box 2. Host fell asleep, cooking was still going on

Case Study #3. A 28-year Canadian male host fell asleep on the kitchen floor with a pot on the stove, which activated the alarm. He was awoken by Firefighters, who extracted the smoke.

Case Study #4. A 19-year old Canadian male host was cooking on the stovetop. Firefighters found him in the bedroom sleeping. The host did not hear the alarm or Firefighters banging on the door of the house. When Firefighters first arrived, they saw light smoke coming from the kitchen window. They made forcible entry, removed the smoking pot from the stove and woke the host to have him evacuate. Firefighters also extracted smoke.

Case Study #5. A 32-year old Philippine female host put a pot on the stove and went to another room and fell asleep. The host was alerted of the incident by the alarm. She turned the stove off and evacuated the residence. Firefighters removed the pot from the residence and ventilated.

Case Study #6. A 35-year old Nigerian male host fell asleep while two pots were cooking on the stovetop. The host was alerted of the incident after being awoken by Firefighters and the caretaker entering the suite. A neighbour had called 9-1-1 after seeing smoke coming from under the doorway. Firefighters turned the stove off – there was no fire. They also discovered that the suite smoke alarm had been removed from its ceiling mount and explained to the resident that the alarm must be replaced.

Case Study #7. A 50+-year old Canadian male host was cooking with a pot. He fell asleep in the bedroom and forgot about the pot on the stove. The monitored smoke alarm activated and alerted the host. The host turned the burner off. Firefighters ventilated.

their cooking.

Failure to clean (e.g., fat or grease built-up under the element) was a factor in 4.4 per cent of the incidents. In another 2.1 per cent of the incidents, the equipment was unintentionally turned on, set in the wrong setting or not turned off. Some studies have pointed to unintentionally not turning off cooking equipment as a circumstance involved in unattended cooking (e.g., Hall 2006). The circumstances surrounding some of these incidents are exemplified in Cases #8 through #12 (Box 3) obtained from the responding Suppression & Rescue Officer's notes – and where applicable from the Fire Investigator's detailed reports – completed after the incident. Suspected appliance malfunction accounted for 1.4 per cent of incidents. While at first glance these can reasonably be attributed to "accidental" causation, further examination of these incidents shows that many of these were the byproduct of careless cooking or lack of appreciation of the risks involved since the cooking equipment continued to be used despite previous signs of malfunction or mechanical failures which may have resulted from human omissions through lack of maintenance. Perhaps, those who live in low socioeconomic circumstances are more likely to have faulty appliances or find it necessary to continue using them in unsafe ways.

Something that could catch fire was too close to the cooking equipment in one per cent of the cooking incidents. If a heat source is not sufficiently close or hot enough to bring a combustible item to its ignition temperature, no fire will occur. Therefore, sufficient separation between combustibles and cooking heat sources should be encouraged. Cases #13 through #16 (Box 4) serve two purposes: to illustrate the importance of ensuring combustibles are not placed too close to a heat source; and to show the interconnected nature of the contributing human risk factors that caused or triggered the cooking incident, which often interact with one another,

Box 3. Equipment was unintentionally turned on, set in wrong setting or not turned off

Case Study #8. A woman was cooking French fries for her adult son on the basement kitchen stove when she went upstairs to begin preparing supper for the family in the main floor kitchen. A strange smell coming from the basement kitchen alerted the son. As he opened the door, he heard the smoke alarm – the fire was well underway. He called 9-1-1 and got his mother out of the home safely. Fire damage was significant throughout the basement, with heavy smoke damage to the rest of the home. The host thought she had turned the burner off. There were no injuries, with damage valued at $100,000. Photos #9 through #10 capture the severity of this careless cooking fire.

Case Study #9. A two-storey townhouse was completely engulfed in flame, with fire spreading to neighbouring units. The family managed to get out safely. They had recently arrived in Canada, and were slowly starting to settle in with the help of neighbours, many of whom were also Newcomers. The family – a mother and her four children – had been sleeping in their two-storey townhouse when fire broke out in the main floor kitchen. The mother had fallen asleep on the living room couch, and was the first to be alerted to the fire by smoke. She awoke to fire coming out of the kitchen entrance, moving into the dining room and toward the living room. Heavy flame conditions made it impossible for arriving Firefighters to get in. They began to evacuate residents from the three attached townhouse units. Five firefighting crews extinguished this massive fire, taking 2½ hours to bring the fire under control. Four families lost everything. All four adjoining townhouses were destroyed by the fire, with damage estimated at over $1.5 million. The Fire Investigator determined this fire was caused by careless cooking: A pot with food had been left on a stove burner inadvertently left on. Photos #11 through #15 illustrate the severity of this careless cooking fire.

Photos #9 through #10. Outcomes of a careless cooking fire caused when a stove burner was unintentionally left on (Case Study #8)

Photo #9

Regina Fire & Protective Services

Photo #10

Courtesy 980 CJME

Photos #11 through #14. Outcomes of a careless cooking fire caused when a stove burner was inadvertently left on (Case Study #9)

Photo #11

Courtesy CTV Regina

Photo #12

Photo by Bryan Schlosser. Courtesy Regina Leader-Post.

Photo #13

Courtesy 980 CJME

Photo #14

Photo by Bryan Schlosser. Courtesy Regina Leader-Post.

Photo #15. Outcomes of careless cooking fire caused when a stove burner was inadvertently left on (Case Study #9): Cont'd

Courtesy 980 CJME

Box 3. Cont'd

Case Study #10. An eighty-year old Canadian male left an egg carton on the stovetop and turned on the wrong burner. He left the kitchen, then was alerted to the incident when he smelled smoke. The monitored smoke alarm was also activated. The host put the burning carton in the sink and extinguished the fire with water. He then threw the burned egg carton down the garbage shoot of the apartment building. Firefighters retrieved the egg carton from the garbage shoot to ensure there was no fire, and checked the shoot with a thermal imaging camera to ensure there was no fire or heat. Firefighters also ventilated.

Case Study #11. A 25-year Canadian female host was cooking with a pot on the stovetop. She thought she had turned the burner off when she went outside with her children to play. A neighbour heard the home's smoke alarm and called 9-1-1. Firefighters took the pot outside, turned the burner off and ventilated the house.

Case Study #12. A 60-year old Canadian female host left the kitchen while cooking on the stovetop. She thought she had put the burner on low but it was on high heat. She was alerted to the incident by the alarm. The host put the pot in the sink to extinguish. Firefighters ventilated.

Box 4. Combustibles placed too close to heat

Case Study #13. An 18-year old Canadian female host had turned on the oven not realizing that there were oven mitts and plastic containers stored inside. Firefighters removed the smoking oven mitts from the oven and took them outside. Firefighters also extracted smoke.

Case Study #14. A 49-year old Canadian male host turned on the wrong burner and left the kitchen to another room, leaving a plastic spoon on the stovetop. The burning spoon activated the monitored smoke alarm. There was light smoke in the home upon Firefighters' arrival.

Case Study #15. A 30-year old Canadian female host unknowingly turned the wrong burner on and left the kitchen to another room. The burner melted a cutting board that had been left on the stovetop. The host's husband removed the cutting board and threw it outside.

Case Study #16. A 12-year old Canadian female host was home alone. She turned on the wrong burner which ignited a plastic bowl which had been left on the stovetop. The host placed the smoking plastic bowl in the bathtub.

making a bad situation worse.

Being away from home accounted for 7.1 per cent of the cooking incidents. Cases #17 through #23 (Box 5) illustrate the dangerous nature of these cooking incidents, increasing the fire risk (or vulnerability) to persons not cooking but potentially affected by the host's actions, including other residents, neighbours, others in the vicinity, and Firefighters. Other cooking-related scenarios that involved unclassified human failings were grouped under the "other" category (n = 49, 5.5%), either when the identified factors had very low frequency counts or

Box 5. Host left home, something was still cooking

Case Study #17. A 65-year old Canadian male host was cooking with a pot on the stove. He left his home – an apartment building – and forgot about the pot. The incident activated the building's fire alarm system. All occupants evacuated. One of the occupants called 9-1-1, reporting the fire alarm ringing and the smell of smoke. Firefighters found the apartment with smoke coming out the bottom of the door. The door was locked, so they broke the door down and found the apartment filled with heavy smoke. Firefighters found the pot on the stove, removed it to the sink and extinguished it. They also ventilated.

Case Study #18. A female host was cooking. The host forgot and left the home (apartment building). The building fire alarm system sounded and alerted the other occupants who called 9-1-1. Firefighters entered the suite, which was full of heavy smoke down to knee level. Flames from the pot were 18" high and surrounded by combustible materials. The Firefighters extinguished the pot on the stove with dry power extinguisher and ventilated the suite.

Case Study #19. A male host cooking with a pot on the stove left the home (apartment building). The building's alarm system alerted the Superintendent, who called 9-1-1. Firefighters found heavy smoke in the host's unit and a pot on the stovetop. They turned off the burner, extinguished the pot with water and ventilated the suite.

Case Study #20. Host arrived after Firefighters were already on-scene. Firefighters forced entry after hearing the alarm outside and obtaining high temperature readings with a thermal imaging camera. Upon entering they found a pot on the stove and the home full of smoke. They removed the pot, turned off the stove and extracted the smoke.

Box 5. Cont'd

Case Study #21. A 70-year old Canadian male host left home with a pot on the stove, which activated the monitored alarm. Responding Firefighters waited for a contact person to arrive – the monitoring alarm company had called a 'key-holder'. Firefighters removed the smoking pot from the residence and ventilated.

Case Study #22. A 13-year old Canadian male host had been cooking with a pot on the stove and left the residence. The monitoring alarm company contacted the Fire Department and the home owner, who arrived at the residence at the same time as the Firefighters. Firefighters removed the pot from the stove and ventilated the house. The cooking incident resulted in smoke only.

Case Study #23. Firefighters arrived at a pot on the stove and light smoke in the home – no one was home. A 40-year old female host arrived after Firefighters had forced entry. Firefighters turned off the stove, removed the pot from the stove and ventilated the house.

when there was not sufficient information to classify the factor contributing to the start of the incident. In 4.1 per cent of reported cases (n = 36), there was no information on the factor contributing to the cooking incident. These cases were often associated with incidents that were classified as "no fire, just smoke or steam" or as "smoke/steam scares". The human failing(s) behind these cases could not be determined.

While small counts in some of the categories warrant discretion in discerning meaningful patterns, analysis of the data points out to variability in the human acts and omissions causing or

Table 3. Major human factor contributing to residential cooking incident by host's demographic characteristics, RFPS Residential Cooking Fire Data Form 2014-2015

	Away from home	Possibly impaired	Person asleep	Unattended/ unsupervised person	Equipment was unintentionally turned on, set in wrong settings or not turned off	Appliance mal-function	Combustibles placed too close to heat	Failure to clean	Distracted/ forgot	High heat cooking	Other factors
Age											
Less than 25	6.80%	2.90%	4.90%	5.80%	1.00%	2.90%	1.00%	1.90%	47.60%	16.50%	8.70%
25-64 years	6.90%	4.30%	3.80%	0.30%	1.80%	1.10%	0.80%	5.20%	43.10%	23.50%	9.20%
65 plus	9.30%	–	1.60%	3.90%	4.70%	1.60%	1.60%	2.30%	46.50%	16.30%	12.40%
Sex											
Female	8.10%	1.40%	3.30%	1.90%	2.30%	1.00%	0.80%	4.80%	46.00%	21.30%	9.10%
Male	6.00%	6.50%	4.10%	0.80%	1.90%	1.90%	1.10%	3.80%	41.40%	22.10%	10.40%
Born abroad											
Canadian born	4.60%	3.90%	4.10%	1.80%	2.50%	1.50%	1.00%	4.90%	45.10%	23.00%	7.70%
Non-Canadian born	11.60%	2.30%	4.10%	0.60%	1.70%	0.60%	0.60%	3.50%	46.50%	19.20%	9.30%
Not identified	15.70%	2.90%	–	1.00%	1.00%	2.00%	1.00%	2.90%	34.30%	17.60%	21.60%
Total	**7.20%**	**3.50%**	**3.60%**	**1.50%**	**2.10%**	**1.40%**	**0.90%**	**4.40%**	**44.10%**	**21.60%**	**9.60%**

Note. N = 884.

triggering the cooking incident by host's demographic characteristics (Table 3). Specifically, male (6.5% among males vs. 1.4% among females) and Canadian born hosts (3.9% among Canadian born vs. 2.3% among non-Canadian born) were more likely to be involved in cooking incidents related to suspected impairment by alcohol or drugs. Case studies #24 through #26 (Box 6) illustrate these patterns of results.

Leaving cooking equipment unintentionally turned on, set in wrong the setting or not turned off was a behaviour more prevalent among older hosts, going up from a low of 1.0 per cent among hosts below the age of 25, to 1.8 per cent among hosts between the ages 25 and 64, to a high of 4.8 per cent among hosts aged 65 and older. Cases #27 through #29 (Box 7) exemplify this pattern of results.

Leaving the home while cooking was more likely among occupants 65 and older (6.8% among hosts below age of 25 vs. 6.9% among hosts between the ages 25 and 64 vs. 9.3% among hosts aged 65 and older). There were also marked differences between Canadian born and non-Canadian born hosts. Specifically, non-Canadian born hosts were more likely to be associated with cooking incidents resulting from leaving the residence while cooking was still going on (4.6% among Canadian born vs. 11.6% among non-Canadian born). Case studies #30 through #37 (Box 8) illustrate the dangerous nature of this last pattern of results.

Box 6. Cooking under the influence: Canadian males

Case Study #24. A 30-year old Canadian male host was cooking with oil on the stovetop. There were two residents in the home at the time of the fire. Firefighters arrived to observe heavy smoke coming out of the main floor window and an active fire in the kitchen. One person had been assisted out of the residence by a neighbour before the fire crews arrived. Firefighters rescued the second individual from a room upstairs, and extinguished the fire in the kitchen. Both occupants were treated by EMS. There was extensive fire and water damage to the residence. Fire was investigated, and it was determined that the hosts were intoxicated and had left the stove unattended.

Case Study #25. A 32-year old Canadian male host began cooking with a pot on the stove. He fell asleep in the bedroom. A neighbour called 9-1-1. Firefighters found the host in the bedroom. He was intoxicated – passed out. Firefighters rescued the host and brought him out to EMS. Firefighters also extinguished the pot and extracted the smoke.

Case Study #26. A 28-year old Canadian male host was cooking with a pot on the stove. The building's fire alarm system was activated. The building contact provided arriving Firefighters with a key to the host's apartment, where they found the host intoxicated with a pot on the stove and the stove on. Firefighters removed the pot and turned the stove off.

Box 7. Cooking equipment unintentionally turned on, set in wrong setting or not turned off: Older hosts

Case Study #27. The host, a 68-year old Canadian male, was cooking with a pot on the stove. He inadvertently turned on the wrong burner, which melted a plastic container which had been left on the stovetop. He was alerted by the apartment building's fire alarm. The host turned the burner off. Residents of the apartment building evacuated outside. Firefighters checked the suite for heat with a Thermal Imaging Camera.

Case Study #28. A 75-year old female host inadvertently left the burner on after cooking with a napkin holder near the stove. The neighbour entered the suite and put the napkin holder in the sink.

Case Study #29. An 86-year old German male host had turned on the wrong burner and left the kitchen. Grease and/or oil in the pot activated the smoke alarm. The host slid a lid over the pot and removed it to the porch area.

Box 8. Away from home, something was left cooking: Non-Canadian born hosts

Case Study #30. A 23-year old Chinese male host left the residence with a pressure cooker on the stovetop. Arriving Firefighters found smoke damage on the walls and cabinets. They turned the stove off and pulled it from the wall to check for further heat and/or smoke damage. They also extracted smoke.

Case Study #31. A 39-year old Ugandan female host was cooking on the stovetop and left the residence. She returned home when contacted by the monitoring company, arriving at the same time as fire crews. The host removed pot from stove; Firefighters extracted the smoke.

Case Study #32. A 65-year old Fijian female host was cooking on the stovetop and left the home to go shopping. The host returned home to alarms and smoke. She turned the stove off and evacuated the house. Firefighters found no fire upon arrival and minimal smoke.

Case Study #33. A 45-year old Vietnamese female host left a pot on the stovetop, and left the house. An individual hired to do renovations arrived and heard alarms. The worker used a key to enter and removed the pot outside the residence. Firefighters ventilated.

Case Study #34. A 30-year old Philippine male host left the home with a pot cooking on the stovetop. The host arrived at the residence at the same time as the Firefighters, who had been notified by an alarm monitoring company. When the front door was opened, smoke started to come out. The host entered and pulled the pot off the burner. Firefighters asked residents to evacuate and then removed the smoking pot outside and extracted the smoke.

