

HAS FOODBORNE DISEASE OUTBREAK NOTIFICATION AND INVESTIGATION CHANGED SINCE THE LISTERIOSIS OUTBREAK IN SOUTH AFRICA? A REVIEW OF FOODBORNE DISEASE OUTBREAKS REPORTED TO THE NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES, MARCH 2018 - AUGUST 2020

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Summary

Foodborne diseases (FBD) remain an important but often neglected public health challenge globally. The listeriosis outbreak of 2017-2018 in South Africa highlighted the morbidity, mortality and socio-economic consequences that can result from a single event. Since July 2017, FBD outbreaks are reported to the National Institute for Communicable Diseases (NICD) through the Notifiable Medical Conditions (NMC) national surveillance system. A retrospective review and descriptive analysis of FBD outbreaks notified to the NICD through the NMC system following the identification of the listeriosis outbreak source in March 2018 was conducted. A total of 338 outbreaks was notified, of which 129 were investigated. Investigation reports of variable completeness were available for 76% (98/129) of the outbreaks. On average, FBD outbreaks were notified within two days. A total of 2 932 cases was reported, including 316 hospital admissions and 20 deaths. FBD outbreaks in household settings were most common (42%, 54/129), followed by outbreaks in institutional settings (36%, 47/129). Outbreaks were reported throughout the year, but in 2019 more outbreaks were reported in the cooler months. Only 14 outbreaks (11%, 14/129) were comprehensively investigated, with appropriate epidemiological, clinical, food/water and environmental investigations being conducted. The aetiology and source of the outbreak was identified in only five of the outbreaks which were investigated (4%, 5/129), all of which were due to nontyphoidal *Salmonella* (NTS) linked to informally slaughtered food animals. Deaths were reported in 16 outbreaks, and foodborne pathogens were

detected in most (75%, 12/16) of these, with *Shigella* spp. (58%, 7/12) being the most common, followed by NTS (25%, 3/12). The notification and investigation of FBD outbreaks has not improved following the listeriosis outbreak. Reporting practices and approaches to outbreak investigation are still highly variable among the provinces, and the major gaps in the successful investigation of such outbreaks in our setting include awareness, timely detection, prompt response, and appropriate sample collection and testing.

Introduction

The listeriosis outbreak of 2017 to 2018 in South Africa was an example of how a foodborne disease (FBD) outbreak can have catastrophic consequences, and underscored the need for improving food safety control and intervention in the country.¹

Africa has the highest burden of FBD per population worldwide, most of which are attributed to diarrhoeal disease agents. Several factors contribute to the high burden of FBD in this region: unsafe water used for the cleaning and processing of food; poor food-production processes and food-handling; inadequate food storage infrastructure; inadequate or poorly enforced regulatory standards; and a move to intensive animal husbandry practices as economies develop.²

In order to enable policy makers to set public health priorities and allocate resources for food safety concerns, accurate data on the extent and cost of FBD is required. The Centre for Enteric Diseases (CED) of the National Institute for Communicable Diseases (NICD) supports provinces and districts with the investigation of enteric disease outbreaks. The centre focuses on providing outbreak investigation support to better describe and understand the landscape of diarrhoeal disease and inform preventive public health measures.

The CED routinely follows up alerts of suspected diarrhoeal disease outbreaks and cases of epidemic-prone enteric diseases reported through the Notifiable Medical Conditions (NMC) surveillance system or other sources, and where needed provides support for epidemiological, environmental and laboratory investigations. Epidemiological support includes the collection of data on potential risk factors and sources of exposure from affected persons through interviews, conducting case-control studies where feasible, performing data analysis, and interpreting epidemiologic findings and laboratory results. Environmental investigations are undertaken by environmental health

practitioners from the health departments and includes the collection of relevant samples (e.g. food, water, environmental swabs) and inspection of food preparation or manufacturing premises to assess compliance with food safety standards and identify potential hazards. Testing of food, water and environmental samples is performed at specialised public health laboratories in the National Health Laboratory Service (NHLS) or at private laboratories, although the scope of pathogens and bacterial toxins tested for varies considerably among laboratories.

The aim of this review is to describe the FBD outbreaks notified to the NICD since the 2017-2018 listeriosis outbreak, in order to highlight any trends and identify challenges and opportunities to improve FBD outbreak reporting and investigation.

Methods

A retrospective review and descriptive analysis of FBD outbreaks reported through the NMC system and from district and provincial outbreak investigation reports submitted to the NICD from March 2018 to August 2020 was performed.

Results

Between March 2018 and August 2020, 337 outbreaks were notified to the NICD through the NMC surveillance system. A total of 129 outbreaks (38%, 129/337) was investigated in which there were 2 932 cases, including 319 hospital admissions and 20 deaths. Investigation reports of variable completeness were available for 98/129 (76%) of the outbreaks. On average, the outbreaks were notified within 2 days of being diagnosed from health facilities.

