Eskom

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Date: 22 February 2024
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Dear Dr Gwaze,

JANUARY 2024 MONTHLY PROGRESS REPORT ON THE POSTPONEMENT OF MINIMUM EMISSION STANDARD CONDITIONS FOR KUSILE POWER STATION: REF: LSA223027

ESKOM WAS ISSUED A MINIMUM EMISSION STANDARDS (MES) POSTPONEMENT IN RESPECT OF KUSILE'S SO_2 LEVELS BY THE DFFE ON 5 JUNE 2023. THE VARIED ATMOSPHERIC EMISSION LICENCE (AEL) WAS ISSUED BY THE NKANGALA DISTRICT MUNICIPALITY ON 13 JUNE 2023. BOTH THE MES APPROVAL AND THE AEL ALLOW ESKOM TO OPERATE THE TEMPORARY STACKS WITHOUT FGD. THE APPROVALS ARE ISSUED SUBJECT TO SEVERAL CONDITIONS, INCLUDING THAT ESKOM IMPLEMENT MEASURES TO MINIMISE THE IMPACT ON HUMAN HEALTH.

This letter provides an update on key issues, including specific reporting requirements identified by the authorities in the various approvals for the Kusile temporary stacks project. Monitoring and mitigation is being implemented as far as practical in line with the programme in the Kusile Power Station Temporary Stack Monitoring Framework approved by the authorities on 18 September 2023.

It had been agreed with the department that progress reports are to be submitted on or be the 20th of the month going forwards.

As an initial point, I would like to confirm that no exceedances of the stack or ambient trigger level conditions were recorded during January 2024.

1. **Progress of repairs of permanent stacks for the duration of the operation of the temporary stacks.**
    I. The target date for the recovery of the West stack remains 31 December 2024.

II. Unit 1 Vertical Flue Cleaning will start on 22 February 2024.
III. Detailed Schedules for Recovery and Repairs was received by 26 January 2024.
IV. Alimak operation is not possible during windy conditions and wind direction can result in flue gas contamination at the top of the stack from units 1 or 3 preventing safe access to the stack. Total delays experienced from October 2023 is 32 Days.
V. The Permanent Stack recovery progress report is attached (**Annexures A1 and A2**).

2. Temporary Stack Emission Monitoring

Continuous Emission Monitoring (CEMS):

I. Unit 1, 2 and 3 CEMS are installed and commissioned.
II. Particulate Matter (PM) correlation and Gaseous emissions parallel tests for Units 1 and 3 were completed, and the required curves were implemented in January 2024. Units 1 and 3 September – December 2023 monthly emissions reports are being reproduced using valid curves and will be resubmitted once finalized.
III. Unit 2 PM correlation and Gaseous emissions parallel tests are delayed; the Unit is being operated at 71% due to challenges on milling plant. tests will be done by 31 March 2024.
IV. Efforts to fast-track completion of Unit 2 correlation and parallel tests have been undertaken. Progress has been delayed due occasional plant breakdowns during planned testing periods, and the need to ensure quality-controlled process outcomes in the analysis.

Stack Performance:

I. The Kusile Monthly Emission report for January 2024, which includes emission data for Units 1,2, 3 and 4 is attached **(Annexure B**).
II. As indicated, the emission reports for Units 1, and 3 will be updated after the correlation test are completed and correlation factors implemented.
III. **Based on the available information, all Kusile units operated in compliance with the AEL emission limits for PM, NOx or SO_2** during January 2024.
IV. Fall out dust (fugitive dust) reports are submitted to the licensing authority on or before 30th of every month as per Atmospheric Emission License condition. December 2023 report was submitted on the 19 January 2024.

3. Health Screening for the increased SO_2 emission and associated health impacts

I. INFOTOX was appointed on 18 September 2023 to collect data for the Eskom health screening and monitoring on selected communities around the Kusile Power Station.
II. To assist with the execution of the campaign, INFOTOX appointed the Bureau of Market Research (Pty) Ltd (BMR) to conduct a research study, which aimed to liaise with households to register as Community Health Ambassadors directly. Accordingly, the BMR approached adult household members to register as Community Health Ambassadors and concurrently participate in a health screening survey. Both adults and children qualified as data subjects, with the child cohort constructed as follows:

- 0 to 5 years (preschool children).
- 6 to 12 years (primary school children).
- 13 to 17 years (secondary school children).

III. BMR targeted a sample of 1,200 households located within 50 km of the Kusile Power Station. The stratified sampling plan included Gauteng and Mpumalanga clusters near the Kusile Power Station.

IV. The spatial distribution of the household sample included two receptor communities in the Gauteng Province and six in the Mpumalanga Province of South Africa.

V. During the execution of the research study, the BMR adhered to strict research ethical guidelines and applicable national legislation, including the Protection of Personal Information Act (also referred to as the POPI Act or POPIA). To align with research ethics principles, participation in the study was voluntary and all household and personal information was treated confidentially during the data collection process. Households were guaranteed that their personal information would only be used for the Eskom Campaign.

VI. Prior to interviewing, adult consent and child (13-17 years) assent were obtained and recorded on the paper-based questionnaires which were designed by the INFOTOX and BMR team. Separate survey instruments were designed for the four household cohorts. These included:

- An adult household questionnaire focusing on adult health.
- A parent-administrated child (0-5 years) questionnaire focusing on respiratory symptoms in preschool children (0 to 5 years).
- A parent-administrated child (6-12 years) questionnaire focusing on respiratory symptoms in primary school children.
- A child (13-17 years) administrated questionnaire focusing on respiratory symptoms in secondary school children.

VII. To date, Eskom has completed the broad community screening exercise on health issues for the area, interviewing some 2365 respondents. The work done has identified sensitive or vulnerable groups and individuals.

VIII. the intervention has also secured 1203 households and 1 545 Community Health Ambassadors who will support Kusile in executing the Communication and Emergency Response plan.

IX. Efforts to establish an Institutional Health Ambassador register with schools, clinics, hospitals, retirement villages, local municipalities and civil society agencies have been unsuccessful to date, with only 2 of 80 identified institutions having registered thus far.

X. The Community Health Ambassadors will share the information from Eskom with household members, family and their network of friends if the emissions of SO_2 from the Kusile temporary stacks are higher than usual. In these instances, Eskom communications will recommend to stakeholders steps to protect respiratory health and what to do if they experience shortness of breath or difficulty breathing.

XI. The detailed Eskom Community Respiratory Health Screening Report is attached (Annexure C). Database of the Health Ambassadors has been compiled.

XII. A communication system is being developed to enable communication with the health ambassadors in the various receptor areas.

XIII. An SMS system will be used to communicate with the Ambassadors in the receptor areas.

XIV. A toll-free line will be established for community members who would like to call in with concerns (for heath related information)

XV. Engagement with specific businesses in the area will take place.

XVI. A notification has been sent to those specific businesses, still awaiting response from them.

4. Occupational Health and Hygiene status

4.1. Continuous SO_2 Perimeter Monitoring:

I. Daily monitoring of the plant perimeter for SO_2 surges was conducted throughout January 2024.
II. SO_2 levels along the perimeter remained below detection levels, meeting the statutory requirement of 0.5 ppm OEL-STEL/C.
III. No exceedances of the ambient SO_2 or PM2.5 standards were recorded at the Chicken Farm, Phola, Wilge or Balmoral ambient air quality stations in January 2024 (see below for more on the recorded ambient air quality levels).

4.2. Continuous Personal Exposure Sampling:

I. Two Senior Plant Operators underwent personal exposure sampling for SO_2 during January 2024.
II. Their exposure levels were consistently below detection levels and compliant with the statutory requirement of 0.5 ppm OEL-STEL/C.

Table: Personal Exposure Sulphur Dioxide Concentration from July 2023 – January 2024

Month	Number of samples	Areas Sampled	Designation	Concentration (ppm)	Status	Comment(s)
July 2023	-	-	-	-	-	No samples taken.
August 2023	3	FGD	Senior Plant Operator	< 0,5	Complaint	Concentrations below OEL
September 2023	3	FGD	Senior Plant Operator	< 0,5	Complaint	Concentrations below OEL.
October 2023	3	FGD	Senior Plant Operator	0,16	Complaint	SO_2 gas detected at K4 absorber's upper levels.
November 2023	3	FGD	Senior Plant Operator	0,13	Complaint	SO_2 gas detected at K4 absorber's upper levels.
December 2023	3	FGD	Senior Plant Operator	< 0,5	Complaint	Concentrations below OEL.
January 2024	3	FGD	Senior Plant Operator	< 0,5	Complaint	Concentrations below OEL.

4.3. Conclusion:

Our continuous SO2 perimeter monitoring, and personal exposure sampling generally indicated compliance with regulatory limits with no ongoing issues. We will continue to monitor and investigate any anomalies to ensure the safety and well-being of both our workers and the surrounding community.

4.4. Recommendations:

I. Quarterly training and awareness programs for employees and contractors to ensure prompt reporting of any unusual odors or emissions.
II. Continued collaboration with the onsite Environmental department to ensure compliance with regulatory requirements and prompt response to environmental concerns. The environmental department will share CEMS information, and the

occupational hygiene team will highlight personal monitoring results to environmental team and confirm if the two readings (CEMS & Hygiene Survey) are in synergy.

5. Stakeholder Engagement Plan and Status

Stakeholders	Method of engagement	Involvement	Status
Employees	• Awareness sessions Leadership briefings (GM's address) Employee engagements	• Once a month • Every Friday Monthly	Complete
Local Municipalities • Emalahleni • Victor Khanye • Bronkhorstspruit	Face-to-face meeting	Once a quarter	March 2024
Media • Emalahleni FM • Witbank News	• Advert • Print	When required	Eskom media desk to publish

6. Ambient Air Quality Monitoring

I. In order to better assess compliance with national ambient air quality standards, identify potential sources of pollution, protect public health and the environment and establish a baseline for future mitigation measures Eskom has installed additional ambient air quality monitoring stations at Balmoral and Wilge. The existing air quality monitoring stations (Kendal, Phola and Chicken Farm) will complement the additional monitoring sites to reduce uncertainties and improve the understanding of air quality issues in the area.

II. The Balmoral and Wilge monitoring stations are equipped to monitor ambient concentrations of sulphur dioxide (SO_2) continuously. In addition, meteorological parameters of wind velocity, wind direction and ambient temperature, humidity, ambient pressure and rainfall, amongst others, are also recorded. The following parameters, nitrogen dioxide (NO_2), ozone (O_3) and fine particulate matter of particulate size <10µm and particulate size <2.5µm in diameter (PM10 and PM2.5) will be monitored from March 2024.

III. The data for this reporting period (01 – 31 January 2024) were analyzed for ambient SO_2 as monitored at Balmoral, Chicken Farm, Phola and Wilge air quality monitoring stations. The Particulate Matter and NO_2 data were further analyzed for Chicken Farm and Phola with Ogies will be commissioned in March 2024.

IV. There was one (1) exceedance of the SO_2 10-minutes limit of 191 ppb recorded during the monitoring period at Wilge air quality monitoring station (11 January at 14:10). There were no exceedances of the ambient SO_2 limits recorded for other monitoring station during the monitoring period under review.

V. No events that triggered stakeholder notification in terms of the agreed Acute Exposure Guideline Levels (emergency incident trigger) were recorded in January 2024.

VI. There were no exceedances of the NO_2 hourly limit of 106 ppb recorded at the monitoring stations during the January 2024 monitoring period. There were six (6) exceedances of the PM_{10} daily limit of 75 µg/m³ and five (5) exceedances of $PM_{2.5}$ daily limit of 40 µg/m^3 recorded at Chicken Farm monitoring station respectively and

one (1) exceedance of $PM_{2.5}$ daily limit of 40 µg/m^3 recorded at Phola monitoring station.

VII. The highest recorded SO_2 concentrations recorded at the Kusile stations are illustrated in Table 1 below. National Ambient Air Quality standards in ppb are shown in brackets (National ambient air quality standards for SO_2 - 10-min 191 ppb, hourly 134 ppb and daily 48 ppb).

Table 1 Highest SO_2 concentrations recorded (in ppb)

Monitoring Stations	10-min average (191)	Date	Hourly average (134)	Date	Daily average (48)	Date
Balmoral	**112.5**	**09/01/2024 14:20**	**68.5**	**09/01/2024 03:00**	**11.6**	**23/12/2023**
Chicken Farm	**137.3**	**10/01/2024 14:50**	**103.3**	**10/01/2024 03:00**	**15.7**	**01/12/2023**
Phola	**125.6**	**11/01/2024 14:30**	**60.0**	**11/01/2024 03:00**	**14.7**	**28/12/2023**
Wilge	**198.4**	**11/01/2024 14:10**	**57.3**	**04/01/2024 11:00**	**17.2**	**28/12/2023**

VIII. Station stack emissions were well within the normal AEL compliance ranges on 11 January 2024 when the ambient 10- minute SO_2 exceedance was recorded at the Wilge air quality monitoring station (PM less than 20 mg/Nm^3 and SO_2 less than 1800 mg/Nm^3).

IX. Good representative percentage data was recovered for all the parameters monitored during the monitoring period under review at the monitoring stations, except for Phola which experienced several challenges. There was no NO_2 analyser at the Phola monitoring station since it became faulty and was removed for repairs and to be returned to service in February. The data recoveries for $PM_{2.5}$ and PM_{10} were low at the Phola monitoring station due to faulty instrument and are currently undergoing repairs in the air laboratory and to be returned to service in March 2024.

X. A further monitoring station will be commissioned in Ogies in April 2024 as per commitments.

XI. The raw monitoring data, downloaded at 1-minute averages, is available in real-time to the DFFE-managed South African Air Quality Information System (SAAQIS) since the 14th of December 2023 for all Eskom air quality monitoring sites.

XII. The detailed January 2024 Kusile ambient monitoring report is attached (Annexure D).

7. Poultry Health Monitoring

I. A service provider had been appointed for Kendal Poultry monitoring per the condition of environmental authorisation (record of decision) and the MES approval. Execution of the monitoring is on hold due to the outbreak of Avian Influenza.

II. In December 2023 and January 2024, Kendal Poultry provided updates indicating that the outbreak is improving. In January 2024, they indicated that discussions would be held with State Vet on lifting the quarantine and that Eskom would be updated as to when monitoring can commence.

III. Meeting with Kendal Poultry on the progress status is scheduled for the 06 February 2024.

MONTHLY PROGRESS REPORTS ON THE POSTPONEMENT OF MINIMUM EMISSION STANDARD CONDITIONS FOR KUSILE POWER STATION: REF: LSA223027

8. Animal Health Monitoring

I. Engagements with Topigs and GHB Farms regarding animal/pig health monitoring continue. Topigs and GHB farms provided Eskom with environmental and animal health monitoring proposals on 10 October 2023.
II. These were reviewed by Eskom (utilising North-West University as specialist advisors), and comments were returned on 1 December 2023.
III. Based on further engagements during early December 2023, updated proposals have been tabled for consideration.
IV. Eskom responded to an updated proposal received from Topigs and GHB Farms on 13 December 2023, which was followed by correspondence from Topigs and GHB Farms on 18 December 2023, and Eskom responded on 21 December 2023. Engagements between the parties re-commenced mid-January 2024.
V. Engagements are ongoing to have this matter resolved, though is taking longer than anticipated due to technical and administrative complex.

9. Emergency preparedness and response

I. There has been no incidence of exceedance that required emergency response from Kusile Power Station, however the Emergency Response Team (ERT) remain on high alert.
II. The ERT is in regular communication with Emalahleni Local Municipality Emergency Services as per the Mutual Aid Agreement.
III. Emalahleni Local Municipality Emergency Services representatives in Disaster Management, Fire and Emergency Services, and Environment were added in Kusile Power Station Distribution List for regular updates.
IV. All other Service Level Agreement (SLA's) with relevant stakeholder (Kendal Power Station) remain in force for duration of the temporal stack.

In conclusion, I believe the above illustrates that Eskom is committed to complying with the conditions of the approvals granted with respect to the Kusile temporary stacks. Eskom is implementing measures to ensure that it understands its impact and can limit its operations' environmental and health impact. Further, where full implementation of the conditions is not yet completed, Eskom is working with focus to ensure the remaining issues are resolved as soon as possible.

I hope the above is in order. Please contact our team if you require any further information.

Yours sincerely

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Christopher Nani
ACTING GENERAL MANAGER
KUSILE POWER STATION

DATE: 23 Feb 2024

MONTHLY PROGRESS REPORTS ON THE POSTPONEMENT OF MINIMUM EMISSION STANDARD CONDITIONS FOR KUSILE POWER STATION: REF: LSA223027

List of annexures

Annexure A1: Kusile Permanent Stack Recovery progress status – January 2024
Annexure A 2: Kusile West Chimney Recovery Project – January 2024
Annexure B: Kusile Monthly Emission Report –January 2024
Annexure C: Kusile Community Respiratory Health Screening Report
Annexure D: Kusile Ambient Air Quality Report – January 2024

Kusile Power Station
West Chimney Recovery Project

February 2024

Permanent Stack Remediation – Critical Activities

- The **Permanent Stack Remediation** involves the following activities: Establishing **stability within the stack** for safe access.
  - **Installation of an Alimak** external to the stack to allow access to “safe areas”. - Complete
  - **Stabilise compromised levels**: This will be executed by specialist riggers & the associated design and method statements will be produced by ICC. - 151m level stablised/complete, 55m level stabilization in progress,
  - **Cleaning of the Stack and Flue Internals:** Rockent Industrial Services has been identified as subcontractor to assist with this initiative. - In Progress
  - **Fabrication of damaged members and flues** as required -this scope will likely be executed by the temporary stack fabricators. - In Progress
  - **Outages:** to re-connect units to permanent stack (tentative planned).
- **Projected completion** date is envisaged to be **31 December 2024.** (however, dependent on various current unknowns)

Note: A critical activity was the stabilization and load transfer of the 151m level which was successfully completed in November 2023. Stack and Flue internal cleaning trials have commenced in December 2023. Based on the results a project plan will be detailed in January 2024.

Figure 7: 55m, 151m & 180m Platforms – Cameras Installed to Visually Monitor Equipment

Figure 5: 151m Platform Beam – Draw-wire to Measure Deflection

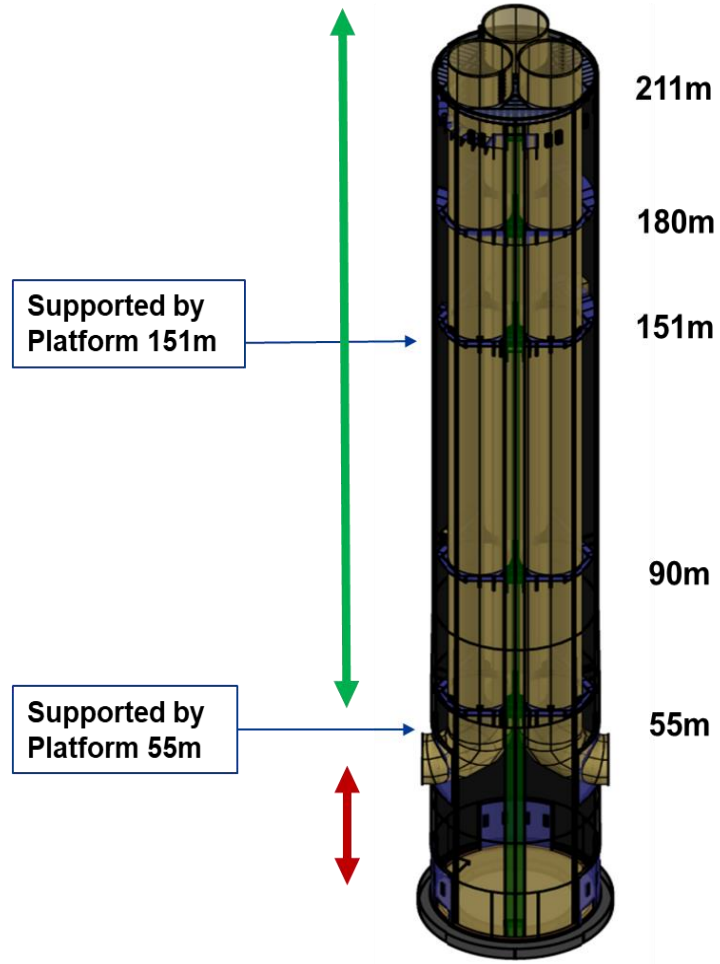
Permanent Stack Remediation - Progress

Platform 151m load transfer:

- Jacking/Load Transfer Methodology – The Final methodology report has been submitted with all identified risks having been fully investigated and mitigation actions taken. Completed on 12 October 2023
- Installation of monitoring equipment support brackets completed at both 151m and 180m platforms. Completed
- 151m Support Brackets – analysis and strengthening post load transfer in progress. Completed
- Installation of jacking platform to commence once load distribution equipment Completed
- Jacking system activate on Unit 1 vertical flue. Completed
- Activation on units 2 & 3 is planned for 4 & 5 November 2023. Completed
- Load transfer from 151m to 180m was scheduled for the 7th of November - Load transfer successfully executed 08 November 2023. The overall stability of chimney west has been established.

55m Level:

- Engineering design and rigging analysis will be based on the success of the load transfer and flue cleaning.
- Preliminary design and rigging concepts discussed with design engineers. Concept proposals for the 55m platform and lobster bend stability to be compiled and submitted for discussion at technical review meetings.
- Rigging studies to be considered for the lobster bend removal and replacement constructability based on the success of the load transfer and flue cleaning.



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Dr P. Gwaze
National Air Quality Officer
Department of Forestry, Fisheries and Environment
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Date: 13 February 2024

Enquiries: S Mahlangu
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Monthly Progress Report for Kusile Power Station West Stack Recovery February 2024:

#	Activities	Status	Start Date	End Date
1.	Clean Horizontal Ducts units 1-3	100%	22 Nov 2023	29 Jan 2023
	Head Frame for Flue Cleaning			
2.	Fabrication	100%	20 Nov 2023	12 Jan 2024
3.	Installation	90%	10 Jan 2024	15 Feb 2024
	Secure Lobster Bends			
4.	Secure Lobster bend K2-3	20%	12 Feb 2024	29 Feb 2024
	Internal lift (Alimak)			
5.	Move Alimak from ground level to 90 ML	100%	5 Feb 2024	5 Feb 2024
6.	Get the internal Alimak operational to 90 ML	100%	6 Feb 2024	12 Feb 2024
	Vertical Flue Cleaning unit 3			
7.	Erect Scaffold to Lobster bend 3	100%		27 Nov 2023
	Clean Lobster bend 3	0%	26 Feb 2024	28 Feb 2024
	Clean Vertical Flue 3	0%	29 Feb 2024	12 April 2024

Notes:

West Stack:

- The target date for the recovery of the West stack remains the 31 December 2024.
- Detailed schedule for recovery and repairs was received on 26 January 2024.

Risks & Issues:

- Alimak operation is not possible during windy conditions and wind direction can result in flue gas contamination at the top of the stack from units 1 or 3 preventing safe access to the stack.
    - Total delays experienced from October 2023 is 32 Days

Correlation Tests:

- Unit 3 Done, Results available 14 December 2023.
- Unit 1 Done, Results available 22 December 2023.
- Unit 2 spot check is scheduled for 15 February 2024 since the unit cannot currently achieve full load.

Trust you find the above in order.

Kind Regards,

……..
Zandi Shange
General Manager - Kusile Power Station Project

Eskom

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Date:

February 2024

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Tel: +27 13 699 7817

Ref: *Kusile Power Station AEL (17/4/AEL/MP311/12/01)*

Dear Ms. Simelane

KUSILE POWER STATION'S MONTHLY EMISSIONS REPORT FOR JANUARY 2024

This serves as the monthly report required in terms of Section 7.6 in Kusile Power Station's Atmospheric Emission License: 17/4/AEL/MP311/12/01. The emissions are for the month of January 2024.

Hoping the above will meet your satisfaction.

Yours sincerely

Christopher Nani
ACTING GENERAL MANAGER
DATE: 15 February 2024

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1. KUSILE POWER STATION MONTHLY EMISSIONS REPORT: Atmospheric Emission License 17/4/AEL/MP311/12/01

2 Raw Materials and Products

Raw Materials and Products	**Raw Material Type**	**Units**	**Max Permitted Consumption Rate**	**Consumption Rate Jan-2024**
	Coal	Tons	*1 818 083*	*551 166*
	Fuel Oil	Tons	*5 533*	*2890.158*
	Limestone	Tons	*72 917*	*4468*
Production Rates	**Product / By-Product Name**	**Units**	**Max Production Capacity Permitted**	**Indicative Production Rate Jan-2024**
	Energy	GWh	*3 214.080*	*1 064.559*
	Ash	Tons	*663 583*	*169 759.131*
	Gypsum	Tons	*129 250*	*2 502.080*
	RE PM	kg/MWh	*not specified*	*0.075*
	RE SOx	kg/MWh	*not specified*	*7.183*

3 Energy source characteristics

Fuel Characteristic	Units	Stipulated Range	Monthly Average Content
Coal CV	MJ/kg	*not specified*	*19.800*
Coal Sulphur	%	*1.3*	*0.857*
Ash in Coal	%	*38*	*30.800*
Fuel Oil Sulphur	%	*3*	*2.580*
Ash in FO	%	*0.02*	*0.028*

4 Emissions Limits (mg/Nm³)

Associated Unit/Stack	PM	SO_2	NOx
North	*50*	*3500*	*750*
South	*50*	*1000*	*750*

5 Abatement Technology (%)

Associated Unit/Stack	Technology Type	Efficiency Jan-2024	Utilisation Jan - 2024	Technology Type	Utilisation Jan 2024	Efficiency Jan-2024
Unit 1	*FFP*	*99.943*	*100*	*FGD*	*100*	*Out of service*
Unit 2	*FFP*	*99.996*	*100*	*FGD*	*100*	*Out of service*
Unit 3	*FFP*	*99.923*	*100*	*FGD*	*100*	*Out of service*
Unit 4	*FFP*	*Off*	*Off*	*FGD*	*Off*	*Off*

Note: Both the FFP and FGD does not have bypass mode operation, hence plant 100% Utilised.

6. Monitoring reliability (%)

Associated Unit/Stack	PM	SO_2	NO
Unit 1	*100*	*100*	*100*
Unit 2	*100*	*96.4*	*96.4*
Unit 3	*100*	*100*	*100*
Unit 4	Unit on outage		

7. Emissions Performance

Table 7.1: Monthly tonnages for the month of Jan - 2024

Associated Unit/Stack	PM	SO_2	NO_x
Unit 1	32.6	3 139	957
Unit 2	1.5	1 201	307
Unit 3	45.2	3 307	758
Unit 4	Unit on outage		
SUM	79.3	7 647	2 021

Table 7.2: Operating days in compliance to PM AEL Limit - January 2024

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average PM (mg/Nm³)
Unit 1	26	0	0	0	0	16.7
Unit 2	21	0	0	0	0	2.2
Unit 3	31	0	0	0	0	21.4
Unit 4	Unit on outage					
SUM	**78**	**0**	**0**	**0**	**0**	

Table 7.3: Operating days in compliance to SO_2 AEL Limit - January 2024

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average SO_2 (mg/Nm³)
Unit 1	30	0	0	0	0	1 413.1
Unit 2	24	0	0	0	0	1 408.9
Unit 3	31	0	0	0	0	1 570.4
Unit 4	Unit on outage					
SUM	**85**	**0**	**0**	**0**	**0**	

Table 7.4: Operating days in compliance to NOx AEL Limit - January 2024

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average NOx (mg/Nm³)
Unit 1	30	0	0	0	0	422.5
Unit 2	24	0	0	0	0	358.4
Unit 3	31	0	0	0	0	358.2
Unit 4	Unit on outage					
SUM	**85**	**0**	**0**	**0**	**0**	

Table 7.5: Legend Description

Condition	Colour	Description
Normal		Emissions below Emission Limit Value (ELV)
Grace		Emissions above the ELV during grace period
Section 30		Emissions above ELV during a NEMA S30 incident
Contravention		Emissions above ELV but outside grace or S30 incident conditions

Figure 1: Kusile Unit 1 PM Emissions - January 2024

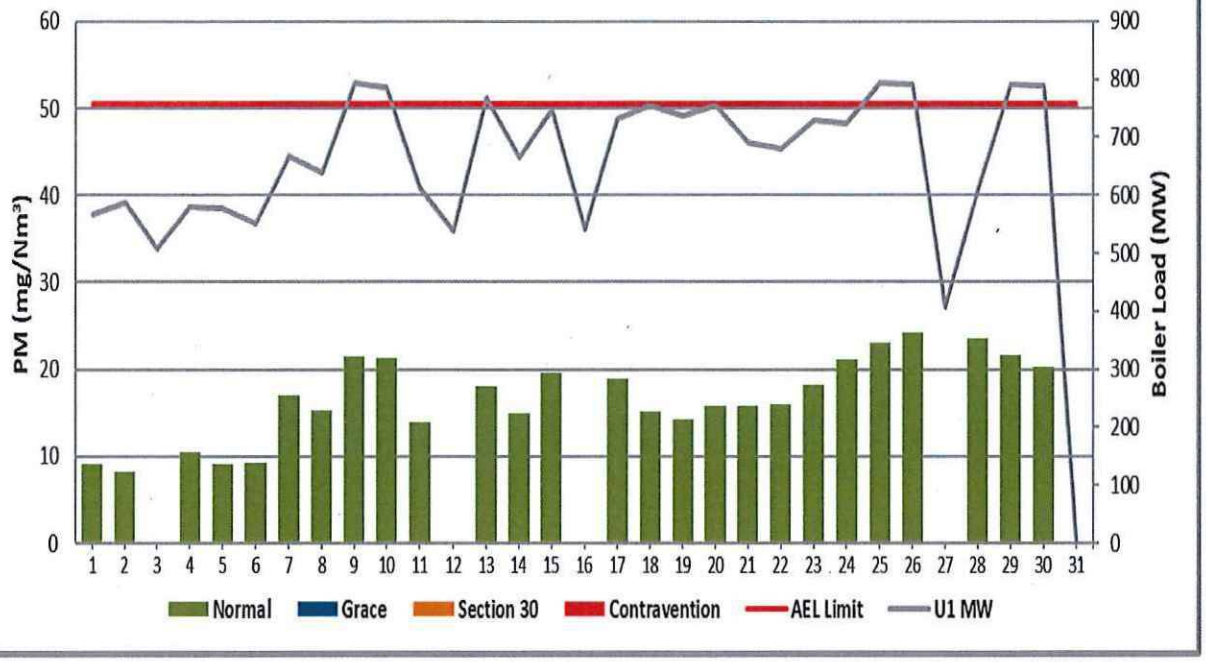
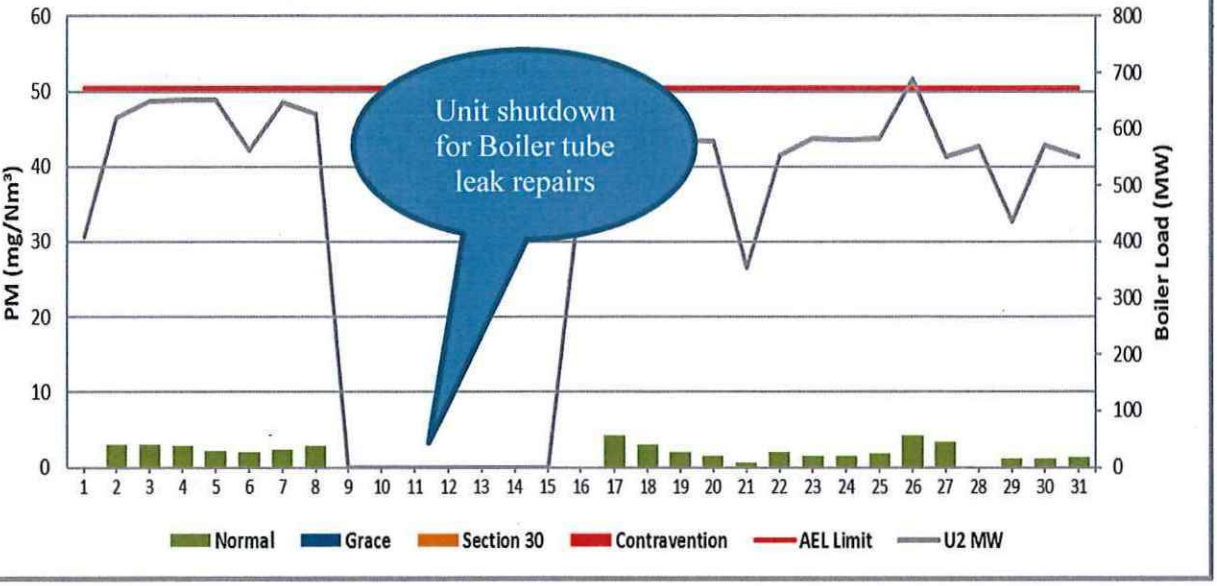


Figure 2: Kusile Unit 2 PM Emissions - January 2024



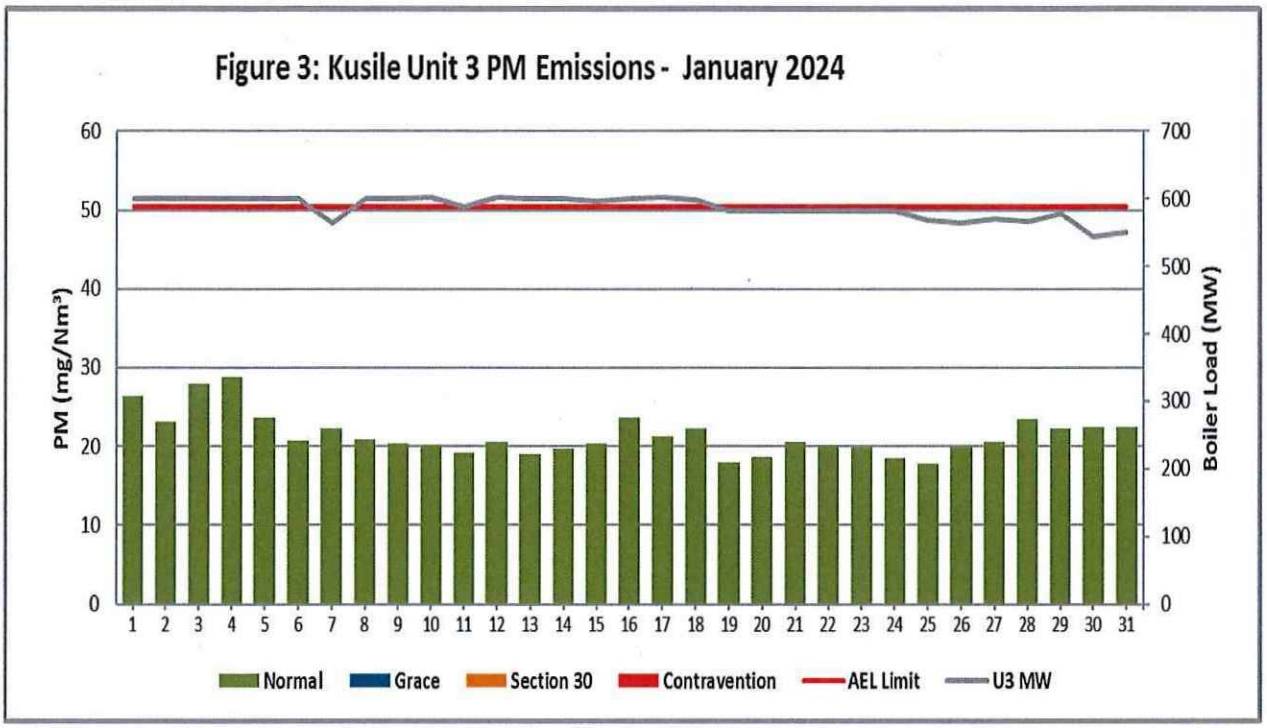


Figure 3: Kusile Unit 3 PM Emissions - January 2024
PM (mg/Nm³)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U3 MW