Box 8. Cont'd

Case Study #35. A 50-year Ghanaian male host left a pot on the stove when he went to the airport. The incident activated the monitored smoke alarm, and the monitoring company notified the Fire Department. No one was home when Firefighters arrived. The host arrived back home while Firefighters were still on-scene. Firefighters removed the blackened dry pot from the stove and turned the burner off. They searched the home for occupants.

Case Study #36. A 40-year old Russian female host was cooking with a pot on the stovetop. She left the home. A neighbour heard the alarm ringing, saw smoke coming from the apartment and called 9-1-1. When Firefighters arrived, they saw the pot on the stove with the burner light on, and found medium smoke in the home. They entered through a basement window so they did not have to break down the door. They removed the pot, turned the burner off and ventilated. When entering the home, they broke two small wall sconces. Before leaving, they cleared up the debris and left a note for the occupant, explaining what happened.

Case Study #37. A 50-year old Philippine female host left a pot on the stovetop and left the home. The incident activated the monitored smoke alarm. Firefighters entered the home through an open window. They found a pot smoldering on the stovetop with the burner on. They turned the burner off, removed the pot to the outside, extinguished it with water and ventilated. Firefighters explained the incident to host when she arrived home.

Falling asleep while something is cooking was more common among hosts below the age of 65, going down from a high of 4.9 per cent among hosts below age of 25, to 3.8 per cent among hosts between the ages 25 and 64 to a low of 1.6 per cent among occupants 65 and older.

Human behaviour factors also concern human activities during – or in the immediate period before – a residential cooking incident, including host's location at the time of the incident and how occupant(s) were first alerted of the incident.

Location of host. At the start of the incident, the majority of hosts were at the appliance or in the kitchen (Table 4). Specifically, one-quarter (25.6%) of hosts were at the cooking appliance implicated in causation. Three in ten hosts (30.0%) reported that they were either in the room where the cooking incident originated (i.e., the kitchen), or were in another room inside the dwelling (31.9%) at the time the incident started. In seven per cent of all cooking incidents reported during the two-year study period, residents were outside the premises or away from the home when the cooking incident started.

Table 4. Location of host at time of residential cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015

Location at time of incident	Frequency	Percent
At the appliance	226	25.6
In the room	265	30.0
In another room	282	31.9
Outside premises/Away from home	65	7.4
Not specified	46	5.2
Total	**884**	**100.0**

Initial detection of incident. The survey also provided information on how cooking incidents were first discovered (Table 5). This question on initial detection also captured

Table 5. How host became alerted of residential cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015

Awareness of the presence of an incident	Frequency	Percent
Smelled smoke	155	17.5
Saw flames/Saw smoke	89	10.1
Smoke alarm alerted people	458	51.8
Smelled smoke and smoke alarm alerted people	61	6.9
Saw flames/smoke and smoke alarmed sounded	14	1.6
Smelled and saw smoke	6	0.7
Saw flames/smoke, smelled smoke and alarm sounded	1	0.1
Not aware (e.g., intoxicated, etc.)	30	3.4
No one home	35	4.0
Other	7	0.8
Not specified	28	3.2
Total	**884**	**100.0**

information on "alarm effectiveness". Generally, the shorter the interval between start and discovery of an incident, the lower the negative resulting outcomes, including severity of the incident and losses attributed to injuries, deaths and property damage. Multiple methods of being alerted to the presence of a cooking incident were recorded. In the majority of incidents (n = 534, 60.4%), an activated smoke alarm alerted residents to the presence of an incident. Significantly, in 52 per cent of all recorded residential cooking incidents, and in 54.4 per cent of cases in which the cooking incident originated on the stovetop, the smoke alarm was the only cue that alerted residents to the presence of the incident. In nearly one in five cases (17.5%), the smell of smoke alerted occupants, while in 10 per cent of incidents, the sight of flames or smoke alerted occupants. The host was not alerted of the incident or someone else provided an alert in seven per cent of the incidents. The "other" category (0.8%) consists of cooking incidents that could not be classified because there was not sufficient information to determine how incidents were first discovered. In 3.2 per cent of incidents (*n* = 28), this information was simply missing.

7.1.2. Hazard Agent Risk Factors of Careless Cooking

Cooking activities reflect cultural and socioeconomic factors, with differential cooking incident risks according to primary cooking agents and methods. The ‘hazard agents’ or the energy transmitting factors refer to the heat source and fuel (e.g., Xiong et al. 2014). Typically, these involve the cooking equipment, such as a stove, and the materials ignited, such as food or oil.

Type of material involved/affected. Not surprisingly, irrespective of ignition status, cooking material was a leading form of material involved, with 87 per cent of residential cooking incidents (*n* = 750) beginning with food or other cooking materials (Table 6). A food item, excluding fat, oil and grease, was the material first affected in over three-quarters (*n* = 581, 77.5%) of all incidents involving cooking materials. Grease, cooking oil, or related substances were the type of materials first affected in about 22.5 per cent of all cooking material incidents.

Table 6. Type of material involved, RFPS Residential Cooking Fire Data Form 2014-2015

Material first ignited	Frequency	Percent
Cooking oil/grease	169	19.7
Food item	581	67.6
Combustibles	48	5.6
Other	62	7.2
Total	**860**	**100.0**

Note. Number of missing cases = 24

Non-food items accounted for about 13 per cent of the objects first affected (*n* =110), with about 44 per cent of these cooking incidents (*n* = 48) being associated with combustibles being placed too close to a heat source (e.g., household utensils, plastic items, potholders, oven mitts tea towels, paper towel, etc.). The “other” category accounted for 56 per cent (*n* = 62) of the non-food objects first affected, including incidents with an unclassified item or where no cooking was occurring (e.g., burner left on, wrong burner turned on or burner left on, etc.).

Appliance providing heat source. Although it is safest to pay constant attention to all cooking, the dangers of careless cooking vary somewhat in degree by type of cooking method and type of cooking equipment. Stoves were the leading type of cooking equipment involved in cooking incidents in the present study (Table 7), with more than two-thirds of reported incidents involving stovetop cooking (*n* = 591, 68.6%). Pot-cooking (*n* = 293) and frying (*n* = 280) dominated the stovetop cooking problem, each accounting for close to half of all stovetop cooking incidents, respectively. Specifically, frying accounted for about 32.5 per cent of all the cooking fire incidents, 81.4 per cent of which are associated with pan- or shallow-frying (*n* = 228) and the rest with deep fat/oil frying (*n* = 52, 18.6%). An additional two per cent of stovetop cooking incidents (*n* = 12) originated not during cooking but when cooking equipment was unintentionally turned on, set in the wrong setting or not turned off.

Table 7. Appliance providing heat source, RFPS Residential Cooking Fire Data Form 2014-2015

Appliance providing heat source	Frequency	Percent
Stove	591	68.6
Oven	176	20.4
Tabletop cooking appliances	95	11.0
Total	**862**	**100.0**

Note. Number of missing cases = 22

It is reasonable to distinguish among cooking methods in terms of estimated risk, with frying as the riskiest. Frying inherently involves a combustible medium in addition to the food, namely the cooking oil or grease: Over one-third of the frying cooking incidents began with cooking oil or oil grease being affected or ignited (n = 105, 37.5%), while 55 per cent of frying incidents began with a food item being affected or ignited (n = 153, 54.6%). A frying pan provides no containment for fire if one begins. For all these reasons, there can be no exceptions to attendance at frying by the host. Because frying is relatively quick, there should be no great hardship in attendance. Deep fryers, in turn, involve larger quantities of hot cooking oil than that involved in regular frying. Because the frying process involves inserting the food into the heated medium, then later removing it and transferring it to a drying location, deep frying with these larger quantities of hot oil involves numerous opportunities for thermal burns and scalds, as well as fire ignitions (e.g., Ahrens 2015, 2013, 2012, 2009; Ahrens et al. 2007).

In incidents that originated in the oven, baking products either fell or dripped onto the heating element and ignited or non-food items were left inside the oven. In total, the oven part of the range accounted for 20.4 per cent of all the cooking incidents. Tabletop cooking appliances accounted for 11 per cent of all cases, with over two-thirds of cases being associated with a toaster (n = 64; 67.4%), 21 per cent with a microwave (n = 20), 7.3 per cent with a kettle or coffee/tea pot (n = 7) and 4.2 with other tabletop appliances (n = 4).

Confinement of cooking incident. In roughly nine out of ten cooking incidents, the incident was confined to the cooking appliance (Table 8).

Table 8. Confinement of cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015

Incident confinement	Frequency	Percent
Confined to appliance	758	89.7
Confined to room	47	5.6
Confined to same floor	24	2.8
Confined to dwelling/suite or building	14	1.7
Spread beyond building	2	0.2
Total	**845**	**100.0**

Note. Number of missing cases = 39

7.1.3. Environmental Risk Factors of Careless Cooking

Environment-related risk factors are related to the characteristics of a dwelling, room of origin, number of people in the occupancy at the time of the incident, neighbourhood of residence, and season, year, day and time of a cooking incident. An overwhelming majority of cooking incidents occurred in private dwellings: 72 per cent occurred in houses, 24 per cent occurred in apartments and units, and the remaining four per cent occurred in care facilities (Table 9). Expectedly, almost all incidents (97.3%) began in the kitchen. Most incidents occurred when one or two people were in the home at the time of the incident. Specifically, half of cooking incidents reported in private residences (n = 427, 50.6%) occurred in dwellings with one or two people at the time of the incident. In comparison, 11.5 per cent of recorded cooking incidents occurred in dwellings with three people; 10.4 per cent occurred in dwellings with four people; and dwellings with five or six people at the time of the incident together accounted for about 7 per cent of all incidents. No one was home in 7.6 per cent of incidents. Most cooking incidents occurred in Regina's central neighbourhoods (n = 241, 27.4%), neighbourhoods which, as will be discussed in greater detail in Section 8.2.1.7, differ both demographically and

Table 9. Distribution of residential cooking incidents by selected characteristics of environment, RFPS Residential Cooking Fire Data Form 2014-2015

Environment risk factors		Freq.	Percent
Neighborhood of residence (*n* = 881)	Central Zone	241	27.4
	East Zone	135	15.3
	North Zone	153	17.4
	South Zone	141	16.0
	West Zone	211	24.0
Type of occupancy (*n* = 880)	House	636	72.3
	Apartment	208	23.6
	Home care facility	36	4.1
Room of incident origin (*n* = 876)	Kitchen	852	97.3
	Other	24	2.7
Number of people in the household at time of incident (*n* = 844)‡	One	214	25.4
	Two	213	25.2
	Three	97	11.5
	Four	88	10.4
	Five	33	3.9
	Six	24	2.8
	Seven or more	32	3.8
	Multi-apartmental units: Number not specified	19	2.3
	No one home	64	7.6
	Missing	60	7.1
Year of incident (*n* = 884)	2014	432	48.9
	2015	452	51.1
Season of the year (*n* = 884)	Fall	242	27.4
	Winter	199	22.5
	Spring	208	23.5
	Summer	235	26.6
Day of the week (*n* = 882)	Monday	121	13.7
	Tuesday	95	10.8
	Wednesday	118	13.4
	Thursday	117	13.3
	Friday	128	14.5
	Saturday	141	16.0
	Sunday	162	18.4
Time of incident (*n* = 882)	Midnight through 5:59	56	6.3
	6:00 through 11:59	182	20.6
	12:00 through 17:59	361	40.9
	18:00 through 23:59	283	32.1

Note. ‡It excludes cooking incidents in home care facilities.

economically from the remainder of the city. The second highest proportion of cooking incidents occurred in the "West Zone" (n = 211, 24.0%). Together, the remaining three zones (East, South, and North) accounted for about 49 per cent of all cooking occurrences. No marked seasonal pattern to cooking incidents was identified. The highest proportion of cooking incidents occurred on Sundays. Careless cooking incidents occurred most frequently between 12 pm and 5 pm (40.9%) and between 6 pm and 11 pm (32.1%). That is, incidents were concentrated at the usual cooking times for lunch and dinner.

7.2. Actions Taken by Hosts in Response to Cooking Incidents Prior to Firefighters' Arrival

In addition to highlighting hosts' behaviours that caused or started the cooking incidents, the survey provides information on how hosts responded once they become aware of incidents, including main activities or actions taken in response to the incident, and specific methods of mitigation or extinguishment (Table 10). The survey results corroborate that when confronted with an incident most individuals do react to the incident by engaging in activities that would either stop a fire or mitigate its escalation once it started. As Table 10 illustrates and will be further elaborated below, most hosts intervened to tackle or mitigate the effects of a cooking incident (e.g., turning burner off, removing pot from burner, etc.).

7.2.1. Host's Intervention Behaviour

Almost one of every four (23.1%) incidents involving cooking equipment was categorized by Suppression & Rescue Officers as "burned out, minor incidents" not requiring any action or activity on the part of the host. These cases refer to incidents where there was "no possibility of fire" (e.g., toaster activated smoke alarm). In 17 per cent of incidents, severity was exacerbated by host's inaction or delayed action, increasing the potential of injury to the host or

Table 10. Host's actions/activities taken in response to residential cooking incident prior to Firefighters' arrival, RFPS Residential Cooking Fire Data Form 2014-2015

Actions taken by host(s)	Frequency	Percent
Burned out, minor incident: No action required	204	23.1
Action(s) taken by host prior to firefighters arrival	500	56.6
Using appropriate methods or actions		
Turn off cooking equipment	150	17.0
Turn down cooking equipment	30	3.4
Lid on pot	14	1.6
Used fire extinguisher	5	0.6
Kept oven door closed	4	0.5
Put salt	2	0.2
Using inappropriate actions		
Separated from heat source or moved outside/Removed burning material from heat		
Removed from heat source	161	18.2
Put in sink	16	1.8
Removed outside	16	1.8
Turn off and removed from heat source	20	2.3
Put water	12	1.4
Put towel over pot/pan	2	0.2
Attempted other actions		
Other known factors	68	7.7
No (or delayed) action taken by host	148	16.7
Evacuated	66	7.5
No action taken: Host-related issues (e.g., impaired, sleeping, out, etc.)	68	7.7
Delayed attempted response: host-related issues (e.g., impaired, sleeping, etc.)	6	0.7
Dealt by somebody else (e.g., neighbour)	8	0.9
Unspecified: No answer	32	3.6
Total	**884**	**100.0**

others. Sleeping, impairment and being out of the home accounted for roughly over half of the incidents where the hosts were “unresponsive”. Where alcohol or substance consumption was suspected, occupants’ responses to cues were slowed, non-existent or inappropriate as many were sleeping or passed out upon Firefighters’ arrival. Previous empirical research findings show that excessive alcohol consumption may inhibit appropriate response by affecting how a person judges or interprets incident cues (e.g., Ahrens et al. 2007; Howland and Hingson 1987; Miller 2005; Warda et al. 1999).

Irrespective of ignition status, in 57 per cent (*n* = 500) of all cooking incidents, the host took some action in efforts to control the incident from escalating into a fire or mitigating its effects or outcomes once it started. Of these, 41 per cent (*n* = 205) reported taking one or more somewhat “appropriate actions” or accepted approaches, including turning off the appliance or heat source and smothering the incident by placing a lid on the pan to remove the oxygen. Occupants cut or turned off power to the cooking equipment in 73.1 per cent of incidents (*n* = 150) where an attempt was made to avoid a fire or mitigate the severity of a cooking incident once it started using somewhat “appropriate actions”, while 14.6 per cent of cooking incidents (*n* = 30) were controlled by lowering the heat. While turning off the cooking equipment is an excellent first step, it may be insufficient by itself unless the cooking equipment provides a tight enclosure (e.g., oven, microwave oven). Using a lid during the early stages of a fire is the preferred safe, effective way to deal with cooking incidents; however, as Table 10 shows, only in about 6.8 per cent of incidents hosts reported putting a lid on pot. A fire extinguisher was used in 2.4 per cent of incidents (*n* = 5). This approach can be effective only if the right type of extinguisher is used under the right conditions, as it is further illustrated in Case #38 (Box 9). Using a lid is safer. It is recommended to keep the oven door shut and to turn off the heat to

Box 9. Host's intervention behaviour(s) involved using a fire extinguisher unsuccessfully

Case Study #38. A 40-year Canadian female host was cooking and went outside. The host heard the telephone ring – it was the monitoring company calling. At the same time, she heard the monitored smoke alarm ringing. The host returned to the kitchen and saw flames in the pan spreading to the upper cabinets. She used an extinguisher in an attempt to extinguish the fire. It did not work. A neighbour came over with a garden hose and extinguished the fire. Firefighters removed pets and ventilated. Photos #16 through #17 capture the outcome of this careless cooking fire.

Photos #16 through #17. Outcomes of a careless cooking fire that involved a host's attempting unsuccessfully to put out the incident with a fire extinguisher (Case Study #38)

Photo #16

Regina Fire & Protective Services

Photo #17

Regina Fire & Protective Services

smother an oven or broiler incident. In four cases, individuals noted keeping the oven door closed on a burning item to mitigate the extent of the cooking incident, accounting for two per cent of all cooking incidents where one or more "appropriate actions" were used to prevent a fire or mitigate the severity of a cooking fire already in progress.