Outbreaks were reported from all of South Africa's provinces, with KwaZulu-Natal Province reporting the most (five outbreaks per 1000 000 population), followed by Gauteng, Limpopo and Free State provinces, each reporting two outbreaks per 1000 000 population (Figure 1). Outbreaks were reported throughout the year, with no consistent seasonal pattern (Figure 2).

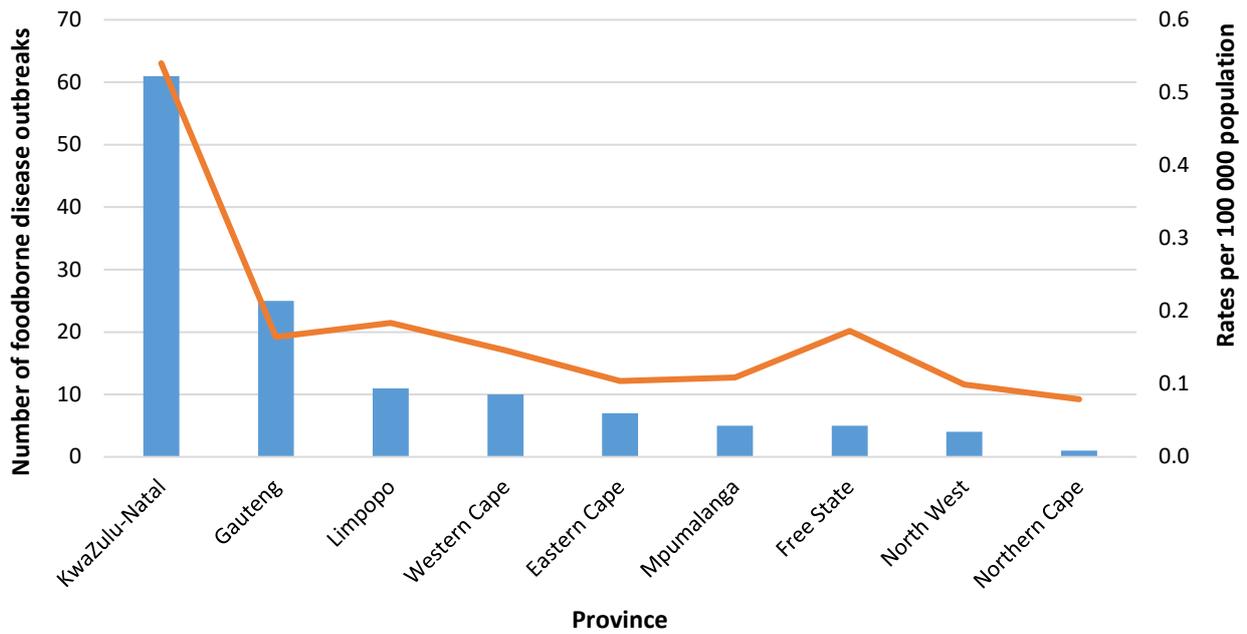


Figure 1. Rates of foodborne disease outbreaks (per 100 000 population) reported to the National Institute for Communicable Diseases (NICD) by province, South Africa, March 2018 - August 2020 (n=129).