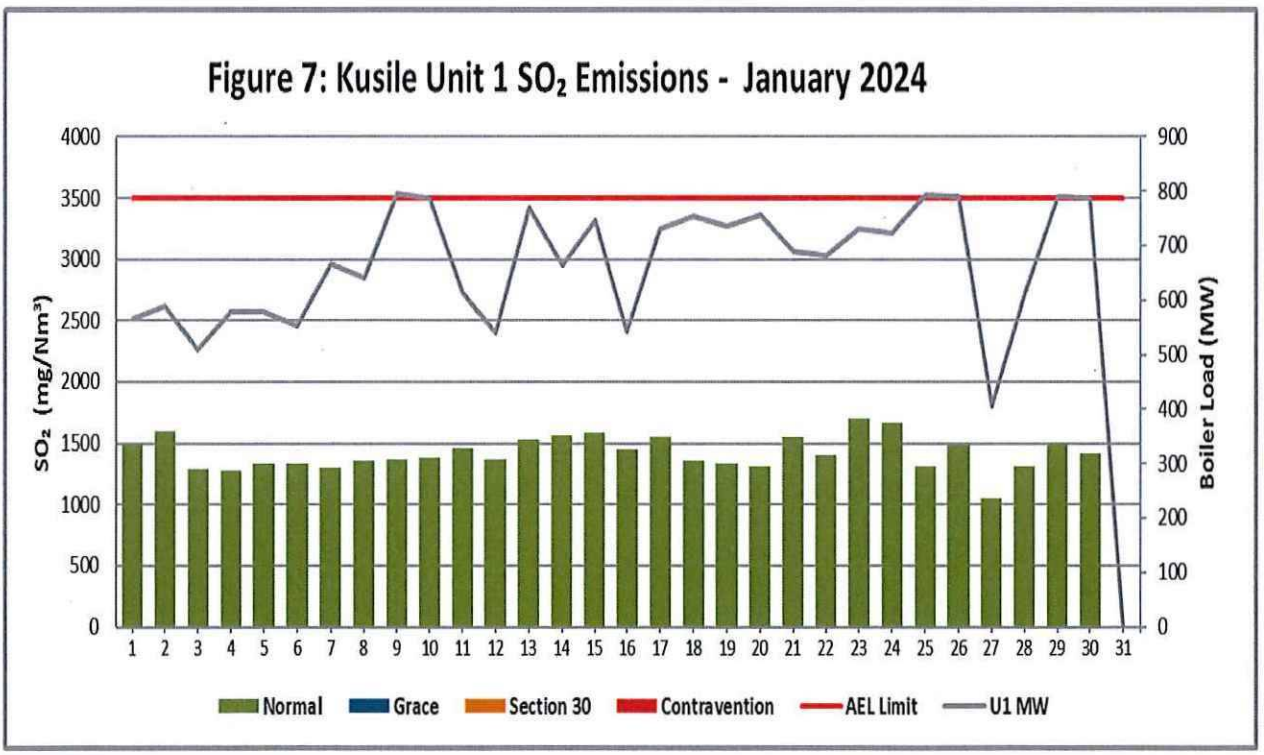


Figure 7: Kusile Unit 1 SO₂ Emissions - January 2024
SO₂ (mg/Nm³)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U1 MW

Figure 8: Kusile Unit 2 SO_2 Emissions - January 2024

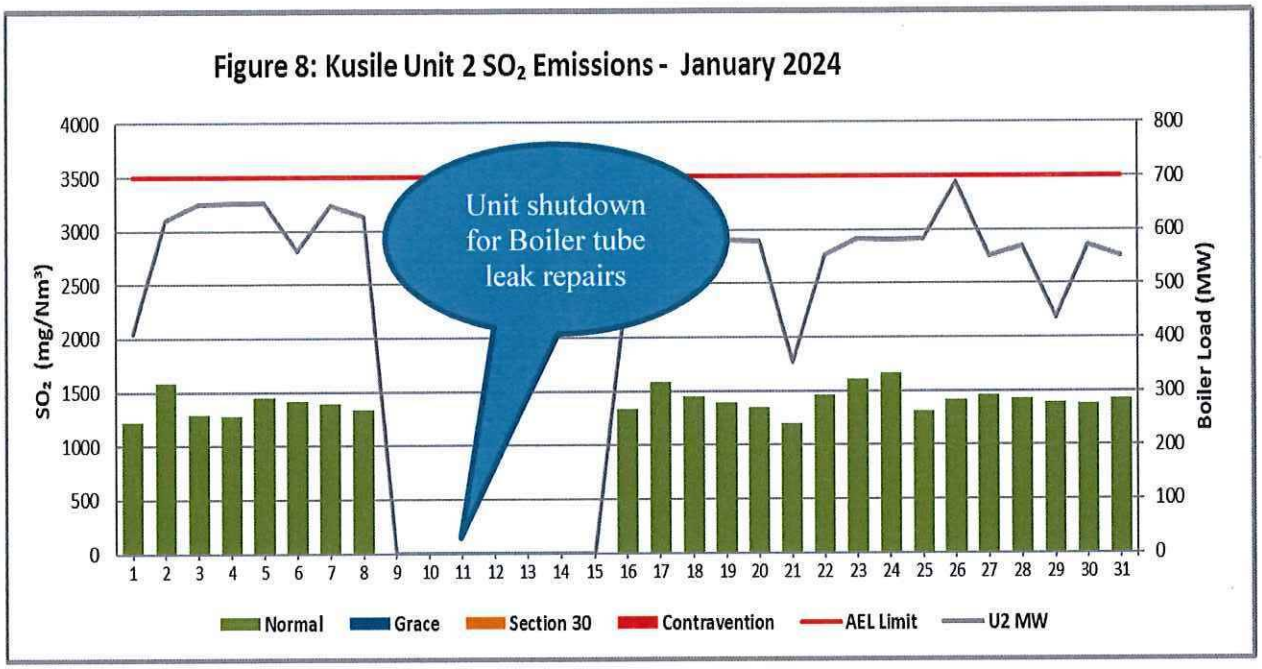


Figure 9: Kusile Unit 3 SO_2 Emissions - January 2024

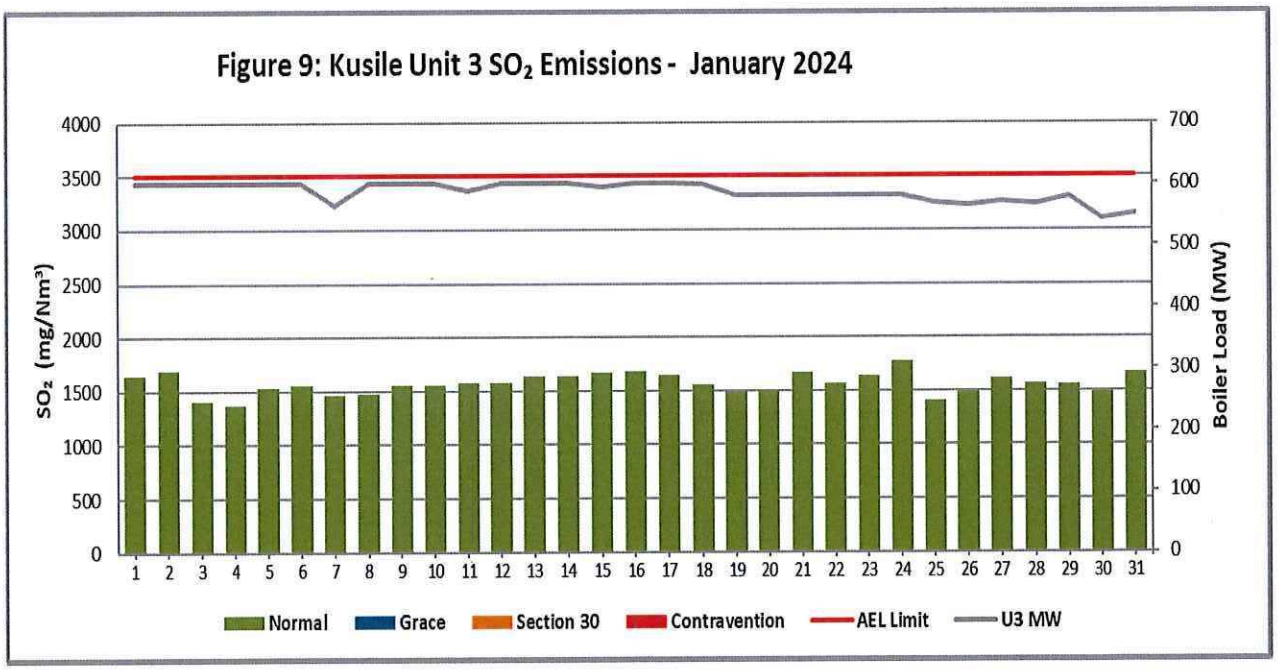


Figure 13: Kusile Unit 1 NOx Emissions - January 2024

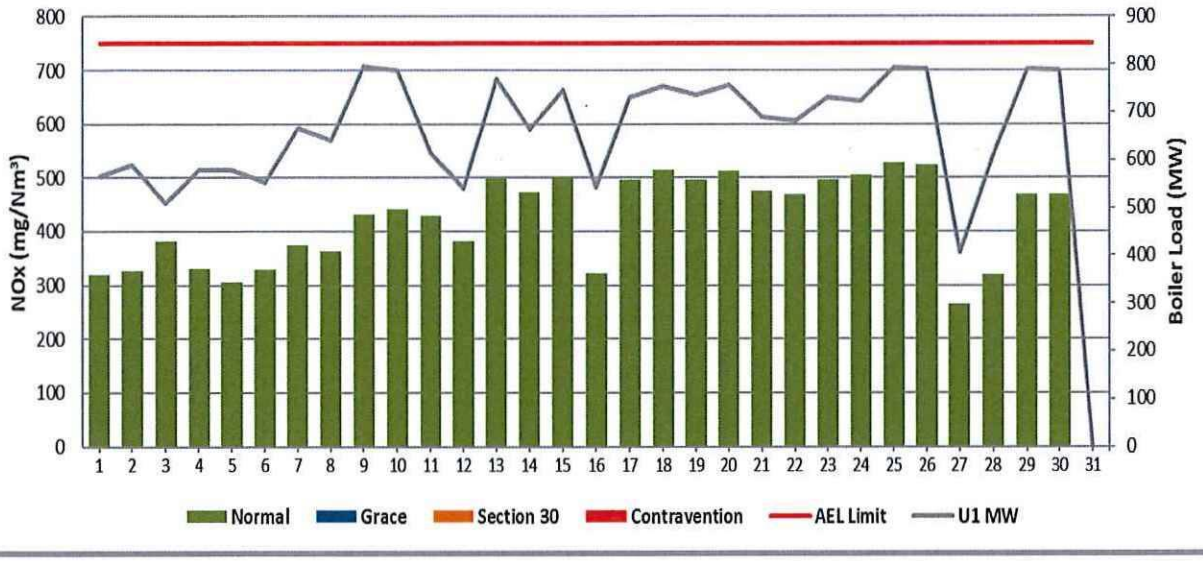
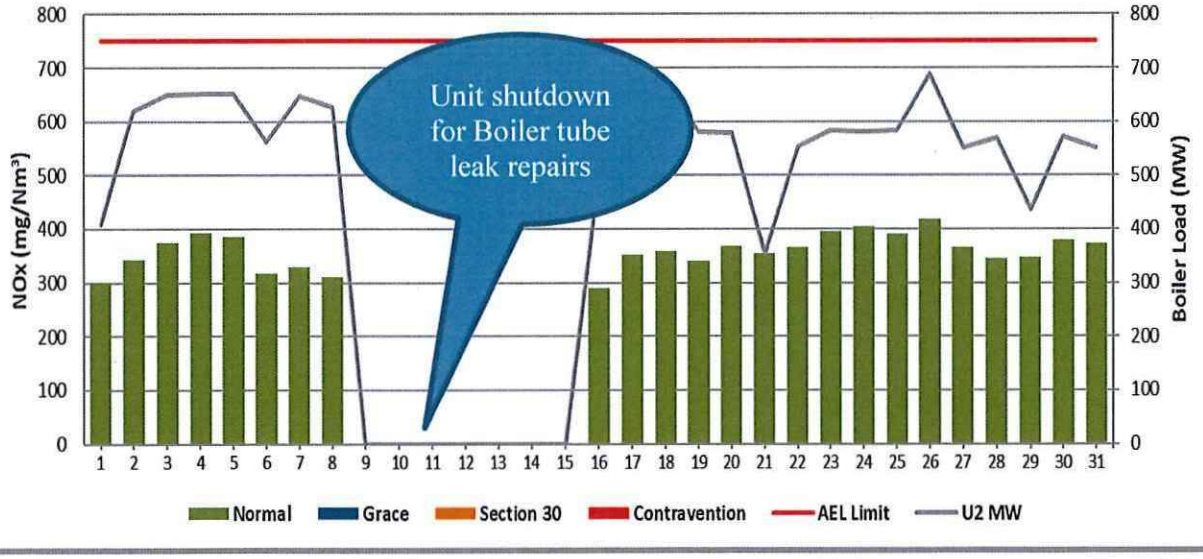
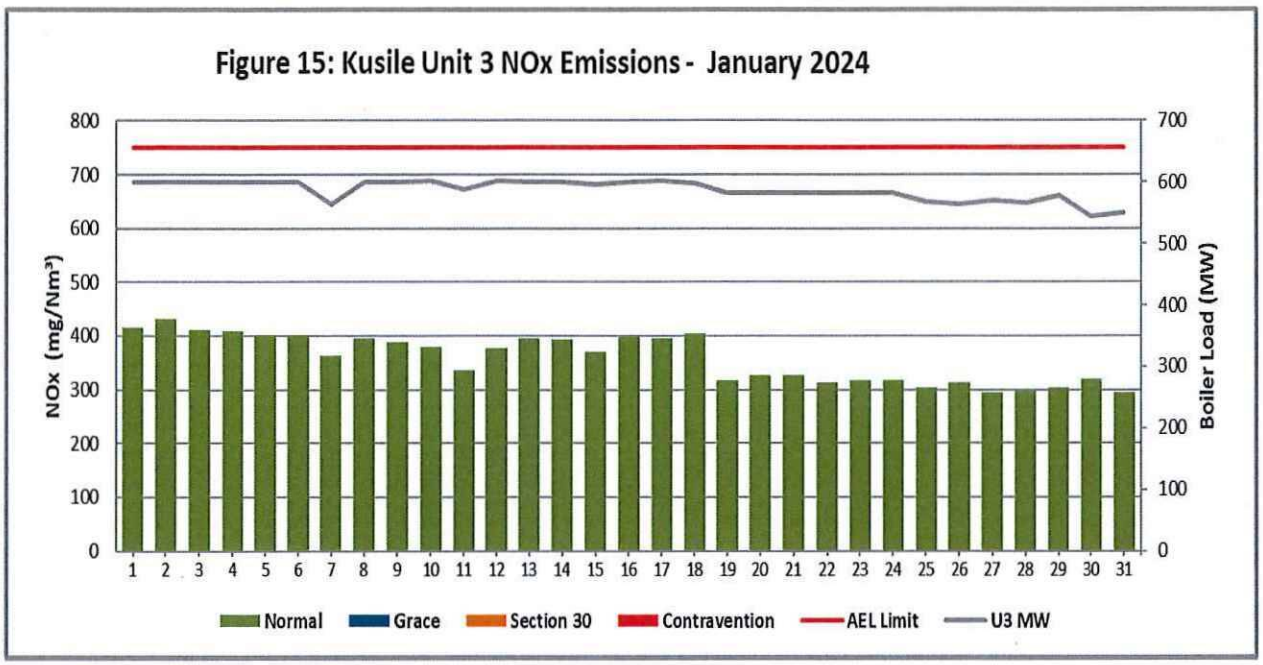


Figure 14: Kusile Unit 2 NOx Emissions - January 2024





8. Shut down and Light up information

Unit No. 1	*Event 1*		*Event 2*		*Event 3*		*Event 4*		*Event 5*	
Breaker Open (BO)	10:20 pm	2024/01 /02	6:20 pm	2024/ 01/11	7:10 pm	2024/01/ 15	7:40 pm	2024/01/ 26	10:50 pm	2024/01/ 30
Draught Group (DG) Shut Down (SD)	DG did not trip or SD	DG did not trip or SD	6:35 pm	2024/ 01/11	7:25 pm	2024/01/ 15	7:40 pm	2024/01/ 26	10:50 pm	2024/01/ 30
BO to DG SD (duration)	n/a	DD:HH: MM	00:00:1 5	DD:H H:MM	15:19:2 5	DD:HH:M M	26:19:40	DD:HH:M M	00:00:00	DD:HH:M M
Fires in time			8:10 pm	2024/ 01/11	8:05 pm	2024/01/ 15	9:25 pm	2024/01/ 26		
Synch. to Grid (or BC)			7:50 am	2024/ 01/12	9:35 am	2024/01/ 16	8:55 am	2024/01/ 27		
Fires in to BC (duration)		DD:HH: MM	00:11:4 0	DD:H H:MM	00:13:3 0	DD:HH:M M	00:11:30	DD:HH:M M		DD:HH:M M
Emissions below limit from BC (end date)			not > limit	not > limit	not > limit	not > limit	not > limit	not > limit		
Emissions below limit from BC (duration)		DD:HH: MM	n/a	DD:H H:MM	n/a	DD:HH:M M	n/a	DD:HH:M M		DD:HH:M M

Unit No. 2	*Event 1*		*Event 2*		*Event 3*		*Event 4*	
Breaker Open (BO)	BO previously	BO previously	6:25 am	2024/01/06	11:20 pm	2024/01/08	4:20 am	2024/01/27
Draught Group (DG) Shut Down (SD)	n/a	n/a	DG did not trip or SD	DG did not trip or SD	10:30 pm	2024/01/09	DG did not trip or SD	DG did not trip or SD
BO to DG SD (duration)	n/a	DD:HH:MM	n/a	DD:HH:MM	00:23:10	DD:HH:MM	n/a	DD:HH:MM
Fires in time	2:35 pm	2024/01/01			3:35 am	2024/01/16		
Synch. to Grid (or BC)	5:40 pm	2024/01/01			10:10 am	2024/01/16		
Fires in to BC (duration)	00:03:05	DD:HH:MM		DD:HH:MM	00:06:35	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit			not > limit	not > limit		
Emissions below limit from BC (duration)	n/a	DD:HH:MM		DD:HH:MM	n/a	DD:HH:MM		DD:HH:MM

Unit No. 2	*Event 5*		*Event 6*	
Breaker Open (BO)	2:17 pm	2024/01/20	8:15 pm	2024/01/29
Draught Group (DG) Shut Down (SD)	10:00 am	2024/01/21	DG did not trip or SD	DG did not trip or SD
BO to DG SD (duration)	00:19:43	DD:HH:MM	n/a	DD:HH:MM
Fires in time	11:20 am	2024/01/21		
Synch. to Grid (or BC)	10:36 pm	2024/01/21		
Fires in to BC (duration)	00:11:16	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit		
Emissions below limit from BC (duration)	n/a	DD:HH:MM		DD:HH:MM

9. Complaints

No complaints reported for the month of January 2024

Date and time complaint was received	Complaint received	Source code name	Root cause analysis	Calculation of impact/emissions associated with incidents and dispersion modelling of pollutants where applicable.	Measures implemented or to be implemented to prevent recurrence	Date by which measures will be implemented
N/A						

RESPIRATORY HEALTH SCREENING SURVEY

Project conducted for

Eskom Holdings SOC Limited

Study Conducted by

INFOTOX (PTY) LTD

&

BUREAU OF MARKET RESEARCH (PTY) LTD
UNIVERSITY OF SOUTH AFRICA (UNISA)

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November 2023
Pretoria

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Interviewers and respondents

- Interviewers who conducted personal face-to-face interviews with household respondents (adults and children) who willingly participated in the health screening surveys.

- Household residents (adults and children) located in the receptor communities of the Kusile Power Station who consented and participated in the health screening surveys.

- Adults who voluntary registered as Eskom Community Health Ambassadors.

CHAPTER 1

BACKGROUND, AIM AND METHODOLOGY

1.1 BACKGROUND AND AIM

This study among adult (18 years and older) and child (younger than 18 years of age) household members forms part of the ESKOM campaign to conduct respiratory health screening in communities near the Kusile Power Station. The study was conducted in close partnership with INFOTOX (Pty) Ltd (a company specialising in health sciences) and stems from the failure of Kusile's west stack in October 2022, which halted the operations of three of its generating units (Units 1, 2 and 3). The incident has resulted in a loss of 2 100 MW of electricity from the national grid, intensifying load-shedding. Consequently, the Minister of Forestry, Fisheries, and the Environment (DFFE) has exempted Kusile from complying fully with national air quality regulations while operating temporary stacks following the damage to Kusile's stacks that will be repaired until December 2024. The DFFE exemption allows Kusile to temporarily emit more sulfur dioxide (SO_2) into the atmosphere, provided that certain mitigation measures are in place to manage potential health risks. In the meantime, Kusile Power Station will operate Units 1, 2 and 3 without abatement (reduction) of SO_2. The DFFE stipulated that Eskom was to undertake a respiratory health screening study, for which Eskom opted to subcontract INFOTOX and the Bureau of Market Research (Pty) Ltd (BMR). A questionnaire survey was conducted, asking questions to household data subjects (adults and children) regarding the health of their respiratory system. The answers to the series of questions were used to determine which population cohorts (adults and children) are sensitive to the health effects of SO_2. SO_2 is an air pollutant emitted by some industries and also by the Kusile Power Station. Some people or population cohorts are more sensitive than others to higher concentrations of SO_2 in the air. This implies that when there is more SO_2 in the air than usual, sensitive people can experience an effect on their respiratory system, and mostly on their lungs. The effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath.

As part of the overall study, the ESKOM campaign, on the one hand, included the recruitment of households near the Kusile Power Station to register as Community Health Ambassadors. For this study, a Community Health Ambassador was defined as a household adult member who voluntarily agrees to register and participate in the Eskom Campaign, which includes communication of vital health information with household members, family, and friends. Such a communication plan aligns with the DFFE requirements for Eskom to communicate with the community if the emissions of SO_2 from the Kusile temporary stacks are higher than usual. In support of the Eskom communication campaign, adult household representatives who opt to register as Community Health Ambassadors, will timely distribute communication from Eskom advising household members, families, and friends regarding steps they can take to protect their respiratory health when there is more SO_2 in the air than usual. The communications will also advise the community (household networks) on what to do if they experience shortness of breath or difficulty breathing. The Eskom communication campaign will run up to December 2024, or the completion of stack repairs, whichever happens first. To support the campaign, the study aimed to collect the details of households that register as Community Health Ambassadors. In addition, the study aimed to construct and maintain a secure household register to be used by Eskom only for the communication campaign as discussed above.

1.2 STUDY SCOPE AND METHODOLOGY

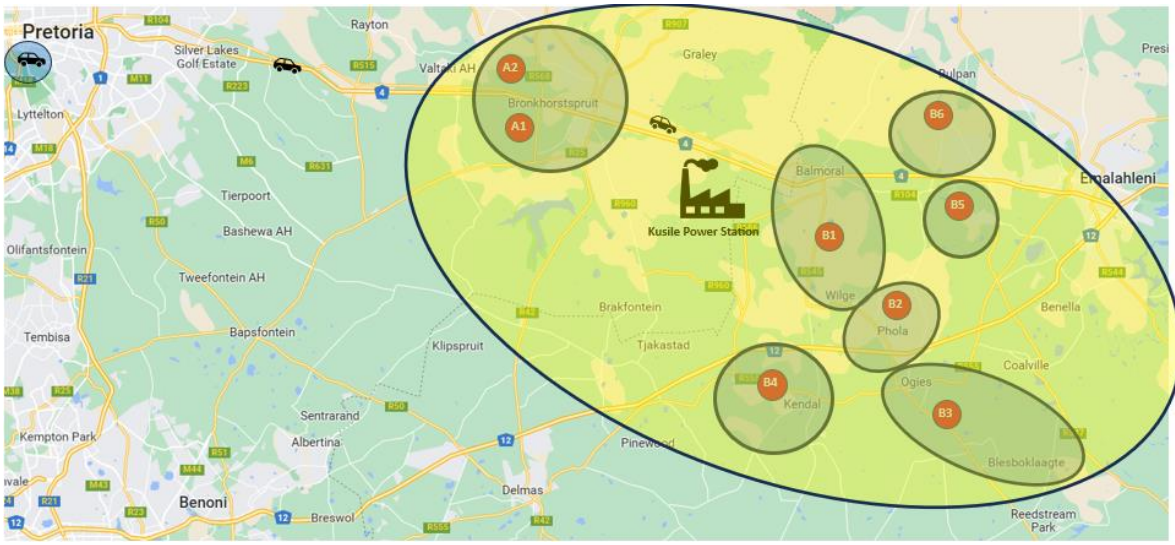
To assist with the execution of the campaign, INFOTOX appointed the Bureau of Market Research (Pty) Ltd (BMR), to conduct a research study, which aimed to directly liaise with households to register as Community Health Ambassadors. Accordingly, adult household members were approached by the BMR to register as Community Health Ambassadors and to concurrently participate in a health screening survey. Both adults and children qualified as data subjects, with the child cohort constructed as follows:

- 0 to 5 years (preschool children).
- 6 to 12 years (primary school children).
- 13 to 17 years (secondary school children).

At the start of the study, the BMR targeted a sample of 1 200 households located within a 50 km distance of the Kusile Power Station. The stratified sampling plan included both Gauteng and Mpumalanga clusters in proximity to the Kusile Power Station, as displayed in figure 1.1. It is evident from figure 1.1 that the spatial distribution of the household sample included two receptor communities in the Gauteng Province and six receptor communities in the Mpumalanga Province of South Africa.

FIGURE 1.1

SAMPLED RECEPTOR COMMUNITIES



CLUSTER A: GAUTENG CLUSTER
Cluster A1: Bronkhorstspruit sub-cluster
Cluster A2: Zithobeni sub-cluster

CLUSTER B: MPUMALANGA CLUSTER
Cluster B1: Balmoral/Wilge sub-cluster
Cluster B2: Phola sub-cluster
Cluster B3: Ogies/Blesboklaagte sub-cluster
Cluster B4: Arbor/Kendal sub-cluster
Cluster B5: Clewer sub-cluster
Cluster B6: Kwa-Guqa/Vosman sub-cluster

A total of 41 interviewers from the community receptor areas shown in figure 1.1 were appointed to conduct personal interviews with the targeted household data subjects. More specifically, the interviewers comprised of University of South Africa (Unisa) students and community members from the Eskom Hub register who reside in the sampled receptor communities and besides locality, were recruited by the BMR based on their qualifications, previous interviewer

experience, access to technology, and availability for interviewing households during the survey period (21 October to 11 November 2023). The interviewers were trained methodically and were contracted to conduct personal face-to-face (F2F) interviews with households in the receptor communities of the Kusile Power Station. The Progress Report displayed in **annexure A1**, captures the details of the fieldwork preparations, the rigorous interviewer selection process, and the training of the interviewers.

The number (n) of households and type of interviews concluded at the end of the fieldwork period (11 November 2023) are displayed in table 1.1. Table 1.2 also displays the realised sample sizes per cluster group and receptor community.

TABLE 1.1

NUMBER AND TYPE OF INTERVIEWS PER HOUSEHOLD COHORT

Household cohort	**n**	**Interview type**
Adults: 18 years and older	1203	Adult personal face-to-face interviews (n = 1173) Adult self-administrated online interviews (n = 30)
Children: 0-5 years	390	Parent-administrated face-to-face interviews
Children: 6-12 years	389	Parent-administrated face-to-face interviews
Children: 13-17 years	383	Child/parent-administrated face-to-face interviews
Total respondents	**2 365**	

TABLE 1.2

RELIASED SAMPLE PER CLUSTER GROUP AND RECEPTOR COMMUNITY

Cluster/ Receptor area	Adults		Children: 0-5 years		Children: 6-12 years		Children: 3-17 years		Total Children		Grand Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Gauteng cluster	**500**	**41.56%**	**161**	**41.28%**	**156**	**40.10%**	**156**	**40.73%**	**473**	**40.71%**	**973**	**41.14%**
Bronkhorstspruit	204	16.96%	60	15.38%	65	16.71%	68	17.75%	193	16.61%	397	16.79%
Zithobeni	296	24.61%	101	25.90%	91	23.39%	88	22.98%	280	24.10%	576	24.36%
Mpumalanga cluster	**703**	**58.44%**	**229**	**58.72%**	**233**	**59.90%**	**227**	**59.27%**	**689**	**59.29%**	**1392**	**58.86%**
Balmoral/Wilge	53	4.41%	17	4.36%	22	5.66%	11	2.87%	50	4.30%	103	4.36%
Phola	409	34.00%	130	33.33%	127	32.65%	143	37.34%	400	34.42%	809	34.21%
Ogies/Blesboklaagte	153	12.72%	48	12.31%	55	14.14%	50	13.05%	153	13.17%	306	12.94%
Arbor/Kendal	15	1.25%	6	1.54%	4	1.03%	4	1.04%	14	1.20%	29	1.23%
Clewer	34	2.83%	15	3.85%	12	3.08%	9	2.35%	36	3.10%	70	2.96%
Kwa-Guqa/Vosman	39	3.24%	13	3.33%	13	3.34%	10	2.61%	36	3.10%	75	3.17%
Total	**1203**	**100.00%**	**390**	**100.00%**	**389**	**100.00%**	**383**	**100.00%**	**1162**	**100.00%**	**2365**	**100.00%**

During the execution of the research study, the BMR adhered to strict research ethical guidelines and applicable national legislation, including the Protection of Personal Information Act (also referred to as the POPI Act or POPIA). To align with research ethics principles, participation in the study was voluntary (out of free will) and all household and personal information were treated confidentially during the data collection process. Households were guaranteed that their personal information would only be used for the purposes of the Eskom Campaign, in which households are expected to play a vital role as Community Health Ambassadors by sharing information received from Eskom with household members, family and network of friends if the emissions of SO_2 from the Kusile temporary stacks are higher than usual. Eskom communications will recommend steps to protect respiratory health and on what to do if they experience shortness of breath or difficulty breathing.

Prior to interviewing, adult consent and child (13-17 years) assent were obtained and recorded on the paper-based questionnaires which were designed by the INFOTOX and BMR team. Separate survey instruments were designed for the four household cohorts. These included:

- An adult household questionnaire focusing on adult health (attached as Annexure B1).
- A parent-administrated child (0-5 years) questionnaire focusing on respiratory symptoms in preschool children (0 to 5 years) (attached as Annexure B2).
- A parent-administrated child (6-12 years) questionnaire focusing on respiratory symptoms in primary school children (attached as Annexure B3).
- A child (13-17 years) administrated questionnaire focusing on respiratory symptoms in secondary school children (attached as Annexure B4).

The source reference sections in **Annexures B1 to B4** confirm that the survey tools which were designed by INFOTOX and the BMR team were based on available research information and applicable international standardised research instruments designed to investigate respiratory symptoms and their impact on adults and children. The sound theoretical basis serves to justify the survey questionnaires as valid and reliable.

Important to note as part of the research tool development phase, was the design and use of a showcard, which was used to clarify relevant health terminology applicable to the study, as well as providing visual images of health symptom domains relevant to the study. The showcard used for the study is displayed in **Annexure B5**.

One adult and child were interviewed per household, which implies that only "family" households hosting children, between the ages of 0 and 17 years qualified as sample units. The child age cohorts were rotated among households to support an equal quota sample distribution among the three child age cohorts. This resulted in approximately a third of the total household sample being equally distributed among the three child age cohorts.

During the interview period, field and central editing were performed by the BMR team to control timely and quality data collection. Concurrently, the BMR performed data capturing, cleaning, and storing functions to prepare the data for analyses and interpretation purposes. **Annexure A2** illustrates the data capturing tasks performed by the BMR team in the UNISA Computer Laboratories.

For data capturing and self-administrated survey completion purposes, the four survey tools were transformed into an online format using the Lime Survey software program. Following the data capturing, the data was downloaded, cleaned, stored, and analysed using the Statistical Package for Social Sciences (SPSS) software program suite.

1.3 REPORT STRUCTURE

This chapter explained the study background, aim and methodology of the Eskom respiratory health screening study. The analysis and interpretation of the research study results are captured in chapters 2 to 5 while chapter 6 concludes the report with a summary and recommendations.

CHAPTER 2

ESKOM RESPIRATORY HEALTH SCREENING STUDY - ADULT HOUSEHOLDS

2.1 INTRODUCTION

This chapter presents the analyses and interpretation of the research results emanating from the personal face-to-face interviews with 1 203 adults who reside in receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station).

2.2 ADULT CONSENT AND HEALTH AMBASSADOR REGISTRATION

Exhibit 2.1 serves to illustrate and confirm the consent ensured by the 1 203 adults who participated in the survey and registered as Eskom Community Health Ambassadors.

EXHIBIT 2.1

ADULT CONSENT TO PARTICIPATE IN THE SURVEY AND REGISTER AS A HEALTH AMBASSADOR

STATEMENT	AGREE
I understand what the household survey is about and what participation will involve.	✓
I understand that participation by the household is voluntary (of free will).	✓
I understand that the household or its representative can withdraw from the survey at any time without giving any reasons for withdrawal.	✓
I understand that the information shared will only be used for the purposes of the Eskom respiratory health campaign.	✓
I have been given the opportunity to ask questions about the household survey.	✓
I understand that a household database/register will be constructed of all households who willingly register as Community Health Ambassadors and that the register will only be used by Eskom to share vital health information with registered Ambassadors.	✓
The institution hereby agrees to participate in the household survey.	✓

2.2.1 Registering adults as Eskom community health ambassadors

Households were approached by the BMR interviewers to willingly register as Community Health Ambassadors (CHAs) in support of the Eskom Community Respiratory Health Campaign. Once agreed, households were requested to provide the personal details of an adult household member (18 years and older) who will act as the primary contact or liaison person between the household and Eskom. If more than one adult household representative was willing to register as a Community Health Ambassador, households were requested to also provide the details of up to a maximum of three household members. Of the 1 203 households, a total of 1 545 adults registered as Community Health Ambassadors. The Household Health Ambassador Data Register accompanies this report as a project deliverable to be used by Eskom to communicate vital health information to households if the emissions of SO_2 from the Kusile temporary stacks are higher than usual.

2.3 PROFILING ADULT COMMUNITY HEALTH AMBASSADORS AND REACH

Tables 2.1 and 2.2 present an overview of the spatial distribution of the households (table 2.1) and household adults (table 2.2) who registered at least one adult member as an Eskom Community Health Ambassador.

TABLE 2.1

DISTRIBUTION OF HOUSEHOLDS REGISTERING AS ESKOM COMMUNITY HEALTH AMBASSADORS BY RECEPTOR COMMUNITY

Receptor cluster | area	n	%
Gauteng	**500**	**41.56%**
Bronkhorstspruit	204	17.00%
Zithobeni	296	24.60%
Mpumalanga	**703**	**58.44%**
Balmoral/Wilge	53	4.40%
Phola	409	34.00%
Ogies/Blesboklaagte	153	12.70%
Arbor/Kendal	15	1.20%
Clewer	34	2.80%
Kwa-Guqa/Vosman	39	3.20%
Total	**1 203**	**100.00%**

TABLE 2.2

DISTRIBUTION OF HOUSEHOLD ADULTS REGISTERING AS ESKOM COMMUNITY HEALTH AMBASSADORS BY RECEPTOR COMMUNITY

Receptor cluster | area	n	%
Gauteng	**593**	**38.38%**
Bronkhorstspruit	249	16.12%
Zithobeni	344	22.27%
Mpumalanga	**952**	**61.62%**
Balmoral/Wilge	72	4.66%
Phola	556	35.99%
Ogies/Blesboklaagte	219	14.17%
Arbor/Kendal	15	0.97%
Clewer	37	2.39%
Kwa-Guqa/Vosman	53	3.43%
Total	**1 545**	**100.00%**

Tables 2.1 and 2.2 show sufficient households and adult household members who registered as Community Health Ambassadors to share vital health information among receptor communities at times when emissions of SO_2 from the Kusile temporary stacks are higher than usual.