Nearly half (*n* = 227, 45%) of hosts who attempted on their own to prevent a fire or limit the severity of a cooking fire once it started reported engaging in actions that are potentially dangerous. Of these, 94 per cent of host (*n* = 213) separated or removed burning materials from the heat source (e.g., tried to carry pot or pan to the sink or outdoors). As Cases #39 and #40 (Box 10) illustrate, carrying burning materials is clearly unsafe, and this action is even more dangerous if it involves carrying a pan with burning oil or grease or opening the door to an oven or microwave oven, which may result in a flare-up from added oxygen to the incident. Only five per cent of hosts attempted to put out the cooking incident by using water, a problematic procedure as water can cause a grease fire to spread. In two cases, salt was used as a mitigating or extinguishing agent. While some experts recommend using baking soda or salt on certain incidents, others consider pouring an adequate amount of salt or baking soda to be dangerous because of the amount and time required to suppress or control the incident. In 14 per cent of incidents (*n* = 68) where the hosts attempted to prevent a fire or mitigate the severity of a cooking fire incident once it started, no detailed descriptions were provided of the specific action(s) used by the host.

Box 10. Host's intervention behaviour involved using inappropriate, potentially dangerous actions

Case Study #39. A 20-year Canadian female host was oil frying on the stovetop when the oil ignited. The host was in the kitchen, but was distracted. She smelled smoke. The host grabbed the pot and threw it out the back door. She sustained burns to her hand and arm and singed her hair. She was treated on-scene by EMS. The incident also damaged the floor. Firefighters ventilated.

Case Study #40. A 60-year old Canadian female host was heating oil in a pot on the burner at the appliance. The material in the pot caught fire. The host carried the pot outside to the backyard, burning her hand and wrist in the process. Three people were home at the time of the fire. Firefighters helped two victims – the host, by helping her put her burns under cool running water in the sink, and a 15-year old female occupant who was coughing from the smoke (she was asthmatic). Firefighters administered oxygen to this victim. EMS took over patient care when they arrived. Damage was estimated at $500.

7.2.2. Host's Intervention Behaviour by Type of Appliance Providing the Heat Source

In roughly three out of ten (28.7%) stovetop cooking incidents, the hosts' involvement to prevent a fire or mitigate its severity once started included actions and activities that were clearly unsafe, such as separating the burning material from the heat source or moving it outside (Table 11). These actions were particularly dangerous if the incident involved carrying a pan with burning oil or grease. About a quarter of stovetop cooking incidents involved hosts using preferred actions (e.g., turning off heat source, smothering the incident, etc.). No action was taken by the host in one-fifth of reported incidents (19.4%).

Just over a quarter of oven cooking incidents (26.6%) were dealt with the host using actions that were deemed safe and effective compared to 21.3 per cent of tabletop cooking appliance incidents. Close to a quarter of oven (22.5%) and tabletop (23.8%) cooking appliance incidents involved using intervention techniques that were clearly unsafe, such as separating the affected material(s) from the heat source. This action in response to incidents involving an oven, toaster or microwave oven required opening the door of the cooking appliance and increasing the risk of a flare-up from added oxygen. Cases #41 and #42 (Box 11) exemplify the circumstances surrounding some of these cooking incidents. The host did not take any mitigating or extinguishing actions in 9.2 per cent of oven cooking incidents and 15 per cent of tabletop cooking appliance incidents, respectively.

Thirty-five per cent of oven and tabletop cooking appliance incidents were classified as "burned out, minor", or not requiring any intervention by the host compared to 19 per cent of stovetop cooking incidents. That is, oven or tabletop cooking appliance incidents were more likely to result in minor cooking incidents as opposed to range or stovetop cooking incidents. As each additional piece of specialized cooking equipment poses its own unique risks, it is

Table 11. Action(s) taken by host in response to the cooking incident by type of appliance providing the heat source, RFPS Residential Cooking Fire Data Form 2014-2015

	Action(s) taken by host prior to firefighters arrival							
Type of appliance providing heat source	**Burned out, minor incident: No action required**	**No (or delayed) action taken by host**	**Host used appropriate methods or actions**	**Host used inappropriate actions**	**Other actions**	**Total**	**Chi Square**	**Cramer's V**
Stovetop	19.20%	19.40%	24.10%	28.70%	8.60%	69.70%		
Oven	35.30%	9.20%	26.60%	22.50%	6.40%	20.70%		
Tabletop cooking appliances	35.00%	15.00%	21.30%	23.80%	5.00%	9.60%		
Total	24.10%	16.90%	24.30%	26.90%	7.80%	100.00%	*31.587****	*0.138*

Note. Number of missing cases = 49. ***p < 0.001.

Box 11. Inappropriate host's intervention: Oven cooking incidents

Case Study #41. A 28-year old Canadian male host was roasting a chicken in the oven when he saw fire and smoke. The host opened the oven door, and pulled the roaster out of the oven to put the fire out. The host incurred minor burns as a result of this action. As there was minor fire damage to the cabinets, the Firefighters used the thermal imaging camera to check for heat and possible fire spread in the home. EMS treated the host on-scene.

Case Study #42. A 12-year old Canadian male host turned on the oven without realizing there was a pizza box inside. The box caught on fire. The host was in the kitchen and was alerted by the monitored smoke alarm. The host put water on the fire (inappropriate intervention – should have closed oven door and turned oven off). Firefighters provided fire-safety education and information to the boy.

important for fire services to promote behavioural prevention, mitigation and extinguishing messages specific to these specialized types of equipment and their associated hosts' behaviours.

As the results clearly demonstrate, hosts were not only involved in causing or starting the incident (i.e., from inadvertent acts, carelessness, or acts of omission), but also in preventing an actual fire or mitigating its extent if started. Considering that these activities were often successful in preventing a fire or quickly controlling the cooking incident before Firefighters' arrival, as will be further elaborated upon in Sections 7.3 and 7.4, it would be an "over-reaction" to try to discourage residents from these activities in all circumstances. So, while it is always safest to get away from a fire and outside of a burning structure, it would be appropriate to devote some educational resources to teach people how and when to safely interact with cooking incidents in efforts to prevent fires or mitigate their severity. Such efforts are particularly noteworthy considering the inappropriate nature of the host's intervention behaviours(s) and the resulting outcomes of the cooking incidents exemplified in Cases #43 through #47 (Box 12) obtained from the responding Officer's notes – and where applicable the Fire Investigator's detailed reports.

Box 12. Inappropriate interventions by hosts and severity of hazard outcome

Case Study #43. While cooking, a resident left the kitchen, leaving a frying pan unattended on the stove. Alerted by the smoke alarm, he went back to the kitchen where he found flames coming from the frying pan on top of the stove. He poured a bucket of water on the pan which reacted with the oil in the pan and caused the fire to spread upwards, igniting the cupboards above. Firefighters extinguished the fire, which was contained to the kitchen. Fire damage was limited to the cupboards and ceiling above the stove. Smoke damage was heavy in the kitchen and living room, and light in the rest of the home. Damage was valued at $35,000.

Case Study #44. A male host came home intoxicated and started cooking with oil on the stovetop. Fire began to spread to the adjacent wall. The host put water on the fire, causing it to spread to the cabinetry. The host was able to extinguish the fire. Arriving Firefighters used a thermal imaging camera to check for heat.

Box 12. Cont'd

Case Study #45. The host was preparing French fries in an open pot when the oil overheated and spattered onto the burner, bursting into flames which ignited the oil in the pot. The host tried to extinguish the fire by picking up the pot and moving it over to the sink. In the process, she spilled burning oil onto the cupboard and her arms, resulting in 2nd and 3rd degree burns. The fire spread to the cupboards over the sink, paper towels on top of the cupboard and a plastic dish rack. Fire damage, although significant, was limited to the kitchen area. There was significant smoke damage throughout the house. Damage was valued at $40,000. Photo #18 captures the severity of this careless cooking fire.

Case Study #46. A male host, under the age of 24, began cooking with oil, became distracted and left the room. Host became aware of fire by alarm sounding. The host was burned while attempting to extinguish the fire.

Case Study #47. A 70-year old Canadian male was pan frying at the stove when the oil/grease flared up and started a fire. The host initially moved the frying pan to the sink which caused fire spread to the cupboards above the sink area. The host then went out in to hallway to find a fire extinguisher and was successful in putting the fire out. Firefighters entered the suite and used extinguishers to ensure the fire was completely out. The thermal imagining camera was used to ensure there were no further hot areas. Firefighters extracted the smoke and issued a notation that the building's sprinkler system did not deploy to mitigate the fire.

Photo #18. Inappropriate intervention taken by host and severity of careless cooking fire outcome (Case Study #45)

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7.3. Firefighters' Actions Taken in Response to Careless Cooking Incidents

In some cases, the cooking incident will escalate despite the host's attempts to intervene and prevent fire start, or mitigate its extent if started. In other cases, the incident will escalate or spread through inappropriate (or no) actions taken prior to the Firefighters' arrival.

Table 12 summarizes actions taken by the Firefighters in response to the cooking incident. About a quarter of the incidents required actions be taken by Suppression & Rescue crews to prevent a fire or mitigate its severity once it started. In a third of incidents (32.5%), host's actions taken in response to the cooking incident prior to the Firefighters' arrival were deemed sufficient with no further actions required by Firefighters. This category refers to cases where the host was alerted and intervened, successfully mitigating escalation or fire spread. Suppression & Rescue Officers classified 42.4 per cent of cases as "burned out, minor incidents", not requiring Firefighters' actions. This category of cases refers to cooking incidents where there was no possibility of fire (e.g., toaster activated smoke alarm) or where the host was alerted and promptly intervened, thus preventing the start of a fire.

Table 12. Firefighters' action(s) taken in response to residential cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015

Action(s) taken by firefighters	Frequency	Percent
Burned out, no action taken	366	42.4
Action(s) taken by host	281	32.5
Action(s) taken by RFPS	201	23.3
-Firefighters forcibly entered the premises	4	0.5
-Firefighters extinguished the cooking incident	20	2.3
-Firefighters extracted the smoke	106	12.3
-Firefighters forcibly entered the premises and extracted the smoke	13	1.5
-Firefighters extinguished the cooking incident and extracted the smoke	10	1.2
-Firefighters forcibly entered the premises, extinguished the cooking incident and extracted the smoke	11	1.3
-Firefighters forcibly entered the premises and extinguished the cooking incident	2	0.2
-Firefighters checked home with thermal imaging camera; host checked by Emergency Medical Services (EMS) for burns	4	0.5
		0.0
-Firefighters forcibly entered the premise, extinguished the cooking incident, and checked home with thermal imaging camera; host taken by EMS	1	0.1
		0.0
-Other firefighters' actions: No description provided of action(s) taken by firefighters	30	3.5
Other: Not specified	16	1.9
Total	**864**	**100.0**

Note. Number of missing cases = 20.

7.4. Interplay between Different Stages or Phases of a Careless Cooking Incident Time Scale

7.4.1. Quantifying the Interplay between Different Stages or Phases of a Careless Cooking Incident Time Scale

Tables 13 through 15 show there are significant associations between the different stages or phases of a careless cooking incident time scale. The host's location at the time of the cooking incident affected how the host became aware of the incident (Table 13), which in turn affected the host's action(s) used to prevent a fire or mitigate its severity once started (Table 14). In turn, a host's effort(s) at preventing ignition or mitigating the spread of a cooking incident once started was significantly related to incident outcome as defined by the actions taken by Firefighters (Table 15). That is, the more successful the host's intervention in response to the cooking incident was, the less severe was the intervention required by Firefighters. The converse was also true. For example, in seven of ten incidents in which the host did not take any action to prevent a fire or mitigate its effects, the Suppression & Rescue Officers had to take one or more actions to deal with the cooking incident. It is important to note that in 18.4 per cent of reported incidents Suppression & Rescue crews still needed to take some action(s) in response to the cooking incident (e.g., extracted smoke, made sure the incident was out and not smoldering in the walls), even when the host had attempted to deal with the incident prior to the Firefighters' arrival.

Table 13. How host became alerted of the presence of cooking incident by location of the host at the time of the incident, RFPS Residential Cooking Fire Data Form 2014-2015

	Awareness of presence of incident						
Location at time of incident	**Saw fire/smoke**	**Smelled smoke**	**Smoke alarmed sounded**	**Not aware**	**Total**	**Chi Square**	**Cramer's V**
At the appliance	18.8%	11.0%	69.3%	0.9%	27.2%		
In the room	9.2%	25.2%	64.9%	0.8%	32.7%		
In another room	5.4%	23.8%	62.7%	8.1%	32.4%		
Outside premises/Away from home	9.7%	3.2%	30.6%	56.5%	7.7%		
Total	10.6%	19.2%	62.7%	7.5%	100.0%	*283.842****	*0.343*

Note. N = 802; number of missing cases = 82. ***p < 0.001.

Table 14. Actions taken by host by how the host became aware of the presence of an incident, RFPS Residential Cooking Fire Data Form 2014-2015

Awareness of the presence of incident	Which actions were taken by host(s)? Burned out, minor incident: No action required	No (or delayed) action taken by host	Action(s) taken by host prior to Firefighters' arrival	Total	Chi Square	Cramer's V
Saw fire/smoke	11.2%	15.7%	73.0%	10.7%		
Smelled smoke	10.1%	18.2%	71.7%	19.1%		
Smoke alarmed sounded	12.4%	29.8%	57.7%	62.8%		
Not aware	87.1%	–	12.9%	7.4%		
Total	17.4%	23.9%	58.7%	100.0%	*244.366****	*0.383*

Note. N = 833; number of missing cases = 51. ***p < 0.001.

Table 15. Firefighters' actions taken in response to cooking incident by actions taken by host(s), RFPS Residential Cooking Fire Data Form 2014-2015

Which actions were taken by host(s)?	Which actions were taken by firefighters? Burned out, no action taken	Action(s) taken by host	Action(s) taken by Firefighters	Total	Chi Square	Cramer's V
Burned out, minor incident: No action required	89.7%	5.6%	4.6%	23.5%		
No (or delayed) action taken by host	18.6%	10.7%	70.7%	16.9%		
Action(s) taken by host prior to Firefighters' arrival	30.2%	51.4%	18.4%	59.6%		
Total	42.2%	33.8%	24.0%	100.0%	*417.334****	*0.502*

Note. N = 829; number of missing cases = 55. ***p < 0.001.

7.4.2. Classification of Incident by Outcome of Careless Cooking Hazard

The classification of observations based on host and Firefighters' intervention efforts in response to the cooking hazard provides a good indicator of the outcome of the careless cooking incidents attended by the Fire Department in the two years under consideration (Table 15)[4]. Specifically, there were 201 cooking incidents, or 24.2 per cent, where there was no possibility of fire (e.g., toaster activated smoke alarmed system). There were 160 cooking incidents, or 19.3 per cent, where the host was alerted and promptly intervened and prevented the start of a fire (e.g., smoke alarmed was activated, host removed pot from burner and turned burner off). In turn, there were 254 cases, or 30.6 per cent, where the host was alerted and intervened, effectively mitigating fire spread (e.g., food in pot caught fire, host used lid to smother the fire and turned burner off). In 199 cooking incidents (24.0%), Firefighters' actions were required (e.g., Firefighters extinguished a fire, removed the burned pot, turned off the stove, and extracted the smoke).

[4] In 15 (out 829) cooking incidents, it was difficult to ascertain whether Firefighters' intervention was required. Because of host-related issues (e.g., due to intoxication host was passed out upon Firefighters' arrival) or the circumstances surrounding the incident (e.g., host was away from home at start of incident or the host evacuated and did not come back while Firefighters were on-scene), these cases could at best be classified as eliciting a delayed response from the host or someone else (e.g., neighbour, building manager, etc.). Yet, in looking at the answers provided by Officers regarding Firefighters' actions, all these cases were classified as "Extinguished by occupant", suggesting that whatever actions were taken by these hosts before passing out, upon returning home and finding out the cooking incident, or before evacuating the premises, were sufficient to mitigate incident escalation and/or spread.

7.5. Severity of Careless Cooking Incident

We determined severity of the cooking incident by combining answers to the following three questions: Was the cooking incident classified as a residential fire?; Did the cooking incident require serious Firefighters' intervention?; and What was the extent of the cooking incident effect; that is, was the incident contained or not? The results are summarized in Table 16. Using these criteria, 20.4 per cent of incidents attended by the Fire Department can be classified as "serious" or "severe" careless cooking occurrences.

Table 16. Classification of incident by seriousness of careless cooking hazard, RFPS Residential Cooking Fire Data Form 2014-2015

Incident classified as serious or severe	2014		2015		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
No	332	78.9	339	80.3	671	79.6
Yes	89	21.1	83	19.7	172	20.4
Total	**421**	**100.0**	**422**	**100.0**	**843**	**100.0**

Note. Number of missing cases = 41. Seriousness or severity of incident was determined by whether a case was classified as: i) a residential fire, ii) requiring serious Firefighters' intervention, and/or iii) not contained.