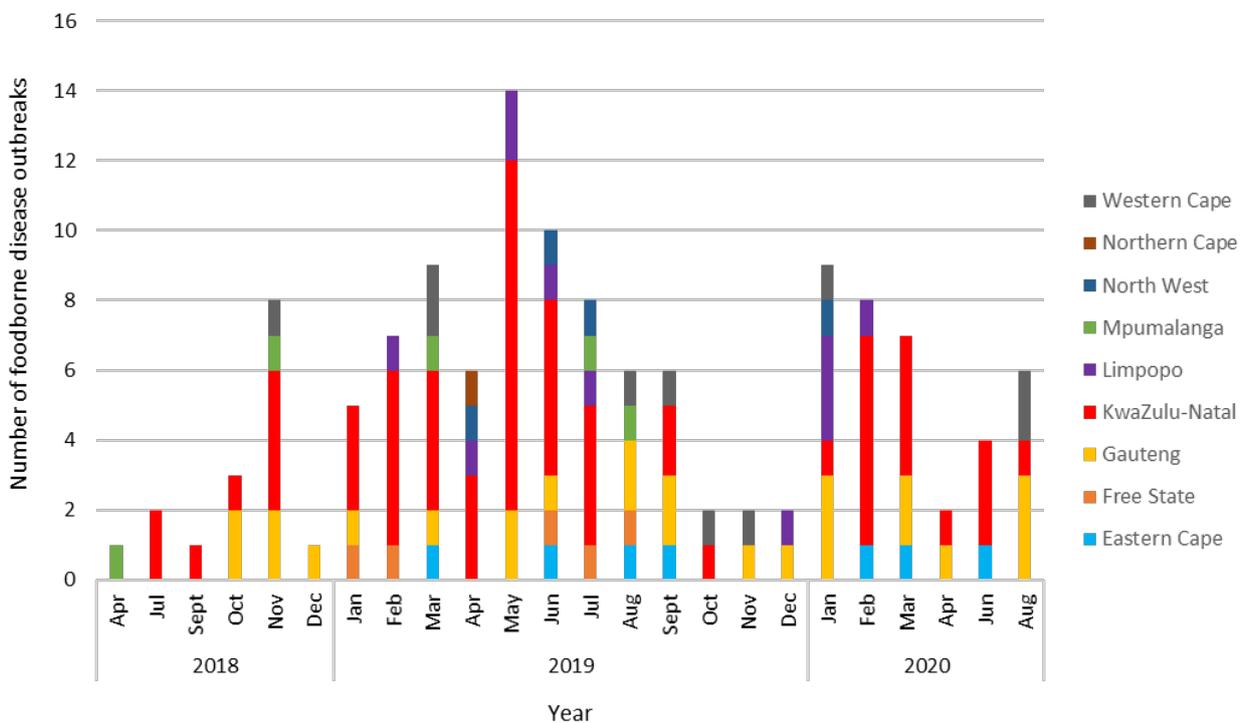


Figure 2. Number of foodborne disease outbreaks reported to the National Institute for Communicable Diseases (NICD) by month and province, South Africa, March 2018 - August 2020 (n=129).

More outbreaks were reported during the period April to December 2019 as compared to the same period in 2018 (56 vs 16 outbreaks respectively). Fewer outbreaks have been reported in 2020 to date (n = 36) compared to the same period in 2019 (n = 65).

Information on the outbreak setting was available for 121 outbreaks (94%): 44% (54/121) occurred in households, 39% (47/121) in institutional settings (including schools, universities, day-care centres and correctional services facilities), and 7% (9/121) at large social gatherings.

Twenty fatalities were reported from 16 outbreaks, most of which (75%, 12/16) occurred in the household setting (Figure 3). The causative pathogens were identified in the majority of the 16 outbreaks (75%, 12/16), and *Shigella* spp. was responsible for 58% (7/12) of these, followed by nontyphoidal *Salmonella* (NTS) (25%, 3/12).