To determine the communication reach secured by the registered households, the study also requested information regarding the size of the household by gender and age cohorts. Table 2.3 displays the registered household Health Ambassadors by respective cohort. The analysis confirms that registered households consist of at least one adult and one child inhabitant. This result confirms adherence to the sampling plan requirements, which targeted family households as a key sample selection criterium. Overall, the average number of inhabitants per household was 4.52 people (adults and children). Using the average number of inhabitants per household and the outcomes of the self-administrated adult household survey (which indicated an average network of about 50 family members and 25 friends per household) as proxy, it was computed that about 90 000 people could be reached via the 1 203 households who registered as Eskom Community Health Ambassadors.

TABLE 2.3

REGISTERED ADULT HOUSEHOLD HEALTH AMBASSADORS BY DEMOGRAPHIC COHORT

Gender | Age group	Sum	Households (n)	Households* (%)	Average
Female Adults: 18 - 35 years	982	764	63.51%	1.29
Male Adults: 18 - 35 years	661	494	41.06%	1.34
Female Adults: 36 - 64 years	757	699	58.10%	1.08
Male Adults: 36 - 64 years	535	499	41.48%	1.07
Female Adults: 65 years and older	118	115	9.56%	1.03
Male Adults: 65 years and older	48	48	3.99%	1.00
Girls: 0-5 years	452	394	32.75%	1.15
Boys: 0-5 years	371	331	27.51%	1.12
Girls: 6-12 years	447	384	31.92%	1.16
Boys: 6-12 years	400	336	27.93%	1.19
Girls: 13-17 years	354	325	27.02%	1.09
Boys: 13-17 years	317	292	24.27%	1.09

*n = 1 203.

The demographic profile for the registered adult household members who registered as Eskom Community Health Ambassadors shows that most are female (72.90%), Black African (96.60%), with an average age of 34 years.

2.4 PREVALENCE AND IMPACT OF RESPIRATORY SYMPTOMS AMONG ADULTS

To determine the self-reported respiratory symptoms prevalent among the adult household members who registered as Eskom Community Health Ambassadors and the impact thereof on adults, the research questions displayed in question box 2.1 were posed to the 1 203 adult (18 years and older) household respondents.

QUESTION BOX 2.1

In the past 4 weeks:

- *How often have you had shortness of breath, wheezing, coughing and/or chest tightness during the day?*
- *How often did you use a rescue inhaler (quick relief inhaler, puffer, or asthma pump) to relieve your shortness of breath, wheezing, coughing and/or chest tightness?*
- *How limited were your activities as a result of shortness of breath, wheezing, coughing and/or chest tightness? ["Limited" means: kept you from the things you usually do during the day.]*
- *How often did you wake up at night due to shortness of breath, wheezing, coughing and/or chest tightness?*

Figures 2.1, 2.2, 2.3 and 2.4 present the outcome of the findings of the leading questions displayed in question box 2.1.

FIGURE 2.1

HOW OFTEN DURING THE PAST FOUR WEEKS HAVE YOU HAD SHORTNESS OF BREATH, WHEEZING, COUGHING AND/OR CHEST TIGHTNESS DURING THE DAY?

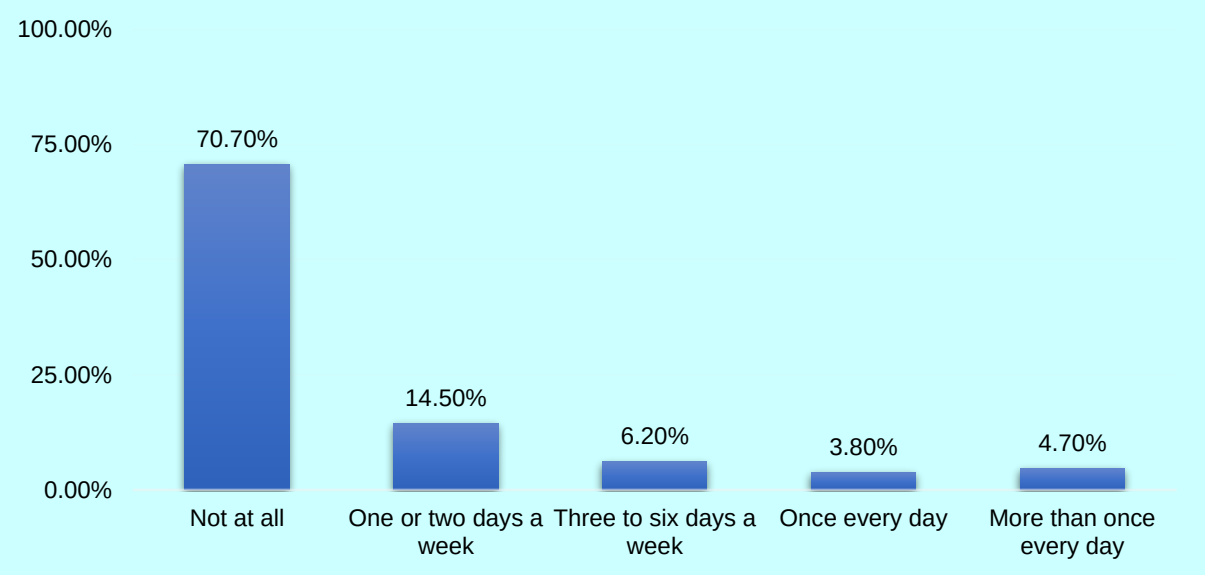


FIGURE 2.2

HOW OFTEN DURING THE PAST FOUR WEEKS DID YOU USE A RESCUE INHALER (QUICK RELIEF INHALER, PUFFER, OR ASTHMA PUMP) TO RELIEVE YOUR SHORTNESS OF BREATH, WHEEZING, COUGHING AND/OR CHEST TIGHTNESS?

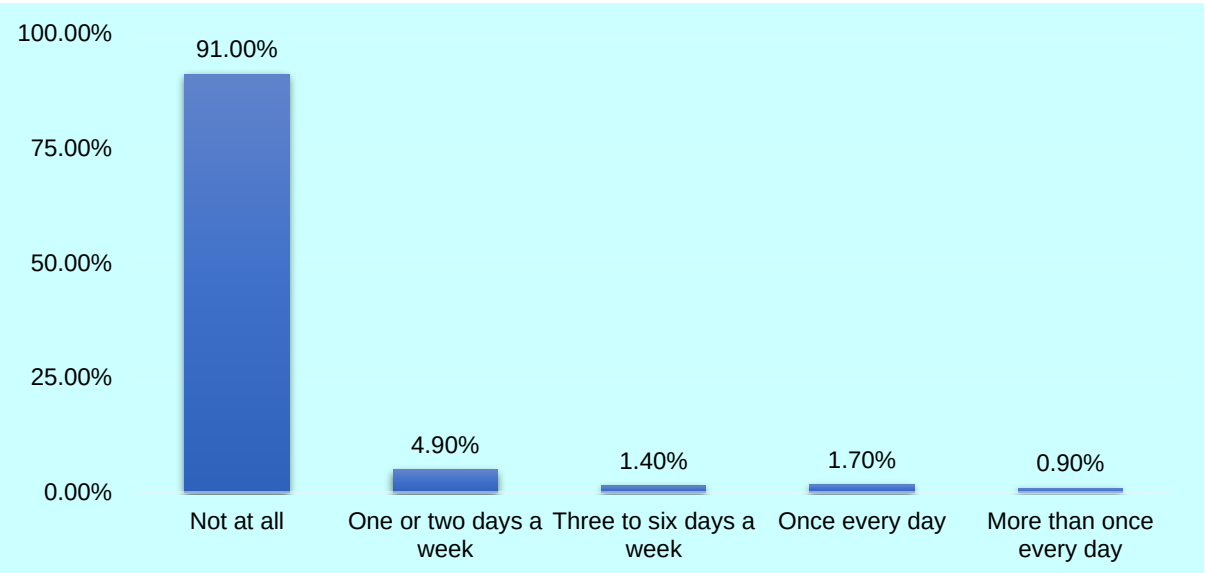


FIGURE 2.3

HOW LIMITED DURING THE PAST FOUR WEEKS WERE YOUR ACTIVITIES AS A RESULT OF SHORTNESS OF BREATH, WHEEZING, COUGHING AND/OR CHEST TIGHTNESS?

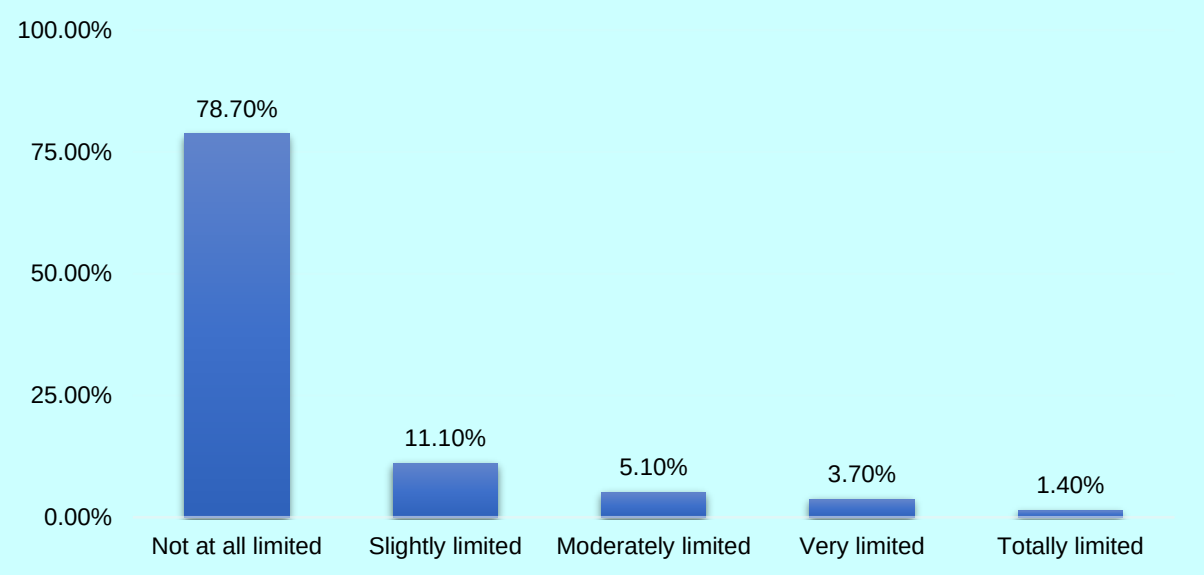


FIGURE 2.4

HOW OFTEN DURING THE PAST FOUR WEEKS DID YOU WAKE UP AT NIGHT DUE TO SHORTNESS OF BREATH, WHEEZING, COUGHING AND/OR CHEST TIGHTNESS?

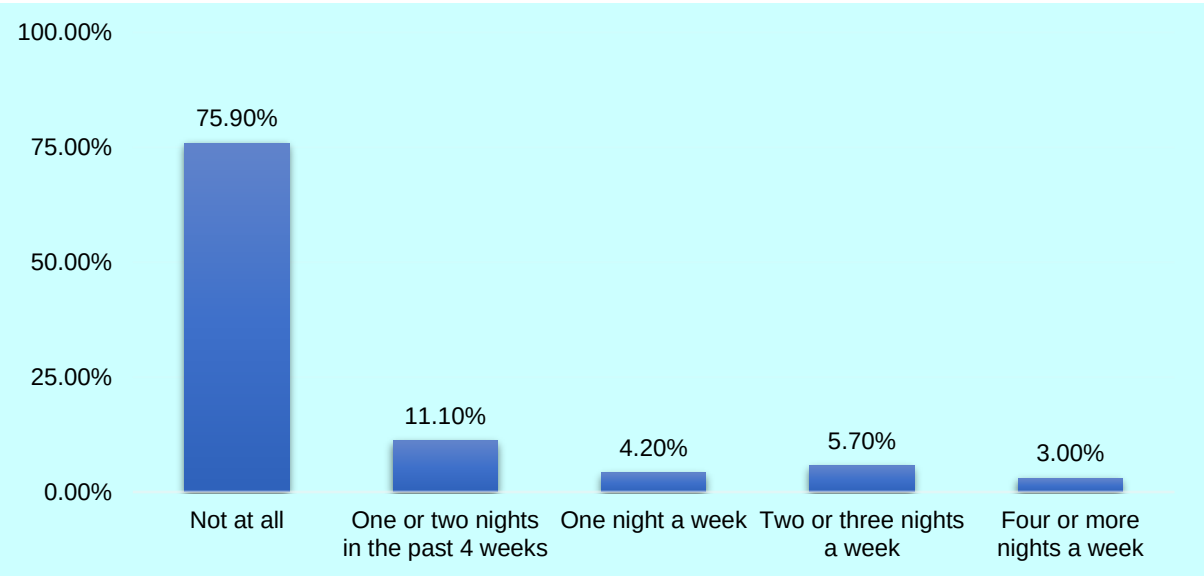


Table 2.4 consolidates the four research questions to display the proportion of adult household members who self-reported that they had experienced respiratory conditions during the four weeks prior to the survey period. The analyses also serve to indicate the prevalence of adult respiratory conditions and the impact thereof on adults. The results indicate that just more than a quarter of adults, during the four weeks prior to the study, experienced shortness of breath, wheezing, coughing and/or chest tightness at least one or two days per week. Although not all adults who reported this experience had to use a rescue inhaler, most experienced activity limitations (to varied degrees) and/or were kept awake for some nights due to shortness of breath, wheezing, coughing and/or chest tightness.

TABLE 2.4

PAST FOUR WEEKS SELF-REPORTED RESPIRATORY SYMPTOMS EXPERIENCED BY ADULTS AND SUBSEQUENT IMPACT

Past four-week self-reported symptoms and impact	Percentage
Experienced shortness of breath, wheezing, coughing and/or chest tightness at least one or two days per week.	29.20%
Used a rescue inhaler (quick relief inhaler, puffer, or asthma pump) at least one or two days a week to relieve shortness of breath, wheezing, coughing and/or chest tightness.	8.90%
Limited (to varied degrees) activities as a result of shortness of breath, wheezing, coughing and/or chest tightness.	21.30%
Woke up at night at least one or two nights in the past four weeks due to shortness of breath, wheezing, coughing and/or chest tightness.	24.00%

In addition to exploring the self-reported respiratory symptoms experienced in the past four weeks (month) and the impact thereof on adult household members, some supplementary research questions posted in question box 2.2 were added to the adult health screening questionnaire.

QUESTION BOX 2.2

Has a doctor ever told you that you have:

- ☐ Asthma?
- ☐ Bronchitis?
- ☐ Pneumonia?
- ☐ Tuberculosis (TB)?
- ☐ Emphysema?
- ☐ Silicosis?

Table 2.5 captures the outcome of the adult response to these six pertinent questions. Of the various respiratory conditions explored, 5 in every 100 adults affirmed that asthma symptoms were diagnosed by a doctor. The survey results presuppose prevalence rates of 5% for asthma and 3.5% for bronchitis among adult participants.

TABLE 2.5

ADULT HOUSEHOLD CONFIRMATION OF RESPIRATORY CONDITIONS DIAGNOSED BY A DOCTOR

Respiratory conditions	% Diagnosed
Asthma	5.00%
Bronchitis	3.50%
Pneumonia	1.20%
Tuberculosis (TB)	1.00%
Emphysema	0.50%
Silicosis	0.30%

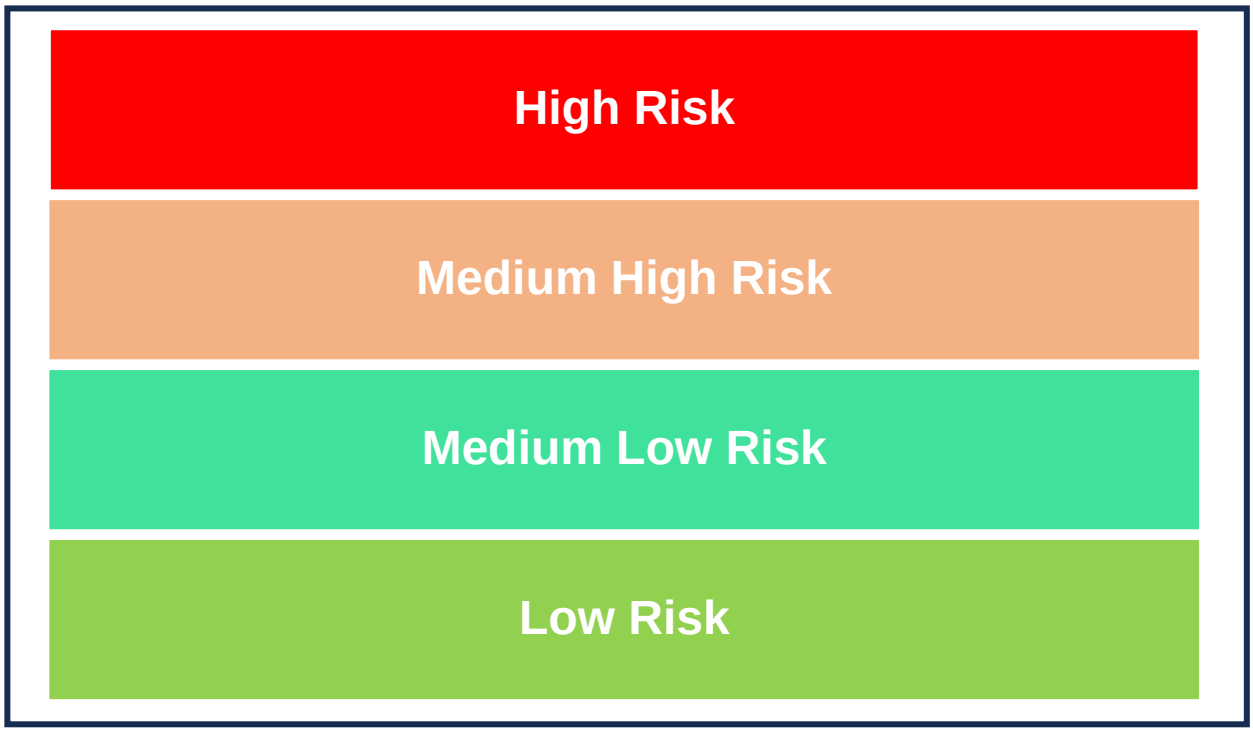
2.5 IDENTIFICATION OF SENSITIVE ADULT HOUSEHOLD MEMBERS

The health screening adult survey was designed to measure the level of sensitivity among adults to air pollutants, such as SO_2. To support this goal, a statistical assessment of adult respiratory health conditions and information reported in the study was conducted to determine the scale of sensitivity or vulnerability of adults to ambient air pollution. This exploration was motivated by the view that ambient air pollution can cause health problems for everyone. However, people with lung diseases, such as asthma, chronic bronchitis, and emphysema will generally have more serious health effects at higher SO_2 levels. In this regard, it is also important to note that “sensitivity” in the study of air pollution impacts on health, frequently refers to groups or persons who are more likely to react to a specific pollutant, e.g., ozone, sulfur dioxide or fine particulates in air, or are more likely to experience a particular health effect, as compared to their peers that are subject to similar exposure concentrations. Therefore, sensitivity is not primarily associated with increased exposure, but may be an inherent biological characteristic of a specific person or a group of persons. In applying the criteria for interpretation of risk, the four risk classes

displayed in figure 2.5 were identified and used to classify sensitive adult household members.

FIGURE 2.5

RISK CATEGORIES TO CLASSIFY SENSITIVE ADULT HOUSEHOLD MEMBERS



Using examples in applying the sensitivity theory, exhibit 2.2 presents interpretations of the four levels of risks being associated with the prevalence of specific respiratory conditions related to each risk category. More specifically, the exhibit applies the respiratory conditions explored in the adult health screening questionnaire.

EXHIBIT 2.2

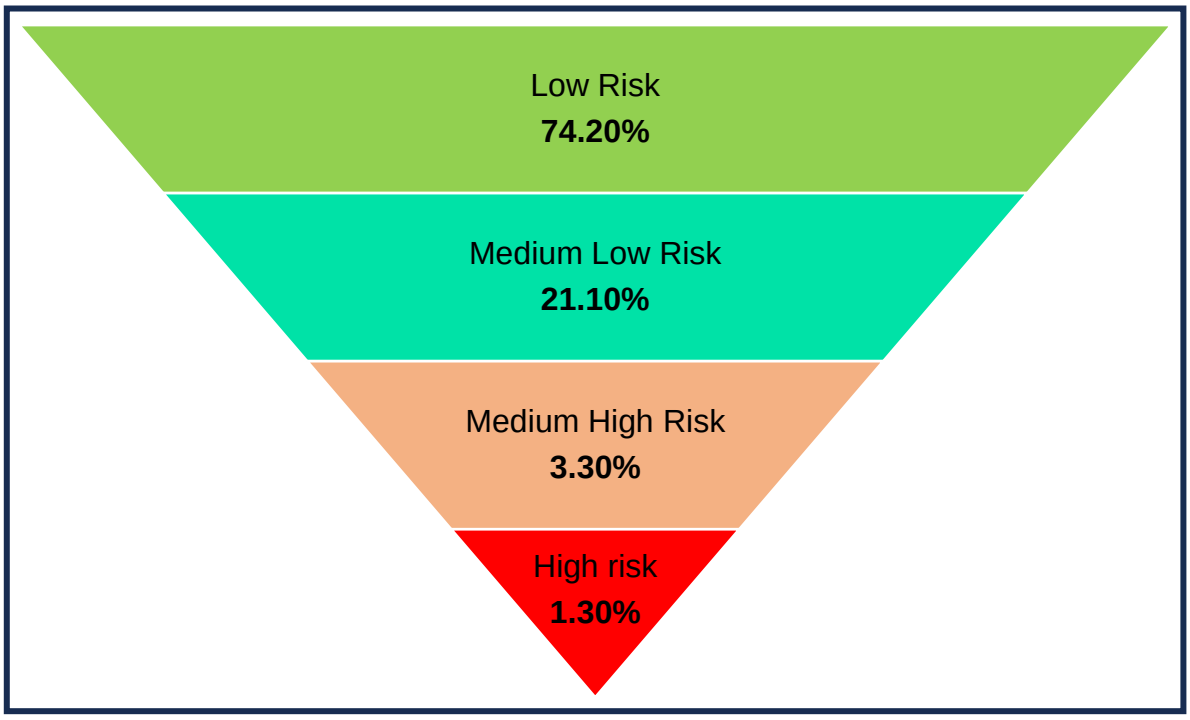
RISK CRITERIA FOR RESPIRATORY HEALTH CONDITIONS TO CLASSIFY SENSITIVE ADULTS

High Risk	A adult respondent that responds affirmative to the following questions: • Has a doctor ever told you that you have emphysema? OR • Has a doctor ever told you that you have silicosis? OR An adult respondent affirming that he/she has **more than once every day**: • Had shortness of breath, wheezing, coughing and/or chest tightness • Used a rescue inhaler (quick relief inhaler, puffer, or asthma pump) to relieve shortness of breath, wheezing, coughing and/or chest tightness. A adult respondent affirming that he/she has: • Participated in **totally limited** activities as a result of shortness of breath, wheezing, coughing and/or chest tightness. • Woke up **four or more nights** a week due to shortness of breath, wheezing, coughing and/or chest tightness
Medium High Risk	An adult respondent affirming that he/she has **once every day**: • Had shortness of breath, wheezing, coughing and/or chest tightness • Used a rescue inhaler (quick relief inhaler, puffer, or asthma pump) to relieve shortness of breath, wheezing, coughing and/or chest tightness. An adult respondent affirming that he/she has: • Participated in **very limited** activities as a result of shortness of breath, wheezing, coughing and/or chest tightness. • Woke up **two or three nights** a week due to shortness of breath, wheezing, coughing and/or chest tightness
Medium Low Risk	An adult respondent affirming that he/she has **three to six days a week**: • Had shortness of breath, wheezing, coughing and/or chest tightness • Used a rescue inhaler (quick relief inhaler, puffer, or asthma pump) to relieve shortness of breath, wheezing, coughing and/or chest tightness. An adult respondent affirming that he/she has: • Participated in **moderately limited** activities as a result of shortness of breath, wheezing, coughing and/or chest tightness. • Woke up **one night** a week due to shortness of breath, wheezing, coughing and/or chest tightness
Low Risk	An adult respondent affirming that he/she has **one or two days a week**: • Had shortness of breath, wheezing, coughing and/or chest tightness • Used a rescue inhaler (quick relief inhaler, puffer, or asthma pump) to relieve shortness of breath, wheezing, coughing and/or chest tightness. An adult respondent affirming that he/she has: • Participated in **slightly limited** activities as a result of shortness of breath, wheezing, coughing and/or chest tightness. • Woke up **one or two nights** in the past four weeks due to shortness of breath, wheezing, coughing and/or chest tightness

In applying the criteria in exhibit 2.2, the respiratory conditions reported by the 1 203 adult household members who participated in the survey were classified according to the varied risk and sensitivity levels. The outcome of this analysis is displayed in figure 2.6. From the analysis it seems that the respiratory health of about 5% of adults is at higher risk of an impact due to ambient air pollutants and that they are more sensitive to health effects at higher concentrations of SO_2.

FIGURE 2.6

ADULTS @ RISK CLASSIFICATION



More confined risk and sensitivity analyses also showcased that households located in the Gauteng receptor communities are less sensitive and at lower risk than those who are in the Mpumalanga cluster (i.e. the Arbor/Kendal receptor community shows the highest levels of sensitivity and the highest level of risk). Likewise, female adults seem more sensitive, and their health is at higher risk due to ambient air pollutants (i.e. SO_2) than male adults. From the analysis, it is also notable that older adults (older than 65 years) may be at higher risk due to weakened immune systems and underlying health conditions. Respiratory issues are more common in this age group, and exposure to SO_2 can exacerbate these conditions.

2.6 HOUSEHOLD COMMUNICATION CHANNEL USAGE AND PREFERENCE

In support of the Eskom Communications and Awareness Campaign, a separate section of the research study explored the pertinent questions which are outlined in question box 2.3.

QUESTION BOX 2.3

- ☐ *Which communication channel(s) does your household currently use when communicating with each other? Select all that apply.*
- ☐ *Which communication channel(s) do you prefer Eskom to use to communicate with the household if the emission levels of SO_2 from the Kusile temporary stacks are higher than usual. Select all that apply.*

Figures 2.7 and 2.8 display the communication channels used and preferred by adult household members. With reference to the preferred communication channel to be used by Eskom when sharing vital information with households (Community Health Ambassadors) if the emissions of SO_2 from the Kusile temporary stacks are higher than usual, SMS/Text messaging topped the list.

FIGURE 2.7

COMMUNICATION CHANNELS USED BY HOUSEHOLDS

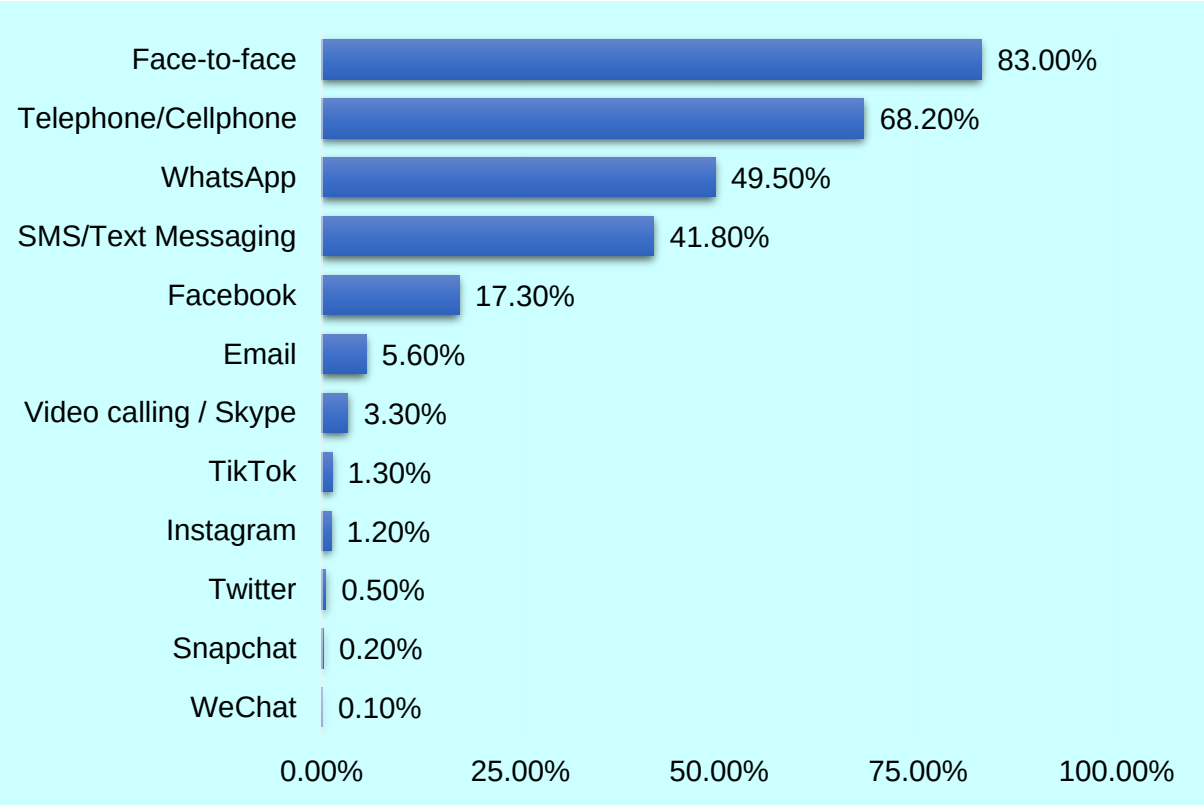
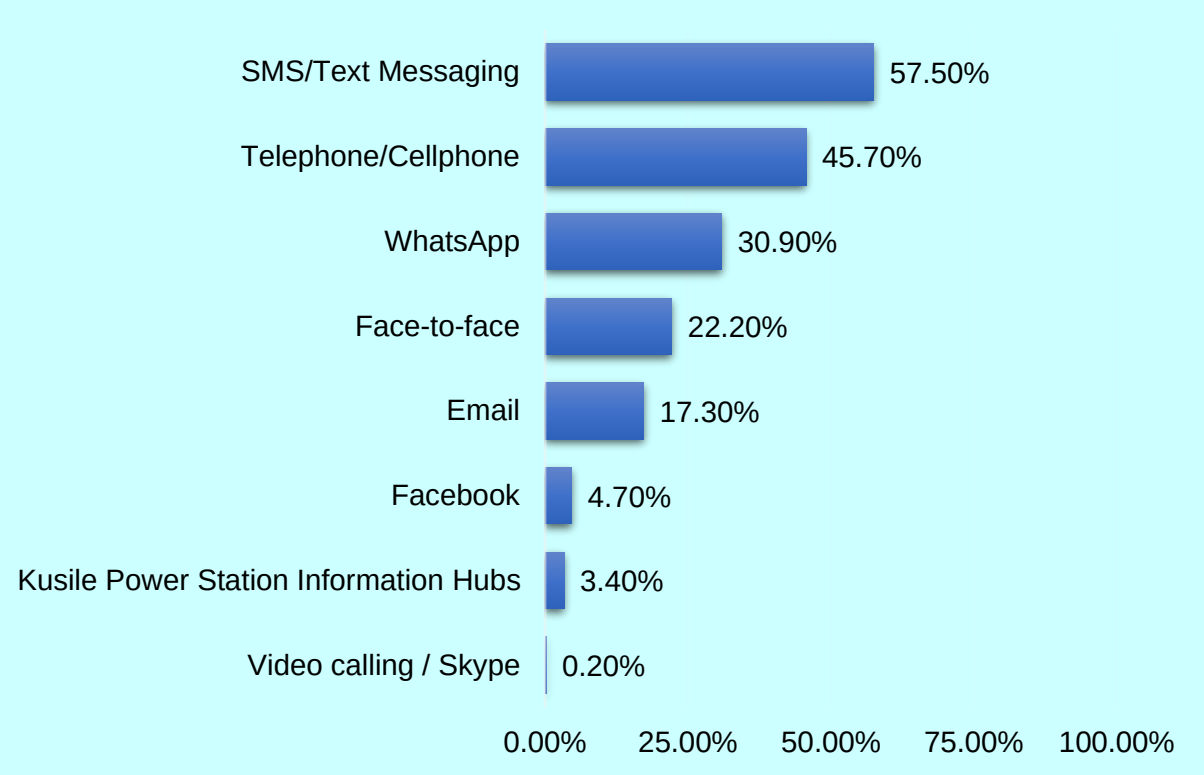


FIGURE 2.8

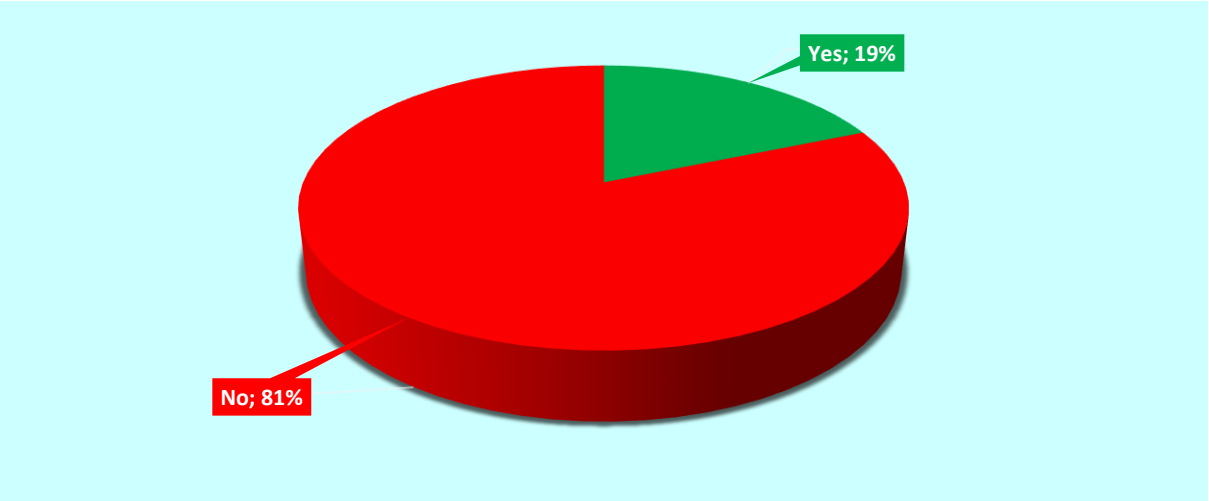
COMMUNICATION CHANNELS PREFERRED BY ADULT HOUSEHOLDS FOR ESKOM INITIATED COMMUNICATION



Adult household members were also prompted to indicate if they have prior to the survey, been aware of the Eskom Communications and Emergency Preparedness Plan, which will assist communities near Kusile to prepare for and respond promptly to higher concentrations of SO_2 in ambient air. Figure 2.9 captures the outcome of this finding. The analysis shows that one in every five adult household members affirmed that they are aware of the Eskom Communications and Emergency Preparedness Plan. This statistic can valuably serve as a benchmark for future studies to assess any changes in the awareness levels of the Eskom Communications and Emergency Preparedness Plan.

FIGURE 2.9

HOUSEHOLD AWARENESS OF ESKOM COMMUNICATIONS AND EMERGENCY PREPAREDNESS PLAN



2.7 SUMMARY AND CONCLUSION

This chapter presented an analysis and interpretation of the research results emanating from the personal face-to-face interviews with 1 203 adults who reside in the receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). A total of 1 545 adults registered as Community Health Ambassadors and it was calculated that approximately 90 000 people can be reached through household, family and friend network structures of those adults who registered as Community Health Ambassadors.

The research findings also indicated that just more than a quarter of adults (29.20%), during the four weeks prior to the study, experienced shortness of breath, wheezing, coughing and/or chest tightness at least one or two days per week. Although not all adults who reported this experience had to use a rescue inhaler, most experienced activity limitations and/or they were kept awake at night due to shortness of breath, wheezing, coughing and/or chest tightness.