7.6. Correlates of Host and Firefighters' Actions Taken in Response to the Residential Cooking Incident and Severity of the Careless Cooking Hazard

7.6.1. Correlates of Host's Intervention Behaviour

Among the demographic characteristics, country of birth was significantly related to a host's response to the cooking incident (Table 17). Cases in which it was not possible to

Table 17. Per cent distribution of residential cooking incidents according to actions taken by hosts prior to Firefighters' arrival by selected characteristics of host, agent and environment, RFPS Residential Cooking Fire Data Form 2014-2015‡

Correlates		No action required: Burned out	No (or delayed) action taken by host	Action(s) taken by host	Chi-Square	Total Freq.	Total %
Human risk factors	*Demographic characteristics: Non-modifiable*						
	Sex				*5.260*		
	Female	20.80%	18.00%	61.20%		472	57.40%
	Male	27.60%	16.50%	55.80%		351	42.60%
	Age				*8.326*		
	Less than 25	14.43%	17.53%	68.04%		97	11.80%
	25-64 years	25.50%	16.40%	58.10%		616	74.80%
	65 plus	21.80%	22.70%	55.50%		110	13.40%
	Born abroad				*25.749****		
	Canadian born	23.60%	14.50%	62.00%		581	70.60%
	Non-Canadian born	19.80%	21.00%	59.30%		167	20.30%
	Not identified	33.30%	32.00%	34.70%		75	9.10%
	Behavioural characteristics: Modifiable						
	Major act or omission				*369.594****		
	Away from home	0.00%	71.90%	28.10%		64	7.80%
	Inhibited response (e.g., asleep, impaired by alcohol or drugs, disability, etc.)	2.70%	65.80%	31.50%		73	8.90%
	Misuse of equipment (e.g., equipment unintentionally turned on, set in wrong settings, not turned off, etc.)	10.30%	17.20%	72.40%		29	3.50%
	Failure to clean &/or cluttered cooking	32.60%	13.00%	54.30%		46	5.60%
	Distracted/forgot	19.90%	7.40%	72.80%		367	44.60%
	High heat cooking	36.70%	2.30%	61.00%		177	21.50%
	Other factors	55.20%	10.40%	34.30%		67	8.10%
	Awareness of presence of an incident				*38.484***		
	Smoke alarmed sounded	29.50%	12.20%	58.40%		502	61.00%
	Something else alerted occupant(s)	14.60%	25.50%	59.80%		321	39.00%
	Location at time of incident				*77.323***		
	In the kitchen	29.20%	7.50%	63.30%		466	56.60%
	Somewhere else	16.50%	30.30%	53.20%		357	43.40%

Note. N = 823. ‡Analysis excludes 36 home care facility cases; $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Continued…

Correlates		No action required: Burned out	No (or delayed) action taken by host	Action(s) taken by host	Chi-Square	Total Freq.	Total %
Agent risk factors	*Appliance providing heat source*				*24.379***		
	Stove	19.40%	19.30%	61.30%		566	70.10%
	Oven	35.10%	9.40%	55.60%		171	21.20%
	Tabletop cooking appliance	31.40%	15.70%	52.90%		70	8.70%
	Object first affected/ignited				*19.081***		
	Cooking oil/grease	17.70%	11.60%	70.70%		164	20.30%
	Combustibles	20.80%	29.20%	50.00%		48	5.90%
	Food item	24.20%	17.10%	58.70%		537	66.50%
	Other	32.80%	22.40%	44.80%		58	7.20%
	Confinement of cooking incident				*14.520***		
	Confined	23.50%	15.40%	61.10%		710	89.80%
	Non-confined	17.30%	32.10%	50.60%		81	10.20%
Environmental risk factors (physical and social)	*Neighborhood of residence*				*29.200***		
	Central Zone	15.00%	24.40%	60.70%		234	28.50%
	East Zone	23.70%	13.00%	63.40%		131	15.90%
	North Zone	31.20%	9.90%	58.90%		141	17.20%
	South Zone	24.80%	21.70%	53.50%		129	15.70%
	West Zone	28.30%	13.90%	57.80%		187	22.70%
	Type of occupancy				*70.144***		
	House	27.00%	11.30%	61.70%		622	75.60%
	Apartment	13.40%	36.30%	50.20%		201	24.40%
	Season of the year				*4.265*		
	Fall	26.50%	17.50%	56.00%		234	28.40%
	Winter	25.30%	14.50%	60.20%		186	22.60%
	Spring	22.30%	19.70%	58.00%		188	22.80%
	Summer	20.50%	17.70%	61.90%		215	26.10%
	Day of the week				*0.936*		
	Weekdays	23.60%	18.20%	58.20%		538	65.50%
	Weekends	24.00%	15.50%	60.40%		283	34.50%
	Time of incident				*31.843***		
	Midnight through 5:59	12.00%	44.00%	44.00%		50	6.10%
	6:00 through 11:59	24.20%	17.40%	58.40%		161	19.60%
	12:00 through 17:59	22.40%	13.70%	64.00%		344	41.90%
	18:00 through 23:59	27.40%	16.90%	55.60%		266	32.40%

Note. N = 823 Missing cases = 21. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001.

determine host's place of birth were more likely to be associated with incidents in which no actions were taken by hosts in response to the cooking incident. This may be an artifact of the circumstances, including cooking incidents where no one was at home, where the host was heavily intoxicated or passed out, or where a serious or stressful event had occurred precluding the responding Officer from gathering this information. Compared to their Canadian born counterparts, non-Canadian born hosts were more likely to be associated with incidents in which no (or delayed) actions were taken by the hosts in response to the incident.

The host's cooking behaviour that caused or stared the incident was the most important correlate of the host's intervention behaviour in response to the cooking incident. Cases where the host was away from home while cooking was still going on, or where the host was asleep, impaired by alcohol or drugs, or where the incident was caused by an unattended or unsupervised person were significantly less likely to elicit host's intervention in response to the cooking incident, and less likely to be classified as "burned out, minor incident". In turn, incidents associated with misused equipment or where the hosts were distracted or forgot something was cooking were more likely to prompt host's intervention in response to the incident, as were cases associated with high heat cooking and failure to clean and/or a cluttered cooking area. In turn, high heat cooking, failure to clean and/or a cluttered cooking area and "other" human contributing factors were more likely to be associated with cooking incidents classified as "burned out, minor incidents"; that is, cases requiring no action on the part of the host.

Cases were significantly more likely to be classified as "no (or delayed) action taken by host" in response to the incident if something other than a smoke alarm alerted the host of the incident and if the host was not in the kitchen at the time of incident. In turn, if a smoke alarm sounded and alerted the host of the incident and the host was in the kitchen, the incident was more likely to be classified as minor, requiring no host intervention.

As noted in section 7.2.2, the appliance providing the heat source was an important correlate of host's intervention behaviour, with stovetop cooking incidents being least likely to be classified as "no action required" from host. Incidents where the cooking oil/grease was the material first affected or ignited were the least likely to be classified as minor, and were the ones most likely to elicit host's intervention behaviour in response to the incident. Cooking incidents where combustibles were the materials first affected or ignited were the most likely to be associated with occurrences in which the host did not take any actions in response to the cooking incident. Confinement of the cooking incident also affected host's intervention behaviour, with hosts being more likely to intervene when the cooking incident was confined. The converse was also true, with incidents being twice as likely to be classified as "no (or delayed) action taken by host" if the cooking hazard was non-confined.

Among the environment-related risk factors, neighbourhood of residence, type of occupancy and time of incident were significantly related to host's intervention behaviour. Incidents in the Central Zone were least likely to be classified as "burned out, minor" or not requiring host intervention, and most likely to be associated with cases were the host took no action in response to the incident. Hosts residing in apartments were significantly more likely to be associated with cases in which no (or delayed) action was taken by host in response to the incident, and were less likely to be involved in incidents requiring no host intervention. Cooking incidents occurring in a house were more likely to elicit host's intervention in response to the incident. Hosts were most likely to take actions in response to cooking incidents occurring between 12 pm and 5 pm, and least likely if the cooking incident occurred between midnight and

5 am. Cases that occurred between midnight and 5 am were least likely to be classified as "burned out, minor incidents."

7.6.2. Correlates of Firefighters' Actions

Age, sex and country of birth of host were significantly related to Firefighters' actions (Table 18). Cases were more likely to be classified as "burned out, minor incident", not requiring Firefighters' action when the host was middle aged and male. The youngest and oldest age groups tended to be involved in cases that required Firefighters' actions in response to the cooking incident. Canadian born hosts were least likely to be involved in cooking incidents classified as requiring Firefighters' intervention. Conversely, non-Canadian born hosts were least likely to be associated with incidents deemed minor, and not requiring Firefighters' intervention. Cases #48 and #50 (Box 13) exemplify the nature of Firefighters' interventions in three cooking incidents where the host was non-Canadian born.

The host's cooking behaviour that caused or started the incident was the most important correlate of Firefighters' actions taken in response to the cooking incident. Expectedly, incidents where the host was away from home while cooking was still going on or where the host was asleep, impaired by alcohol or drugs or where the incident was caused by an unattended or unsupervised person were significantly more likely to require Firefighters' intervention, and were less likely to be associated with incidents classified as "burned out, minor" (i.e., not requiring Firefighters' intervention). Cases #51 through #56 (Box 14) exemplify the nature of Firefighters' interventions in six cooking incidents where the host was intoxicated. In turn, Cases #57 through #59 (Box 15) provide further examples of Firefighters' intervention efforts associated with hosts who fell asleep while cooking was still going on. Cases #60 and #61 (Box 16) provide two additional examples of the nature of Firefighters' actions in response to

Table 18. Per cent distribution of residential cooking incidents according to Firefighters' actions taken by selected characteristics of host, agent and environment, RFPS Residential Cooking Fire Data Form 2014-2015‡

Correlates		Burned out, no action taken	Action(s) taken by host	Action(s) taken by Firefighters	Chi-Square	Total Freq.	Total %
	Demographic characteristics: Non-modifiable						
	Sex				*8.377**		
	Female	38.00%	35.90%	26.10%		463	57.02%
	Male	48.10%	30.40%	21.50%		349	42.98%
	Age				*16.851***		
	Less than 25	32.63%	32.63%	34.74%		95	11.70%
	25-64 years	44.50%	34.81%	20.69%		609	75.00%
	65 plus	38.89%	26.85%	34.26%		108	13.30%
	Born abroad				*15.881***		
	Canadian born	43.11%	35.43%	21.47%		573	70.57%
	Non-Canadian born	35.37%	34.15%	30.49%		164	20.20%
	Not identified	52.00%	17.33%	30.67%		75	9.24%
	Behavioural characteristics: Modifiable						
	Major act or omission				*337.810****		
Human risk factors	Away from home	4.80%	6.50%	88.70%		62	7.60%
	Inhibited response (e.g., asleep, impaired by alcohol or drugs, disability, etc.)	16.90%	12.70%	70.40%		71	8.70%
	Misuse of equipment (e.g., equipment unintentionally turned on, set in wrong settings, not turned off, etc.)	24.10%	34.50%	41.40%		29	3.60%
	Failure to clean &/or cluttered cooking area	63.60%	18.20%	18.20%		44	5.40%
	Distracted/forgot	40.40%	43.50%	16.10%		361	44.50%
	High heat cooking	51.40%	41.80%	6.80%		177	21.80%
	Other factors	83.80%	14.70%	1.50%		68	8.40%
	Awareness of the presence of an incident				*51.168****		
	Smoke alarmed sounded	49.19%	35.02%	15.79%		494	60.84%
	Something else alerted occupant(s)	31.76%	31.13%	37.11%		318	39.16%
	Location at time of incident				*100.251****		
	In the kitchen	51.30%	37.61%	11.09%		460	56.70%
	Somewhere else	30.68%	28.13%	41.19%		352	43.30%

Note. N = 812. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001.

Continued…

Correlates		Burned out, no action taken	Action(s) taken by host	Action(s) taken by Firefighters	Chi-Square	Total Freq.	Total %
Agent risk factors	*Appliance providing heat source*				*36.400****		
	Stove	35.37%	37.88%	26.75%		557	69.97%
	Oven	59.28%	25.15%	15.57%		167	20.98%
	Tabletop cooking appliance	55.56%	23.61%	20.83%		72	9.05%
	Object first affected/ignited				*19.173***		
	Cooking oil/grease	37.65%	36.42%	25.93%		162	20.33%
	Combustibles	30.43%	21.74%	47.83%		46	5.77%
	Food item	43.40%	35.09%	21.51%		530	66.50%
	Other	47.46%	25.42%	27.12%		59	7.40%
	Confinement of cooking incident				*27.633****		
	Confined	43.70%	34.60%	21.70%		709	90.32%
	Non-confined	25.00%	26.30%	48.70%		76	9.68%
Environmental risk factors (physical and social)	*Neighborhood of residence*				*20.783***		
	Central Zone	37.07%	31.03%	31.90%		232	28.61%
	East Zone	44.09%	38.58%	17.32%		127	15.66%
	North Zone	44.29%	35.00%	20.71%		140	17.26%
	South Zone	36.80%	33.60%	29.60%		125	15.41%
	West Zone	50.27%	32.09%	17.65%		187	23.06%
	Type of occupancy				*46.811****		
	House	45.45%	36.20%	18.34%		616	75.86%
	Apartment	32.65%	25.00%	42.35%		196	24.14%
	Season of the year				*1.989*		
	Fall	43.23%	33.62%	23.14%		229	28.20%
	Winter	42.39%	35.33%	22.28%		184	22.66%
	Spring	39.78%	34.95%	25.27%		186	22.91%
	Summer	43.66%	30.52%	25.82%		213	26.23%
	Day of the week				*4.404*		
	Weekdays	65.01%	61.40%	70.77%		528	65.19%
	Weekends	34.99%	38.60%	29.23%		282	34.81%
	Time of incident				*23.410***		
	Midnight through 5:59	27.45%	23.53%	49.02%		51	6.30%
	6:00 through 11:59	40.00%	36.88%	23.13%		160	19.80%
	12:00 through 17:59	41.96%	36.90%	21.13%		336	41.50%
	18:00 through 23:59	47.15%	29.28%	23.57%		263	32.50%

Note. N = 812; Missing cases = 32. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001.

Box 13. Nature of Firefighters' intervention: Non-Canadian born hosts

Case Study #48. A 30-year old Pakistani female host was cooking with oil on the stove. She finished cooking but forgot to turn the burner off and left the kitchen. The family was alerted to the problem by the smell of smoke and evacuated the building. Firefighters extinguished the fire with dry powder and water extinguishers. There was fire and smoke damage to the apartment suite and hallway.

Case Study #49. A 20-year old Syrian female host, who had arrived in Canada three weeks earlier, was cooking with a pot on the stove. She left the kitchen and went to another room to change her child's diaper. A fire started in the pot and spread to the cupboards above the stove. A neighbour called 9-1-1 and tried to extinguish the fire in the pot, which was still smoldering when Firefighters arrived. After extinguishing the fire, Firefighters provided education and advised the host never to leave the kitchen when cooking, indicating this had nearly become a very significant fire.

Case Study #50. A 40-year Indian female host was cooking with oil in the basement of the residence. Cooking was left unattended. The incident activated the smoke alarm. Firefighters extracted the smoke. Firefighters commented that this was the third alarm at this home for similar incidents.

Box 14. Nature of Firefighters' intervention: Intoxicated hosts

Case Study #51. A 58-year old Canadian male host placed a kettle on the stovetop and left the kitchen to the bedroom, where he passed out (intoxicated). The incident activated the apartment building's fire alarm system. Another tenant called 9-1-1. Firefighters forced entry, turned the burner off, woke up the host and used a Thermal Imaging Camera to check for heat in the kitchen.

Case Study #52. A 38-old Canadian host was cooking while intoxicated. He fell asleep. At 3:00 am, the incident activated the smoke alarm; it did not wake the host. The neighbour called the Fire Department upon hearing the smoke alarm and seeing smoke coming from the house next door. Firefighters saw the pot on the stove through the window. They forced entry, removed the pot, turned the burner off and woke the host. Firefighters ventilated.

Case Study #53. A 14^{+}-year old Canadian male host was cooking and fell asleep in the bedroom. The apartment building's fire alarm system was activated and alerted other tenants. The host remained asleep – intoxicated – and was awoken by Firefighters. Arriving Firefighters used a Thermal Imaging Camera and could see heat in the entrance door crack. They forced entry, found a pot on the stove, removed it from the stove and turned the burner off. They woke the host in the bedroom and extracted the smoke.

Case Study #54. A 48-year old Asian male host was intoxicated while cooking with a pot on the stove. The host left kitchen to another room, and forgot the pot on the stove. The smoke alarm sounded and alerted a neighbour who called 9-1-1 reporting a smoke alarm sounding in the apartment below her and that smoke was coming into her apartment. The host evacuated. Firefighters extinguished the fire and ventilated.