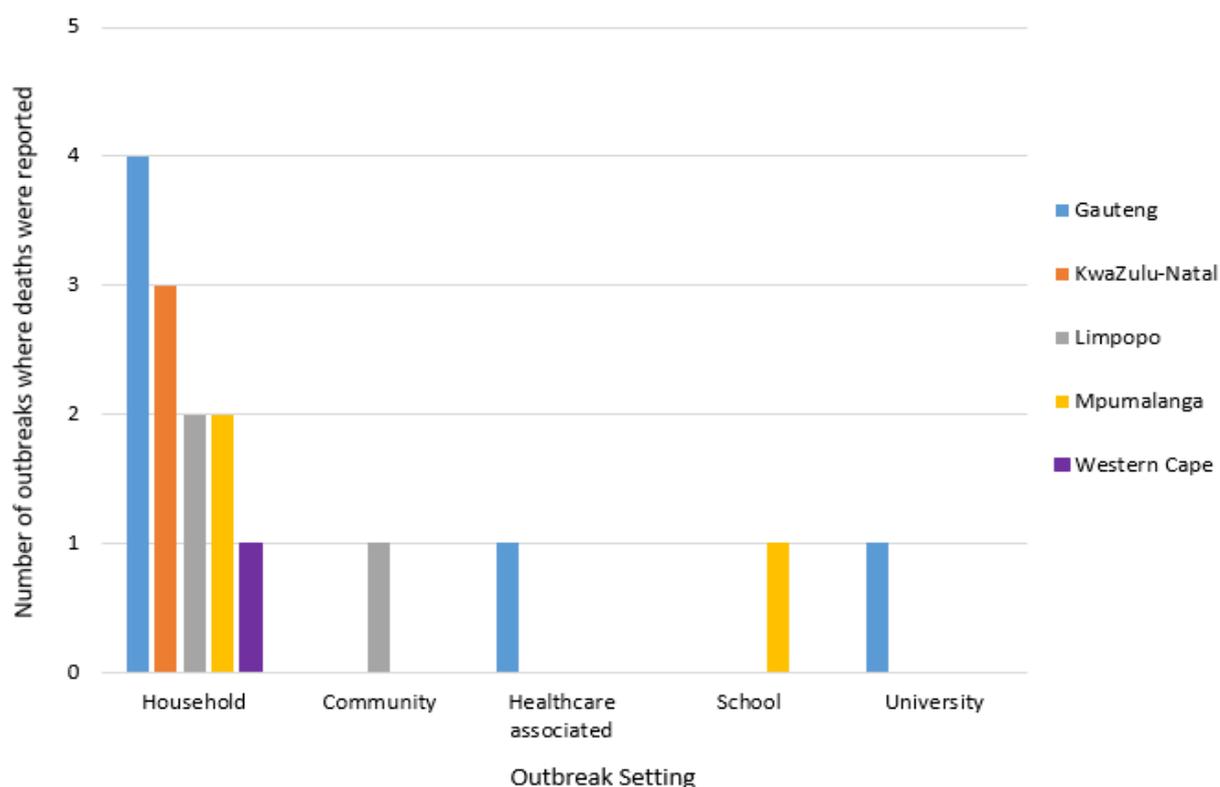


Figure 3. Number of foodborne disease outbreaks with deaths reported to the National Institute for Communicable Diseases (NICD) by province and outbreak setting, South Africa, March 2018 - August 2020 (n=16).

Data on age and gender of case-patients were often not reported and are not included in this review. Information on risk factors including food consumption history was obtained by patient interview in 76% (98/129) of the outbreaks investigated. Such epidemiologic data must however be complemented by appropriate laboratory testing of environmental and clinical samples (and trace-back investigations, where applicable) in order to definitively identify the vehicle and source of the outbreak. Where information was available, clinical samples were collected and tested in 63% (71/113) of the outbreaks, and food samples were submitted for testing in 22% (22/101) of the outbreaks.

Comprehensive epidemiological, laboratory and environmental investigations were conducted in only 11% (14/129) of the outbreaks investigated. NTS was the pathogen most commonly isolated from stool samples (42%, 27/64) followed by *Shigella* spp. (19%, 12/64) and *Salmonella typhi* (5%, 3/64). NTS was also the most common pathogen isolated from food samples (36%, 8/22). Of the 14 comprehensively investigated outbreaks, the outbreak vehicle or source was proven in five (38%) of which all were due to NTS (detected from clinical and food samples) associated with meat from informally-slaughtered food animals.

Discussion and conclusions

Of the FBD outbreaks reported, several recurring themes and risk factors were noted. A substantial proportion of reported outbreaks occurred in the household setting, where it is likely that unsafe food storage and handling practices played an important role. Health education on food safety practice in the home is therefore a critical public health intervention that needs urgent attention.

Nontyphoidal *Salmonella* was the most commonly identified foodborne pathogen, and in most outbreaks was linked to food of animal origin and associated with informally-slaughtered food animals. There is a clear need for targeted health education in communities where informal slaughtering of food animals is common, and also a need to explore local surveillance strategies in a One Health context.³

Laboratory investigations of clinical and food/environmental samples differ among the testing laboratories. For example, testing for enterotoxin-producing bacteria (including *Bacillus cereus*, *Staphylococcus aureus* and *Clostridium perfringens*) is not routinely offered at clinical diagnostic

laboratories and in some of the public health laboratories (within the NHLS) that test food and environmental samples. Testing for viral foodborne pathogens in food/environmental samples is also not routinely available at NHLS public health laboratories or private laboratories, and testing for viral foodborne pathogens in stool samples is not available at most NHLS clinical laboratories. This is a critical limiting factor in that the scope of pathogens tested for is typically very restricted, and therefore a range of foodborne pathogens will not be detected even if they are present. For example, norovirus is one of the most common causes of FBD outbreaks worldwide.¹ and therefore one would expect to see many norovirus FBD outbreaks each year. The fact that norovirus was not identified in any of the FBD outbreaks reported in South Africa over the last two and a half years is merely a reflection of the lack of testing for this pathogen, not its true absence.

Shonhiwa *et al.*⁴ reviewed the FBD outbreaks reported to the Outbreak Response Unit at the NICD from 2013 to 2017. Despite the listeriosis outbreak of 2017 to 2018 bringing food safety and FBD outbreaks to the fore, there has not been a noticeable improvement in the notification and investigation of FBD outbreaks since then. The major gaps in the FBD notification and investigation process remain the same: lack of awareness and underreporting by healthcare workers, delayed (or lack of) response to such outbreaks, lack of appropriate clinical and environmental sample collection and testing, and the variable scope of testing performed at different laboratories.

Prompt and comprehensive FBD outbreak investigation and response remains a challenge countrywide; standardised notification and outbreak investigation practices, as well as appropriate clinical and food/environmental sample collection and laboratory testing for relevant pathogens, are key to identifying the causes and contributing factors of FBD outbreaks.

Limitations of this review include the use of secondary data from the NMC system and district outbreak investigation reports. Although better data are needed for the purposes of estimating FBD burden and informing major policy and public health interventions, targeted health education is an important intervention that can easily be implemented and could prevent many FBD outbreaks.

Acknowledgements

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