The survey results revealed doctor-diagnosed prevalence rates of 5% for asthma and 3.5% for bronchitis among adult participants and that the respiratory health of about 5% of adults is at higher risk of an impact due to ambient air pollutants and that they are more sensitive to health effects at higher concentrations of SO_2. More confined risk and sensitivity analyses also showcased that households located in the Gauteng receptor communities are less sensitive and at lower risk than those who are in the Mpumalanga cluster.

With reference to the preferred communication channel to be used by Eskom when sharing vital health information with households (Community Health Ambassadors) if the emissions of SO_2 from the Kusile temporary stacks are higher than usual, SMS/Text messaging topped the list. Finally, the analysis showed that one in every five adult household members affirmed that they are aware of the Eskom Communications and Emergency Preparedness Plan.

CHAPTER 3

PARENT-ADMINISTRATED CHILD SURVEY ON RESPIRATORY SYMPTOMS IN PRESCHOOL CHILDREN (0-5 YEARS)

3.1 INTRODUCTION

This chapter presents the analyses and interpretation of the research results emanating from the personal face-to-face interviews with 390 parents/ caregivers/guardians who consented to complete a questionnaire on the prevalence of respiratory symptoms in preschool children (0-5 years). The survey tool for younger children (0-5 years) was developed by INFOTOX and the BMR team and had to be completed by parents/caregivers/guardians who are most knowledgeable about their children's health status and respiratory symptoms. Annexure B2 displays the survey tool used within this household cohort.

The research design applied a parent-administrated child survey which was completed by 390 parents/caregivers/ guardians residing in households located in receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). The findings resulting from the preschool children survey are analysed and interpreted in this chapter.

3.2 PRESCHOOL CHILDREN PARENTS / CAREGIVERS / GUARDIANS CONSENT

Exhibit 3.1 serves to confirm the consent ensured by 390 parents/caregivers/guardians of preschool children who participated in the preschool health screening survey. To adhere to sound research ethics principles, participation in the preschool survey was voluntary and adult respondents (parents/caregivers/guardians) could withdraw at any stage before or during the survey. No foreseeable risks in participating in this health screening survey were anticipated nor occurred. Participation involved the completion of a questionnaire by parents/caregivers/guardians regarding the health of a child in their care, between the ages of 0 to 5 years. Parents/caregivers/guardians were randomly sampled and requested to complete the preschool child questionnaire with the assistance of a trained

BMR interviewer. The BMR ensured the respondents that any personal details collected about the child would not be revealed to people outside the group of researchers who were involved in the project. The BMR also confirmed that no personal details of the child will be shared in the research report or made public. Against this background, 390 parents/caregivers/ guardians agreed to all research ethics conditions stated at the start of the survey. Confirmation of the adult (n = 390) consent adhering to all research ethics conditions is displayed in exhibit 3.1.

EXHIBIT 3.1

PARENTS/CAREGIVERS/GUARDIANS CONSENT TO PARTICIPATE IN THE PRESCHOOL CHILD SURVEY

STATEMENT	AGREE
I have read and understood what the respiratory health screening survey is about and what my participation will involve.	✓
I understand that my participation is voluntary.	✓
I understand that I can withdraw at any time without giving any reasons for why I no longer want to take part in the health screening survey.	✓
I understand my personal details will not be revealed to people outside the group of researchers.	✓
I understand that the information shared will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.	✓
I have been given the opportunity to ask questions about the respiratory health screening survey.	✓
I hereby agree to participate in the respiratory health screening survey.	✓

n = 390.

3.3 PROFILING PARENTS/CAREGIVERS/GUARDIANS OF PRESCHOOL SURVEY

Tables 3.1, 3.2 and 3.3 profile the participating parents/caregivers/guardians of preschool children by selected demographic cohort. The sample distribution ratio between the Gauteng and Mpumalanga clusters was about 40:60, while the gender participation is equal. Most parent/caregiver/guardian participants were Black Africans.

TABLE 3.1

PARENTS/CAREGIVERS/GUARDIANS OF PRESCHOOL CHILDREN BY RECEPTOR COMMUNITY

Receptor community	n	%
Gauteng Cluster	**161**	**41.30%**
Bronkhorstspruit	60	15.40%
Zithobeni	101	25.90%
Mpumalanga Cluster	**216**	**58.60%**
Balmoral/Wilge	17	4.40%
Phola	130	33.30%
Ogies/Blesboklaagte	48	12.30%
Arbor/Kendal	6	1.50%
Clewer	15	3.80%
Kwa-Guqa/Vosman	13	3.30%
Total	**390**	**100.00%**

TABLE 3.2

PARENTS/CAREGIVERS/GUARDIANS OF PRESCHOOL CHILDREN BY GENDER

Gender	n	%
Male	195	50.00%
Female	192	49.20%
Other/Prefer not to answer	3	0.80%
Total	**390**	**100.00%**

TABLE 3.3

PARENTS/CAREGIVERS/GUARDIANS OF PRESCHOOL CHILDREN BY POPULATION GROUP

	n	%
Black/African	379	97.20%
Indian/Asian	1	0.30%
Coloured	2	0.50%
White	8	2.10%
Other	0	0.00%
Total	**390**	**100.00%**

3.3.1 Profiling preschool children by age

The age profile of the preschool children reported by the parents/caregivers/ guardians is shown in table 3.4. The analysis shows representation across all six age groups, with the average age being calculated at 2.65 years. Of the total preschool sample, about 40% attend a crèche or playschool (see figure 3.1).

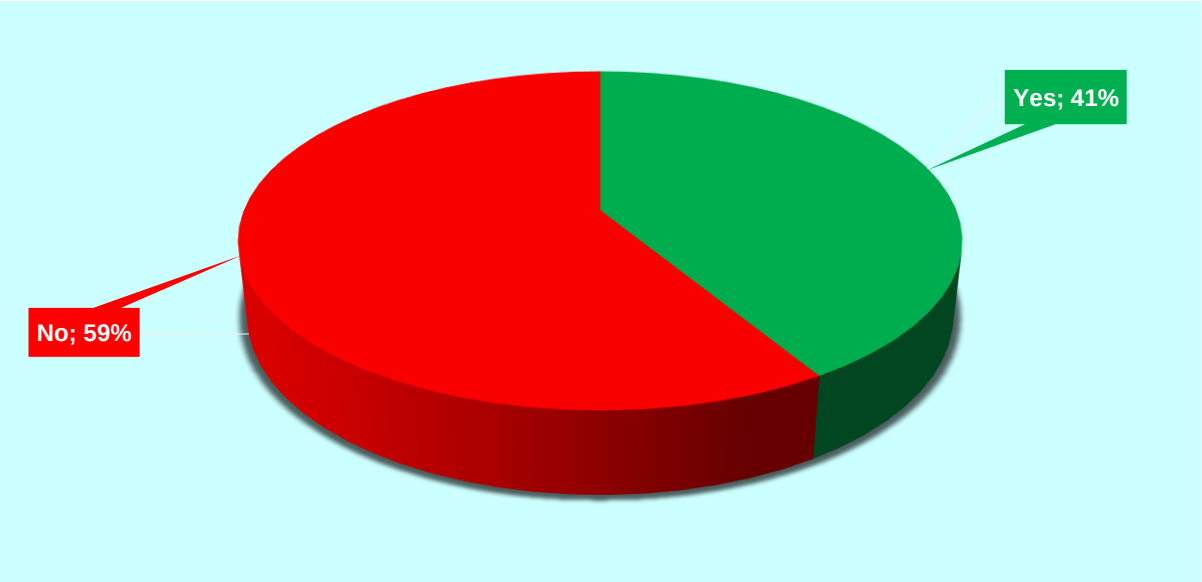
TABLE 3.4

AGE PROFILE OF PRESCHOOL CHILDREN

Years	n	%
0	49	12.60%
1	52	13.30%
2	76	19.50%
3	78	20.00%
4	81	20.80%
5	54	13.80%
Total	**390**	**100.00%**

FIGURE 3.1

PRESCHOOL CHILDREN ATTENDING A CRÈCHE OR PLAYSCHOOL



n = 390.

3.4 PREVALENCE AND IMPACT OF RESPIRATORY SYMPTOMS IN PRESCHOOL CHILDREN (0-5 YEARS)

3.4.1 Preschool children's respiratory symptoms

The questions shown in question box 3.1 were used to profile the respiratory symptoms experienced by preschool children.

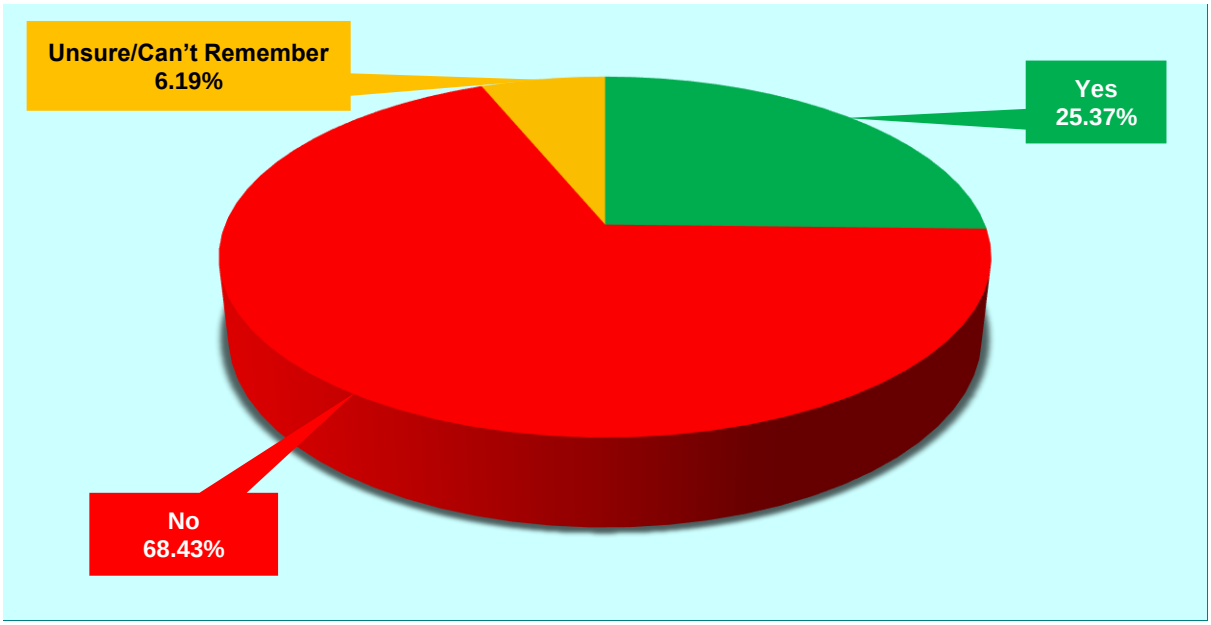
QUESTION BOX 3.1

- *Has your child ever had wheezing or whistling in the chest at any time in the past?*
- *Has a doctor ever told you that your child has asthma?*
- *Does your child's parents have asthma?*
- *Has a doctor ever told you that your child has atopic dermatitis?*
- *During the past 12 months, how many episodes of wheezing or whistling in the chest has your child had?*

Figures 3.2 to 3.6 and table 3.5 show the outcome of the research findings related to the questions displayed in question box 3.1.

FIGURE 3.2

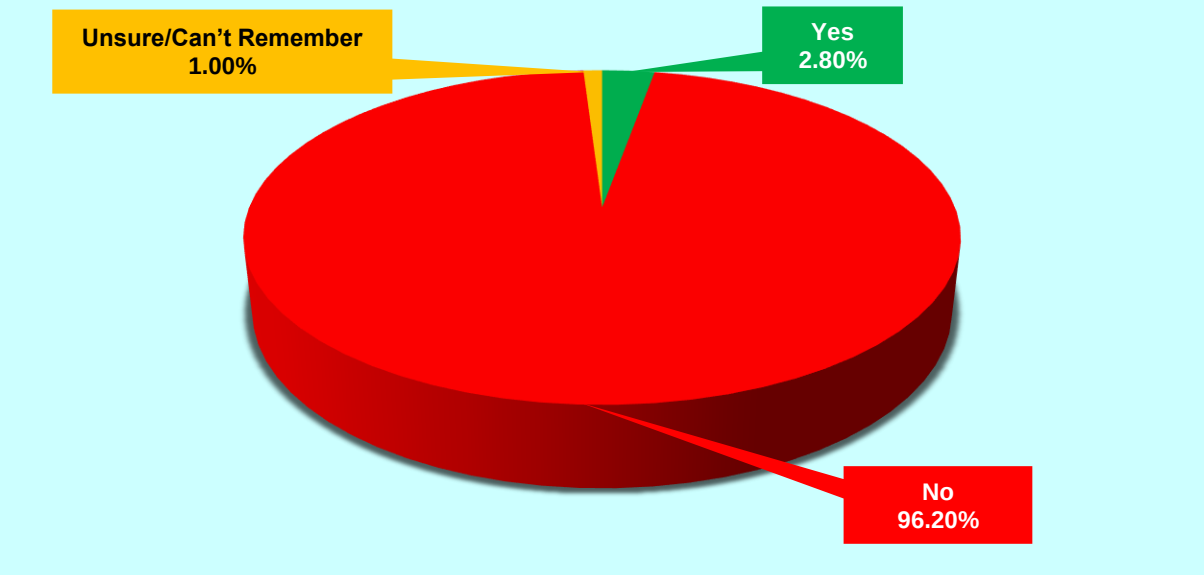
HAS YOUR CHILD EVER HAD WHEEZING OR WHISTLING IN THE CHEST AT ANY TIME IN THE PAST?



n = 390.

FIGURE 3.3

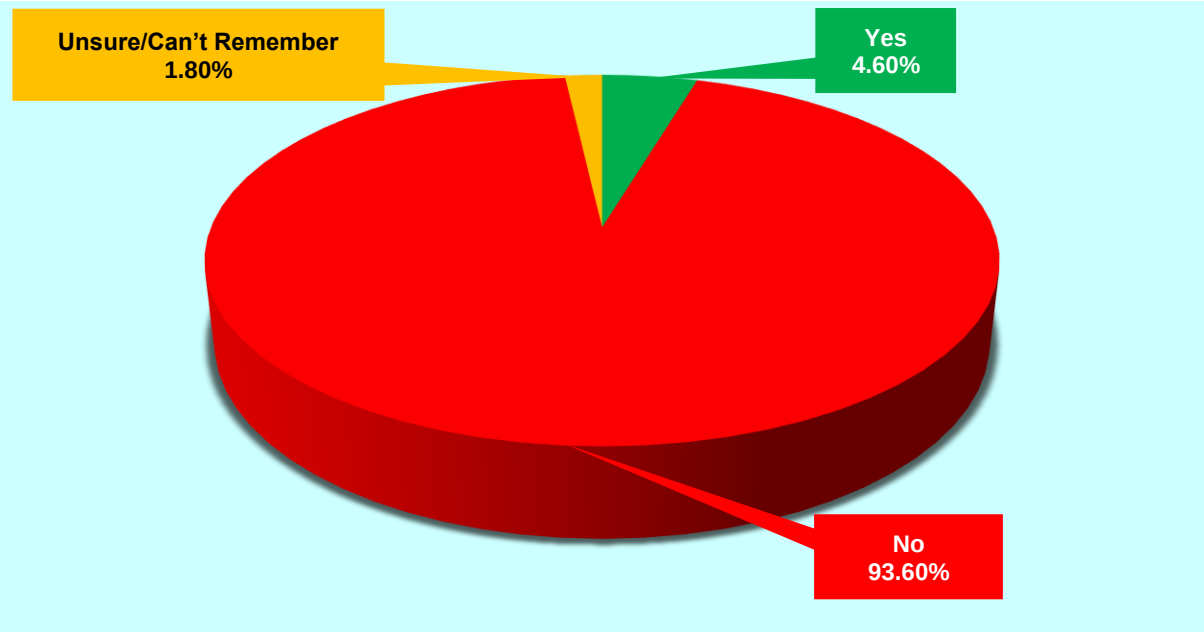
HAS A DOCTOR EVER TOLD YOU THAT YOUR CHILD HAS ASTHMA?



n = 390.

FIGURE 3.4

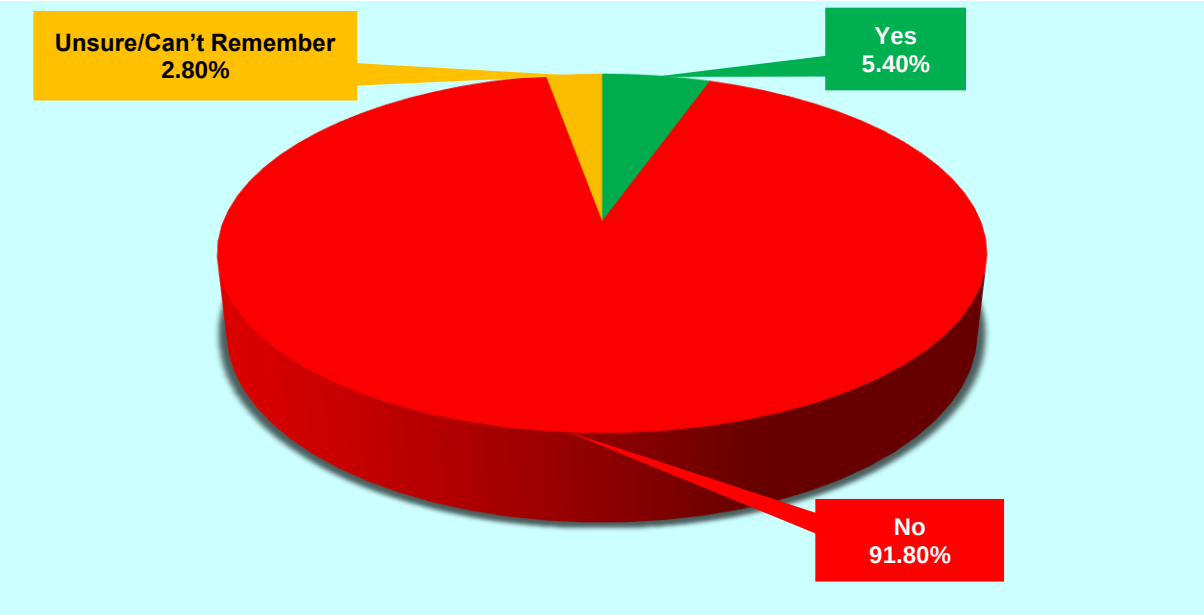
DO YOUR CHILD'S PARENTS HAVE ASTHMA?



n = 390.

FIGURE 3.5

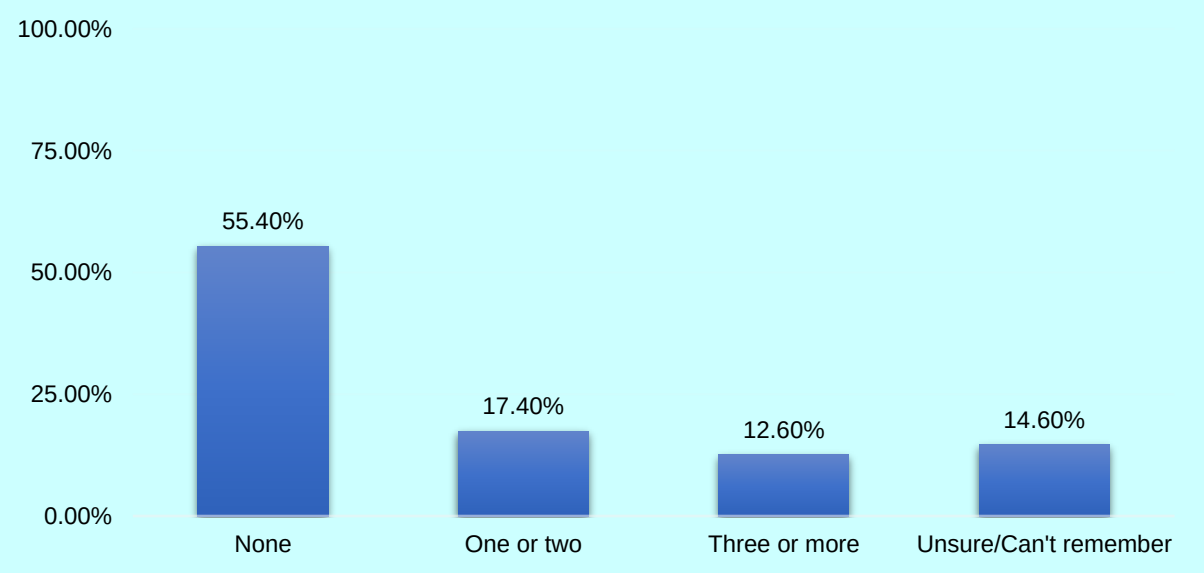
HAS A DOCTOR EVER TOLD YOU THAT YOUR CHILD HAS ATOPIC DERMATITIS?



n = 390.

FIGURE 3.6

DURING THE PAST 12 MONTHS, HOW MANY EPISODES OF WHEEZING OR WHISTLING IN THE CHEST HAS YOUR CHILD HAD?



n = 390.

Table 3.5 captures the respiratory symptoms experienced by preschool children. From the analyses it is clear that about a quarter (25.4%) of preschool children ever had wheezing or whistling in the chest at any time in the past. Just less than a third of preschool children (30.00%) had at least one episode of wheezing or whistling in the chest during the 12 months prior to the study. Parents/caregivers/guardians confirmed a prevalence rate of 2.80% for child asthma and 5.40% for atopic dermatitis among preschool (0-5 years) children.

TABLE 3.5

SUMMARY - RESPIRATORY SYMPTOMS AND IMPACT ON PRESCHOOL CHILDREN (0-5 YEARS)

Respiratory symptoms	**YES**
Has your child ever had wheezing or whistling in the chest at any time in the past?	25.40%
Has a doctor ever told you that your child has asthma?	2.80%
Does your child's parents have asthma?	4.60%
Has a doctor ever told you that your child has atopic dermatitis?	5.40%
During the past 12 months, did your child have at least one episode of wheezing or whistling in the chest?	30.00%

n = 390.

3.4.2 Preschool children - Symptoms experienced during the day

The question displayed in question box 3.2 was used to determine the symptoms experienced by preschool children during the day.

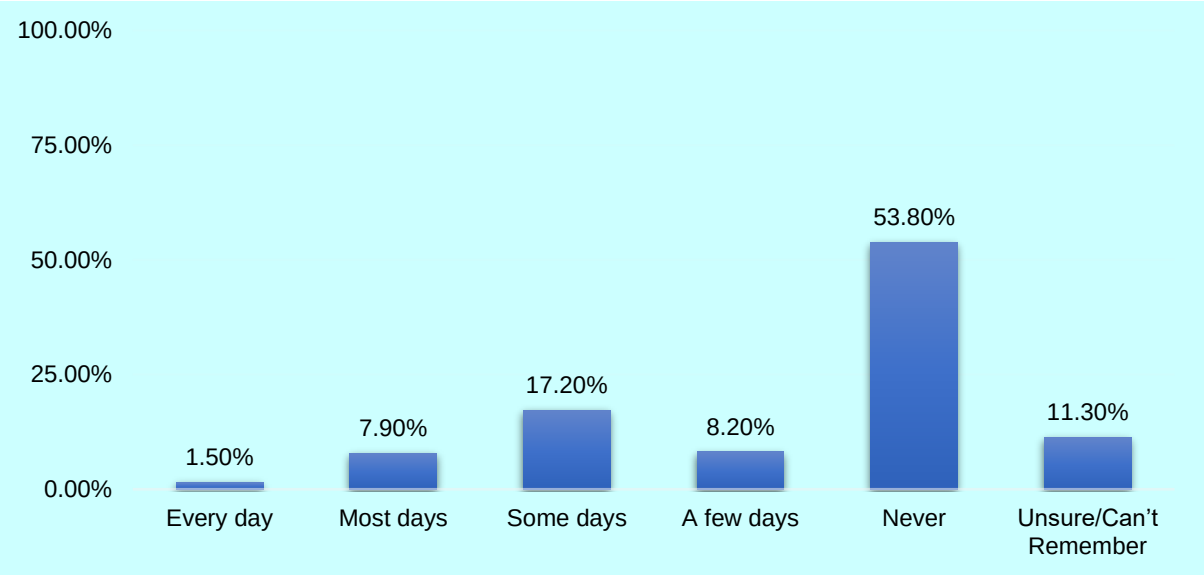
QUESTION BOX 3.2

- *During the past 3 months, has your child been wheezy during the day?*
- *During the past 3 months, has your child coughed during the day?*
- *During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the day?*
- *During the past 3 months, has your child been short of breath or complained of being short of breath during the day?*

Figures 3.7 to 3.10 and table 3.6 show the outcome of the research findings related to the questions displayed in question box 3.2.

FIGURE 3.7

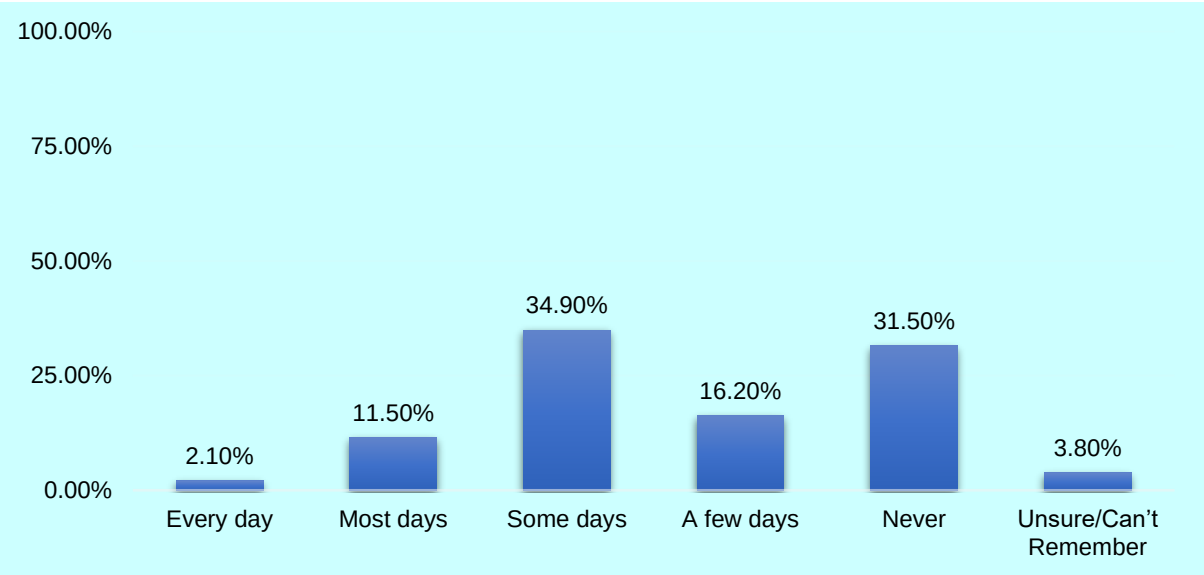
DURING THE PAST 3 MONTHS, HAS YOUR CHILD BEEN WHEEZY DURING THE DAY?



n = 390.

FIGURE 3.8

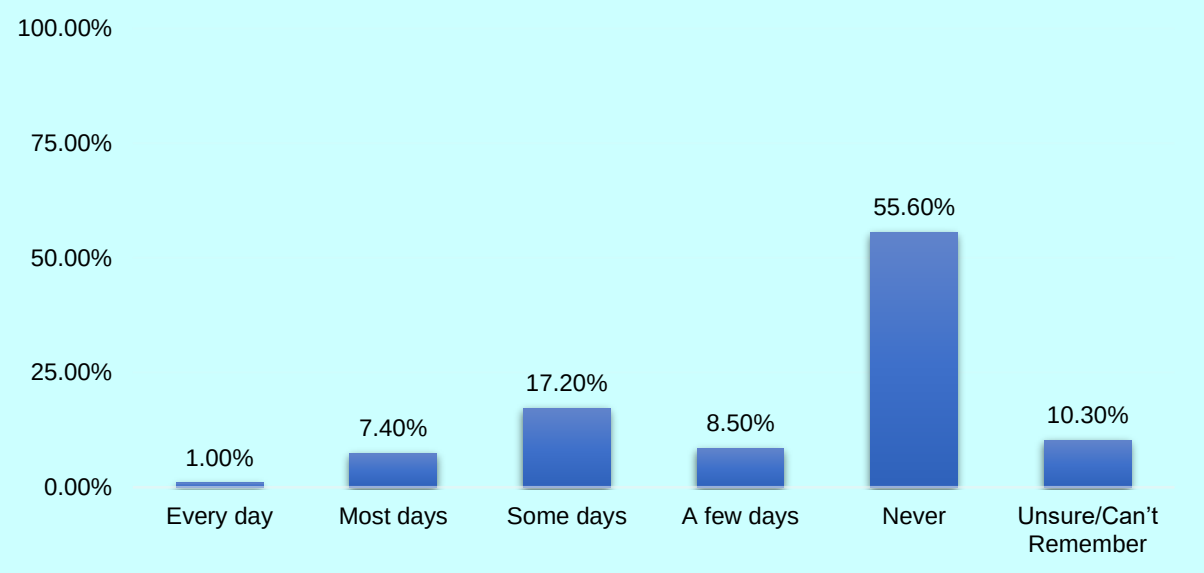
DURING THE PAST 3 MONTHS, HAS YOUR CHILD COUGHED DURING THE DAY?



n = 390.

FIGURE 3.9

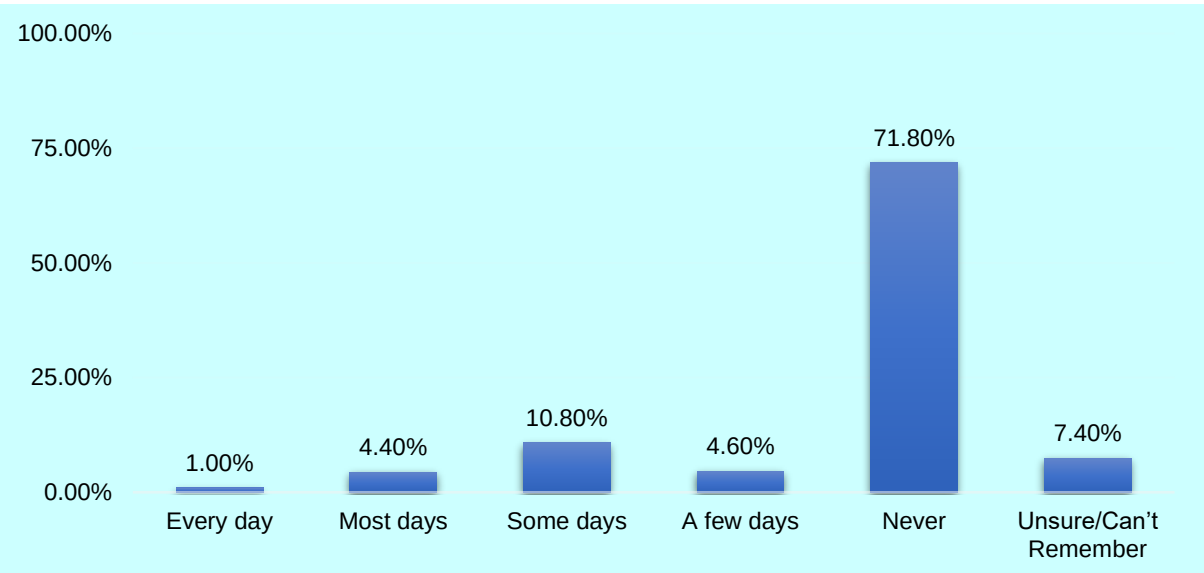
DURING THE PAST 3 MONTHS, HAS YOUR CHILD HAD A RATTLY CHEST (RATTLING SOUND WHEN BREATHING) DURING THE DAY?



n = 390.

FIGURE 3.10

DURING THE PAST 3 MONTHS, HAS YOUR CHILD BEEN SHORT OF BREATH OR COMPLAINED OF BEING SHORT OF BREATH DURING THE DAY?



n = 390.

TABLE 3.6

SUMMARY: PAST THREE MONTHS SYMPTOMS EXPERIENCED BY PRESCHOOL CHILDREN DURING THE DAY

Respiratory symptoms experienced during the day	**YES**
During the past 3 months, has your child been wheezy during the day for at least a few days?	34.80%
During the past 3 months, has your child coughed during the day for at least a few days?	64.70%
During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the day for at least a few days?	34.10%
During the past 3 months, has your child been short of breath or complained of being short of breath during the day for at least a few days?	20.80%

n = 390.

The analyses displayed in table 3.6 show that during the past three months prior to the study, about a third of preschool children (0-5 years) have been wheezy (34.80%) or had a rattly chest (34.10%) during the day for at least a few days, while about two-thirds of children coughed during the day for at least a few days. Also, during the three months preceding the study, about one in every five (20.80%) preschool children have been short of breath or complained of being short of breath during the day for at least a few days.

3.4.3 Preschool children - Symptoms experienced when child does <u>not</u> have a cold

The questions displayed in question box 3.3 were used to determine the symptoms experienced by preschool children when the child does not have a cold.

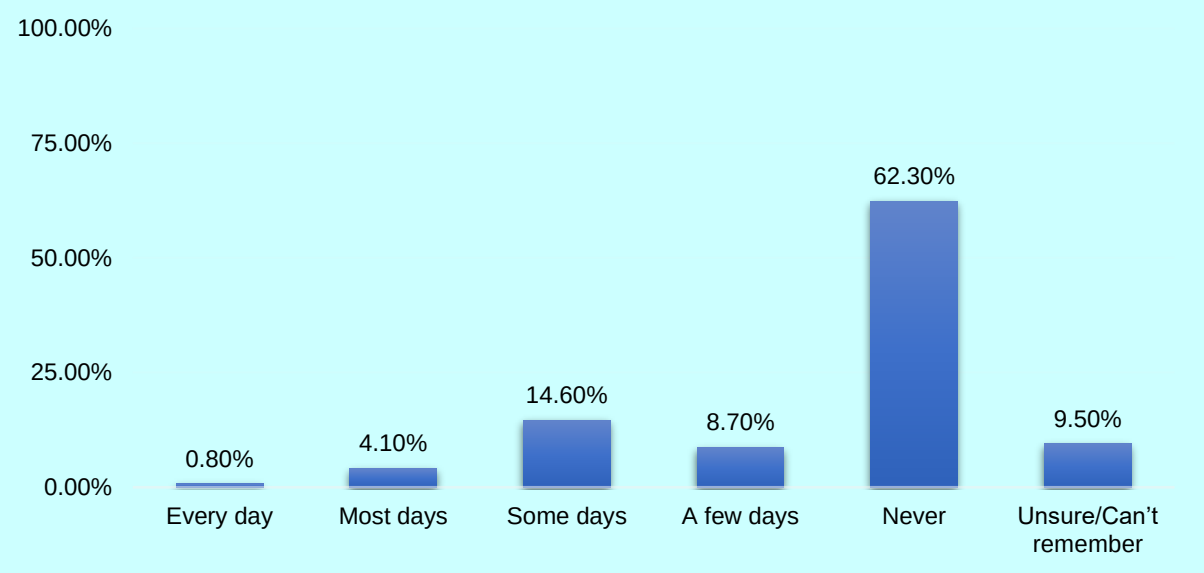
QUESTION BOX 3.3

- *During the past 3 months, when NOT having a cold, has your child been wheezy?*
- *During the past 3 months, when NOT having a cold, has your child coughed during the day?*
- *During the past 3 months, when NOT having a cold, has your child had a rattly chest (rattling sound when breathing) during the day?*
- *During the past 3 months, when NOT having a cold, has your child been short of breath or complained of being short of breath during the day?*

Figures 3.11 to 3.14 and table 3.7 show the outcome of the research findings related to the questions displayed in question box 3.3.