Box 14. Cont'd

Case Study #55. Two 20-something- year old Canadian male and female occupants in an apartment building had been cooking when they left the kitchen and passed out. They were heavily intoxicated. Firefighters entered the apartment to heavy smoke with near zero visibility. The removed the pot to the outside and awoke the occupants. Firefighters ventilated.

Case Study #56. A 28-year old Canadian host and another occupant fell asleep with a pot on the stove. The pot activated the smoke alarm, which alerted a neighbour who called 9-1-1. Firefighters forced entry and woke the two intoxicated occupants, removed a pot from the stove and turned the burner off. Firefighters ventilated.

incidents where the host was away while cooking was still occurring.

Another group of cases characterized as requiring Firefighters' intervention included those where equipment was unintentionally turned on, set in the wrong setting or not turned off or where the host knowingly continued using a malfunctioning appliance. Distractions that pull the cook outside of the kitchen (e.g., doorbell, screaming child, a phone call, etc.), forgetting something was cooking and high heat cooking were associated with incidents that were more likely to be classified as not requiring Firefighters' intervention, either because these were classified as "burned out, minor incidents" or because the host's timely intervention in response to the incident before Firefighters' arrival was deemed sufficient. In turn, cases related to failure to clean or cluttered cooking area or other human factors were significantly more likely to be classified as "burned out, minor incidents". Cases where something other than a smoke alarm alerted the host of an incident and where the host was not in the kitchen at the time of incident

Box 15. Nature of Firefighters' intervention: Host was sleeping, while cooking was still occurring

Case Study #57. A 30-something-year old Canadian male host was pan frying. He left the kitchen to another room and fell asleep. A neighbour called 9-1-1 after hearing the smoke alarm and smelling smoke. Firefighters entered the house to medium smoke, found the occupant, woke him up and got him outside to fresh air. They removed two pots from the stovetop to the outside and turned the burners off. They also extracted the smoke.

Case Study #58. A 43-year old Canadian host was cooking with a pot on the stove. She went to the bedroom where she fell asleep. The building's fire alarm system was activated. Another tenant called 9-1-1. Firefighters woke the host, removed the pot from the stove and extinguished the fire.

Case Study #59. A 61-year old Canadian female host was cooking with a pot on the stove. She fell asleep on the couch in the living room. The incident activated the monitored fire alarm, alerting the Fire Department. Arriving Firefighters woke the host, took the pot off the stove, turned the burner off and extracted the smoke.

Box 16. Nature of Firefighters' intervention: Host left the residence, while cooking was still going on

Case Study #60. A 20-something Canadian male host left his home with a pot on the stove. A neighbour called 9-1-1 upon smelling plastic and noticing smoke. Firefighters forced entry, searched the home, extinguished the fire by removing the pot on the stove to the sink and using water and extracted the smoke.

Case Study #61. A 24-year old Canadian female host left the house with a pot on the stove still cooking. The incident activated the smoke alarm which alerted a neighbour who called 9-1-1. The host arrived home as Firefighters were on-scene. Firefighters entered the home and found it very smoky. A dog ran outside when they entered. They turned off the stove and placed the pan outside. Firefighters ventilated.

were more likely to require Firefighters' intervention. If a smoke alarm alerted the host of the incident and the host was in the kitchen, the case was more likely to be classified as "burned out, minor incident", and not needing Firefighters' intervention.

Among the hazard agent risk factors, the appliance providing the heat source was an important correlate of Firefighters' intervention in response to the cooking incident. Cases associated with the oven and tabletop cooking appliances were considerably more likely to be classified as "burned out, minor incidents", not requiring Firefighters' actions. Oven cooking incidents were the least likely to require Firefighters' intervention. Cooking incidents where combustibles were the materials first affected or ignited were the most likely to require Firefighters' intervention. Confinement of the cooking incident also affected Firefighters' intervention, with non-confined incidents being over twice more likely to require Firefighters taking actions in response to the incident.

Among the environment-related risk factors, neighbourhood of residence, type of occupancy and time of incident were significantly related to Firefighters' intervention. Incidents in the Central and South zones were the most likely to require Firefighters' actions in response to the incident, whereas incidents in the West Zone were more likely to be classified as "burned out, minor incidents", or not requiring Firefighters' intervention. Incidents that occurred in apartments were close to three times more likely to require Firefighters' actions in response to the cooking incident. On the other hand, cooking incidents occurring in a house were more likely to be classified as not requiring Firefighters' intervention either because the host's timely intervention in response to the incident was sufficient or because the incident was classified as minor, hence not requiring any intervention. As predicted, cases that occurred between midnight and 5 am were more than twice as likely to require Firefighters' intervention.

7.6.3. Correlates of Severity or Seriousness of the Careless Cooking Incident

The youngest and oldest age groups were more likely to be associated with serious or severe incidents (Table 19). Non-Canadian born hosts were more likely to be involved in serious cooking incidents. The host's cooking behaviour that caused or started the incident was the most important correlate of the severity or seriousness of the cooking incident. Incidents were the host was away from home while cooking was still going on or where the host was asleep, impaired by alcohol or drugs, or where the incident was caused by an unattended or unsupervised person were considerably more likely to be associated with serious cooking incidents. Cases where something other than a smoke alarm alerted the host of an incident and where the host was not in the kitchen at the time of incident were more than twice as likely to be classified as severe

Table 19. Per cent distribution of seriousness of residential cooking incidents by selected characteristics of host, agent and environment, RFPS Residential Cooking Fire Data Form 2014-2015‡

		Cooking Incident Classified as Serious				
Correlates		**No**	**Yes**	**Chi Square**	**Freq.**	**%**
Human risk factors	*Demographic characteristics: Non-modifiable*					
	Sex			*2.829*		
	Female	77.60%	22.40%		465	57.60%
	Male	82.50%	17.50%		342	42.40%
	Age			*8.620**		
	Less than 25	71.90%	28.10%		96	11.90%
	25-64 years	82.10%	17.90%		603	74.70%
	65 plus	73.10%	26.90%		108	13.40%
	Born abroad			*4.699*		
	Canadian born	80.50%	19.50%		569	70.50%
	Non-Canadian born	74.20%	25.80%		163	20.20%
	Not identified	85.30%	14.70%		75	9.30%
	Behavioural characteristics: Modifiable					
	Major act or omission			*132.560****		
	Away from home	39.00%	61.00%		59	7.30%
	Inhibited response (e.g., asleep, impaired, disability, etc.)	47.90%	52.10%		71	8.80%
	Misuse of equipment	75.90%	24.10%		29	3.60%
	Failure to clean &/or cluttered cooking area	80.40%	19.60%		46	5.70%
	Distracted/forgot	84.80%	15.20%		361	44.70%
	High heat cooking	90.80%	9.20%		173	21.40%
	Other factors	94.10%	5.90%		68	8.40%
	Awareness of presence of an incident			*27.845****		
	Smoke alarmed sounded	85.60%	14.40%		494	61.20%
	Something else alerted occupant(s)	70.30%	29.70%		313	38.80%
	Location at time of incident			*36.965****		
	In the kitchen	87.30%	12.70%		455	56.40%
	Somewhere else	69.90%	30.10%		352	43.60%
	Action(s) taken by host prior to Firefighters' arrival			*90.567****		
	Minor incident: No action required	89.50%	10.50%		181	22.90%
	No (or delayed) action taken by host	49.60%	50.40%		135	17.10%
	Action(s) taken by host	84.00%	16.00%		475	60.10%

Note. N = 807. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001.

Continued …

Correlates		Cooking Incident Classified as Serious: No	Cooking Incident Classified as Serious: Yes	Chi Square	Freq.	%
Agent risk factors	*Appliance providing heat source*			*6.468**		
	Stove	77.40%	22.60%		554	69.90%
	Oven	85.80%	14.20%		169	21.30%
	Tabletop cooking appliance	84.10%	15.90%		69	8.70%
	Object first affected/ignited			*15.379***		
	Cooking oil/grease	73.80%	26.30%		160	20.20%
	Combustibles	62.50%	37.50%		48	6.00%
	Food item	82.80%	17.20%		534	67.30%
	Other	76.90%	23.10%		52	6.50%
Environmental risk factors (physical and social)	*Neighborhood of residence*			*23.745****		
	Central Zone	69.70%	30.30%		228	28.30%
	East Zone	78.30%	21.70%		129	16.00%
	North Zone	82.90%	17.10%		140	17.40%
	South Zone	83.30%	16.70%		126	15.60%
	West Zone	88.00%	12.00%		183	22.70%
	Type of occupancy			*10.571***		
	House	82.30%	17.70%		610	75.60%
	Apartment	71.60%	28.40%		197	24.40%
	Season of the year			*2.306*		
	Fall	82.30%	17.70%		232	28.70%
	Winter	80.60%	19.40%		186	23.00%
	Spring	76.70%	23.30%		189	23.40%
	Summer	78.50%	21.50%		200	24.80%
	Day of the week			*0.903*		
	Weekdays	78.70%	21.30%		525	65.10%
	Weekends	81.50%	18.50%		281	34.90%
	Time of incident			*17.678***		
	Midnight through 5:59	57.70%	42.30%		52	6.50%
	6:00 through 11:59	80.00%	20.00%		160	19.90%
	12:00 through 17:59	82.90%	17.10%		339	42.10%
	18:00 through 23:59	79.60%	20.40%		255	31.60%

Note. N = 807; Missing cases = 37. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001.

cooking incidents. Cases in which the host did not take any action in response to the cooking incident were markedly more likely to be classified as serious incidents. Stovetop cooking incidents and those where combustibles were affected or ignited were significantly more likely to be serious cooking incidents. Similarly, cooking incidents occurring in the central neighbourhoods, in apartments and between midnight and 5 am were more likely to be serious or severe incidents.

7.7. Multivariate Analyses

Multinomial, ordered and binary logistic regression models were undertaken to assess the relative contributions of human, hazard agent and environment-related risk factors in predicting host and Firefighters' actions and to determine the relative contribution of human factors vis-à-vis technological and engineering detection solutions (e.g., presence of operating smoke alarms) in the extent of careless cooking incident outcomes and severity. The results are summarized in Tables 20 to 23.

7.7.1. Predictors of Host's Intervention Behaviour

Multinomial logistic regression was used to predict the log odds that a cooking incident was classified as 'not requiring any intervention by host' ("burned out, minor incident") or 'host did not take any action in response to the cooking incident' (relative to 'host took one or more actions in response to the incident') for each of the independent variables considered in the analysis, net of the effects of the other factors considered. Age of host, country of birth, major act or omission, how host became alerted of the presence of incident, appliance providing heat source, neighbourhood of residence, type of occupancy and year of incident made unique contributions to the prediction of (the log odds of) host's intervention behaviour, after all other factors were controlled for (Table 20). Compared to hosts aged 65 plus, hosts between ages 25

Table 20. Parameter estimates from forward stepwise multinomial logistic regression of host's action(s) in response to a cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015 (N= 767)‡

Predictors	No (or delayed) action attempted by host[a]				No action required: Burned out, minor incident[a]			
	B	SE	Sig.	Exp(B)	B	SE	Sig.	Exp(B)
Intercept	-2.052	0.168	0.000		-1.521	0.188	0.000	
Age								
Less than 25	-0.123	0.134	0.358	0.884	-0.254	0.110	0.021	0.776
25-64 years	-0.277	0.116	0.017	0.758	0.116	0.105	0.267	1.123
65 plus[b]	0.000				0.000			
Born abroad								
Not specified	0.529	0.122	0.000	1.697	0.161	0.111	0.148	1.174
Non-Canadian born[b]	0.000				0.000			
Major act or omission								
Away from home	0.843	0.095	0.000	2.324	-0.601	0.318	0.059	0.549
Inhibited response	0.986	0.098	0.000	2.681	-0.902	0.393	0.022	0.406
High heat cooking	-0.308	0.201	0.125	0.735	0.238	0.084	0.005	1.268
Other specified factors	0.079	0.163	0.630	1.082	0.461	0.084	0.000	1.585
Distracted/forgot[b]	0.000				0.000			
Awareness of presence of incident								
Smoke alarmed sounded	-0.278	0.127	0.028	0.757	0.337	0.104	0.001	1.401
Something else alerted occupant(s)[b]	0.000				0.000			
Appliance providing heat source								
Oven	-0.095	0.149	0.525	0.909	0.256	0.089	0.004	1.291
Stove[b]	0.000				0.000			
Neighborhood of residence								
Central Zone	0.065	0.123	0.598	1.067	-0.292	0.106	0.006	0.747
West Zone[b]	0.000				0.000			
Type of occupancy								
Apartment	0.299	0.111	0.007	1.348	-0.086	0.110	0.436	0.918
House[b]	0.000				0.000			
Year of incident								
2014	0.073	0.131	0.575	1.076	-0.277	0.097	0.004	0.758
2015[b]	0.000				0.000			
-2 Log likelihood	**1063.827 (χ^2=370.820, df=24, p<0.001)**							
Cox and Snell R Square	**0.383**							
Nagelkerke R Square	**0.453**							

Note. [a]Baseline category= Action(s) taken by host; [b]Reference category. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001. All predictors were orthogonalized. The following predictors did not meet entry criteria: Sex of host; location at time of incident; object first affected; confinement of cooking incident; season of the year; day of the week; and time of incident.

and 64 were significantly more likely to intervene in response to a cooking incident ($p<0.05$). Compared to hosts aged 65 plus, hosts between below age 25 were less likely to be involved in "burned out, minor incidents" that did not require host's intervention ($p<0.05$). Compared to cases where the host was non-Canadian born, cases in which Firefighters could not specify the host's country of birth were more likely to involve cooking incidents in which no action was taken by host ($p<0.001$). Again, as previously noted, this pattern of results may be an artifact of the circumstances surrounding certain incidents, including cooking incidents where no one was home, where the host was heavily intoxicated or passed out, or where the seriousness or stressfulness of the event precluded the Officer from gathering this 'sensitive' information.

The host's cooking behaviour that caused or started the incident was the most important predictor of the (log odds of) host's intervention behaviour in response to the cooking incident. Compared to cases in the category "distracted/forgot", incidents where the host was away from home while cooking was still going on ($p<0.001$) or where the host was asleep, impaired by alcohol or drugs, or where the incident was caused by an unattended or unsupervised person ($p<0.001$) were significantly more likely to be classified as the 'host did not take any action in response to the cooking incident'. In turn, compared to cases in the category "distracted/forgot", cases resulting from high heat cooking ($p<0.01$) or "other" human contributing factors ($p<0.001$) were significantly more likely to be associated with cooking incidents classified as "burned out, minor incidents", that is, cases not requiring any action on the part of the host. Conversely, compared to cases in the category "distracted/forgot", cases associated with "inhibited response" were significantly less likely to be classified as "burned out, minor incidents" ($p<0.05$).

How hosts were first alerted of the incident was the second most important predictor of the host's intervention behaviour in response to the cooking incident. Cooking incidents were less likely to involve an “unresponsive” host ($p<0.05$), or more likely to be classified as “burned out, minor incidents” ($p<0.01$), requiring no host’s intervention if a smoke alarm alerted the host of the presence of the incident.

Compared to stovetop cooking, oven cooking incidents were more likely to be classified as “burned out, minor incidents”, not requiring host’s intervention ($p<0.01$). In contrast, compared to the West Zone, cooking incidents in the central neighbourhoods were less likely to be classified as requiring no host’s intervention ($p<0.01$). Cases that occurred in apartments versus those that occurred in houses were more likely to be associated with cooking incidents where hosts took no actions in response to the incident ($p<0.01$). Compared to cases that occurred in 2015, cooking incidents that took place in 2014 were less likely to be classified as “burned out, minor incidents” or requiring no host’s intervention ($p<0.01$).