FIGURE 3.11

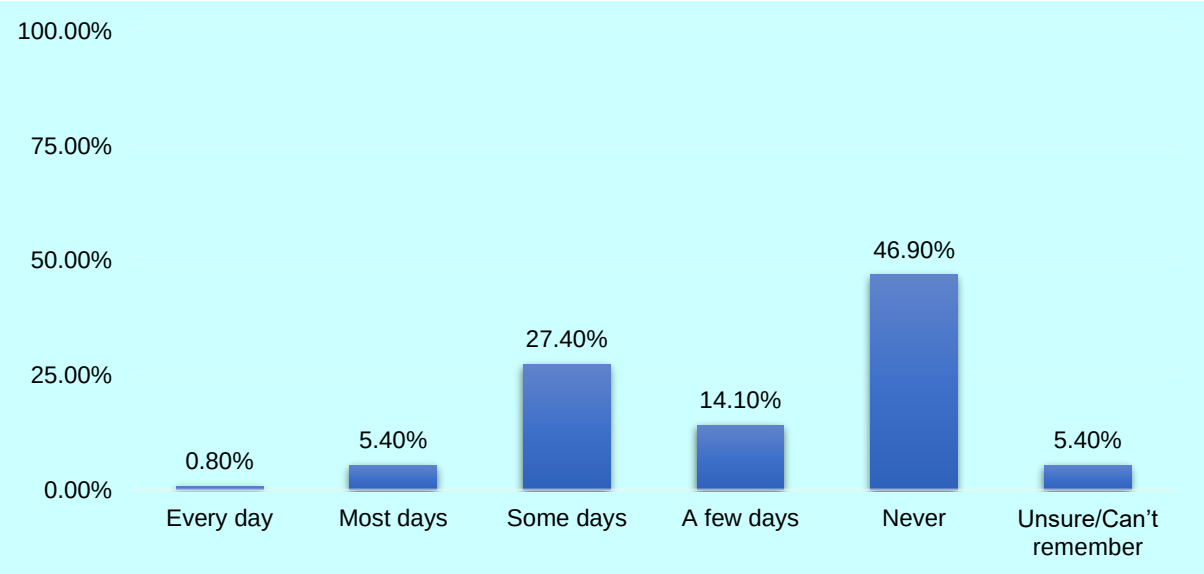
DURING THE PAST 3 MONTHS, WHEN NOT HAVING A COLD, HAS YOUR CHILD BEEN WHEEZY?



n = 390.

FIGURE 3.12

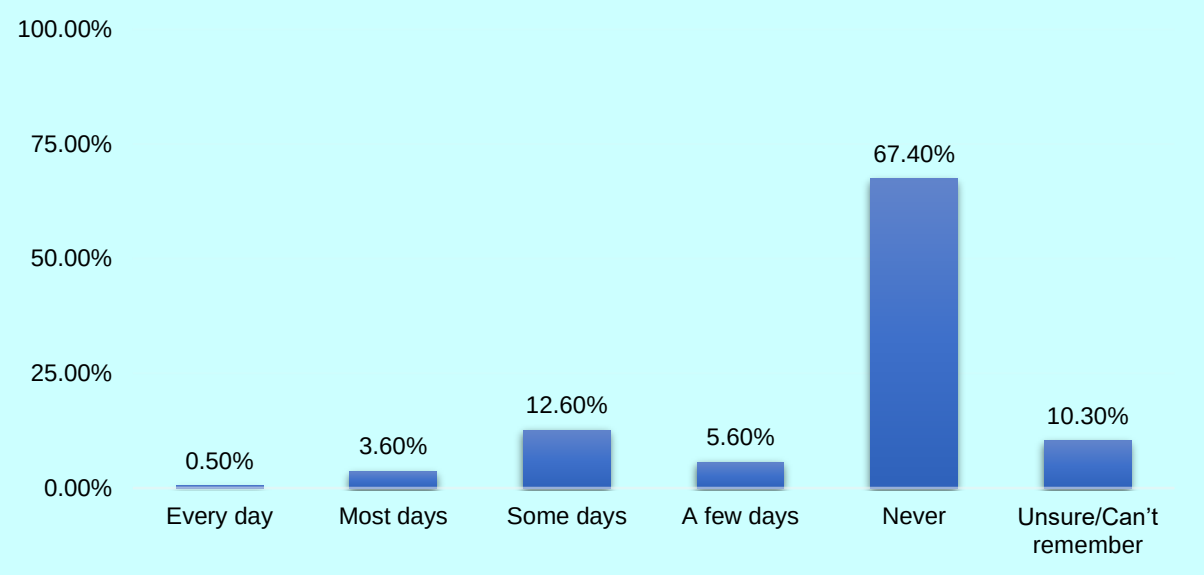
DURING THE PAST 3 MONTHS, WHEN NOT HAVING A COLD, HAS YOUR CHILD COUGHED DURING THE DAY?



n = 390.

FIGURE 3.13

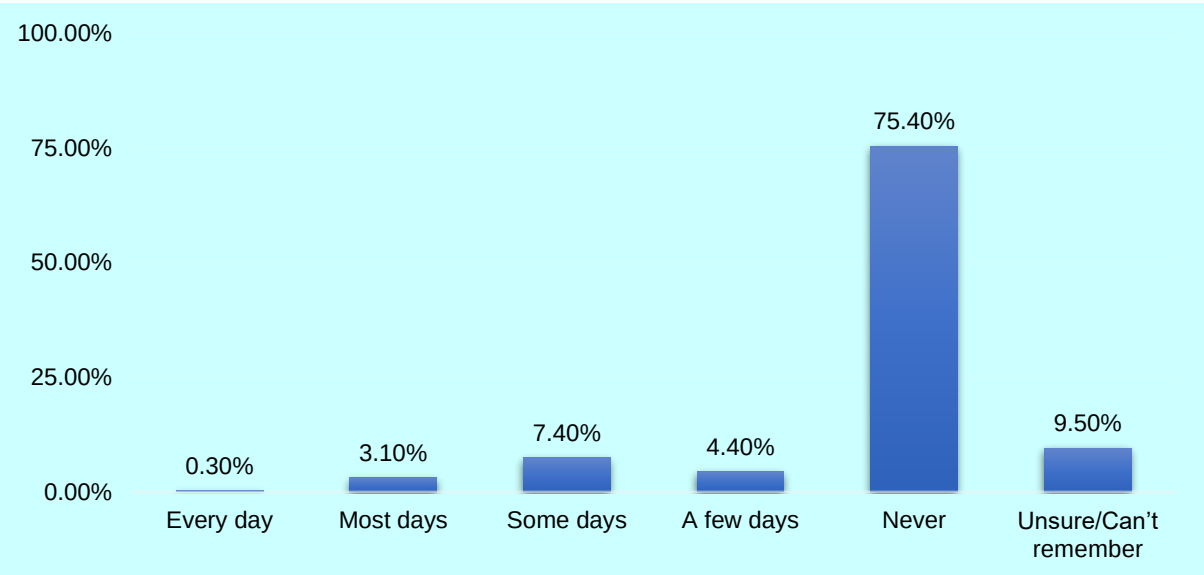
DURING THE PAST 3 MONTHS, WHEN NOT HAVING A COLD, HAS YOUR CHILD HAD A RATTLY CHEST (RATTLING SOUND WHEN BREATHING) DURING THE DAY?



n = 390.

FIGURE 3.14

DURING THE PAST 3 MONTHS, WHEN NOT HAVING A COLD, HAS YOUR CHILD BEEN SHORT OF BREATH OR COMPLAINED OF BEING SHORT OF BREATH DURING THE DAY?



n = 390.

TABLE 3.7

SUMMARY: SYMPTOMS EXPERIENCED DURING THE PAST THREE MONTHS BY PRESCHOOL CHILDREN WHEN NOT HAVING A COLD

Respiratory symptoms experienced when not having a cold	YES
During the past 3 months, when NOT having a cold has your child been wheezy for at least a few days?	28.20%
During the past 3 months, when NOT having a cold, has your child coughed during the day for at least a few days?	47.70%
During the past 3 months, when NOT having a cold, has your child had a rattly chest (rattling sound when breathing) during the day for at least a few days?	22.30%
During the past 3 months, when NOT having a cold, has your child been short of breath or complained of being short of breath during the day for at least a few days?	15.20%

n = 390.

The analyses displayed in table 3.7 show that during the past three months prior to the study, about a quarter of preschool children (0-5 years) have been wheezy (28.20%) or had a rattly chest (22.30%) when not having a cold for at least a few days, while about half of children (47.70%) coughed during the day when not having a cold for at least a few days during the past three months. During the three months preceding the study, about one in every five (15.20%) preschool children have been short of breath or complained of being short of breath during the day when not having a cold for at least a few days.

3.4.4 Preschool children - Symptoms experienced when child is active

The questions displayed in question box 3.4 were used to determine the symptoms experienced by preschool children when active. This section excluded preschool children younger than 12 months of age, which constituted 12.56% of the preschool child sample.

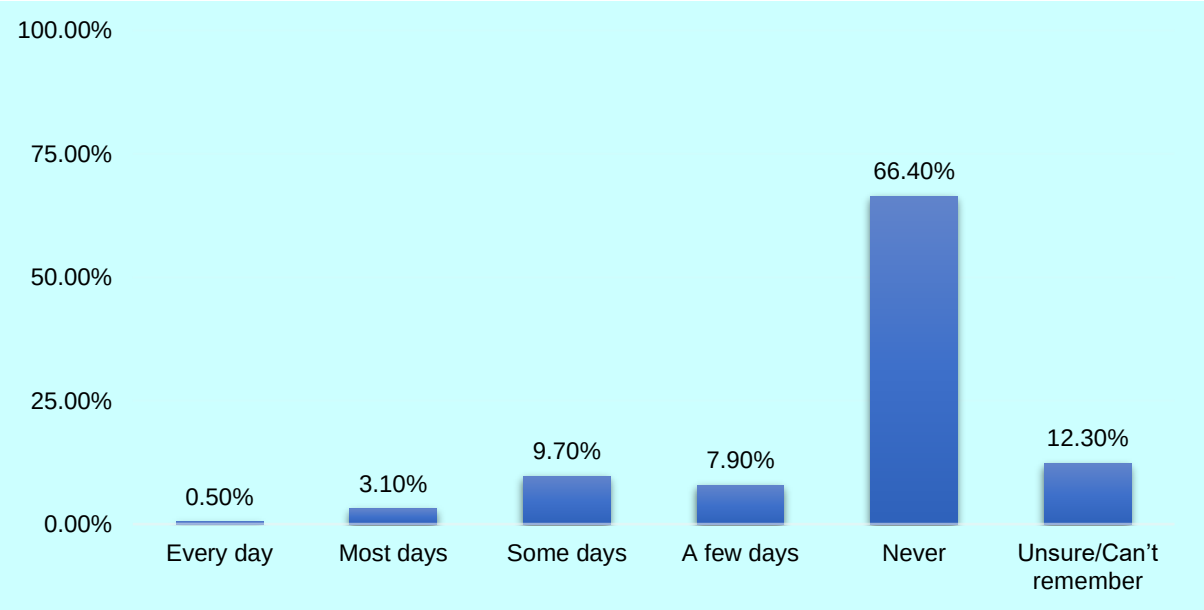
QUESTION BOX 3.4

- *During the past 3 months, when your child was active, has your child been wheezy?*
- *During the past 3 months, when your child was active, has your child coughed?*
- *During the past 3 months, when your child was active, has your child had a rattly chest (rattling sound when breathing)?*
- *During the past 3 months, when your child was active, has your child been short of breath or complained of being short of breath?*

Figures 3.15 to 3.18 and table 3.8 show the outcome of the research findings related to the questions displayed in question box 3.4.

FIGURE 3.15

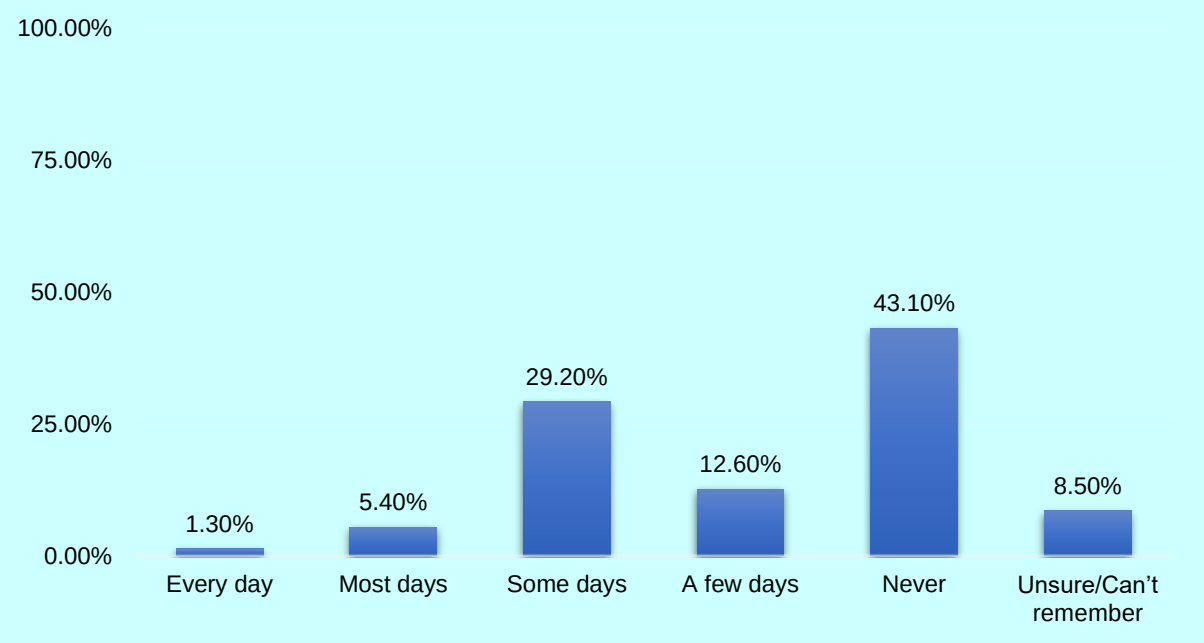
DURING THE PAST 3 MONTHS, WHEN YOUR CHILD WAS ACTIVE, HAS YOUR CHILD BEEN WHEEZY?



n = 341.

FIGURE 3.16

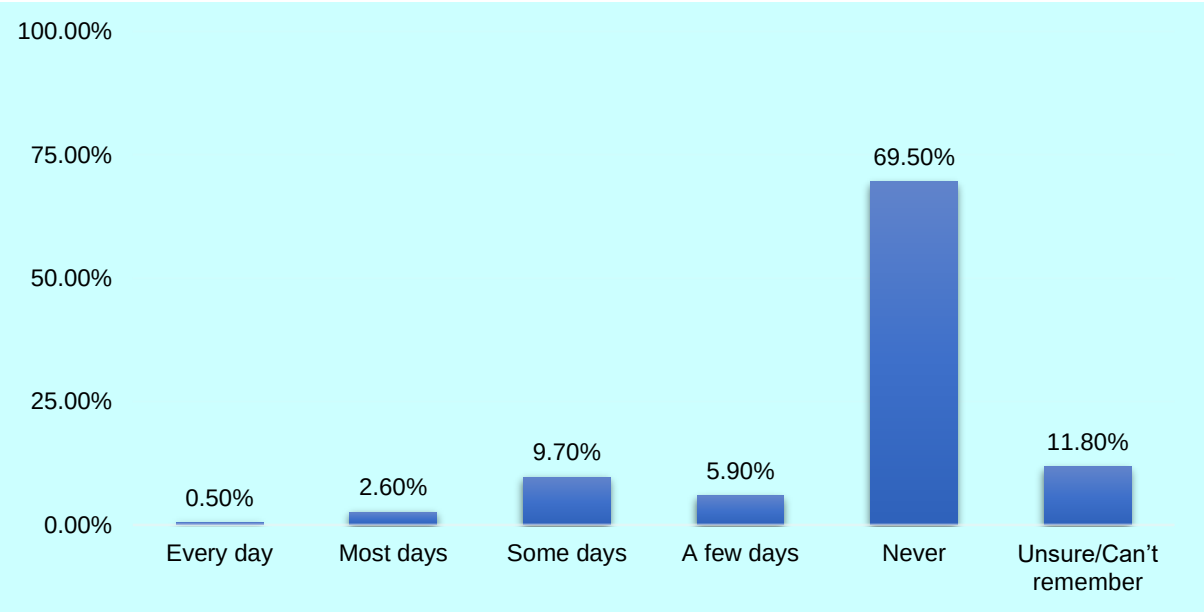
DURING THE PAST 3 MONTHS, WHEN YOUR CHILD WAS ACTIVE, HAS YOUR CHILD COUGHED?



n = 341.

FIGURE 3.17

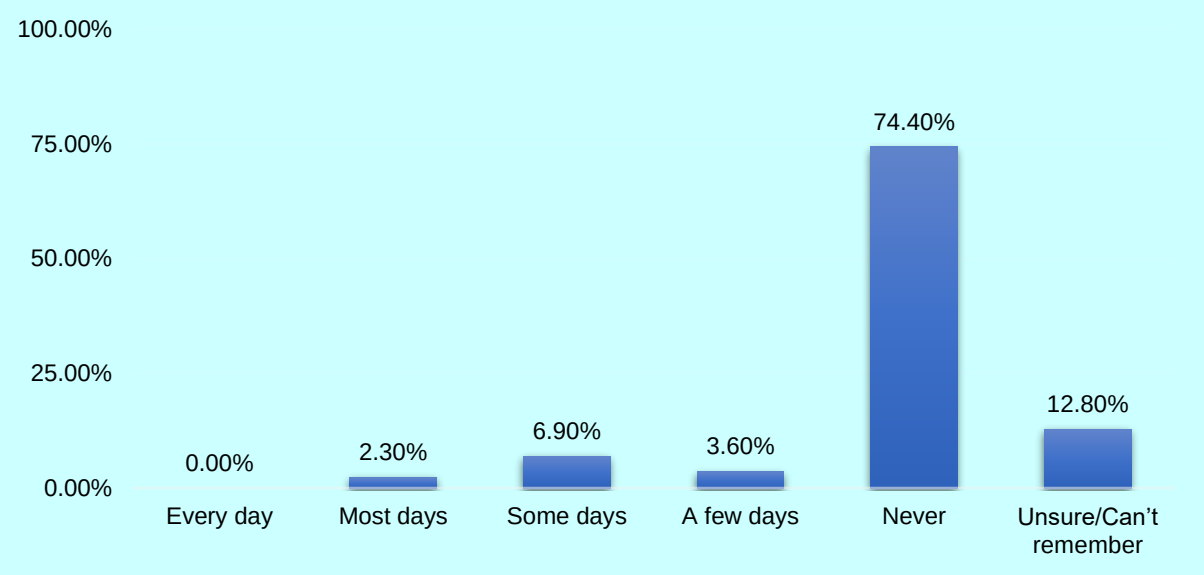
DURING THE PAST 3 MONTHS, WHEN YOUR CHILD WAS ACTIVE, HAS YOUR CHILD HAD A RATTLY CHEST (RATTLING SOUND WHEN BREATHING)?



n = 341.

FIGURE 3.18

DURING THE PAST 3 MONTHS, WHEN YOUR CHILD WAS ACTIVE, HAS YOUR CHILD BEEN SHORT OF BREATH OR COMPLAINED OF BEING SHORT OF BREATH?



n = 341.

TABLE 3.8

SUMMARY: SYMPTOMS EXPERIENCED BY PRESCHOOL CHILDREN WHEN ACTIVE DURING THE PAST THREE MONTHS

Respiratory symptoms experienced when active	YES
During the past 3 months, when your child was active has your child been wheezy for at least a few days?	21.20%
During the past 3 months, when your child was active, has your child coughed for at least a few days?	48.50%
During the past 3 months, when your child was active, has your child had a rattly chest (rattling sound when breathing) for at least a few days?	18.70%
During the past 3 months, when your child was active, has your child been short of breath or complained of being short of breath for at least a few days?	12.80%

n = 341.

The analyses displayed in table 3.8 show that during the past three months prior to the study, about a fifth of preschool children (0-5 years) have been wheezy (21.20%) or had a rattly chest (28.70%) when being active for at least a few days, while about half of children (48.50%) coughed during the day when active for at least a few days during the past three months. During the three months preceding the study, about one in every ten (12.80%) preschool

children have been short of breath or complained of being short of breath during the day when active for at least a few days.

3.4.5 Preschool children - symptoms experienced at night

The questions displayed in question box 3.5 were used to determine the symptoms experienced by preschool children during the night.

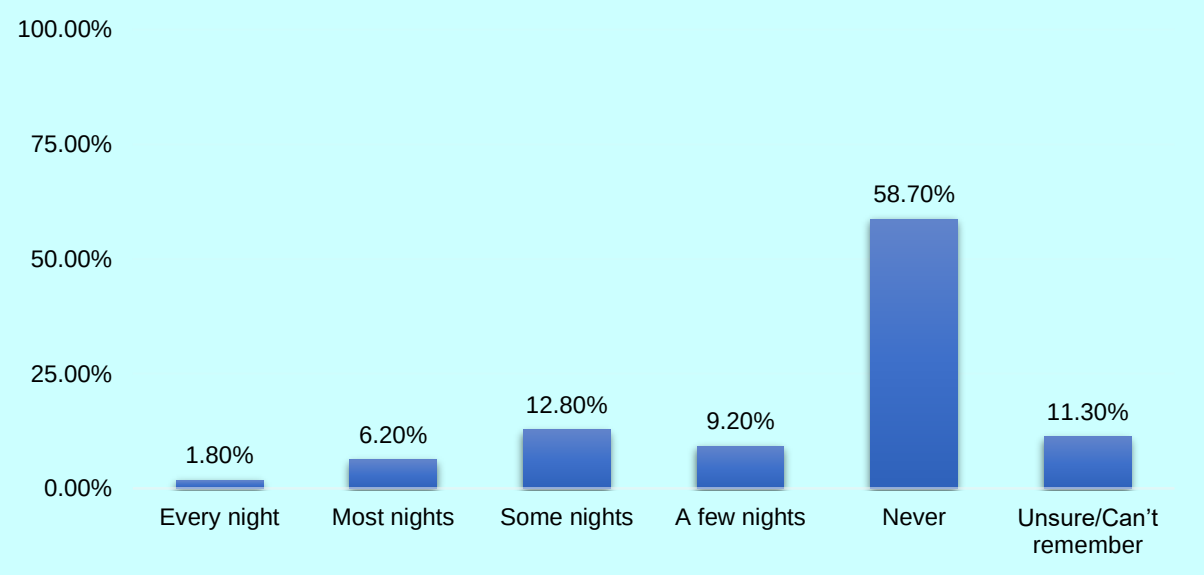
QUESTION BOX 3.5

- *During the past 3 months, has your child been wheezy at night?*
- *During the past 3 months, has your child coughed during the night?*
- *During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the night?*
- *During the past 3 months, has your child been short of breath or complained of being short of breath during the night?*

Figures 3.19 to 3.22 and table 3.9 show the outcome of the research findings related to the questions displayed in question box 3.5.

FIGURE 3.19

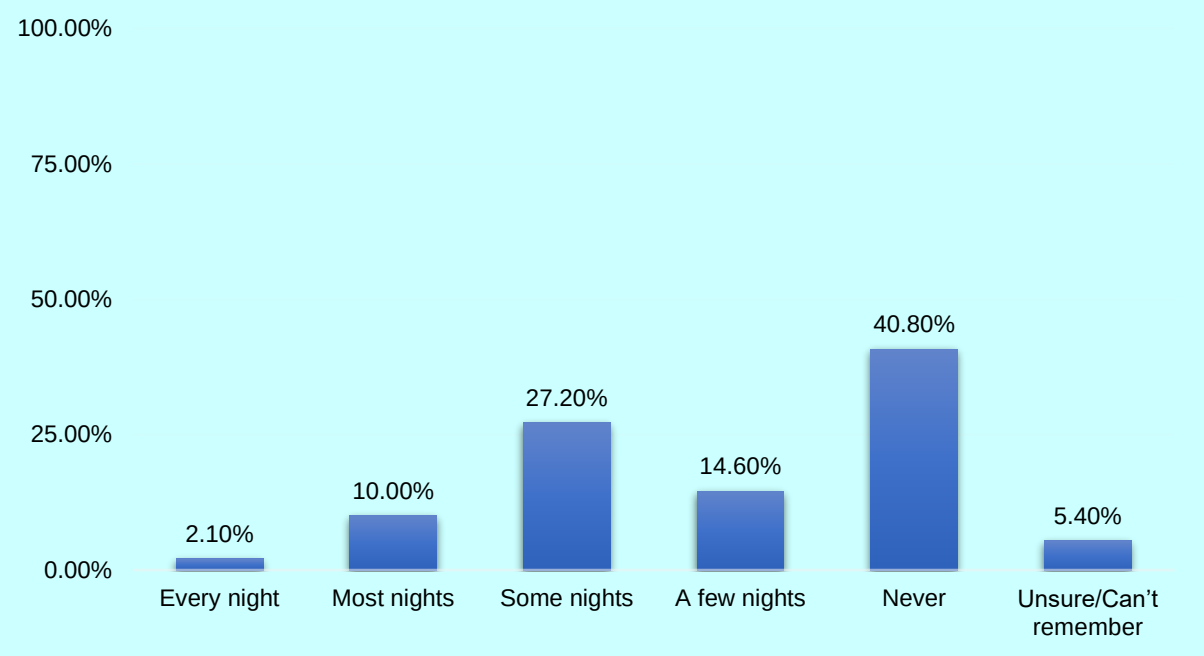
DURING THE PAST 3 MONTHS, HAS YOUR CHILD BEEN WHEEZY AT NIGHT?



n = 390.

FIGURE 3.20

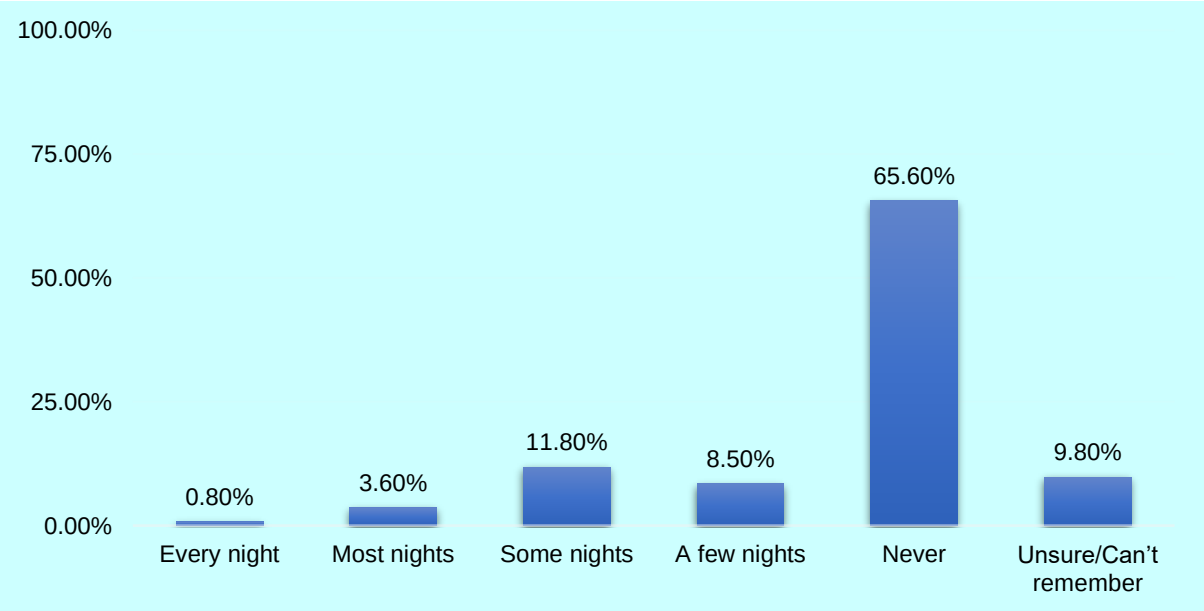
DURING THE PAST 3 MONTHS, HAS YOUR CHILD COUGHED DURING THE NIGHT?



n = 390.

FIGURE 3.21

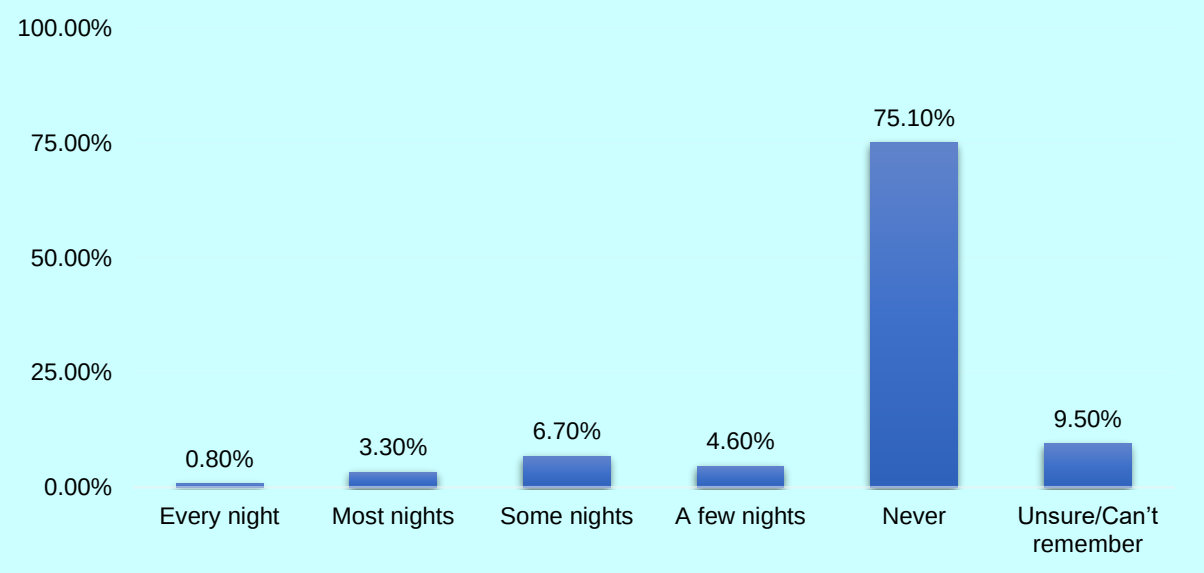
DURING THE PAST 3 MONTHS, HAS YOUR CHILD HAD A RATTLY CHEST (RATTLING SOUND WHEN BREATHING) DURING THE NIGHT?



n = 390.

FIGURE 3.22

DURING THE PAST 3 MONTHS, HAS YOUR CHILD BEEN SHORT OF BREATH OR COMPLAINED OF BEING SHORT OF BREATH DURING THE NIGHT?



n = 390.

TABLE 3.9

SUMMARY: SYMPTOMS EXPERIENCED BY PRESCHOOL CHILDREN AT NIGHT

Respiratory symptoms experienced at night	YES
During the past 3 months, has your child been wheezy at night for at least a few nights?	30.00%
During the past 3 months, has your child coughed during the night for at least a few nights?	53.90%
During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the night for at least a few nights?	24.70%
During the past 3 months, has your child been short of breath or complained of being short of breath during the night for at least a few nights?	15.40%

n = 390.

The analyses displayed in table 3.9 show that during the past three months prior to the study, between a quarter and a third of preschool children (0-5 years) have been wheezy (21.20%) or had a rattly chest (24.70%) during the night for at least a few nights, while about half of children (53.90%) coughed during the night for at least a few nights during the past three months. During the three months preceding the study, about one in every ten (15.40%)

preschool children have been short of breath or complained of being short of breath during the night for at least a few nights.

3.4.6 Preschool children - Impact of respiratory symptoms on preschool child

The questions displayed in question box 3.6 were used to determine the impact of respiratory symptoms on the preschool child.

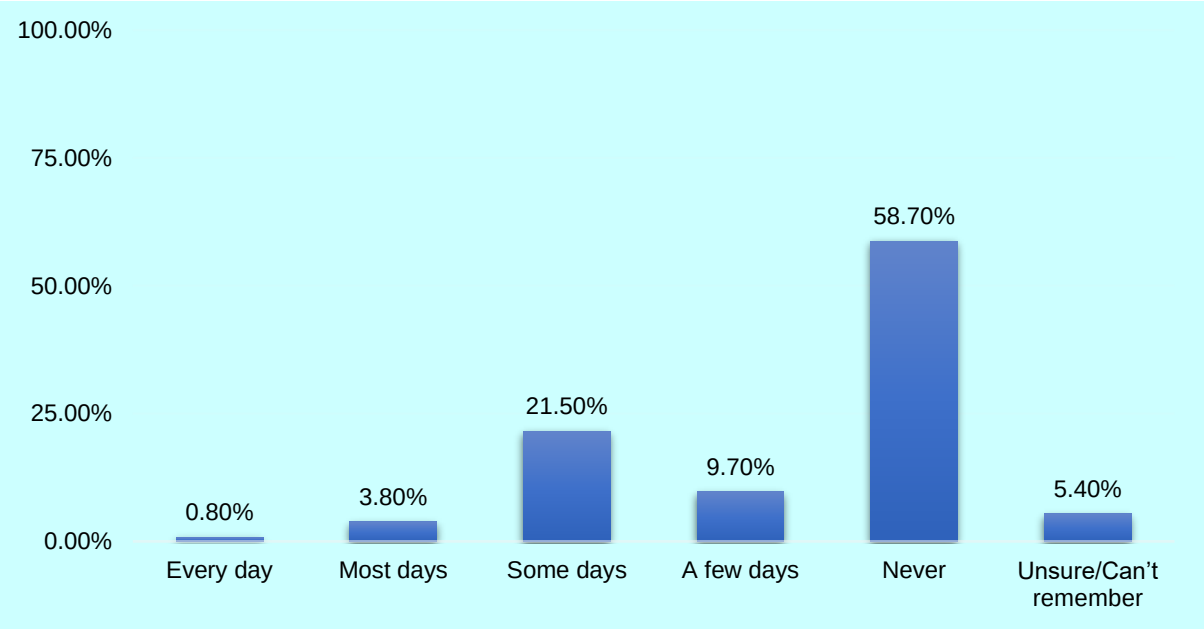
QUESTION BOX 3.6

- *During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to have trouble drinking or eating?*
- *During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to wake up during the night?*
- *During the past 3 months has your child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day)?*
- *During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to be more tired than usual?*

Figures 3.23 to 3.26 and table 3.10 show the outcome of the research findings related to the questions displayed in question box 3.6.

FIGURE 3.23

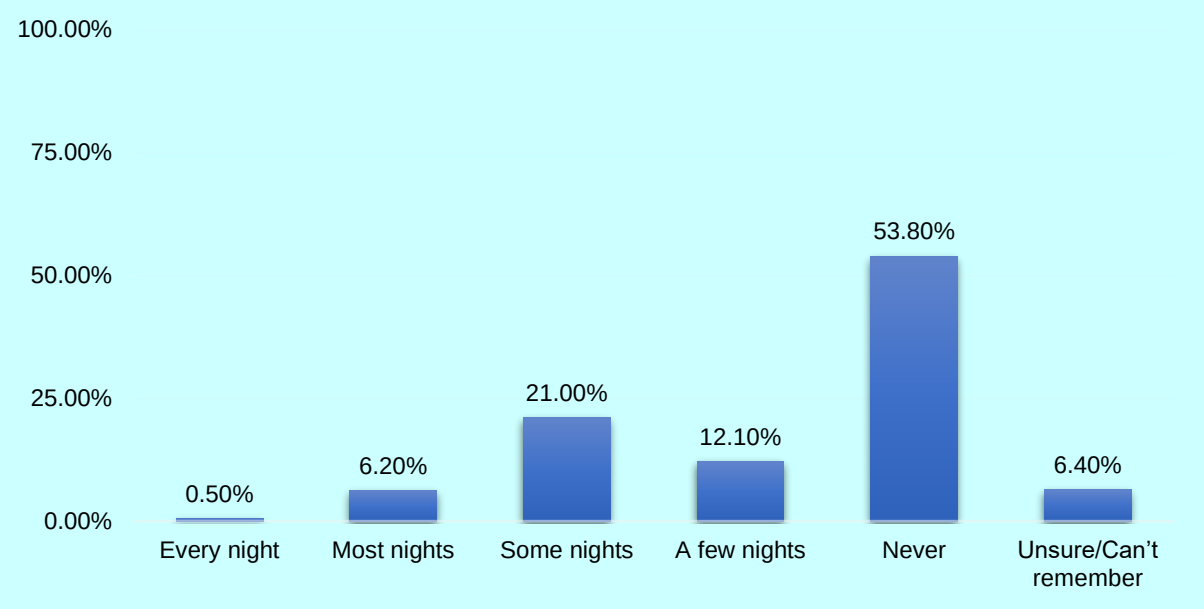
DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED HIM/HER TO HAVE TROUBLE DRINKING OR EATING?



n = 390.

FIGURE 3.24

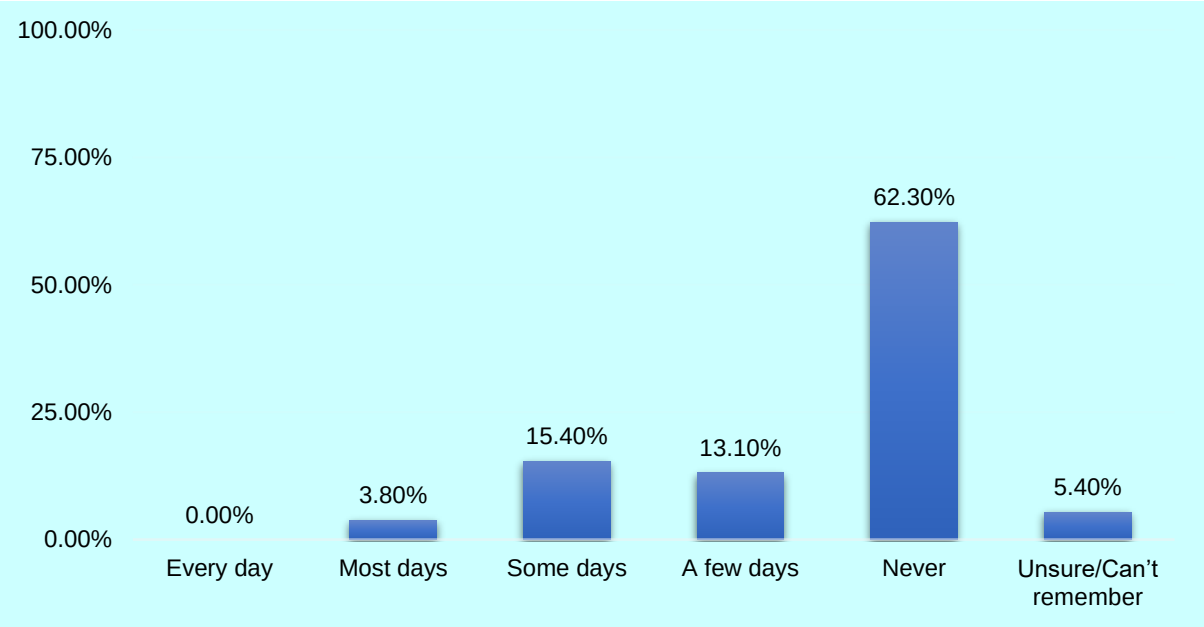
DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED HIM/HER TO WAKE UP DURING THE NIGHT?



n = 390.

FIGURE 3.25

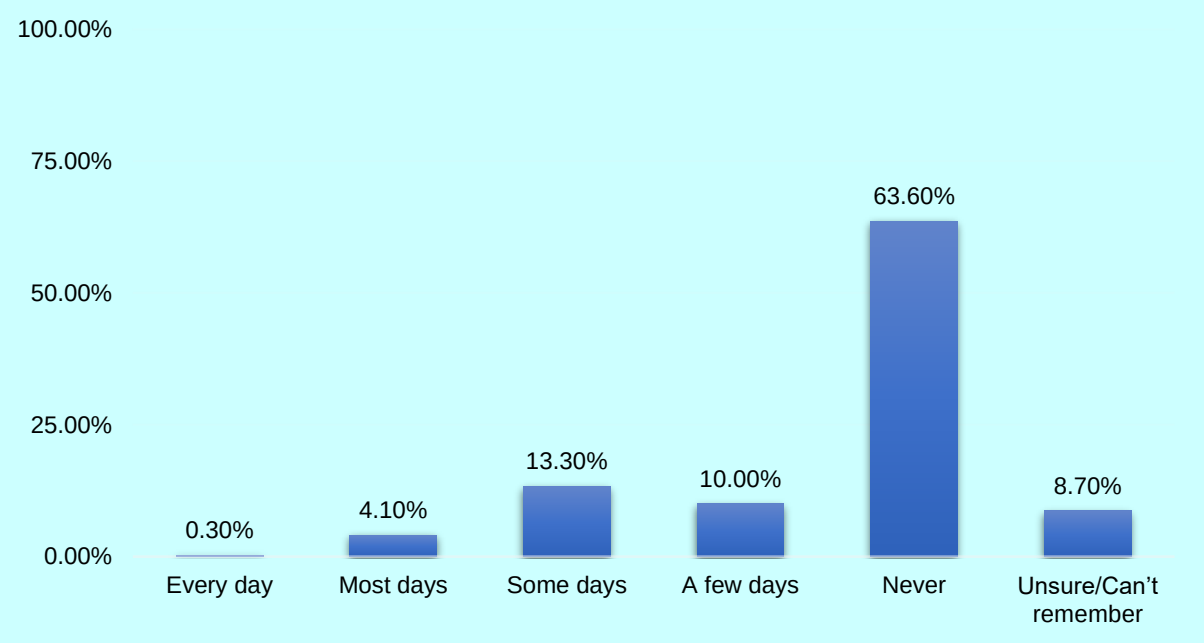
DURING THE PAST 3 MONTHS HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED HIM/HER DIFFICULTY WITH HIS/HER USUAL ACTIVITIES (KEPT HIM/HER FROM THE THINGS HE/SHE USUALLY DOES DURING THE DAY)?



n = 390.

FIGURE 3.26

DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED HIM/HER TO BE MORE TIRED THAN USUAL?



n = 390.

TABLE 3.10

SUMMARY: IMPACT OF RESPIRATORY SYMPTOMS ON PRESCHOOL CHILD

Impact of symptoms on preschool child	YES
During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to have trouble drinking or eating for at least a few days?	35.80%
During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to wake up during the night for at least a few nights?	39.80%
During the past 3 months has your child's coughing, wheezing or being short of breath caused him/her difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day) for at least a few days?	32.30%
During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to be more tired than usual for at least a few days?	27.70%

n = 390.

From table 3.10 it is clear that respiratory symptoms prevalent among preschool children during the three months prior to the study, have resulted in about a third of preschool children having trouble drinking or eating (35.80%), sleeping (39.80%), doing usual activities (32.30%) and/or being more tired than usual (27.70%) for at least a few days/nights during the three months prior to the study.

3.4.7 Preschool children - Impact of preschool child respiratory symptoms on family

The questions displayed in question box 3.6 were used to determine the impact of symptoms on the family.

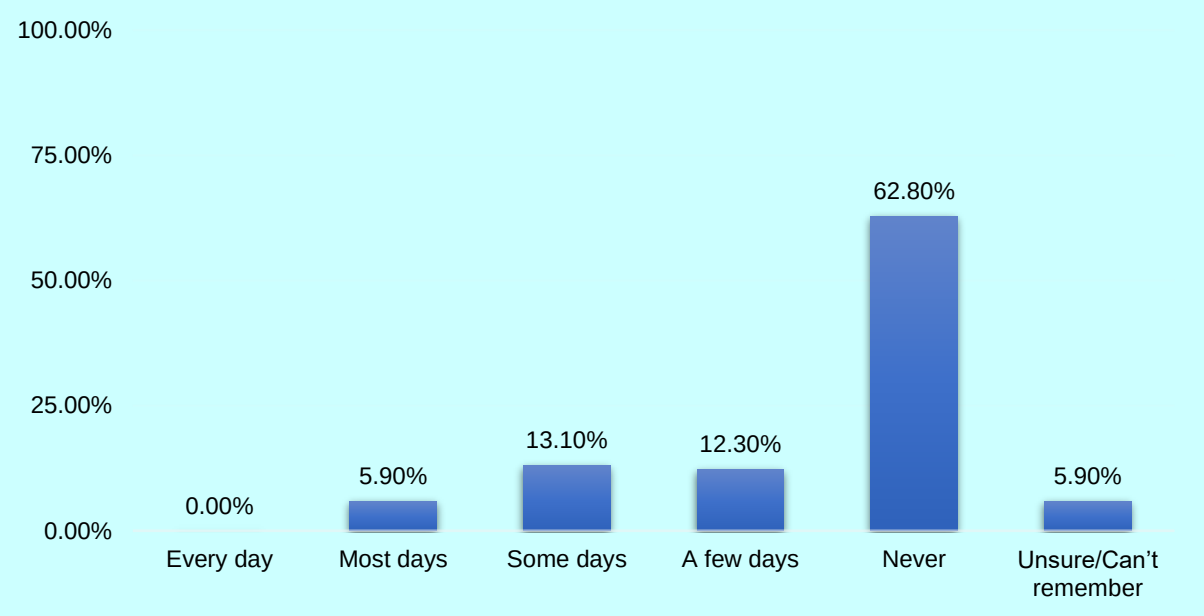
QUESTION BOX 3.6

- *During the past 3 months, has your child's coughing, wheezing or being short of breath caused you or your child's other parent to not go to work, or to stay at home instead of going out to your usual activities?*
- *During the past 3 months, has your child's coughing, wheezing or being short of breath caused your family to make adjustments, such as cancelling or changing plans for visits, family outings or holidays?*
- *During the past 3 months, has your child's coughing, wheezing or being short of breath disturbed the family's sleep?*
- *During the past 3 months, has your child's coughing, wheezing or being short of breath caused your family to worry about the child?*

Figures 3.27 to 3.30 and table 3.11 show the outcome of the research findings related to the questions displayed in question box 3.6.

FIGURE 3.27

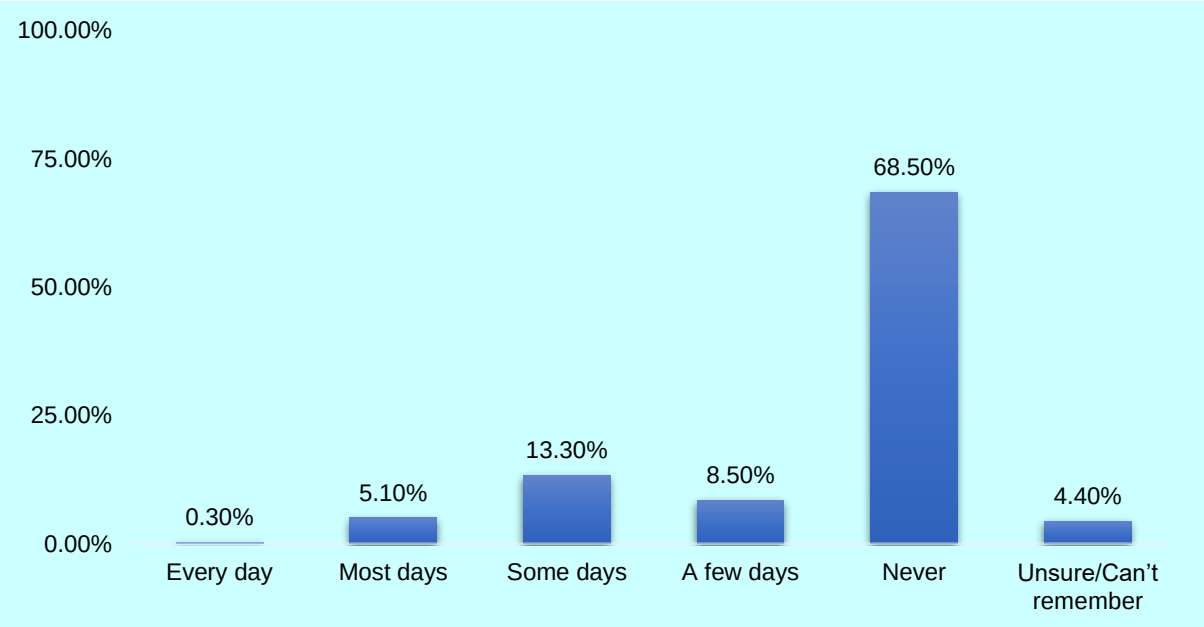
DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED YOU OR YOUR CHILD'S OTHER PARENT TO NOT GO TO WORK, OR TO STAY AT HOME INSTEAD OF GOING OUT TO YOUR USUAL ACTIVITIES?



n = 390.

FIGURE 3.28

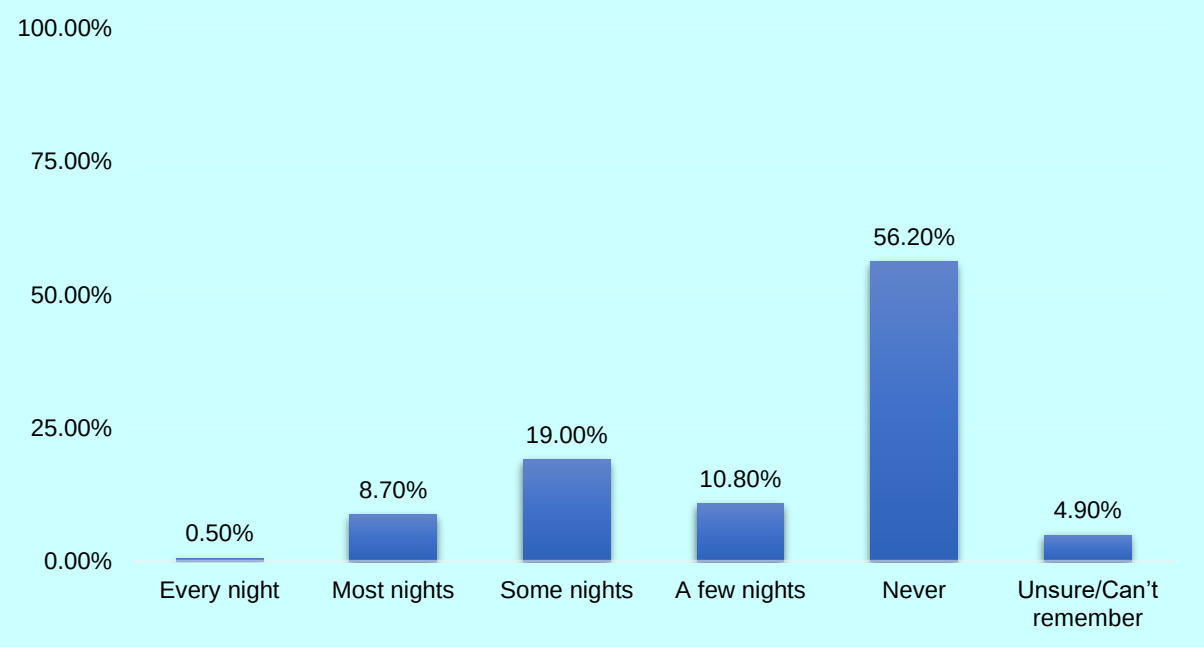
DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED YOUR FAMILY TO MAKE ADJUSTMENTS, SUCH AS CANCELLING OR CHANGING PLANS FOR VISITS, FAMILY OUTINGS OR HOLIDAYS?



n = 390.

FIGURE 3.29

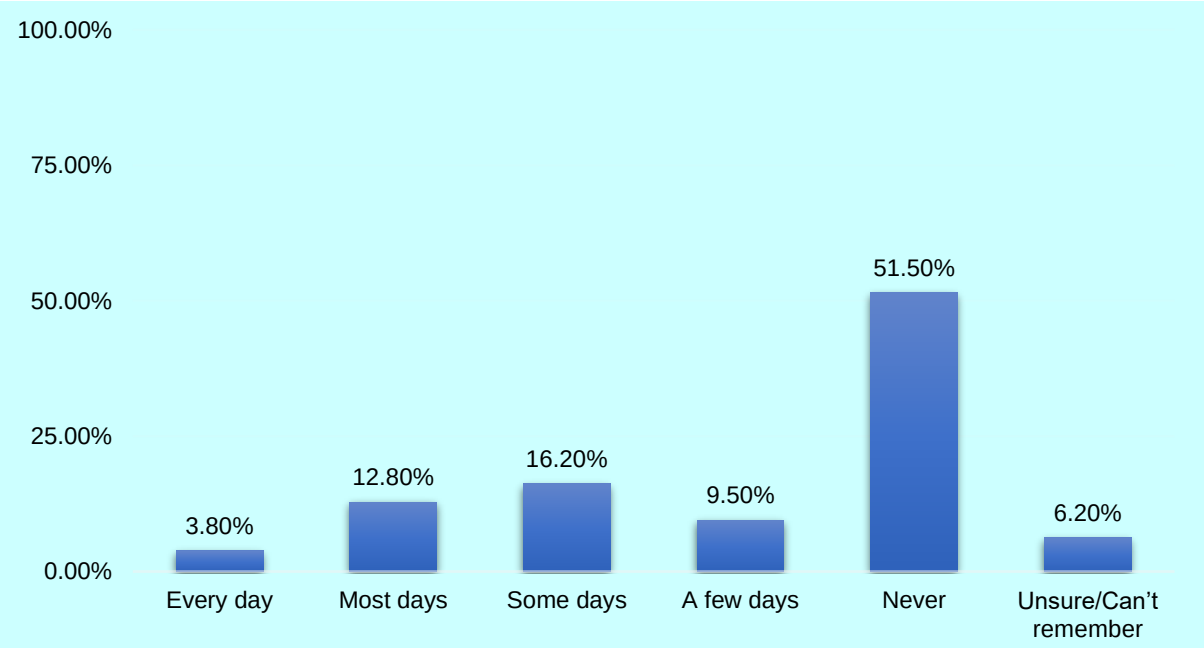
DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH DISTURBED THE FAMILY'S SLEEP?



n = 390.

FIGURE 3.30

DURING THE PAST 3 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED YOUR FAMILY TO WORRY ABOUT THE CHILD?



n = 390.

TABLE 3.11

SUMMARY: IMPACT OF PRESCHOOL CHILD SYMPTOMS ON FAMILY

Impact of preschool child symptoms on family	YES
During the past 3 months, has your child's coughing, wheezing or being short of breath caused you or your child's other parent to not go to work, or to stay at home instead of going out to your usual activities for at least a few days?	31.30%
During the past 3 months, has your child's coughing, wheezing or being short of breath caused your family to make adjustments, such as cancelling or changing plans for visits, family outings or holidays for at least a few days?	27.20%
During the past 3 months, has your child's coughing, wheezing or being short of breath disturbed the family's sleep for at least a few nights?	39.00%
During the past 3 months, has your child's coughing, wheezing or being short of breath caused your family to worry about the child for at least a few days?	42.30%

n = 390.

Table 3.11 shows that about one in every three households have been impacted during the three months prior to the study by the respiratory symptoms of preschool children which caused families to stay at home (31.30%) or to cancel plans (27.20%) for at least a few days. Also, during the three months prior to the study, about four in every 10 families have been impacted by the respiratory symptoms of preschool children, which disturbed the family's sleep (39.00%) and/or cause the family to worry about the child (42.30%) for at least a few days/nights.

3.5 IDENTIFICATION OF SENSITIVE PRESCHOOL CHILDREN (0-5 YEARS)

Similar to the health screening adult survey (see section 2.5 of chapter 2), the health screening preschool (0-5 years) children survey was also designed to measure the level of sensitivity among preschool children to air pollutants impacting on the respiratory system, such as SO_2. To support this goal, a statistical assessment of preschool child health conditions and information reported in the study was conducted to determine the scale of sensitivity or vulnerability of preschool children to ambient air pollution. In applying the criteria for interpretation of risk, the four risk classes displayed in figure 2.5 (see chapter 2) were again used to classify sensitive preschool children.

As indicated in chapter 2, part of the study objectives was to identify sensitive individuals that would be vulnerable to the health effects of SO_2, of which the main impact is on the respiratory system. As mentioned, the effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath, depending on the sensitivity of the exposed individual, and on the exposure conditions, such as the period and concentration of exposure. Considering these insights, the outcomes of the health screening survey results of preschool children, as reported by parents, have been used to determine the proportion of preschool children whose respiratory health may be at increased risk and are more sensitive to exposure to higher SO_2 levels in ambient air.

Using examples in applying the sensitivity theory, exhibit 3.2 presents interpretations on the four levels of risks being associated with the prevalence of specific respiratory conditions related to each risk category. More specifically, the exhibit applies the respiratory conditions explored in the preschool health screening questionnaire.

EXHIBIT 3.2

RISK CRITERIA FOR RESPIRATORY HEALTH CONDITIONS TO CLASSIFY SENSITIVE PRESCHOOL CHILDREN

High risk	A parent/caregiver/guardian that responds affirmative to the following questions: • Has your child ever had wheezing or whistling in the chest at any time in the past? OR A parent/caregiver/guardian affirming that the preschool child has **during the past three months showed the following symptoms (i) during the day, (ii) when not having a cold, (iii) when active, (iv) at night**: • been wheezy **every day.** • coughed **every day**. • had a rattly chest (rattling sound when breathing) **every day.** • short of breath or complained of being short of breath **every day.** OR A parent/caregiver/guardian affirming that **daily**, during the past three months a preschool child's coughing, wheezing or being short of breath caused him/her to: • Have trouble drinking or eating. • Wake up during the night. • Face difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day). • Be more tired than usual. A parent/caregiver/guardian affirming that **daily**, during the past three months a preschool child's coughing, wheezing or being short of breath caused the family to: • Not go to work, or to stay at home instead of going out to their usual activities. • Cancel or change plans for visits, family outings or holidays. • Disturb the family's sleep. • Worry about the preschool child.

Continue…

Medium High risk	A parent/caregiver/guardian affirming that the preschool child has during the past three months showed the following symptoms (i) during the day, (ii) when not having a cold, (iii) when active, (iv) at night: • been wheezy most days. • coughed most days. • had a rattly chest (rattling sound when breathing) most days. • short of breath or complained of being short of breath most days. A parent/caregiver/guardian affirming that **on most days** during the past three months a preschool child's coughing, wheezing or being short of breath caused him/her to: • Have trouble drinking or eating. • Wake up during the night. • Face difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day). • Be more tired than usual. A parent/caregiver/guardian affirming that **on most days**, during the past three months a preschool child's coughing, wheezing or being short of breath caused the family to: • Not go to work, or to stay at home instead of going out to their usual activities. • Cancel or change plans for visits, family outings or holidays. • Disturb the family's sleep. • Worry about the preschool child.
Medium low risk	A parent/caregiver/guardian affirming that the preschool child has during the past three months showed the following symptoms (i) during the day, (ii) when not having a cold, (iii) when active, (iv) at night: • been wheezy some days. • coughed some days. • had a rattly chest (rattling sound when breathing) some days. • short of breath or complained of being short of breath some days. A parent/caregiver/guardian affirming that **on some days**, during the past three months, a preschool child's coughing, wheezing or being short of breath caused him/her to: • Have trouble drinking or eating. • Wake up during the night. • Face difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day). • Be more tired than usual. A parent/caregiver/guardian affirming that **on some days**, during the past three months, a preschool child's coughing, wheezing or being short of breath caused the family to: • Not go to work, or to stay at home instead of going out to their usual activities. • Cancel or change plans for visits, family outings or holidays. • Disturb the family's sleep. • Worry about the preschool child.

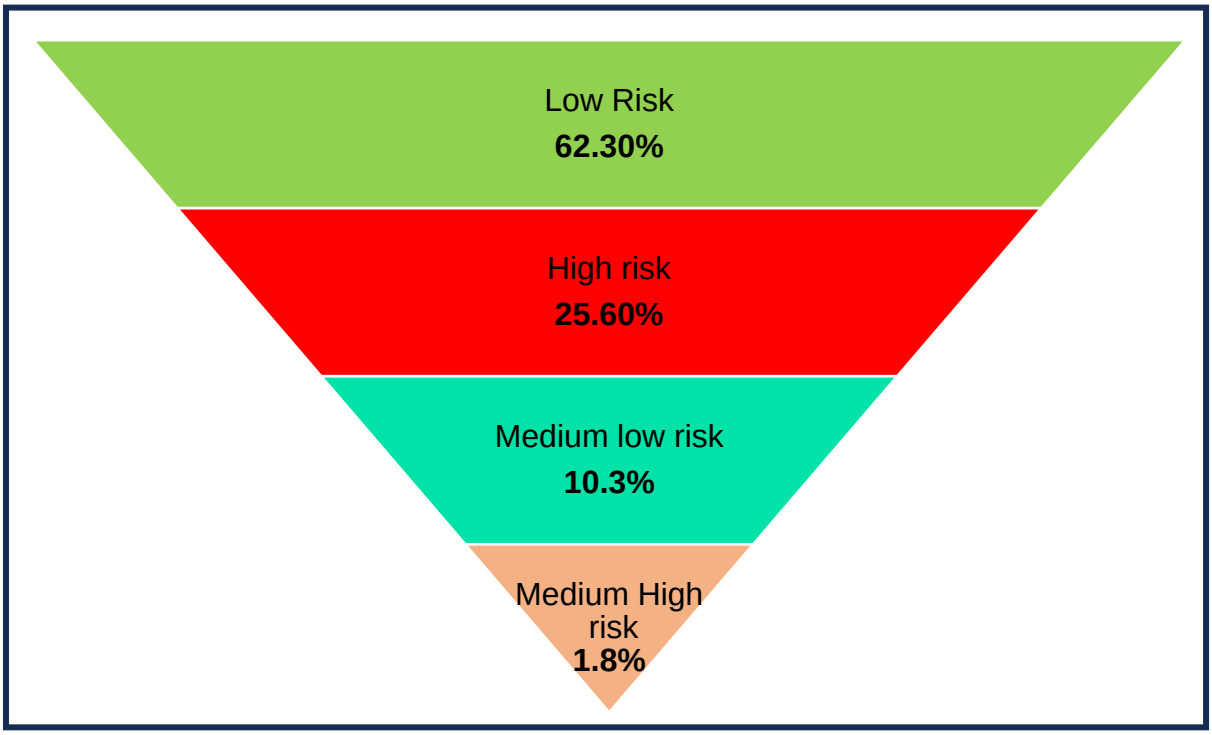
Continue…

Low Risk	A parent/caregiver/guardian affirming that the preschool child has, during the past three months, showed the following symptoms (i) during the day, (ii) when not having a cold, (iii) when active, (iv) at night: • been wheezy a few days. • coughed for a few days. • had a rattly chest (rattling sound when breathing) a few days. • short of breath or complained of being short of breath a few days. A parent/caregiver/guardian affirming that **on a few days**, during the past three months, a preschool child's coughing, wheezing or being short of breath caused him/her to: • Have trouble drinking or eating. • Wake up during the night. • Face difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day). • Be more tired than usual. A parent/caregiver/guardian affirming that **on a few days**, during the past three months, a preschool child's coughing, wheezing or being short of breath caused the family to: • Not go to work, or to stay at home instead of going out to their usual activities. • Cancel or change plans for visits, family outings or holidays. • Disturb the family's sleep. • Worry about the preschool child.

In applying the criteria in exhibit 3.2, the respiratory conditions of preschool children reported by the 390 parents/caregivers/guardians were classified according to the varied risk and sensitivity levels. The outcome of this analysis is displayed in figure 3.31. From the analysis it seems that the respiratory health of about 25% of preschool children is at higher risk of an impact due to ambient air pollutants and that they are more sensitive to health effects at higher concentrations of SO_2.

FIGURE 3.31

PRESCHOOL CHILDREN @ RISK CLASSIFICATION



More confined sensitivity analyses also showcased that preschool children located in the Gauteng receptor communities are less sensitive and at a lower risk than those who are in the Mpumalanga cluster (i.e. the Balmoral/Wilge and Kwa-Guqa/Vosman receptor communities showed the highest sensitivity and health risk levels for preschool children).

3.6 SUMMARY AND CONCLUSION

This chapter presented an analyses and interpretation of the research results emanating from the personal face-to-face interviews with 390 parents/ caregivers/guardians who had children between the ages 0 to 5 years (preschool) in their care and resided in the receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). The sample distribution ratio between the Gauteng and Mpumalanga clusters for the preschool children survey was about 40:60, while the gender participation was equal, with most parent/caregiver/guardian participants being Black Africans.

Salient findings from the preschool children health screening survey include the following:

- About a quarter (25.4%) of preschool children ever had wheezing or whistling in the chest **at any time** in the past. Just less than a third of preschool children (30.00%) had at least one episode of wheezing or whistling in the chest during the 12 months prior to the study. Parents/caregivers/guardians also confirmed a prevalence rate of 2.80% for doctor-diagnosed child asthma and 5.40% for atopic dermatitis among preschool (0-5 years) children.
- During the past three months prior to the study, about a third of preschool children (0-5 years) have been wheezy (34.80%) or had a rattly chest (34.10%) **during the day** for at least a few days, while about two-thirds of children coughed during the day for at least a few days. About one in every five (20.80%) preschool children have been short of breath or complained of being short of breath during the day for at least a few days during the three months preceding the study.
- During the past three months prior to the study, about a quarter of preschool children (0-5 years) have been wheezy (28.20%) or had a rattly chest (22.30%) for at least a few days **when not having a cold**, while about half of children (47.70%) coughed during the day **when not having a cold** for at least a few days during the past three months. About one in every five (15.20%) preschool children have been short of breath or complained of being short of breath during the day, **when not having a cold**, for at least a few days during the three months preceding the study.
- During the past three months prior to the study, about a fifth of preschool children (0-5 years) have been wheezy (21.20%) or had a rattly chest (28.70%) **when being active** for at least a few days, while about half of children (48.50%) coughed during the day **when active** for at least a few days during the past three months. About one in every ten (12.80%) preschool children have been short of breath or complained of being short of breath, **when active** during the day, for at least a few days during the three months preceding the study,.

- During the past three months prior to the study, between a quarter and a third of preschool children (0-5 years) have been wheezy (21.20%) or had a rattly chest (24.70%) **during the night** for at least a few nights, while about half of children (53.90%) coughed during the night for at least a few nights during the past three months. About one in every ten (15.40%) preschool children have been short of breath or complained of being short of breath **during the night** for at least a few nights during the three months preceding the study.
- Three months prior to the study, about a third of preschool children had difficulty drinking or eating (35.80%), sleeping (39.80%), doing usual activities (32.30%) and/or were more tired than usual (27.70%) for at least a few days/nights.
- Three months prior to the study, the respiratory symptoms of preschool children caused families to stay at home (31.30%) or to cancel plans (27.20%) for at least a few days. About four in every 10 families have been impacted by the respiratory symptoms of preschool children, which disturbed the family's sleep (39.00%) and/or cause the family to worry about the child (42.30%) for at least a few days/nights during the three months prior to the study.
- About 25% of preschool children are at higher risk of a respiratory health effect due to ambient air pollutants and are more sensitive to health effects at higher concentrations of SO_2.

CHAPTER 4

PARENT-ADMINISTRATED CHILD SURVEY ON RESPIRATORY SYMPTOMS IN PRIMARY SCHOOL CHILDREN (6-12 YEARS)

4.1 INTRODUCTION

This chapter presents the analyses and interpretation of the research results emanating from the personal face-to-face interviews with 389 parents/ caregivers/guardians who consented to complete a questionnaire on the prevalence of respiratory symptoms in primary school children (6-12 years). The survey tool was developed by INFOTOX and the BMR team and had to be completed by parents/caregivers/guardians with primary school children between the ages of 6 to 12 years in their care and who were most knowledgeable about the child's health status and respiratory symptoms. Annexure B3 displays the survey tool used within this household cohort.

The research design applied a parent-administrated child survey which was completed by 389 parents/caregivers/ guardians residing in households located in receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). The findings resulting from the primary school children survey are analysed and interpreted in this chapter.

4.2 PRIMARY SCHOOL CHILDREN PARENTS/CAREGIVERS/GUARDIANS CONSENT

Exhibit 4.1 serves to confirm the consent ensured by 389 parents/caregivers/ guardians of children between the ages of 6 to 12 years who participated in the primary school health screening survey. To adhere to sound research ethics principles, participation in the primary school survey was voluntary and adult respondents (parents/caregivers/ guardians) could withdraw at any stage before or during the survey. No foreseeable risks in participating in this health screening survey were anticipated nor occurred. Participation involved the completion of a questionnaire by parents/caregivers/guardians regarding the health of a child between the ages of 6 to 12 years in their care. Parents/caregivers/guardians were randomly sampled and requested to complete the primary school child questionnaire with the assistance of a trained

BMR interviewer. The BMR ensured the respondents that any personal details collected about the child would not be revealed to people outside the group of researchers who were involved in the project. The BMR also confirmed that no personal details of the child will be shared in the research report or made public. Against this background, 389 parents/caregivers/guardians agreed to all research ethics conditions stated at the start of the survey. Confirmation of the adult (n = 389) consent adhering to all research ethics conditions is displayed in exhibit 4.1.

EXHIBIT 4.1

PARENTS/CAREGIVERS/GUARDIANS CONSENT TO PARTICIPATE IN THE PRIMARY SCHOOL CHILD SURVEY

STATEMENT	AGREE
I have read and understood what the respiratory health screening survey is about and what my participation will involve.	✓
I understand that my participation is voluntary.	✓
I understand that I can withdraw at any time without giving any reasons for why I no longer want to take part in the health screening survey.	✓
I understand my personal details will not be revealed to people outside the group of researchers.	✓
I understand that the information shared will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.	✓
I have been given the opportunity to ask questions about the respiratory health screening survey.	✓
I hereby agree to participate in the respiratory health screening survey.	✓

n = 389.

4.3 PROFILING PARENTS/CAREGIVERS/GUARDIANS OF THE PRIMARY SCHOOL CHILD HEALTH SCREENING SURVEY

Tables 4.1, 4.2 and 4.3 profile the participating parents/caregivers/guardians of primary school children by selected demographic cohort. The sample distribution ratio between the Gauteng and Mpumalanga clusters is 40:60, while the gender participation is slightly biased towards females. Most participants were Black Africans.

TABLE 4.1

PARENTS/CAREGIVERS/GUARDIANS OF PRIMARY SCHOOL CHILDRENBY RECEPTOR COMMUNITY

Receptor community	n	%
Gauteng Cluster	**156**	**40.10%**
Bronkhorstspruit	65	16.70%
Zithobeni	91	23.40%
Mpumalanga Cluster	**233**	**59.90%**
Balmoral/Wilge	22	5.70%
Phola	127	32.60%
Ogies/Blesboklaagte	55	14.10%
Arbor/Kendal	4	1.00%
Clewer	12	3.10%
Kwa-Guqa/Vosman	13	3.30%
Total	**389**	**100.00%**

TABLE 4.2

PARENTS/CAREGIVERS/GUARDIANS OF PRIMARY SCHOOL CHILDREN BY GENDER

Gender	n	%
Male	182	46.80%
Female	205	52.70%
Other/Prefer not to answer	2	0.50%
Total	**389**	**100.00%**

TABLE 4.3

PARENTS/CAREGIVERS/GUARDIANS OF PRIMARY CHILDREN BY POPULATION GROUP

Population group	n	%
Black/African	382	98.20%
Indian/Asian	0	0.00%
Coloured	2	0.50%
White	5	1.30%
Other	0	0.00%
Total	**389**	**100.00%**

4.3.1 **Profiling primary school children by age**

The age profile of the primary school children reported by the parents/caregivers/guardians is shown in table 4.4. The analysis shows representation across all six age groups, with the average age being calculated at 8.88 years. Parents/caregivers/guardians were also requested to list the name of the primary school attended by the child (see exhibit 4.2).