7.7.2. Predictors of Firefighters’ Actions

Multinomial logistic regression was used to predict the log odds that a cooking incident was classified as ‘not requiring Firefighters’ intervention’ or ‘host intervention prior to Firefighters’ arrival was deemed sufficient’ (relative to ‘requiring Firefighters’ intervention’) for each of the independent variables considered in the analysis, net of the effects of the other factors considered. Age, sex, country of birth, major act or omission, how host became alerted of the incident, host’s location at time of incident, appliance providing heat source, object first affected or ignited and year of incident made unique contributions in the prediction of (log odds of) Firefighters’ intervention, after all other factors were controlled for (Table 21). Compared to their male counterparts, female hosts were less likely to be associated with cases classified as “burned out, minor incident”; that is, cases not requiring further Firefighters’ action ($p<0.01$). Compared to hosts 65 and older, hosts between the ages of 25 and 64 were less likely to be

Table 21. Parameter estimates from forward stepwise multinomial logistic regression of Firefighters' action(s) in response to a cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015 (N= 760)‡

	Burned out, no action needed[a]				Action(s) taken by host[a]			
Predictors	**B**	**SE**	**Sig.**	**Exp(B)**	**B**	**SE**	**Sig.**	**Exp(B)**
Intercept	1.057	0.177	0.000		0.954	0.177	0.000	
Sex								
Female	-0.340	0.124	0.006	0.712	-0.101	0.123	0.413	0.904
Male[b]	0.000				0.000			
Age								
Less than 25	-0.386	0.114	0.001	0.680	-0.282	0.109	0.009	0.755
25-64 years	0.437	0.115	0.000	1.548	0.402	0.112	0.000	1.495
65 plus[b]	0.000				0.000			
Born abroad								
Canadian born	0.326	0.121	0.007	1.385	0.238	0.116	0.039	1.269
Non-Canadian born[b]	0.000				0.000			
Major act or omission								
Away from home	-1.195	0.181	0.000	0.303	-0.948	0.137	0.000	0.388
Inhibited response	-1.023	0.121	0.000	0.359	-0.962	0.123	0.000	0.382
Misuse of equipment	-0.387	0.107	0.000	0.679	-0.266	0.098	0.007	0.766
Failure to clean or cluttered area	-0.122	0.111	0.271	0.885	-0.391	0.131	0.003	0.676
Other specified factors	1.135	0.367	0.002	3.112	0.685	0.370	0.064	1.983
Distracted/forgot[b]	0.000				0.000			
Awareness of presence of incident								
Smoke alarmed sounded	0.525	0.118	0.000	1.691	0.370	0.115	0.001	1.447
Something else alerted host(s)[b]	0.000				0.000			
Location at time of incident								
In the kitchen	0.401	0.118	0.001	1.493	0.309	0.117	0.008	1.362
Somewhere else[b]	0.000				0.000			
Appliance providing heat source								
Oven	0.246	0.125	0.049	1.278	-0.035	0.129	0.784	0.965
Tabletop cooking appliances	0.120	0.113	0.292	1.127	-0.124	0.120	0.301	0.883
Stove[b]	0.000				0.000			
Object first affected/ignited								
Food item	0.296	0.122	0.016	1.345	0.327	0.119	0.006	1.387
Cooking oil/grease[b]	0.000				0.000			
Year of incident								
2014	-0.163	0.122	0.181	0.849	0.066	0.120	0.585	1.068
2015[b]	0.000				0.000			
-2 Log likelihood	**1250.143 (χ^2=383.587, df=30, p<0.001)**							
Cox and Snell R Square	**0.396**							
Nagelkerke R Square	**0.448**							

Note. [a]Baseline category= Action(s) taken by Firefighters; [b]Reference category. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001. All predictors were orthogonalized. The following predictors did not meet entry criteria: Confinement of cooking incident; neighborhood of residence; type of occupancy; season of the year; day of the week; and time of incident.

associated with cooking incidents requiring Firefighters' intervention. In contrast, hosts younger than 25 vis-à-vis their older counterparts 65 and older (reference category) were more likely to be involved in incidents requiring Firefighters' intervention in response to the cooking incident. Compared to their non-Canadian born counterparts, Canadian born hosts were significantly less likely to be involved in cooking incidents classified as requiring Firefighters' intervention.

The host's cooking behaviour that caused or started the incident was the most important predictor of the (log odds of) Firefighters' intervention in response to the cooking incident. Compared to cases in the category "distracted/forgot", incidents where the host was away from home while cooking was still going on or where the host was asleep, impaired by alcohol or drugs, or where the incident was caused by an unattended or unsupervised person were significantly more likely to require Firefighters' intervention. Similarly, cases where equipment was unintentionally turned on, set in the wrong setting or not turned off, or where the host knowingly continued using a suspected malfunctioning appliance were significantly more likely to be associated with incidents that required Firefighters' intervention. In turn, compared to cases in the category "distracted/forgot", cooking incidents associated with "failure to clean or a cluttered cooking area" were less likely to be classified as effectively being dealt by the host prior to firefighters' arrival ($p<0.01$), thus requiring Firefighters' intervention.

How hosts were first alerted of the incident was the second most important predictor of Firefighters' intervention in response to the cooking incident. If a smoke alarm alerted the host of the incident, the incident was less likely to require Firefighters' intervention. Similarly, cases where the host was in the kitchen at the time of incident were significantly less likely to require Firefighters' intervention.

Among the hazard agent risk factors, the appliance providing the heat source was an important predictor of Firefighters' intervention in response to the cooking incident. Incidents associated with the oven were more likely to be classified as "burned out, minor incidents", and not needing Firefighters' actions ($p<0.05$). Compared to cases where the cooking oil/grease was the first object affected or ignited, cooking incidents where food items were the materials first affected or ignited were less likely to require Firefighters' intervention. While the distribution of cases requiring Firefighters' intervention was very similar in the two years under study, there were fewer cooking incidents classified as "burned out, minor incidents" (i.e., not requiring Firefighters' intervention) in 2014 compared to 2015, with reported incidents being more likely to be classified as successfully dealt by host prior to Firefighters' arrival.

7.7.3. Predictors of Outcome or Escalation of Careless Cooking Incident

The multivariate analysis presented in this section is based on an ordinal/ordered logistic regression model, where the dependent variable (outcome of careless cooking hazard) was defined as follows: (1) No possibility of fire (i.e., minor, least severe); (2) Host prevented a fire (i.e., no incident); (3) host mitigated fire spread; and (4) Firefighters' action was required (i.e., major/significant, most severe). Since the dependent variable, an ordinal variable, provides information on the outcome or escalation of the careless cooking incident, a positive coefficient can be interpreted as indicating a more severe or escalated outcome (i.e., higher scores/categories in the dependent variable are more likely) whereas the converse is true when coefficients are negative (lower scores/categories in the dependent variable are more likely).

Age, sex, country of birth, major act or omission, how host became alerted of the incident, host's location at time of incident, appliance providing heat source and year of incident made unique contributions in the prediction of (ordered log odds of) the outcome or escalation of a cooking incident, after controlling for other variables (Table 22). The coefficient for female is

Table 22. Parameter estimates from stepwise ordered logistic regression of outcome or escalation of careless cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015 (N= 739)‡

Predictors	B	SE	Sig.
Outcome 1= No possibility of fire	-1.790	0.108	0.000
Outcome 2= Host prevented fire	-0.615	0.093	0.000
Outcome 3= Host mitigated fire spread	1.361	0.110	0.000
Sex			
Female	0.240	0.072	0.001
Male[b]	0.000		
Age			
Less than 25	0.264	0.072	0.000
25-64 years	-0.269	0.077	0.000
65 plus[b]	0.000		
Born abroad			
Canadian born	-0.207	0.074	0.005
Non-Canadian born[b]	0.000		
Major act or omission			
Away from home	1.105	0.138	0.000
Inhibited response	0.861	0.094	0.000
Misuse of equipment	0.251	0.071	0.000
Other specified factors	-0.498	0.078	0.000
Distracted/forgot[b]	0.000		
Awareness of presence of incident			
Smoke alarmed sounded	-0.346	0.072	0.000
Something else alerted host(s)[b]	0.000		
Location at time of incident			
In the kitchen	-0.177	0.071	0.012
Somewhere else[b]	0.000		
Appliance providing heat source			
Oven	-0.248	0.071	0.000
Tabletop cooking appliances	-0.150	0.071	0.034
Stove[b]	0.000		
Year of incident			
2014	0.196	0.072	0.007
2015[b]	0.000		
Log likelihood	**-838.126 (LR $\chi^2(13)=351.685$, p<0.001)**		
Cox and Snell R Square	**0.379**		
Nagelkerke R Square	**0.405**		

Note. [b]Reference category. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001. All predictors were orthogonalized. The following predictors did not meet entry criteria: Object first ignited; confinement of cooking incident; neighbourhood of residence; type of occupancy; season of the year; day of the week; and time of incident.

positive. That means it is associated with higher scores/categories on the dependent variable. Specifically, compared to their male counterparts, being female increased the likelihood of being in a higher escalation category ($p<0.01$). In contrast, the coefficient for Canadian born is negative, which means it is associated with lower escalation outcomes: Being Canadian born reduced the likelihood of being in a higher escalation category. Put differently, compared to their non-Canadian born counterparts, Canadian born hosts were significantly more likely to be involved in cooking incidents whose outcomes were minor (less severe) or that did not escalate ($p<0.01$). Compared to hosts 65 and older, being between the ages of 25 and 64 significantly decreased the likelihood of being in a higher escalation category ($p<0.001$). In turn, hosts younger than 25 vis-à-vis their older counterparts 65 and above (reference category) were more likely to be involved in cooking incidents that had higher escalation outcomes ($p<0.001$).

The host's cooking behaviour that caused or started the incident was the most important predictor of hazard outcome or escalation. Compared to cases in the category "distracted/forgot", incidents where the host was away from home while cooking was still going on ($p<0.001$) or where the host was asleep, impaired by alcohol or drugs, or where the incident was caused by an unattended or unsupervised person ($p<0.001$) were significantly more likely to be observed in a higher escalation category. Similarly, cooking incidents where equipment was unintentionally turned on, set in the wrong setting or not turned off, or where the host knowingly continued using a suspected malfunctioning appliance were more likely to be associated with higher escalation outcomes ($p<0.001$). Compared to cases in the category "distracted/forgot", observations associated with the "other" category had a decreased likelihood of being in a higher escalation category ($p<0.001$).

If a smoke alarm alerted the host of the incident ($p<0.001$) and the host was in the kitchen when the incident started ($p<0.05$), the cooking hazard event was less likely to be observed in a higher escalation category. Similarly, outcomes of cooking incidents associated with the oven ($p<0.001$) and tabletop cooking appliances ($p<0.05$) were significantly less likely to escalate. Compared to cases that occurred in 2015, cooking incidents that happened in 2014 were more likely to be observed in a higher escalation category ($p<0.01$).

7.7.4. Predictors of Severity or Seriousness of Careless Cooking Incident

Because the dependent variable is dichotomous ("yes" or "no"), binary logistic regression was used to predict the probability that an observation falls into one of the two categories of the outcome variable – severity of careless cooking incident– based on values of the selected host, hazard agent and environment predictors. As summarized in Table 23, age, major act or omission, how host became alerted of the incident, host's intervention behaviour, object first affected or ignited and neighbourhood of residence made unique contributions in the prediction of (log odds of) severity or seriousness of the careless cooking incident, after all other factors were controlled for.

Incidents associated with hosts aged less than 25 vis-a-vis those of hosts aged 65 plus (reference category) were more likely to be serious in nature ($p<0.05$), whereas cases associated with hosts between the ages of 25 and 64 (compared to those of older hosts) were less likely to be severe cooking incidents ($p<0.05$). The host's cooking behaviour that caused or started the incident was the most important predictor of the (log odds of) severity or seriousness of the cooking incident. Incidents were the host was away from home while cooking was still going on ($p<0.001$) or were the host was asleep, impaired by alcohol or drugs, or where the incident was caused by an unattended or unsupervised person ($p<0.001$) were considerably more likely to be associated with serious cooking incidents, after controlling for all other variables in the model.

Table 23. Parameter estimates from forward stepwise binary logistic regression of severity or seriousness of careless cooking incident, RFPS Residential Cooking Fire Data Form 2014-2015 (N= 767)‡

	B	S.E.	Sig.	Exp(B)
Intercept	-1.616	0.110	0.000	0.199
Age				
Less than 25	0.225	0.094	0.017	1.253
25-64 years	-0.240	0.094	0.011	0.787
65 plus[a]	0.000			
Major act or omission				
Away from home	0.634	0.086	0.000	1.885
Inhibited response (e.g., asleep, impaired, etc.)	0.611	0.083	0.000	1.843
Distracted/forgot[a]	0.000			
Awareness of presence of incident				
Smoke alarmed sounded	-0.297	0.099	0.003	0.743
Something else alerted occupant(s)[a]	0.000			
Action(s) taken by host prior to Firefighters' arrival				
No action taken by host	0.254	0.085	0.003	1.290
Action(s) taken by host[a]	0.000			
Object first affected/ignited				
Food item	-0.304	0.101	0.003	0.738
Combustibles	0.188	0.092	0.041	1.207
Cooking oil/grease[a]	0.000			
Neighbourhood of residence				
Central Zone	0.254	0.096	0.008	1.290
East Zone	0.283	0.098	0.004	1.327
West Zone[a]	0.000			
-2 Log likelihood	**627.719 (χ^2=157.846, df=10, p<0.001)**			
Hosmer and Lemeshow Test	**χ^2=7.175, df=8, p>0.05**			
Nagelkerke R Square	**0.290**			

Note. [a]Reference category. ‡Analysis excludes 36 home care facility cases; *p < 0.05, **p < 0.01, ***p < 0.001. All predictors were orthogonalized. The following predictors did not meet entry criteria: Host's sex and country of birth; location at time of incident; appliance providing heat source; type of occupancy; year of incident; season of the year; day of the week; and time of incident.

Cases where a smoke alarmed alerted the host of an incident were significantly less likely to be severe in nature ($p<0.01$). Actions taken by the host in response to the incident was the second most important predictor in the model. Specifically, compared to observations where the host intervened, cases in which the host did not take any action in response to the cooking incident were markedly more likely to be associated with serious incidents ($p<0.01$).

Compared to cases where the cooking oil/grease was the first object affected or ignited, cooking incidents where food items were the materials first affected or ignited were less likely to be severe ($p<0.01$), whereas cases where combustibles were the materials first affected or ignited tended to be more serious ($p<0.05$). Compared to cases in the West zone, cooking incidents occurring in central ($p<0.01$) and eastern ($p<0.01$) neighbourhoods of the city were more likely to involve serious incidents.

7.8. Cooking Incidents in Home Care Facilities

Table 24 summarizes some of the most important characteristics of cooking incidents that occurred in home care facilities (n = 34). Some of these cooking incidents happened in the same care facility over multiple times. For example, 12 out of 23 incidents where the name of the care facility was provided in the survey form happened in Facility #1. Ten of these 12 incidents were classified as “burned out, minor incidents” associated with a toaster. While the majority of these “repeat” cooking incidents often required no host or Firefighters’ interventions given their inconsequential nature, this trend is problematic not only because it puts pressure on limited Fire Department’s resources but it also desensitizes residents from following prompt evacuation procedures upon activation of a smoke alarm system. Residents and staff become complacent, and may eventually deem every smoke alarm activation as a likely “nuisance” alarm and fail to react quickly and safely to alarm cues.