TABLE 4.4

AGE PROFILE OF PRIMARY SCHOOL CHILDREN

Age	n	%
6	72	18.50%
7	45	11.60%
8	63	16.20%
9	55	14.10%
10	45	11.60%
11	49	12.60%
12	60	15.40%
Total	**389**	**100.00%**

EXHIBIT 4.2

PRIMARY SCHOOLS* ATTENDED BY PRIMARY SCHOOL CHILDREN (6-12 YEARS)

Althea Independent School; Arbor Primary School; Baweze Primary School - Ekangala, Bronkhorstpruit; Blackhill Schoongezicht Primary School – Kwaguqa; Bronkhorstspruit Primary School; Charles Duna Public School; Clewer Primary School; Ed-U-College – Emalahleni; Edward Matyeka Primary School – Kwaguqa; Enkangala Comprehensive School – Bronkhorstspruit; Hlangu Phala Primary School; Hlangu Phala Primary School; Hlolisisa Primary School; Home Schooling, Ilanga Private Academy; Isibonelo Nursery School; Kgoro Primary School (Zithobeni); Laerskool Balmoral; Laerskool Du Preez van Wyk – Bronkhorstspruit; Laerskool Duvhapark – Emalahleni; Laerskool Panorama – Emalahleni; Laerskool Tasbetpark – Emalahleni; Little Scholars; Makause Combined School; Makause Combined School; Minenhle Pre- School / Day-Care; Mshuluzane Mayisela Primary School; Mshuluzane Mayisela Primary School - Zithobeni, Bronkhorstspruit; Njinga Sindane Primary School; Ogies Combined School; Rethabiseng Primary School; Robert Carruthers Primary School; Samuel Mhlanga Primary School; Sibongindawo Primary School; Sihluziwe Primary School - Ekangala, Bronkhorstspruit; Sinenhlanhla Primary School – Bronkhorstspruit; Siyathokoza Primary School – Emalahleni; St John's; St. Josefs Comprehensive School; Sukumani Primary School; Taalfees Laerskool (Witbank); Thuthukani Primary School; Vezulwazi Primary School; Witbank Christian Academy (Private Combined School).

* List includes nursery schools for 6-year-old children.

n = 389. 12.5% of respondents did not indicate the school's name.

4.4 PREVALENCE AND IMPACT OF RESPIRATORY SYMPTOMS AMONG PRIMARY SCHOOL CHILDREN (6-12 YEARS)

4.4.1 Prevalence of asthma and other respiratory diseases in primary school children

The questions shown in question box 4.1 were used to assess asthma and other respiratory diseases prevalent among primary school children.

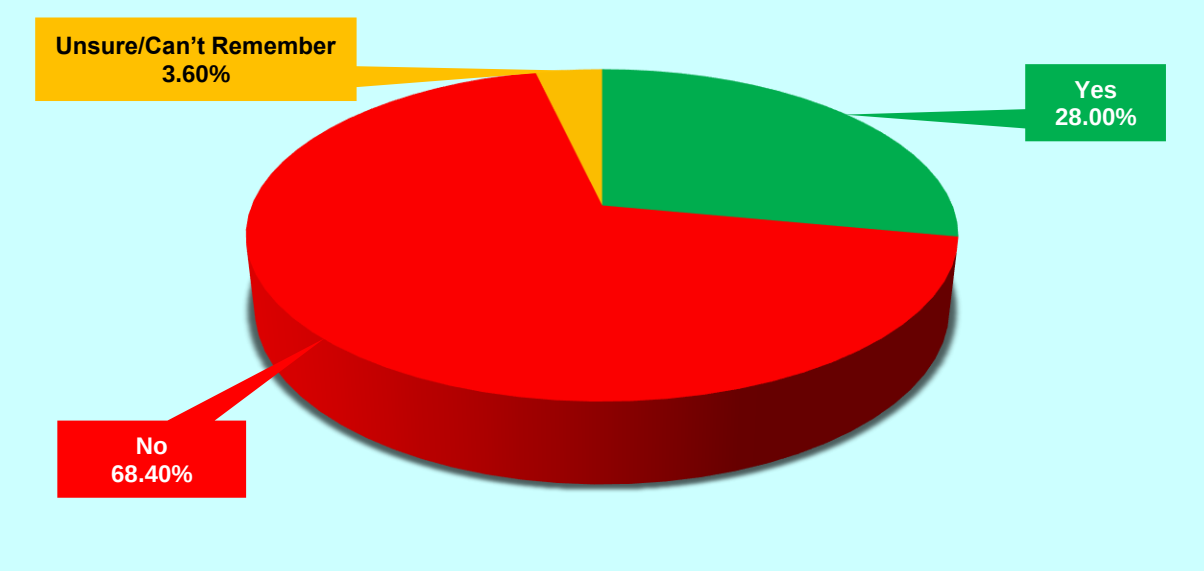
QUESTION BOX 4.1

- *Has your child ever had wheezing or whistling in the chest at any time in the past?*
- *Has your child had wheezing or whistling in the chest in the past 12 months?*
- *How many attacks of wheezing has your child had in the past 12 months?*
- *In the past 12 months, how often, on average, has your child's sleep been disturbed due to wheezing?*
- *In the past 12 months, has wheezing ever been severe enough to limit your child's speech to only one or two words at a time between breaths?*
- *Has a doctor ever told you that your child has asthma?*
- *In the past 12 months, has your child's chest sounded wheezy during or after exercise?*
- *In the past 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?*
- *In the past 12 months, has your child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day)?*
- *Has a doctor ever told you that your child has bronchitis?*
- *Has a doctor ever told you that your child has pneumonia?*
- *Has a doctor ever told you that your child has TB (Tuberculosis)?*

Figures 4.1 to 4.12 and table 4.5 show the outcome of the research findings related to the questions displayed in question box 4.1.

FIGURE 4.1

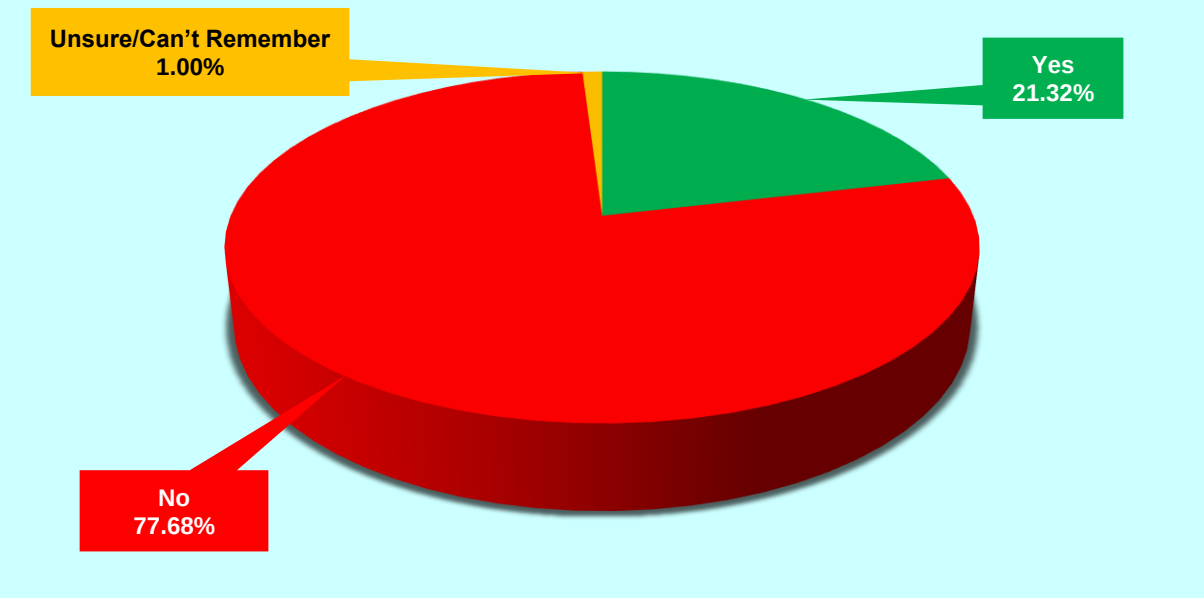
HAS YOUR CHILD EVER HAD WHEEZING OR WHISTLING IN THE CHEST AT ANY TIME IN THE PAST?



n = 389.

FIGURE 4.2

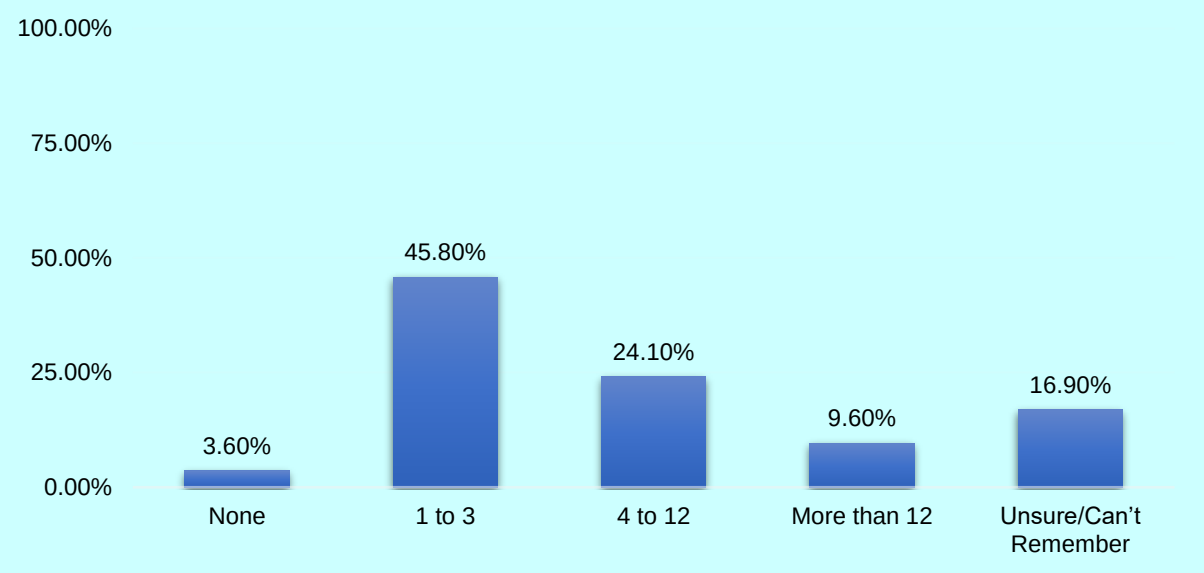
HAS YOUR CHILD HAD WHEEZING OR WHISTLING IN THE CHEST IN THE PAST 12 MONTHS?



n = 389.

FIGURE 4.3

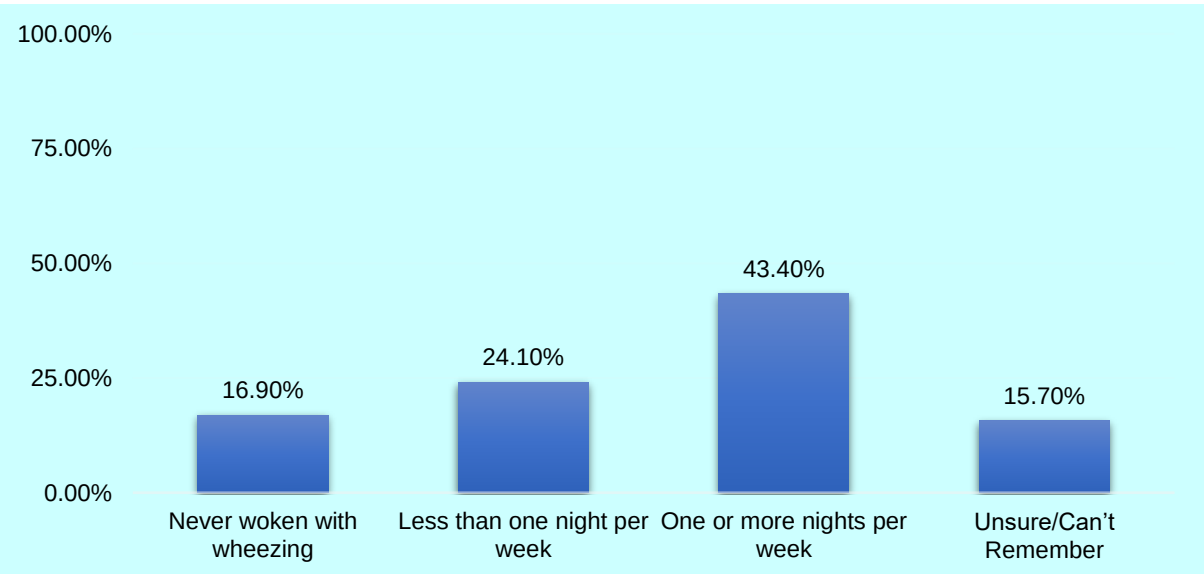
HOW MANY ATTACKS OF WHEEZING HAS YOUR CHILD HAD IN THE PAST 12 MONTHS?



n = 83.

FIGURE 4.4

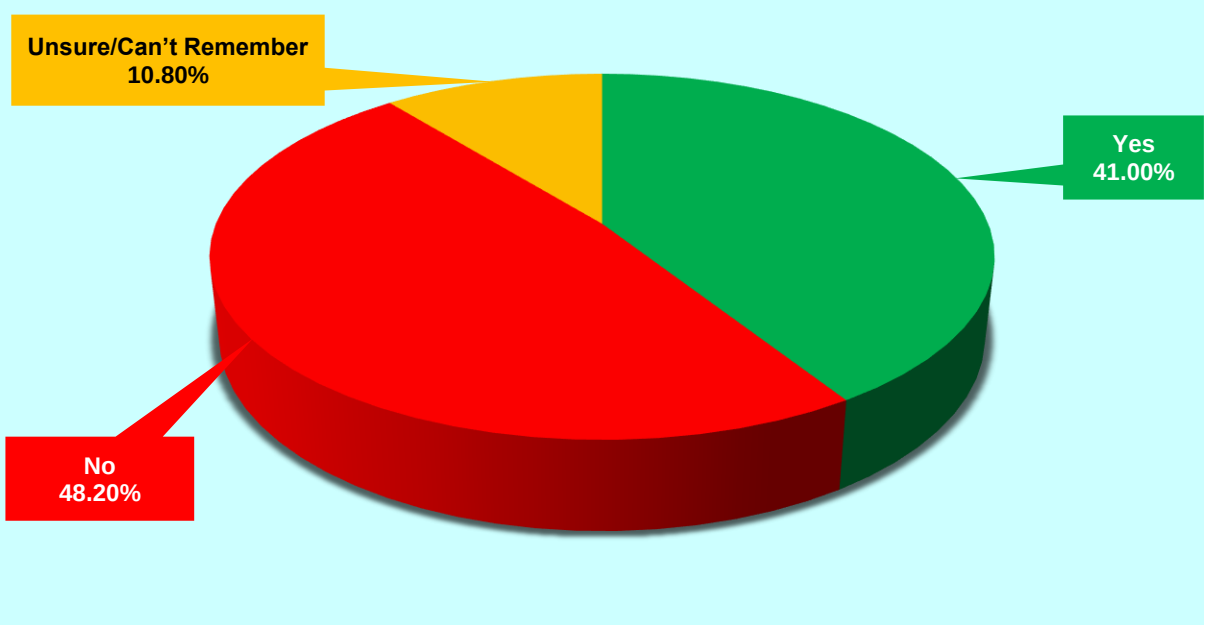
IN THE PAST 12 MONTHS, HOW OFTEN, ON AVERAGE, HAS YOUR CHILD'S SLEEP BEEN DISTURBED DUE TO WHEEZING?



n = 83.

FIGURE 4.5

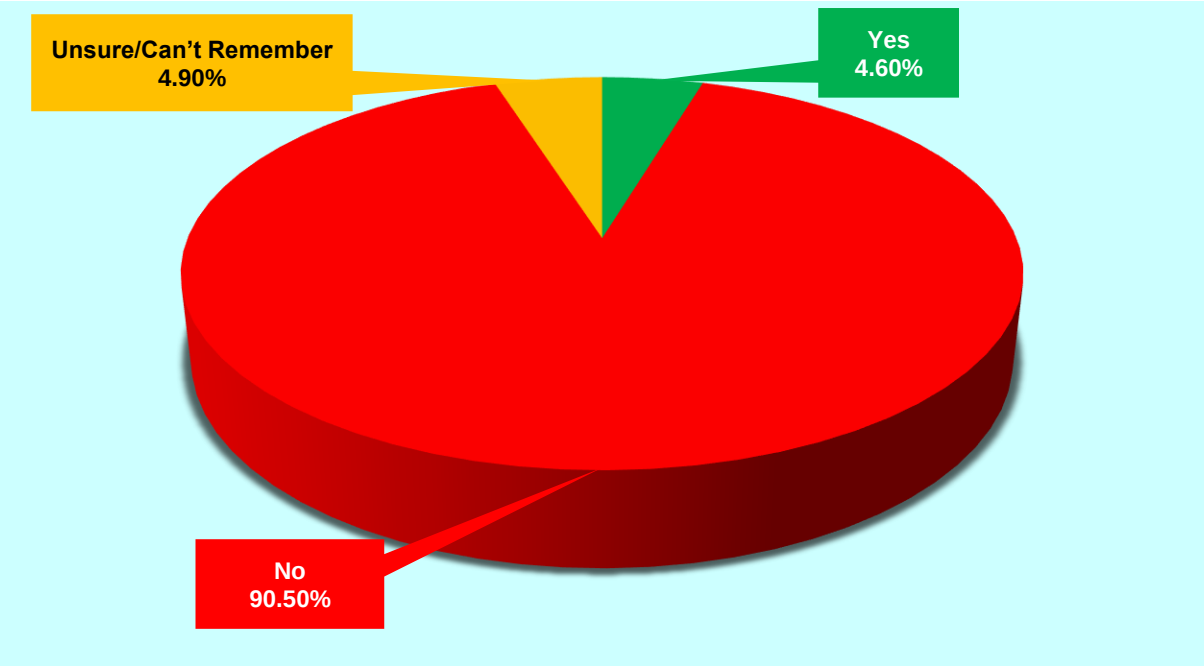
IN THE PAST 12 MONTHS, HAS WHEEZING EVER BEEN SEVERE ENOUGH TO LIMIT YOUR CHILD'S SPEECH TO ONLY ONE OR TWO WORDS AT A TIME BETWEEN BREATHS?



n = 83.

FIGURE 4.6

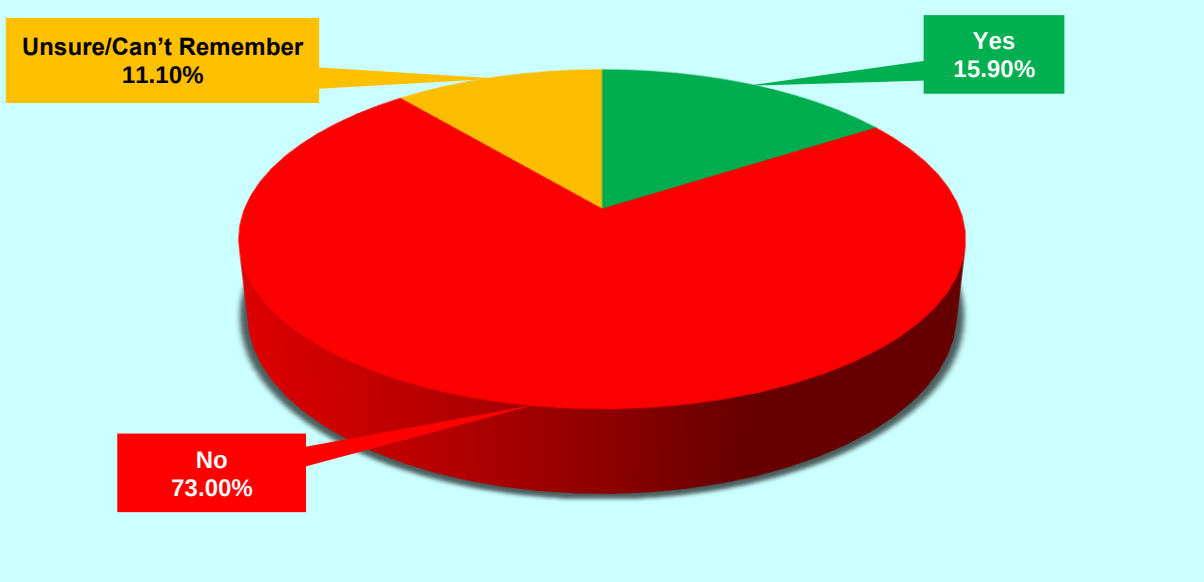
HAS A DOCTOR EVER TOLD YOU THAT YOUR CHILD HAS ASTHMA?



n = 389.

FIGURE 4.7

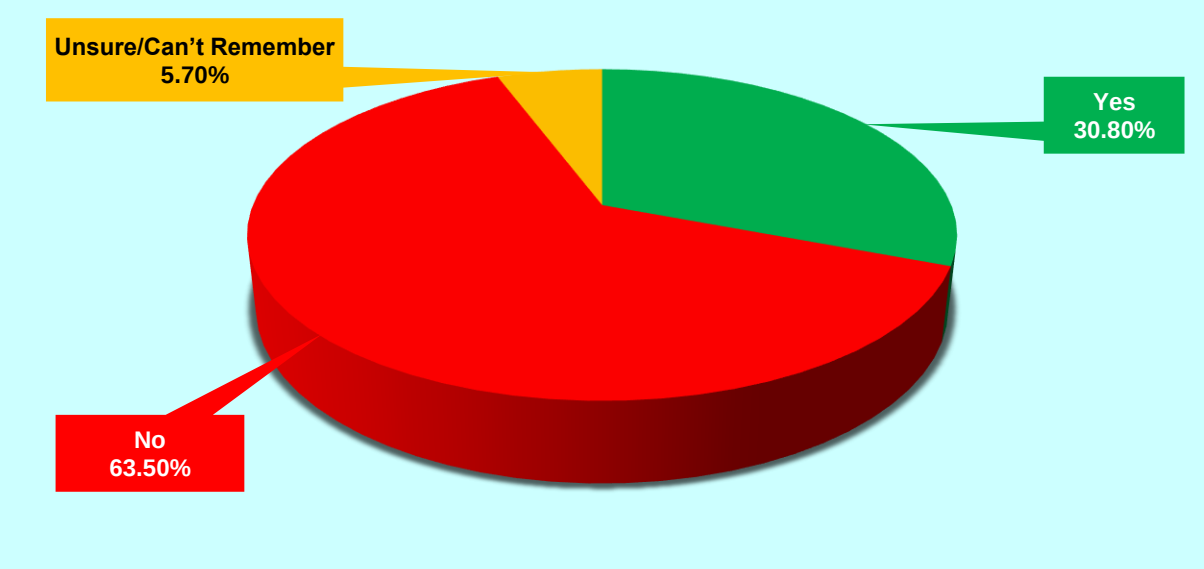
IN THE PAST 12 MONTHS, HAS YOUR CHILD'S CHEST SOUNDED WHEEZY DURING OR AFTER EXERCISE?



n = 389.

FIGURE 4.8

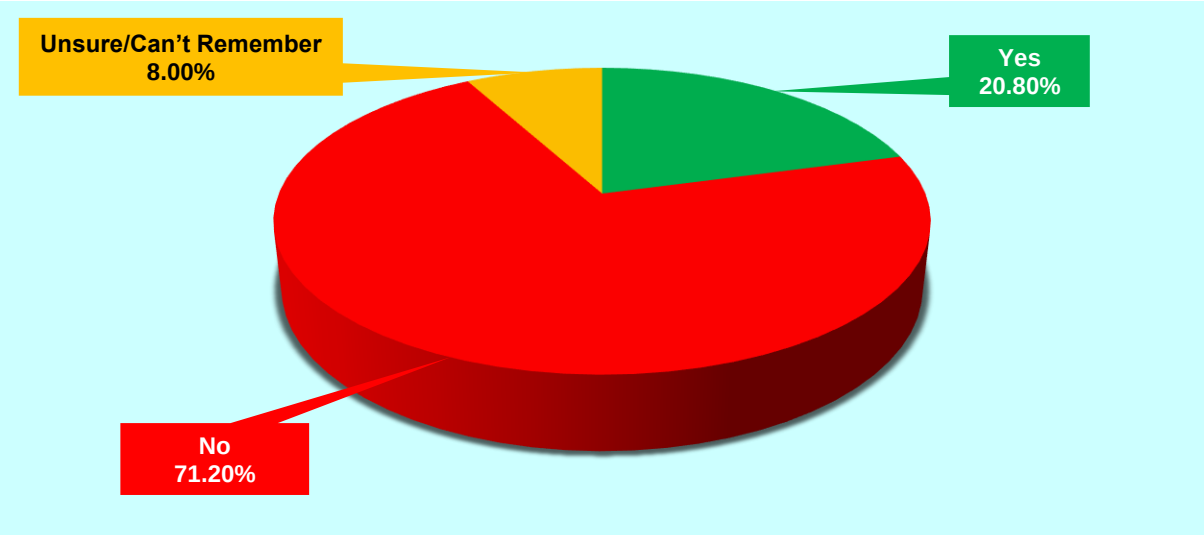
IN THE PAST 12 MONTHS, HAS YOUR CHILD HAD A DRY COUGH AT NIGHT, APART FROM A COUGH ASSOCIATED WITH A COLD OR CHEST INFECTION?



n = 389.

FIGURE 4.9

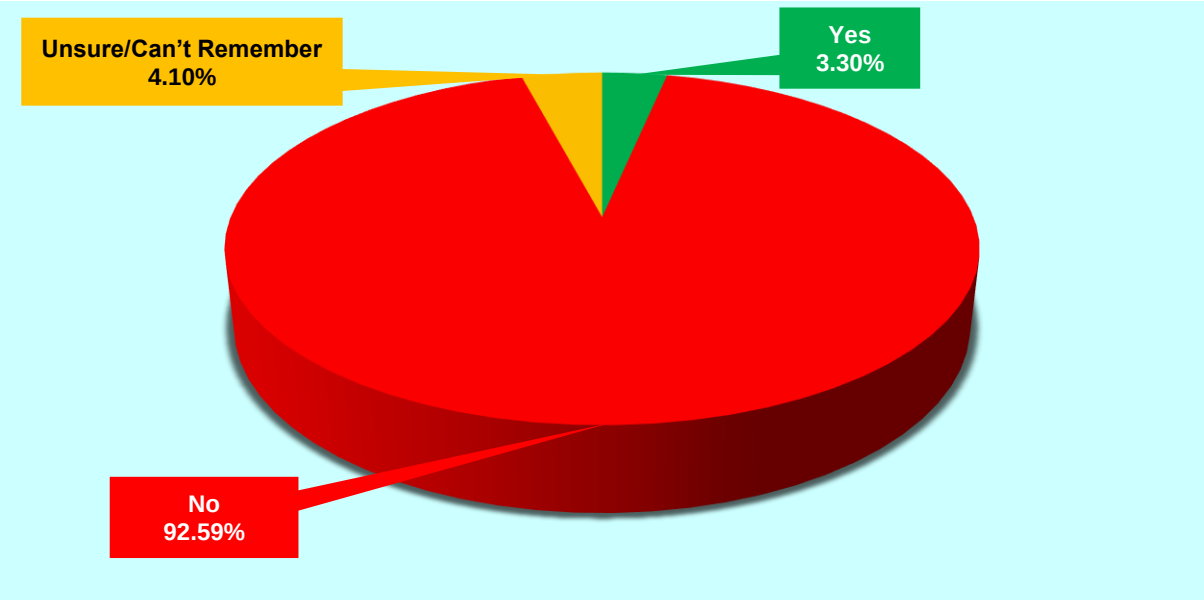
IN THE PAST 12 MONTHS, HAS YOUR CHILD'S COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED HIM/HER DIFFICULTY WITH HIS/HER USUAL ACTIVITIES (KEPT HIM/HER FROM THE THINGS HE/SHE USUALLY DOES DURING THE DAY)?



n = 389.

FIGURE 4.10

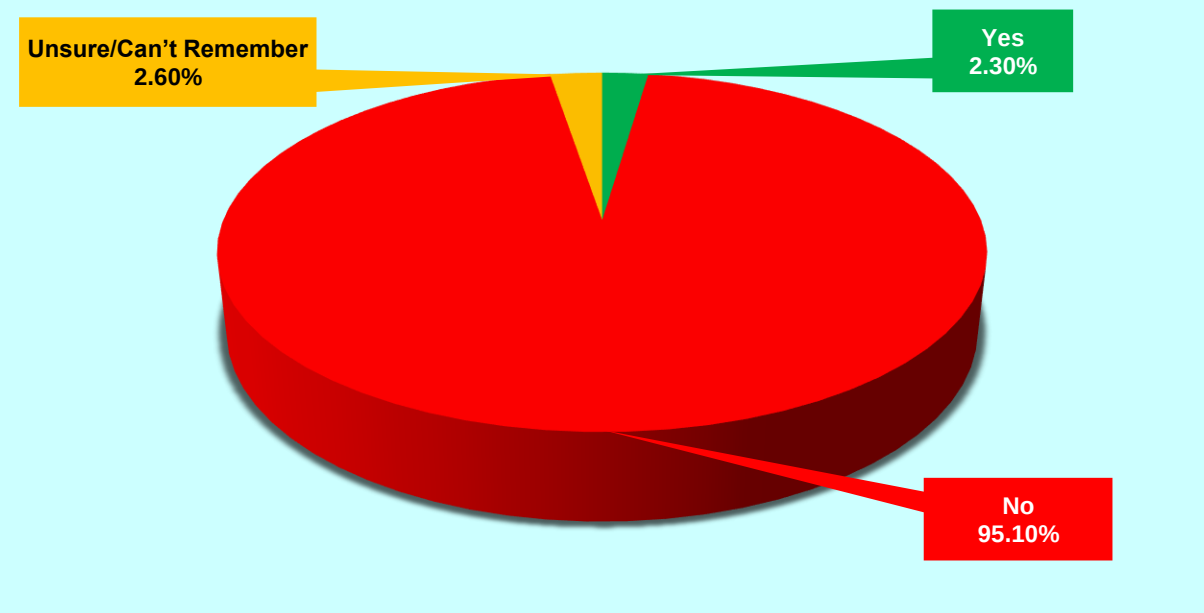
HAS A DOCTOR EVER TOLD YOU THAT YOUR CHILD HAS BRONCHITIS?



n = 389.

FIGURE 4.11

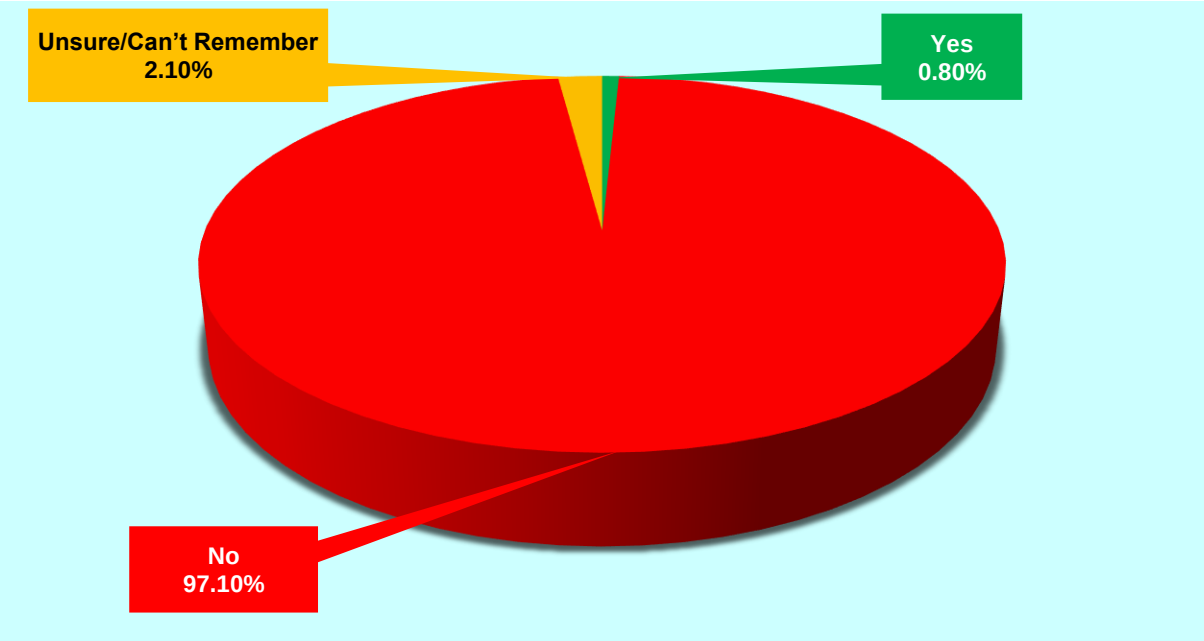
HAS A DOCTOR EVER TOLD YOU THAT YOUR CHILD HAS PNEUMONIA?



n = 389.

FIGURE 4.12

HAS A DOCTOR EVER TOLD YOU THAT YOUR CHILD HAS TB (TUBERCULOSIS)?



n = 389.

TABLE 4.5

SUMMARY - RESPIRATORY SYMPTOMS AND IMPACT ON PRIMARY SCHOOL CHILDREN (6-12 YEARS)

Respiratory symptoms	**YES**
Has your child ever had wheezing or whistling in the chest at any time in the past?	28.00%
Has your child had wheezing or whistling in the chest in the past 12 months?	21.30%
Has your child had at least one attack of wheezing in the past 12 months?	69.90%
In the past 12 months, on average, has your child's sleep been disturbed due to wheezing for at least one night per week?	67.50%
In the past 12 months, has wheezing ever been severe enough to limit your child's speech to only one or two words at a time between breaths?	41.00%
Has a doctor ever told you that your child has asthma?	4.60%
In the past 12 months, has your child's chest sounded wheezy during or after exercise?	15.90%
In the past 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?	30.90%
In the past 12 months, has your child's coughing, wheezing or being short of breath caused him/her difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day)?	20.80%
Has a doctor ever told you that your child has bronchitis?	3.30%
Has a doctor ever told you that your child has pneumonia?	2.30%
Has a doctor ever told you that your child has TB (Tuberculosis)?	0.80%

n = 389.

Table 4.5 captures the prevalence and impact of respiratory symptoms on primary school children. From the analyses it is clear that about a quarter (28.00%) of primary school children **ever** had wheezing or whistling in the chest at any time in the past. The corresponding statistic for the past **12-month** experience was 21.30%.

Significantly, about seven in every 10 primary school children (69.90%) had at least one attack of wheezing in the past 12 months, while about two-thirds (67.50%) of children's sleep has been disturbed in the 12 months prior to the study due to wheezing occurring for at least one night per week.

For four in every 10 primary school children (41.00%), wheezing during the 12 months prior to the study has been severe enough to limit the child's speech to only one or two words at a time between breaths. Likewise, 15.90% of primary school children's chests sounded wheezy during or after exercise during the 12 months prior to the study.

During the 12 months prior to the study, about a third (30.90%) of primary school children had a dry cough at night, apart from a cough associated with a cold or chest infection.

Primary school children's coughing, wheezing or being short of breath during the 12 months prior to the study has caused difficulty for one in every five children (20.80%) to continue with usual activities.

Finally, the analysis in table 4.5 reveals prevalence rates of below 5% for children diagnosed by a medical practitioner for asthma (4.6%), bronchitis (3.3%), pneumonia (2.3%) and TB (0.8%).

4.4.2 **Prevalence of rhinitis and allergies in primary school children**

Seven questions have been included in the primary school child questionnaire to determine the prevalence of rhinitis and allergies among primary school children. To clarify the meaning, "rhinitis" has been explained carefully in the survey questionnaire and was described to include any of the following symptoms: blocked, runny, or itching nose, or sneezing. Likewise, "eczema" or "atopic dermatitis" was included in the survey questionnaire and was described as an inflammatory condition that causes itchy, rough, and cracked patches of skin.

The questions displayed in question box 4.2 were used to determine the prevalence and impact of rhinitis and allergies in primary school children.