Table 24. Characteristics of cooking incidents that occurred in home care facilities, RFPS Residential Cooking Fire Data Form 2014-2015

Facility	Year	Region	Act or omission	Host's location	How were occupants first alerted?	Appliance	Host's intervention behaviour	Firefighters actions	Severity
1	West	2014	High heat cooking	Somewhere else	Something else	.	.	No action required	No
.	West	2014	Distracted/forgot	In the kitchen	Smoke alarmed sounded	Oven	No action required	No action required	No
.	West	2015	High heat cooking	In the kitchen	Smoke alarmed sounded	Oven	Action(s) by host	Action(s) by host	Yes
1	West	2014	High heat cooking	Somewhere else	Something else	Tabletop appliances	.	No action required	No
.	West	2014	High heat cooking	Somewhere else	Something else	Tabletop appliances	.	No action required	No
1	West	2014	High heat cooking	Somewhere else	Something else	Tabletop appliances	.	No action required	No
1	West	2014	High heat cooking	Somewhere else	Something else	Tabletop appliances	.	No action required	No
1	West	2014	Other factors	Somewhere else	Something else	Tabletop appliances	.	No action required	Yes
1	West	2014	Distracted/forgot	Somewhere else	Something else	Tabletop appliances	.	No action required	No
1	West	2014	Distracted/forgot	Somewhere else	Something else	Tabletop appliances	.	No action required	No
1	West	2014	Distracted/forgot	Somewhere else	Something else	Tabletop appliances	.	No action required	No
1	West	2014	Distracted/forgot	In the kitchen	Smoke alarmed sounded	Tabletop appliances	Action(s) by host	Action(s) by host	No
1	West	2014	Distracted/forgot	Somewhere else	Something else	Tabletop appliances	.	Action(s) by RFPS	Yes
1	West	2015	Other factors	Somewhere else	Smoke alarmed sounded	Tabletop appliances	No action required	No action required	No
1	West	2015	Unsupervised person	In the kitchen	Smoke alarmed sounded	Tabletop appliances	No action by host	No action required	No
.	West	2014	Distracted/forgot	Somewhere else	Smoke alarmed sounded	Stovetop	Action(s) by host	Action(s) by host	No
5	West	2015	Other factors	Somewhere else	Smoke alarmed sounded	Stovetop	No action required	.	.
.	South	2014	Distracted/forgot	In the kitchen	Something else	Stovetop	Action(s) by host	No action required	No
.	South	2014	Distracted/forgot	Somewhere else	Something else	Stovetop	No action by host	No action required	No
.	South	2014	Distracted/forgot	Somewhere else	Smoke alarmed sounded	Stovetop	Action(s) by host	Action(s) by host	No
.	South	2014	Distracted/forgot	In the kitchen	Something else	Stovetop	Action(s) by host	Action(s) by host	No
.	South	2015	High heat cooking	In the kitchen	Smoke alarmed sounded	.	Action(s) by host	Action(s) by host	No
2	South	2014	Distracted/forgot	Somewhere else	Something else	Tabletop appliances	.	No action required	No
2	South	2015	Other factors	In the kitchen	Smoke alarmed sounded	Tabletop appliances	No action required	No action required	No
2	South	2015	Other factors	In the kitchen	Smoke alarmed sounded	Tabletop appliances	No action required	No action required	No
.	South	2014	Distracted/forgot	Somewhere else	Smoke alarmed sounded	Stovetop	Action(s) by host	Action(s) by RFPS	Yes
3	North	2015	Other factors	In the kitchen	Something else	Tabletop appliances	No action required	.	.
5	North	2015	Other factors	In the kitchen	Smoke alarmed sounded	Tabletop appliances	No action required	No action required	No
5	North	2015	Distracted/forgot	In the kitchen	Smoke alarmed sounded	Tabletop appliances	Action(s) by host	Action(s) by host	Yes
.	North	2014	Distracted/forgot	In the kitchen	Something else	Stovetop	Action(s) by host	Action(s) by host	No
3	North	2015	Distracted/forgot	In the kitchen	Smoke alarmed sounded	Stovetop	No action required	.	No
3	North	2015	Distracted/forgot	In the kitchen	Smoke alarmed sounded	Stovetop	No action by host	No action required	No
.	East	2014	Appliance malfunction	In the kitchen	Smoke alarmed sounded	Tabletop appliances	No action required	No action required	Yes
.	Central	2014	Distracted/forgot	Somewhere else	Smoke alarmed sounded	Stovetop	Action(s) by host	Action(s) by RFPS	Yes
4	Central	2015	Failure to clean	In the kitchen	Smoke alarmed sounded	Stovetop	Action(s) by host	Action(s) by RFPS	No
4	Central	2015	Distracted/forgot	Somewhere else	Something else	Stovetop	Action(s) by host	Action(s) by RFPS	Yes

8. APPLICATION OF RESEARCH FINDINGS

8.1. Highlights: Major Findings

Careless cooking is an ongoing and serious problem in the City of Regina, one the Fire Department is working to curtail through the development of relevant educational programs. Regina Fire & Protective Services (RFPS) delivers a comprehensive performance-driven, evidence-based public education program mandated to identify evolving community fire risks, and provide relevant fire- and life-safety educational programming to high-risk groups, with the aim of changing unsafe behaviours (RFPS Standards of Cover 2015). Lack of systematic data on careless cooking fires and their associated risk factors have made it difficult to recognize trends, allocate resources effectively, and develop appropriate strategies to prevent or mitigate these incidents. Without data, it is not possible to quantify the prevalence of the careless cooking problem, determine its associated risk factors, and identify how widely certain factors or circumstances are represented in the population. It is therefore not possible to produce effective, evidence-based educational programming and interventions to influence behavioural change. The research project has provided detailed data on 884 cooking incidents involving the Fire Department in 2014 and 2015. Analyses of these data provided crucial information that will lead to effective educational programming to modify the unsafe cooking practices demonstrated by the identified target groups.

The findings support past empirical studies that identified the host's careless cooking behaviour as the leading cause of fire incidents. The host's acts (actions) or omissions (inactions) were relevant to every stage of a cooking fire-related incident. This human risk contributing factor was the most important predictor of:

- Host's intervention;

- Firefighters’ actions;
- Incident outcome (e.g., whether the cooking incident became a fire); and
- Severity of cooking hazard.

The findings also pinpoint the important role of a working smoke alarm in predicting host intervention to prevent a fire or mitigate the effect of fire once it started, reducing the need for Firefighters’ intervention and the incident’s resulting damage. That being said, in every regression model considered, host’s major act or omission that caused or started the incident was the most important predictor (by far) of the host’s and Firefighters’ intervention efforts in response to the cooking incident, the outcome of the incident, and the hazard severity. In short, it is people who cause cooking incidents, therefore, it is people who can prevent them.

In relating these findings to theoretical formulations to develop improved life and fire-safety and public education initiatives, we reiterate the importance of a firefighting paradigm shift from a traditional, reactive model to an interactive, holistic approach that acknowledges the human dimension of careless cooking– that is, the impact of sociodemographic and behavioural characteristics of hosts on the circumstances and outcomes of cooking incidents. As the findings show, the host’s cooking behaviour(s) that caused or started the incident, and the host’ intervention behaviour in response to the incident, can either mitigate or exacerbate the outcomes of these careless cooking incidents. The study findings also echoed previous empirical findings which identified the host’s demographic characteristics (e.g., age, sex and country of birth), type of occupancy and neighbourhood of residence as significant predictors of the host’s behaviour(s) before and during the cooking incident as well as differential hazard risk causation and severity of resultant outcomes of these cooking incidents among certain high-risk segments of the population. In short, in line with Rhodes and Reinholtd’s (1998) observations based on their analysis of risks of residential fire fatality in Australia, this research project “also revealed that there are usually several [human, hazard agent and environment] factors which together define the vulnerability and therefore compound the risk” (41). The challenge is to create and deliver effectively evidence-based public education fire-safety and fire prevention recommendations and strategies that will be relevant to the different at-risk groups identified in this research, recognizing that different groups may respond better to different emphases (Ahrens et al. 2007:21).

8.2. Development of Educational Programming to Change Unsafe Cooking Behaviours

After identifying the circumstances, risk factors and outcomes of the target problem, namely the persistent residential fires caused by careless cooking behaviours in the city, the next steps in the development of educational programming aimed at decreasing the risk of cause, spread and severity are to:

- Identify target audiences.
- Develop educational messaging specific to the unsafe cooking behaviours identified by the research project for each target audience.
- Identify and enlist community partners.
- Develop and implement educational delivery models for each target audience.
- Evaluate the impact of this educational programming.

8.2.1. Target Audiences: Characteristics and Behaviours

The research project has completed the first step of this development process by identifying the following target audiences, by behaviour type:

- Young people (below age 25);
- Seniors (65 and older);

- Adults (ages 25 to 59);
- Adult males;
- Newcomers;
- Residents living in apartment buildings; and
- Residents living in central neighbourhoods.

8.2.1.1. Young Hosts: Below Age 25

Findings from the research project indicate that older teens and young adults were more vulnerable to the more serious effects of cooking incidents. More specifically, this population group generally did not know how to intervene to prevent a fire or mitigate its effects once in progress. Younger hosts were more likely to use ineffective and potentially unsafe actions and activities, which increased their risk of injury and often failed to prevent incident escalation or mitigate its severity. The young hosts were also involved in cooking incidents that were more severe in nature and required Firefighters' intervention.

8.2.1.2. Senior Hosts: 65 and Older

The research project points out that seniors were particularly vulnerable to the effects of cooking incidents. While the overall incident numbers for seniors were lower compared to their middle-aged counterparts, those cooking incidents that did involve seniors were often more severe in nature. In line with previous research (e.g., Wijayasinghe 2012), seniors were significantly more likely to be associated with cases where no action was taken by the host in response to the incident, and compared to their middle-aged counterparts, they were more likely to require Firefighters' intervention and more likely to experience more severe cooking incident outcomes. Several factors account for the elderly's higher risk of incident severity: they are known to have a lower prevalence of smoke detectors; they may be hearing impaired, and not hear the smoke alarm; they are often mobility impaired, slowing or completely preventing escape; and they may use older appliances, or live in older homes, introducing a higher risk of residential fire (e.g., Warda et al. 1999).

8.2.1.3. Adults: Ages 25 to 59

Middle-aged individuals, as a proportion of the general population, experienced the most cooking-related incidents. This finding suggests that this group is quite vulnerable to careless cooking, especially considering that individuals in this age bracket are not among those who spend the most time cooking. In fact, findings from the 2010 Canadian General Social Survey showed that individuals aged 65 and older spent the most time cooking of all Canadians. For example, individuals 65 to 74 and those 75 and over spent on average 50 to 70 and 55 to 80 minutes daily cooking over a seven-day week, respectively (Statistics Canada 2011:18-19). In turn, individuals 25 to 34, 35 to 44, and 45 to 54 spent 40 to 60, 48 to 68, and 44 to 65 minutes daily cooking, respectively (ibid:14-17). Individuals below the age of 25 spent on average 18 to 42 minutes daily cooking over a seven-day week (ibid:13).

Adults in this age group are the most time-stressed of all Canadians, providing a plausible explanation for this finding. A Statistics Canada (2011) study, based on analysis of the 2010 Canadian General Social Survey, found that 41 per cent of Canadians aged 25 to 34, 47 per cent of Canadians aged 35 to 44, and 40 per cent of Canadians aged 45 to 54 reported “feeling constantly under stress trying to accomplish more than … [they] can handle” (27). In comparison, just 35 per cent of individuals 24 years old or younger reported feeling time-stressed, and only 15 per cent and 10 per cent of seniors aged 65 to 74 and 75+, respectively, reported feeling time stressed (ibid:27).

The findings also illustrate that this age group is most likely to successfully intervene in preventing incident escalation and fire spread. Although this target group experienced the highest actual number of cooking incidents, these incidents often required less (or no) Firefighters' intervention as opposed to those incidents caused by their younger or senior counterparts, indicating that this adult target group is more likely and able to successfully intervene to prevent a fire or mitigate its outcomes once in progress.

8.2.1.4. Male Hosts: Intoxication and Sleeping Behaviours while Cooking

As past research suggests (see, for example, Barnett 2008), men's proclivity toward risk-taking behaviour results in their higher vulnerability to fires and their related outcomes. The results of the project corroborate male hosts' increased likelihood to engage in risk-taking behaviours while cooking. Specifically, males were markedly over-represented among cooking incidents where the host was cooking under the influence of alcohol or drugs. Males were also more likely to be associated with incidents where the host was sleeping while cooking was still going on. While together these two types of reckless behaviours accounted for less than 10 per cent of all cooking incidents in the two-year study period, these incidents: were significantly more likely to be associated with no, or delayed and ineffective, host's action(s) in response to the cooking hazard; were more likely to require considerable Firefighters' intervention; and were more likely to escalate and be severe in nature.

8.2.1.5. Newcomers

The research project's results show that Regina's newcomers were more vulnerable to careless cooking in terms of both numbers of incidents experienced as a proportion of their population base, and in terms of the incident outcome as defined by the actions taken by Firefighters and the escalation and severity of the cooking incident. The bivariate findings show that, compared to their Canadian counterparts, non-Canadian born hosts were more likely not to intervene in response to a cooking incident, and were less likely to be associated with "burned out, minor incidents" that did not require host intervention. In the multivariate analysis, however, being born abroad was not a significant predictor of host's intervention, which means that the impact of country of birth was indirect through its impact on other factors such as host's cooking behaviour and type of cooking involved. In both the bivariate and multivariate results, non-Canadian born hosts were less likely to be represented in cases where no Firefighters' interventions were required, even after controlling for other predictor variables. The converse was also true: They were significantly more likely to require Firefighters' intervention compared to their Canadian counterparts. They were also more likely to be associated with cooking incidents that escalated.

Bivariate results show that non-Canadian born hosts were more likely to be associated with severe cooking incidents. However, once all variables were controlled for, country of birth was no longer a significant predictor. This means that host's country of birth affected the severity of the cooking incident through its impact on other factors. For example, being born abroad influenced host's cooking behaviour, with non-Canadian born hosts being markedly more likely to leave the residence while cooking was still going on, a problematic and dangerous behaviour that affects the safety of others, including other household occupants, neighbours and Firefighters. Non-Canadian born hosts were also more likely to cook with oil and grease, and to be associated with cases in which no action was taken by host in response to the incident. Once these were controlled for in the multivariate model, the impact of country of birth was considerably attenuated, which means that these were three potential underlying mechanisms explaining how country of birth indirectly affected severity of a careless cooking incident.

These findings point to the need for further research into the underlying causes of these disparities among Canadian and non-Canadian born hosts, particularly into the cultural and social influences which formed cooking behaviours among newcomers before their arrival to Canada. Similarly, research into the building construction and materials of residences in newcomers' countries of origin is required, as initial discussions in the field are showing that these also influence cooking behaviours transferred to different types of building construction in Canada. Culture could be another challenge, with some ethnic groups discouraging women, who in many cases are the homemakers, from speaking to authority figures, including Firefighters (see also, Tennant 2014).

Social, economic, cultural and behavioural risk factors interact, compounding each other's effects, increasing the vulnerability to fire risk of newcomers, especially among individuals of lower socioeconomic status, such that they are repeatedly exposed to the hazard and its resulting outcomes. For instance, various studies (e.g., Taylor-Butts 2015) provide empirical evidence that low socioeconomic status often exists at the intersection of a number of factors that exacerbate fire-risk and its outcomes including: lack of economic resources to prevent fire (for example, inability to purchase and maintain fire-safety technology and/or safe cooking equipment); lack of social resources to mitigate fire (for example, a network of reliable individuals to turn to in an emergency event); and, finally, lack of personal, or "internal" resources (for example, self-esteem) to both prevent a fire and mitigate the effects of one once it starts. In relation to this, Neelu Sachdev, the executive director of the Regina Immigrant Women Centre, argued that while "[newcomers] know the ins and outs of the kitchen, … they do not know … how to ensure … they can operate some of the gadgets and the appliances safely" (Silva 2015). Particularly, switching from gas to electric stoves can pose a significant challenge, with new users unintentionally leaving electric stoves on since there is no flame visible or the sound of gas to remind them the stove is on.

Put differently, risk factors that increase the likelihood of a severe cooking incident define the vulnerability of people to the careless cooking hazard (e.g., Rhodes and Reinholtd 1998). Given the human dimension of this vulnerability, it becomes apparent that mere technological solutions and advances are not enough to mitigate the effects of careless cooking on vulnerable populations. Rather, systemic issues – such as racism, discrimination, cultural barriers and the economic and social exclusion of immigrants – must be addressed to fundamentally alter hazard vulnerability. It is imperative RFPS continue forming and strengthening its outreach partnership efforts with external organizations and agencies that support newcomers' integration to help them with life skills training related to fire-safety. We concur with Neelu Sachdev, who pointed out that, "[f]ire safety is not something that they may have had education on before or any conversations on before, … it's just a whole new ballgame" (Silva 2015).

8.2.1.6. Residents Living in Apartment Buildings

The bivariate results showed that cooking incidents which occurred in apartments were close to three times more likely to require Firefighters' actions in response to the cooking incident and be classified as severe. However, once all predictors were controlled for in the regression models, type of occupancy failed to reach statistical significance in predicting Firefighters' intervention, hazard outcome and severity of cooking incident, which means that some of these predictors acted as underlying mechanisms explaining how type of occupancy indirectly affected these three outcomes. In other words, type of occupancy was operating through its impact on some of these other predictor variables.

The findings, both bivariate and multivariate, showed that hosts residing in apartments were significantly less likely to take any action in response to the cooking incident, which points to the need to further define these residents' demographics and characteristics in terms of their "knowledge, perception, culture, experience, environment, and attitudes" that could potentially impact whether they will engage in life and fire-safety intervention behaviours (Berard-Reed and Vastis 2015).

8.2.1.7. Residents Living in Central Neighbourhoods

As Jennings (1996) notes, "treating fires as individual unconnected occurrences obscures lessons that could be learned from analysis on a neighbourhood scale" (6). When grouping the research project data by metropolitan area, the findings showed that the greatest number of cooking incidents occurred in the most economically depressed area of the city, the "Central Zone" – comprised of the neighbourhoods of Al Ritchie, Gladmer Park, Heritage, Cathedral, Eastview, Downtown, and North Central. A quarter of these cooking incidents happened in North Central (25.3%). Statistics Canada's 2011 National Household Survey revealed that almost half (45%) of all North Central's residents aged 15 or older earned $19,999 or less annually in 2010, a rate almost 1.5 times that of the Regina population (30%) (City of Regina's Neighbourhood Profiles 2015:9). Roughly over one-third of North Central families were lone parents (34%) and lived in households below the low-income measure (34%) in 2010 compared to 19 per cent and 13 per cent in Regina as a whole, respectively (ibid:8, 10). Almost half (44%) of the population in North Central identified as Aboriginal in 2010, compared 10 per cent in Regina (ibid:10). Other factors that contribute to North Central's higher fire risk vulnerability include having some of the city's smallest and oldest homes, with the highest proportion of rental properties and transient rate.

The economic and social marginalization of Aboriginal Canadians is well-documented. In 2010, based on analysis of Statistics Canada 2011 National Household Survey, the median (after-tax) income for Aboriginal people was just over $20,000 compared to $27,600 for their non-Aboriginal counterparts (Statistics Canada 2015:26). That is, on average, Aboriginal Canadians earned only 72 per cent of what non-Aboriginal Canadians earned annually. Analysis of the 2011 National Household Survey also revealed that irrespective of education attained, Aboriginal people were still less likely than non-Aboriginal people to be employed, with "[a] gap of 5 percentage points … between the employment rates of Aboriginal people (76.2%) and of the non-Aboriginal population (81.1%) for those with a high school diploma and a postsecondary certificate, diploma or degree, compared to a gap of 13 percentage points (62.5% versus 75.8%) when all levels of education [we]re accounted for" (Statistics Canada 2015:22). Aboriginals are four times more likely than non-Aboriginal Canadians to experience food insecurity, are significantly more vulnerable to chronic disease, and are significantly less likely to attain high-school education (e.g., Raphael and Mikkonen 2010).

The fact that the greatest number of cooking incidents occurred in the Central Zone, specifically in the North Central neighbourhood, corroborate existing literature that points to socioeconomic status as a key determinant of hazard risk and vulnerability (e.g., Duncanson et al. 2002; Jennings 2013; Barnett 2008; Miller 2005). Vulnerable populations – such as residents of Regina's North Central neighborhoods and newcomers – experience high risk of careless cooking due to their lack of economic and social capital. And, when conceptualized using Haddon's Matrix, the risk faced by these individuals can be seen pervading every time-stage of the careless cooking hazard (Rhodes and Reinholtd 1998). For many individuals, lacking economic capital precludes the purchase and maintenance of safe, quality cooking equipment, and acts as a barrier to the possession and maintenance of fire-safety measures such as smoke alarms, which directly contribute to creating a physical environment conducive to fire causation and spread. This may be somewhat mitigated in Regina, where the current Fire Bylaw requires landlords and property owners to install and maintain hard-wired smoke alarms in rental properties. Research also shows that individuals who lack economic capital are more likely to be socially isolated, and thus have few people to rely on for financial or emotional help during, and after, a fire incident (Taylor-Butts 2015), which negatively impacts hazard mitigation and recovery.

In addition, research has shown that self-confidence plays a role in emergency preparedness and mitigation: Individuals with high-self esteem tend to take a more positive view of their capabilities in an emergency event, and are more likely to engage in emergency preparedness activities (Taylor-Butts 2015). This finding is significant, particularly because a meta-review of the relationship between socioeconomic status and self-esteem found that, on average, individuals with higher levels of economic and social capital have greater self-esteem (Twenge and Campbell 2002).

Jennings' (2006, 2013), among other scholars (e.g., Asgary et al. 2010; Chhetri et al. 2010), stressed the value of aggregate data in revealing trends not observable at the individual level. A next step in the research collaboration will be the examination of careless cooking incident rates at the aggregate level. Specifically, we will examine aggregate data of residential cooking incident rates and their causes to assess the relationship between levels of socio-economic disadvantage and underlying socio-economic characteristics at small area level, and the risk of fire incidence and negative outcomes (e.g., severity, property damage, etc.) of careless cooking hazard. By analyzing the incidence of careless cooking occurring within particular communities, it is possible to identify common factors present within communities that can be targeted by fire-safety education and awareness campaigns.

8.2.2. Fire Intervention Behaviours

The research project findings show that people often intervened to prevent a fire or mitigate its effects once started, with nearly six out of ten hosts taking one or more actions in response to the cooking incident. Specifically, host intervention played a large role in successfully preventing a cooking fire (n = 160, 19.3%), or mitigating the outcomes of cooking incidents while these were still small (n = 254, 30.6%). The research project findings suggest that if people had not dealt with these cooking incidents on their own, these could have escalated or spread. The data also showed that hosts who were unable to intervene – due to physical impairment (seniors, intoxicated persons) or physical displacement (away from the kitchen or the home) – were the most vulnerable to the most severe effects or outcomes of careless cooking incidents. Supporting Brennan and Thomas' (2001) proposition, the findings of this study highlight the interactive, rather than reactive relationship that humans have with cooking incidents. Analyses of the data revealed that rather than simply becoming aware of a cooking incident, individuals implicated in these occurrences had an agentic, interactive relationship with the cooking hazard, both in their initiatory roles (for example, through carelessness, intoxication, or ignorance) and their post-ignition responses. Similar conclusions were reached by other researchers in the field (e.g., Thompson and Wales 2015; Wales and Thompson 2013). Human agency is a powerful causal force in terms of a careless cooking incident's ignition, spread, and severity.

Education must target not only prevention of fire start, but also fire intervention behaviours. The research project findings stress the importance of quality fire intervention education to promote safer intervention behaviours. This is especially important considering that the findings show a tendency among many hosts to try to prevent a fire or fight a fire once started, and that almost half (n = 227, 45%) of the behaviours engaged in by hosts were demonstrably unsafe or inappropriate.

People want to "tackle or mitigate the effects of" their home fires for a variety of reasons. It is important to ensure they know the difference between when it is safe to do so and when it is not (for similar conclusions see also, Thompson and Wales 2015; Wales and Thompson 2013). This is succinctly elaborated upon by Tennant (2014) who argued:

> As public educators, we cannot stress enough the importance of … people understand[ing] that homes burn eight times faster than they did 30 years ago. We have all encountered situations in which people have experienced small fires in their homes and their first reaction is to try extinguish[ing] them – and they believe they can. Occupants attempt to put out fires using extinguishers or garden hoses, but the modern, synthetic materials burn so quickly that the fire fight becomes a losing battle. We know that in the 1980s residents may have had up to 15 minutes to evacuate, considerably longer than they do now – clearly, in many cases, they don't understand (22).

Findings of a qualitative, exploratory pilot study in Kent, UK, also showed a clear tendency among interviewees who reported interacting with the fire by taking one or more actions to attempt to curtail their home fires themselves (Thompson and Wales 2015).

The prevalence of host's intervention in residential cooking fires, as well as its deleterious impacts on individual's safety, have been documented previously (see, for examples, Ahrens 2015; Ontario Office of the Fire Marshal 2009; Thompson and Wales 2015; Wales and Thompson 2013). Host intervention is dangerous not only in the risks it poses in terms of injury and fatality, but also because when uninformed or poorly informed, the host's attempt to suppress a fire can exacerbate, rather than mitigate, the outcomes or effects of an incident (NFPA 2011). For example, based on a qualitative pilot study with ten interviewees who had experienced injuries in "accidental" dwelling fires, Thompson and Wales (2015) found that, “because of a lack of understanding and awareness of the potentially rapid development and effects of smoke, interviewees attempted to tackle or otherwise mitigate the fires in their homes with, at best, very limited knowledge, or assessment, of the possible risks inherent in such actions” (459). Particularly relevant here is examining individuals’ sense of “self-efficacy” that, if actions were to be taken in response to the cooking incident, do they believe they could successfully prevent a fire or mitigate its effects once in progress? Seen as such, and in line with Berard-Reed and Vastis’ (2015) conclusion, one of the programmatic implications of these findings is that “[p]eople need skills, resources, and support … to believe … they will be able to successfully engage in the [prevention and intervention] behaviour.” Therefore, “consistent, sound, and realistic” recommendations on when and how to intervene are needed (Ahrens et al. 2007:4).

There are many messages which are contradictory about the best way to handle cooking incidents. These messages can leave people unsure about how to proceed, or even lead to demonstrably unsafe actions and activities that can make a bad situation worse. To complicate matters, there is little detailed empirical research on the relative effectiveness or the relative fire injury risks associated with different approaches to handling small residential fires, despite widespread acknowledgement in the relevant fire literature of people’s predisposition to intervene in the presence of a fire incident and the potential danger associated with ineffective host intervention (e.g., Thompson and Wales 2015; Wales and Thompson 2013). In relation to this, Wales and Thompson (2013) succinctly noted, “This means that the fire service has no formal understanding of, or indeed empirical evidence to support, stated assumptions about the way people behave in a dwelling fire” (97). Thus, many of the decisions required to develop program recommendations on how to handle and possibly fight cooking incidents must be made at the best judgments of experts rather than evidence-based research (Ahrens et al. 2007; Wales and Thompson 2013). It is imperative to develop and disseminate targeted fire intervention and suppression education specific to cooking incidents among those most commonly implicated in cooking incident hazard, namely adults ages 25-59, those least likely to take any action in response to the incident, such as residents living in apartment buildings, and those most commonly affected in terms of incident escalation and severity and requiring Firefighters' intervention, including new immigrants, seniors, and young people. The educational programming and strategies associated with these results are further elaborated upon in Section 8.2.3.

8.2.3. Application of Successful Education Models to the Unsafe Cooking Fire Behaviours in the City of Regina

The findings of this study will form the foundation for public education programming aimed at changing unsafe cooking behaviours among the identified target audience groups in Regina. More specifically, the programming will concentrate on how individuals can prevent cooking fires in the first place, and given what the research is showing us, how they can more effectively intervene to mitigate fire progression. The expected outcome is decreased fire risk or vulnerability for the target groups, in terms of both fire start and fire severity. This cannot be simply accomplished through mass media campaigns to the general public. Education needs to be specific to the behaviours of the target populations identified by the research in order to be meaningful to them, thereby increasing the likelihood of changes to their unsafe behaviours.

This evidenced-based approach proved successful in decreasing other types of fire risks in certain target groups in Regina in the past. For example, young preschool-aged children were at a heightened fire risk due to fire play behaviours involving matches and lighters. The specific behaviours were identified and analyzed, which in turn allowed the Fire Department to pinpoint the specific gaps in knowledge leading to this fire risk. Educational programming and strategies were developed to fill this knowledge gap. Programming was implemented, and the fire risk for this high-risk population group dropped significantly and has remained at low levels.

In the present collaboration, the *Residential Cooking Fires Research Project* (RCFRP) has provided the research partners with data specific to the behaviours causing careless cooking incidents in the city, and the behaviours affecting the scope of their impact. This information will be used, in the same way as the detailed, evidence-based behaviour information concerning child-caused fires was used, to inform successful educational programming aimed at decreasing careless cooking risk and its resultant outcomes. The research project will also result in data collection methods that will be incorporated into the Fire Department's existing processes for long-term collection and educational programming evaluation.

8.3. Conclusion: Where Do We Go from Here?

Fire services across North America are tasked with providing an array of services designed to protect its citizens from a large variety of risks. Responding to these risks requires equipment and highly trained personnel. This costs money.

RFPS' 2016 budget was $41.8 million. Of this, approximately $350,000, or less than one per cent (0.84%), was directly allocated to public education, excluding Suppression and Rescue resources, such as Firefighters' salaries, which support the public education program. In total, $1.4 million (or 3.32%) of the department's budget was allocated to all prevention services in 2016, including the Fire Inspection, Fire Investigation and Public Education programs. The limited funding available for educational programming must be allocated in the most efficient and effective way possible. Programming must be specific, targeted and evidence-based to be effective. Data from the present study will help ensure funding to fight careless cooking incidents and their resulting outcomes is used in the most effective manner.

The experience in Regina is that this type of targeted, evidence-based programming shows demonstrated results in decreasing life and fire-safety risks associated with residential fires. Fire services are challenged to balance the need to have trained personnel and equipment such as fire trucks to help people in immediate need with the responsibility to prevent those tragedies in the first place. It is people that cause fires. It is people who can prevent them. Targeted education has shown that with the right information and motivation, people can prevent fires. The fire service industry could be more effective in protecting its residents by balancing its limited resources with a greater emphasis on educational services, while still upholding its mandate to respond to emergent situations.

The research findings presented in this report are a component of a much larger collaborative research contribution. To reiterate, the results of the project will be used to inform the development of public education programming aimed at changing unsafe cooking behaviours that directly contribute to careless cooking hazard, severity, and outcomes among the identified target audience groups. Public education strategies will be developed to address each of these stages of the host-agent-environment interaction. The Haddon Matrix, which was used in this report to organize the various risk factors related to careless cooking across an incident time scale, can also be used to develop (and organize) effective strategies to prevent these incidents and to minimize their consequences when they do occur.

The implemented educational delivery models for each target audience will also need to be evaluated to quantify their impact in effecting positive change over time. Evaluation of public education programming requires data and ongoing analysis, which in turn may identify areas of success and any issues that require further attention. Increased attention to data standardization, completeness, relevance, accuracy and analysis are necessary for RFPS to more accurately identify and assess the fire issues in the community. One recommendation, with long-term implications for data collection on cooking incidents in the city, includes integration of the *Residential Cooking Fire Data Form* – developed to meet the objectives of the present project – into the RFPS FDM system.

More research devoted to the examination of the human dimension of careless cooking vulnerability is necessary, since as this and past research support, differential vulnerability to careless cooking incidents is largely based on a myriad of complex social mechanisms and structures. Hankivsky (2014) encompassed this by noting, “From an intersectionality perspective, what makes people vulnerable to. . . [hazards and disasters] is the result of multiple factors and processes that are linked together within systems of power” (17). Essentially, the varying degree to which certain hosts are vulnerable to careless cooking causation, escalation and severity is not random, but rather is an observable manifestation of economic, cultural and social inequalities pervasive in the population.

In response to this, the research project partners are interested in developing a broader understanding of the causes of residential cooking fires, their ignition sources, what objects ignited first and the behavioural factors associated with these fires nationally. Recently the research project partners were successful in obtaining funding from the CCFMFC and the CAFC. This funding is available for research projects using a newly formed National Fire Information Database (NFID), which collected and standardized a decade of fire records in Canada. This funding offers the research project partners a key opportunity to fill important gaps in the Canadian fire literature by undertaking secondary analysis of residential cooking fire incidents nationally and provincially. This will provide an opportunity to better understand the nature of residential fires and the injuries, death and property damage they cause, and to identify specific groups in the population at greater risk, to effectively address the various factors that define residential cooking fire risk and vulnerability.

In particular, analyses of the NFID data on cooking fires will feed and inform the current research efforts in the City Regina to identify and assess the fire-safety impact of careless cooking in the city compared to similar Canadian cities. Expanding the scope of the analyses to study national patterns and trends will enable us to place Regina's careless cooking problem and associated risks factors in a broader context. Echoing other Canadian scholars regarding the importance of having an ongoing, comparable Canadian fire database (e.g., Bounagui and Bénichou 2007, 2005; Wijayasinghe 2012, 2011; Maxim et al. 2010), we contend that examination of the NFID to study residential cooking fires will allow us to compare (and contrast) incident dynamics nationwide and jurisdictionally. We may learn that what may, at first, appear random, ambiguous, or unique at municipal and provincial levels is linked to emerging trends and issues nationally, effectively enhancing identification of high fire-vulnerable populations.

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Appendix A Survey Instrument

Regina Fire & Protective Services

Residential Cooking Fire Data Form

1. Alarm number: __________

Information Regarding the Person Cooking at Time of Fire

2. Age: ____________

3. Gender: Female Male

4.a. In what country was person born?_______
b. In what year did person first come to Canada?
____

5. Where was the person when fire started?
   - at the appliance
   - in the room
   - in another room
   - on the premises outside
   - away from home

6. Which factors may apply in this fire?
   - person asleep
   - distracted/forgot
   - mental disability
   - physical disability
   - impairment (alcohol/drugs)
   - other __________________________

7. Which actions were taken by occupants?
   - evacuated premises
   - attempted to extinguish, describe ______________________________
   - other, describe __________________

8. How were occupants first alerted to fire?
   - saw fire/ smoke
   - smelled smoke
   - smoke alarmed sounded
   - other, describe___________________

Information Regarding the Fire

9. Area of Origin
   - kitchen
   - other, describe __________________

10. Type of Cooking
    - pot on stovetop
    - deep fat/oil frying
    - pan frying
    - no cooking, burner was left on
    - kettle on stovetop
    - other, describe

11. Object First Ignited
    - cooking oil/grease
    - tea towel/cloth/pot holder
    - cooking utensil
    - apparel
    - food item
    - other, describe

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12. Secondary Object Ignited
    - cabinetry
    - curtains
    - clothing
    - other, describe

13. Factor contributing to ignition or spread of fire (one only)
    - cooking left unattended
    - children playing with stove
    - children playing around stove
    - burner left on after cooking
    - wrong burner turned on
    - appliance malfunction
    - loose fitting clothing
    - other, describe ________________

14. Extent of Fire
    - confined to appliance
    - confined to room
    - confined to same floor
    - confined to dwelling or suite
    - confined to building
    - spread beyond building

15. Action Taken
    - burned out, no action taken
    - extinguished by occupant
    - extinguished by RFPS
    - extinguished by automatic sprinkler
    - smoke extracted by RFPS
    - other, describe ________________

Information Regarding Damage and Loss

16. Number of People in Dwelling: __________

17. Estimated Dollar Loss: ____________

18. Total Injuries: ________________________

19. Total Fatalities: ______________________

IMPORTANT

- *Form to be completed after all cooking fire incidents by attending Captain.*
- *Please answer all questions. Data to be analyzed annually.*

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