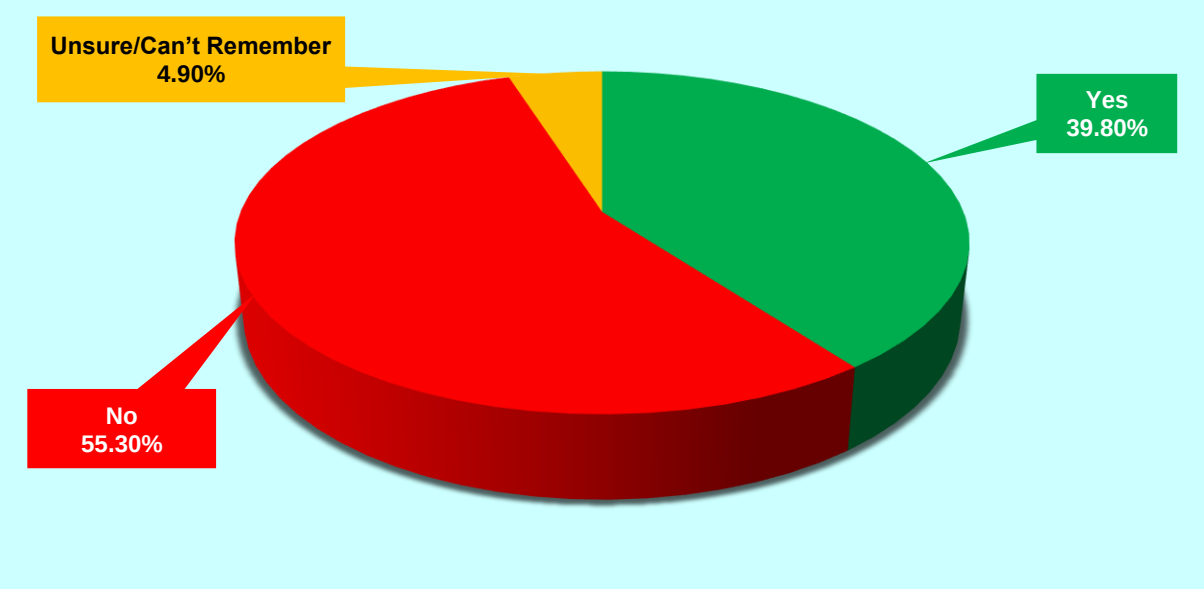
QUESTION BOX 4.2

- *Has your child ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?*
- *In the past 12 months, has your child had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?*
- *In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?*
- *In which month(s) did this nose problem occur?*
- *In the past 12 months, how much did this nose problem interfere with your child's daily activities?*
- *Has a doctor ever told you or your child that he/she has hay fever?*
- *Has a doctor ever told you or your child that he/she has atopic dermatitis or eczema?*

Figures 4.13 to 4.19 and table 4.6 show the outcome of the research findings related to the questions displayed in question box 4.2.

FIGURE 4.13

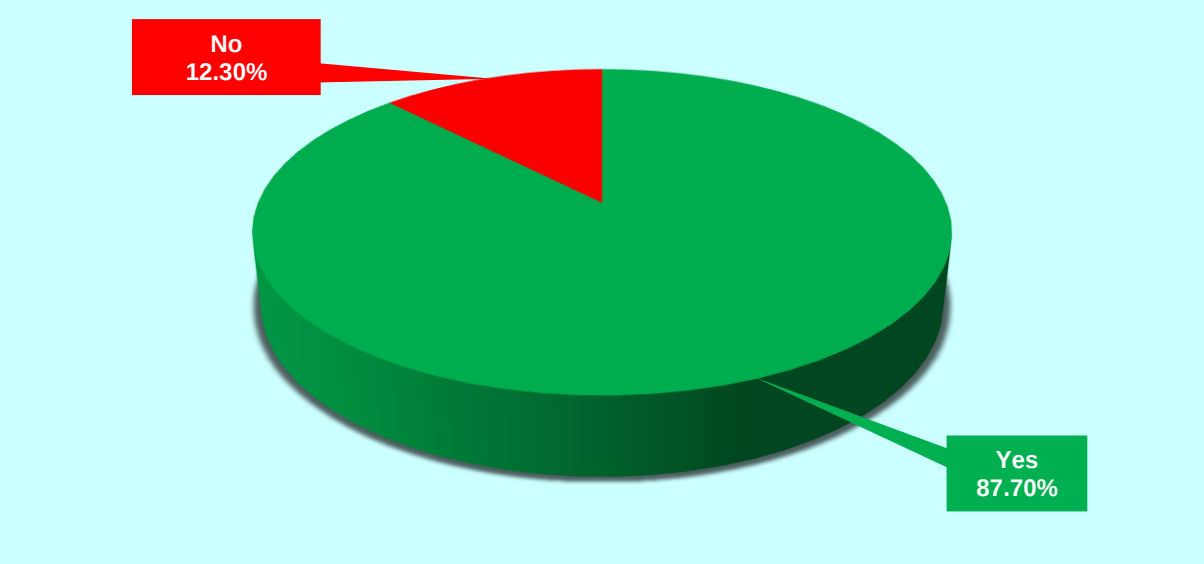
HAS YOUR CHILD EVER HAD A PROBLEM WITH SNEEZING, OR A RUNNY, OR BLOCKED NOSE WHEN HE/SHE DID NOT HAVE A COLD OR FLU?



n = 389.

FIGURE 4.14

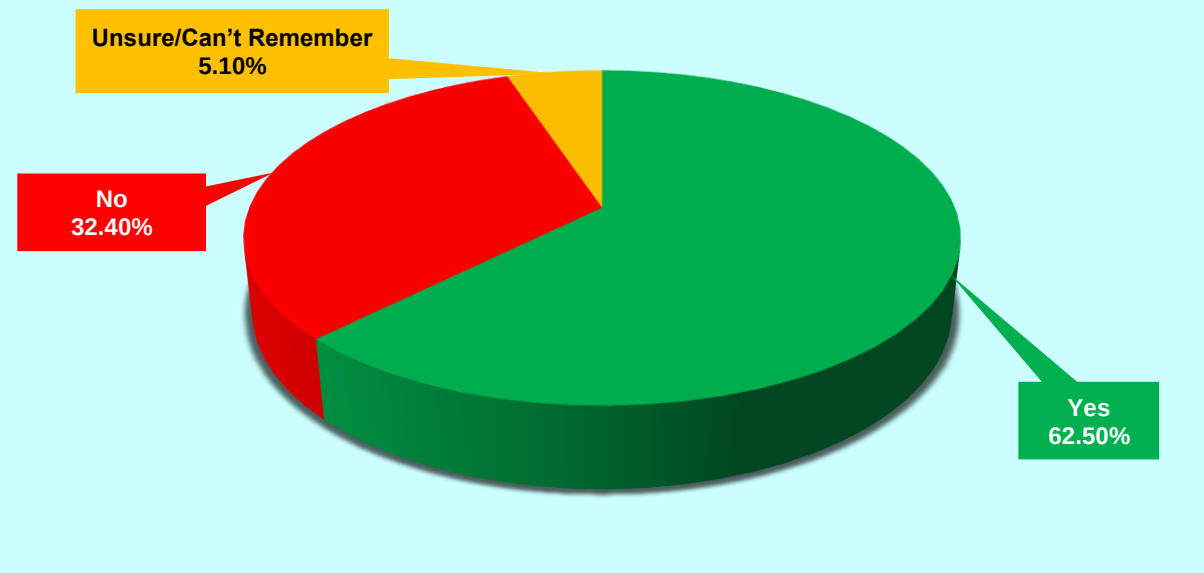
IN THE PAST 12 MONTHS, HAS YOUR CHILD HAD A PROBLEM WITH SNEEZING, OR A RUNNY, OR BLOCKED NOSE WHEN HE/SHE DID NOT HAVE A COLD OR FLU?



n = 155.

FIGURE 4.15

IN THE PAST 12 MONTHS, HAS THIS NOSE PROBLEM BEEN ACCOMPANIED BY ITCHY-WATERY EYES?

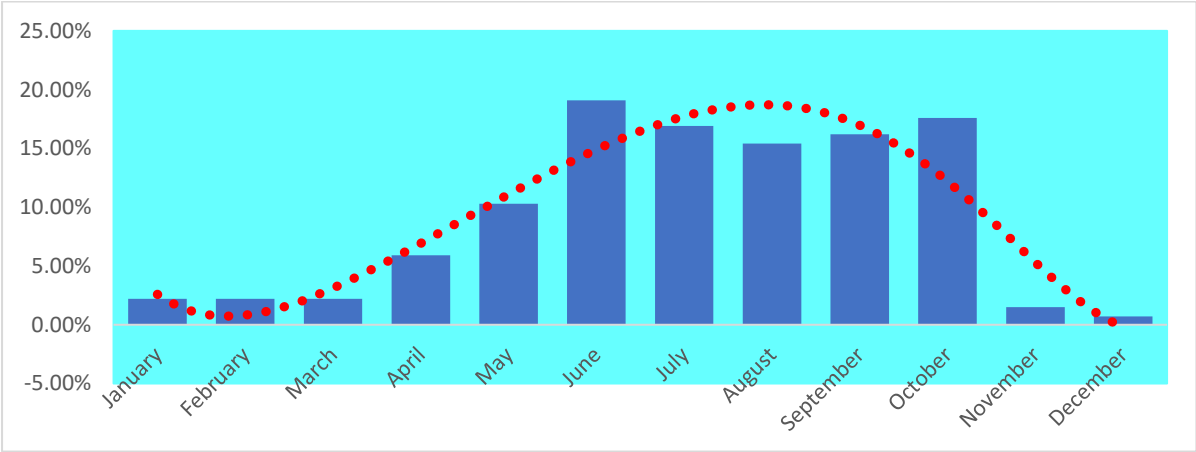


n = 136.

FIGURE 4.16

IN WHICH MONTH(S) DID THIS NOSE PROBLEM OCCUR?

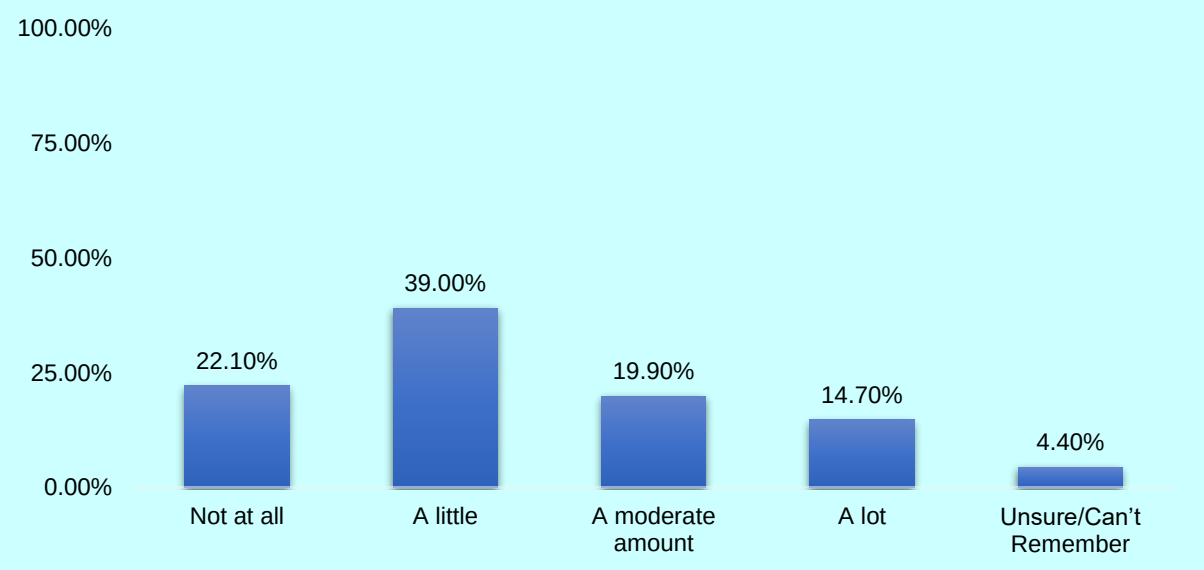
January	2.20%	July	16.90%
February	2.20%	August	15.40%
March	2.20%	September	16.20%
April	5.90%	October	17.60%
May	10.30%	November	1.50%
June	19.10%	December	0.70%
Unsure/Can't Remember			40.40%



n = 389.

FIGURE 4.17

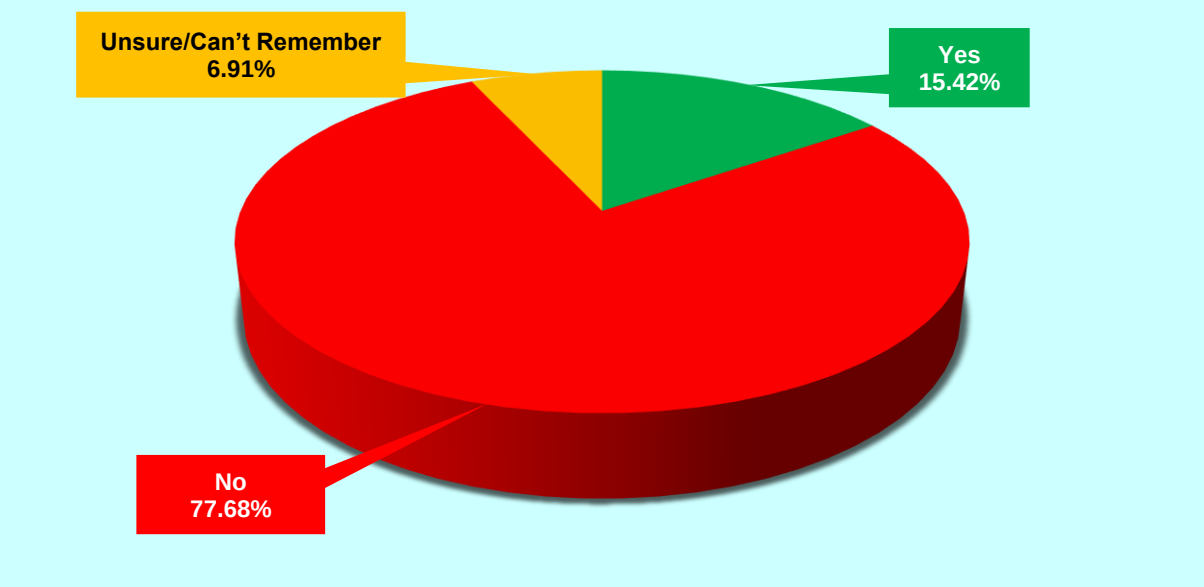
IN THE PAST 12 MONTHS, HOW MUCH DID THIS NOSE PROBLEM INTERFERE WITH YOUR CHILD'S DAILY ACTIVITIES?



n = 136.

FIGURE 4.18

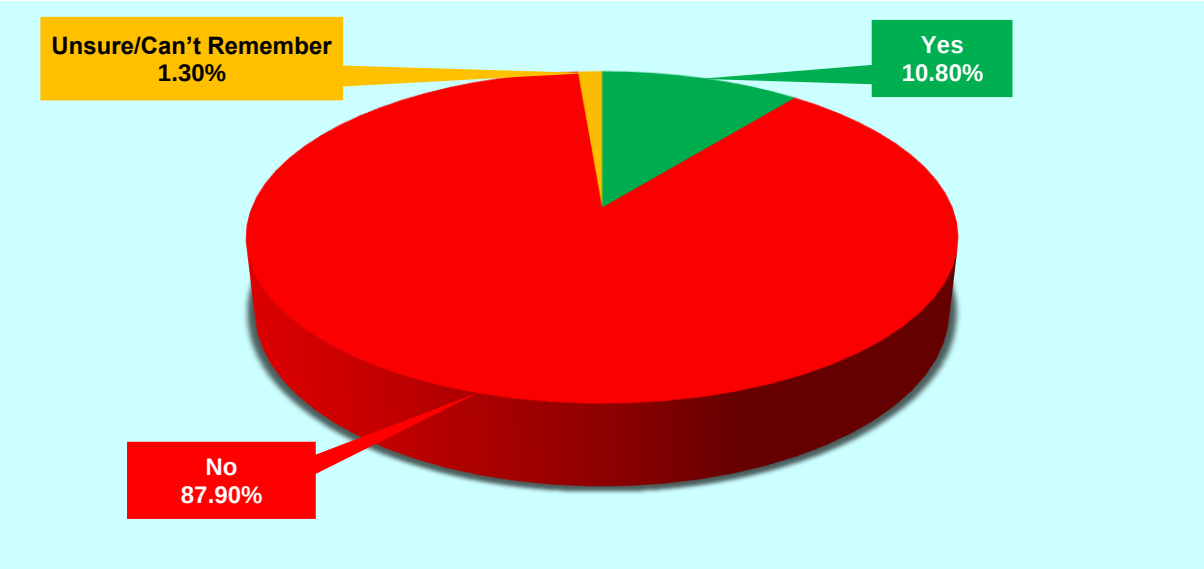
HAS A DOCTOR EVER TOLD YOU OR YOUR CHILD THAT HE/SHE HAS HAY FEVER?



n = 389.

FIGURE 4.19

HAS A DOCTOR EVER TOLD YOU OR YOUR CHILD THAT HE/SHE HAS ATOPIC DERMATITIS OR ECZEMA?



n = 389.

TABLE 4.6

SUMMARY: PREVALENCE OF RHINITIS AND ALLERGIES IN PRIMARY SCHOOL CHILDREN

Respiratory symptom experienced during the day	YES
Has your child ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?	39.80%
In the past 12 months, has your child had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?	87.70%
In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?	62.50%
In the past 12 months, did this nose problem interfere at least a little with your child's daily activities?	73.60%
Has a doctor ever told you or your child that he/she has hay fever?	15.40%
Has a doctor ever told you or your child that he/she has atopic dermatitis or eczema?	10.80%

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The analyses displayed in table 4.6 show that during the past three months prior to the study, about four in every 10 (39.80%) primary school children experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. The corresponding statistic for the past 12 months prior to the study was significantly high at 87.70% for those children who ever experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. For six in every 10 (62.50%) of these children, nose problems have been accompanied by itchy-watery eyes. Likewise, for seven in every 10 (73.60%) of these children, the nose problem interfered at least a little with their daily activities.

For one in every 10 primary school children, a doctor ever told the parent/ guardian/caregiver or child, that he/she has hay fever (15.40%) or atopic dermatitis or eczema (10.80%).

Finally, it is important to note from the survey outcomes that nose problems among primary school children mainly occur between the months of June to October. This period is typically associated with seasonal changes (winter and spring) which could contribute to respiratory symptoms especially nose problems due to fluctuating temperatures and environmental conditions.

4.5 IDENTIFICATION OF SENSITIVE PRIMARY SCHOOL CHILDREN (6-12 YEARS)

Similar to the health screening adult and preschool child surveys (see section 2.5 of chapter 2 and section 3.5 of chapter 3), the health screening primary school child survey was also consciously designed to measure the level of sensitivity among primary school children between the ages 6 to 12 year, to air pollutants, such as SO_2. To support this goal, a statistical assessment of primary school child health conditions and information reported in the study was conducted to determine the scale of sensitivity or vulnerability of primary school children to ambient air pollution. In applying the criteria for interpretation of risk, the four risk classes displayed in figure 2.5 (see chapter 2) were again used to classify sensitive primary school children.

As indicated in chapters 2 and 3, part of the study objectives were to identify sensitive individuals that would be vulnerable to the health effects of SO_2, of which the main impact is on the respiratory system. As mentioned, the effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath, depending on the sensitivity of the exposed individual, and on the exposure conditions, such as the period and concentration of exposure. Considering these insights, the outcomes of the health screening survey results of primary school children, as reported by parents, have been used to determine the proportion of primary school children who are sensitive to the respiratory health effects of exposure to higher SO_2 levels.

Using examples in applying the sensitivity theory, exhibit 4.3 presents interpretations of the four levels of risks being associated with the prevalence of specific respiratory conditions related to each risk category. More specifically, the exhibit applies the respiratory conditions explored in the primary school health screening questionnaire.

EXHIBIT 4.3

RISK CRITERIA FOR RESPIRATORY HEALTH CONDITIONS TO CLASSIFY SENSITIVE PRIMARY SCHOOL CHILDREN

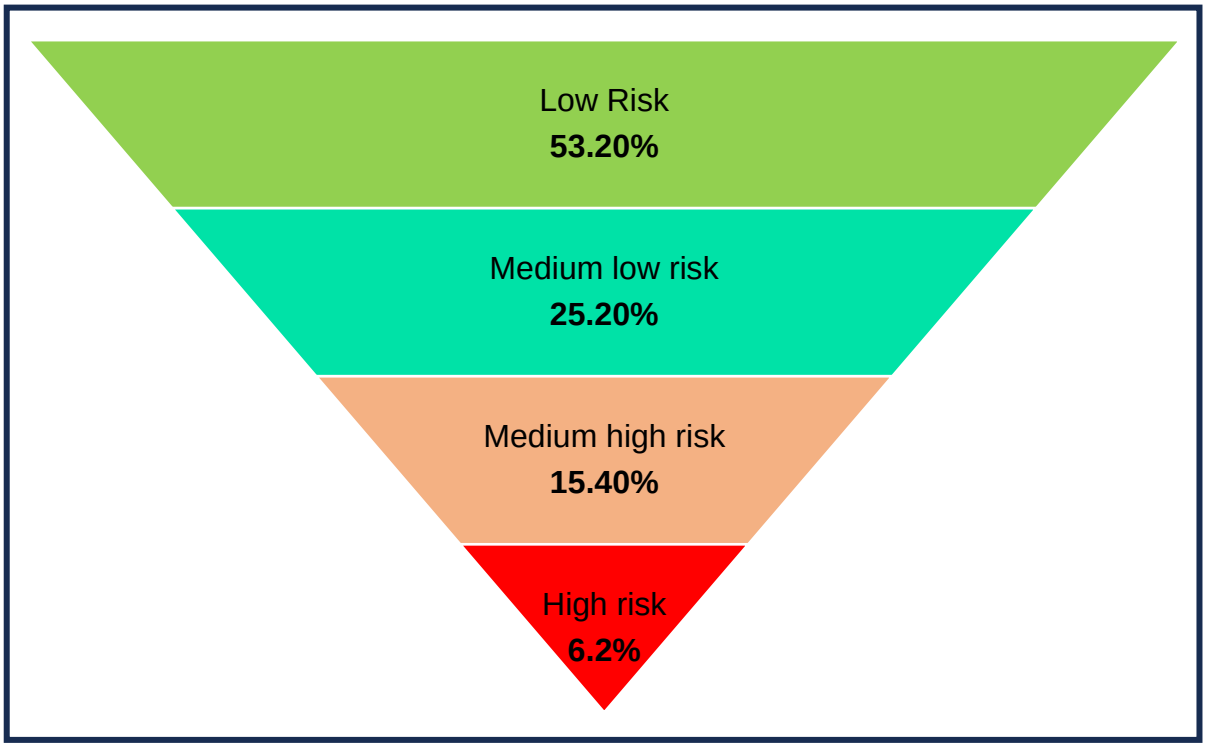
High risk	A parent/caregiver/guardian that responds affirmative to the following question: • Has your child ever had wheezing or whistling in the chest at any time in the past? AND A parent/caregiver/guardian that responds affirmative to the following question: Has your child had wheezing or whistling in the chest in the past 12 months? AND A parent/caregiver/guardian affirming that: • Wheezing has ever been severe enough in the past 12 months to limit a primary school child's speech to only one or two words at a time between breaths. • A doctor ever told him/her that their child has asthma. • The child's chest sounded wheezy during or after exercise in the past 12 months. • The child had a dry cough at night, apart from a cough associated with a cold or chest infection in the past 12 months. • The child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day). A parent/caregiver/guardian affirming that: • The child had at least 4 attacks of wheezing in the past 12 months
Medium High risk	A parent/caregiver/guardian that responds affirmative to the following question: • Has your child ever had wheezing or whistling in the chest at any time in the past? AND A parent/caregiver/guardian that responds affirmative to the following question: • Has your child had wheezing or whistling in the chest in the past 12 months? AND A parent/caregiver/guardian disagreeing with at least one of the following statements: • Wheezing has ever been severe enough in the past 12 months to limit a primary school child's speech to only one or two words at a time between breaths. • A doctor ever told him/her that their child has asthma. • The child's chest sounded wheezy during or after exercise in the past 12 months. • The child had a dry cough at night, apart from a cough associated with a cold or chest infection in the past 12 months. • The child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day). A parent/caregiver/guardian affirming that: • The child had at least one attack of wheezing in the past 12 months

Medium low risk	A parent/caregiver/guardian that responds affirmative to the following question: • Has your child ever had wheezing or whistling in the chest at any time in the past? AND A parent/caregiver/guardian that disagrees with the following question: • Has your child had wheezing or whistling in the chest in the past 12 months? OR A parent/caregiver/guardian affirming that: • Has your child ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?
Low Risk	A parent/caregiver/guardian that disagrees with the following question: • Has your child ever had wheezing or whistling in the chest at any time in the past? AND A parent/caregiver/guardian disagrees that: • Has your child ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?

In applying the criteria in exhibit 4.3, the respiratory conditions of primary school children reported by the 389 parents/caregivers/guardians were classified according to the varied risk and sensitivity levels. The outcome of this analysis is displayed in figure 4.20. From the analysis it seems that the respiratory health of about 20% of primary school children is at increased risk due to ambient air pollutants and that they are more sensitive to higher concentrations of SO_2.

FIGURE 4.20

PRIMARY SCHOOL CHILDREN @ RISK CLASSIFICATION



n = 389.

More confined sensitivity analyses also showcased that households located in the Gauteng receptor communities are less sensitive and at a lower risk than those who are in the Mpumalanga cluster (i.e. the Arbor/Kendal receptor community shows the highest levels of sensitivity and the highest level of risk).

4.6 SUMMARY AND CONCLUSION

This chapter presented an analyses and interpretation of the research results emanating from the personal face-to-face interviews with 389 parents/ caregivers/guardians with children between the ages of 6 to 12 years in their care, who reside in the receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). The sample distribution ratio between the Gauteng and Mpumalanga clusters for the primary school children survey was about 40:60, while the gender participation was slightly biased towards females, with most parent/caregiver/guardian participants being Black Africans.

Salient findings from the preschool child health screening survey include the following:

- About a quarter (28.00%) of primary school children **ever** had wheezing or whistling in the chest at any time in the past. The corresponding statistic for the past **12-month** experience was 21.30%.
- About seven in every 10 primary school children (69.90%) had at least one attack of wheezing in the past 12 months, while about two-thirds (67.50%) of children's sleep has been disturbed in the 12 months prior to the study due to wheezing occurring for at least one night per week.
- During the past three months prior to the study, about four in every 10 (39.80%) primary school children experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. The corresponding statistic for the past 12 months prior to the study was significantly high at 87.70% for those children who ever experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. For six in every 10 (62.50%) of these children, nose problems have been accompanied by itchy-watery eyes. Likewise, for seven in every 10 (73.60%) of these children, the nose problem interfered at least a little with their daily activities.
- For one in every 10 primary school children, a doctor ever told the parent/ guardian/caregiver or child, that the child has hay fever (15.40%) or atopic dermatitis or eczema (10.80%).
- Most nose problems among primary school children occur between June to October, with most nose problems occurring in June.
- For four in every 10 primary school children (41.00%), wheezing during the 12 months prior to the study has been severe enough to limit the child's speech to only one or two words at a time between breaths. Likewise, 15.90% of primary school children's chests sounded wheezy during or after exercise during the 12 months prior to the study.
- During the 12 months prior to the study, about a third (30.90%) of primary school children had a dry cough at night, apart from a cough associated with a cold or chest infection.

- Primary school children's coughing, wheezing or being short of breath during the 12 months prior to the study has caused difficulty for one in every five children (20.80%) to continue with usual activities.
- Prevalence rates of below 5% were recorded for doctor-diagnosed asthma (4.6%), bronchitis (3.3%), pneumonia (2.3%) and TB (0.8%) among primary school children.
- During the past three months prior to the study, about four in every 10 (39.80%) primary school children experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. The corresponding statistic for the past 12 months prior to the study was significantly high at 87.70% for those children who ever experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. For six in every 10 (62.50%) of these children, nose problems have been accompanied by itchy-watery eyes. Likewise, for seven in every 10 (73.60%) of these children, the nose problem interfered at least a little with their daily activities.
- For one in every 10 primary school children, a doctor ever told the parent/ guardian/caregiver or child, that the child has hay fever (15.40%) or atopic dermatitis or eczema (10.80%).
- Most nose problems among primary school children mainly occur between June to October. In the month of June, most nose problems occur among primary school children, which falls within the South African winter season.

CHAPTER 5

PARENT-ADMINISTRATED CHILD SURVEY ON RESPIRATORY SYMPTOMS IN SECONDARY SCHOOL CHILDREN (13-17 YEARS)

5.1 INTRODUCTION

This chapter presents the analyses and interpretation of the research results emanating from the personal face-to-face interviews with 383 secondary school children between the ages of 13 to 17 years, who assented to complete a questionnaire on the prevalence of respiratory symptoms in children (13-17 years). It should be noted, that although most children are 13 to 14 years old in grade 8 (secondary school), some children are 13 years old in grade 7 (primary school). The survey included all identified children aged 13 years, irrespective of whether they were attending a primary or secondary school. For the purpose of the reporting of the findings, reference will be made to secondary school children.

Before approaching children for assent to participate in the survey, parents/caregivers/guardians were approached for consent, and no child was allowed to participate in the survey without adult consent. The rationale for interviewing children in the older age group in person (instead of adult parents/caregivers/guardians), was based on the fact that secondary school children are increasingly gaining independence from their parents/caregivers/guardians and are aware of their own health status and respiratory symptoms, as opposed to younger children who are mostly dependent on their parents/caregivers/guardians and less knowledgeable about their health status. .

The survey tool was developed by INFOTOX and the BMR team and had to be completed by secondary school children between the ages of 13 to 17 years. The research approach allowed for parents/caregivers/guardians to be present during the face-to-face interview and provide assistance when required. However, the interview was conducted with the child participant and parents/caregiver/guardians were refrained from unnecessary interfering with

the interviewing process. Annexure B4 displays the survey tool used to explore the respiratory symptoms in secondary school children (13-17 years).

The research design applied a child-administrated survey which was completed by 383 secondary school children who form part of households located in receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). The findings resulting from the secondary school child survey are analysed and interpreted in this chapter.

5.2 SECONDARY SCHOOL CHILDREN ASSENT AND PARENTS/ CAREGIVERS/GUARDIANS CONSENT

Exhibition 5.1 serves to confirm the assent ensured by 383 secondary school children who participated in the health screening survey. To adhere to sound research ethics principles, participation in the secondary school survey was voluntary and child respondents (13-17 years) could withdraw at any stage before or during the survey. No foreseeable risks in participating in this health screening survey were anticipated nor occurred. Children (13-17 years) were judgmentally sampled and participation involved the completion of a questionnaire by children (13-17 years) after seeking the consent of parents/caregivers/guardians. In this regard, all parents/caregivers/ guardians were presented with an information sheet and letter of consent which needed to be signed before participation in the study. The BMR provided detailed background information about the study and ensured the parents/caregivers/guardians that any personal details would not be revealed to people outside the group of researchers who were involved in the project. The BMR also confirmed that no personal details of the child will be shared in the research report or made public. Against this background, 389 children and parents/caregivers/guardians agreed to all research ethics conditions stated at the start of the survey.

Confirmation of the child (n = 383) assent adhering to all research ethics conditions is displayed in exhibit 5.1.

EXHIBIT 5.1

CHILD ASSENT TO PARTICIPATE IN THE SECONDARY SCHOOL CHILD SURVEY

STATEMENT	AGREE
I understand what the respiratory health screening survey is about and what my participation will involve.	✓
I understand that my participation is voluntary (of free will).	✓
I understand that I can withdraw at any time without giving any reasons for why I no longer want to take part in the respiratory health screening survey.	✓
I understand my personal details will not be revealed to people outside the group of researchers.	✓
I understand that the information shared will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.	✓
I have been given the opportunity to ask questions about the respiratory health screening survey.	✓
I hereby agree to participate in the respiratory health screening survey.	✓

n = 383.

5.3 PROFILING CHILD PARTCIPANTS OF THE SECONDARY SCHOOL HEALTH SCREENING SURVEY

Tables 5.1, 5.2 and 5.3 profile the participating secondary school children by selected demographic cohort. The sample distribution ratio between the Gauteng and Mpumalanga clusters is 40:60, while the gender participation is slightly biased towards females. Most child participants were Black Africans.

TABLE 5.1

SECONDARY SCHOOL CHILDREN BY RECEPTOR COMMUNITY

Receptor community	n	%
Gauteng Cluster	**156**	**40.73%**
Bronkhorstspruit	68	17.80%
Zithobeni	88	23.00%
Mpumalanga Cluster	**227**	**59.27%**
Balmoral/Wilge	11	2.90%
Phola	143	37.30%
Ogies/Blesboklaagte	50	13.10%
Arbor/Kendal	4	1.00%
Clewer	9	2.30%
Kwa-Guqa/Vosman	10	2.60%
Total	**383**	**100.00%**

TABLE 5.2

SECONDARY SCHOOL CHILDREN BY GENDER

Gender	n	%
Male	177	46.20%
Female	204	53.30%
Other/Prefer not to answer	2	0.50%
Total	**383**	**100.00%**

TABLE 5.3

SECONDARY SCHOOL CHILDREN BY POPULATION GROUP

Population group	n	%
Black/African	372	97.10%
Indian/Asian	0	0.00%
Coloured	2	0.50%
White	7	1.80%
Other	2	0.50%
Total	**383**	**100.00%**

5.3.1 Profiling secondary school children by age

The age profile of the secondary school children is shown in table 5.4. The analysis shows representation across all six age groups, with the average age of children being calculated at 14.95 years. Child respondents were also requested to indicate whether they attended a secondary school (see figure 5.1) and to list the name of the secondary school attended, which is disclosed in exhibit 5.2.

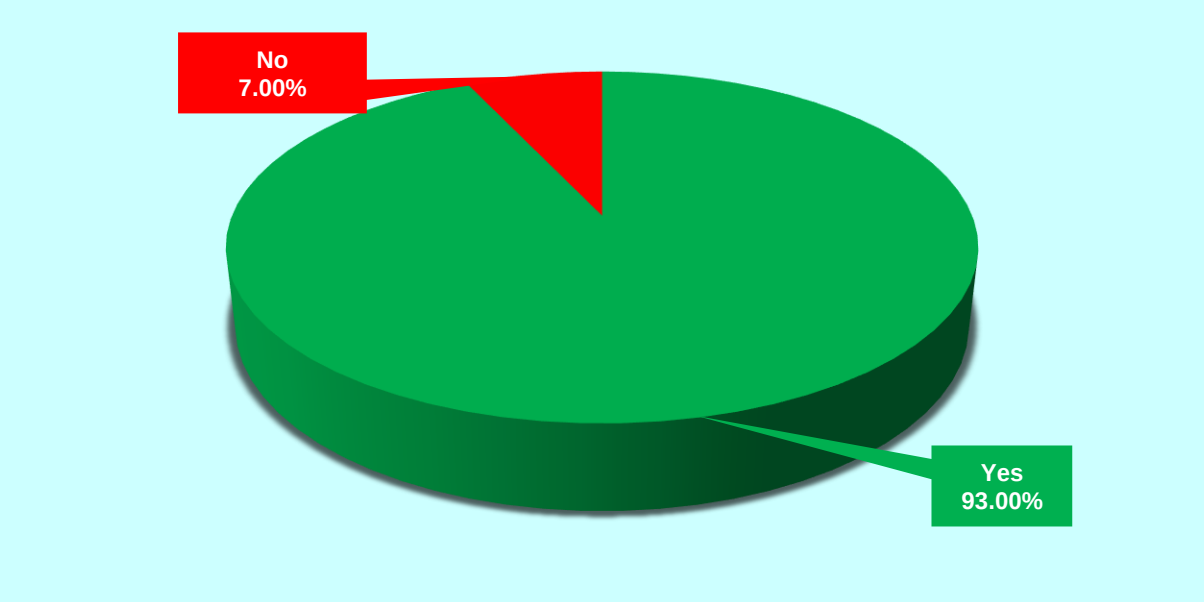
TABLE 5.4

AGE PROFILE OF THE SECONDARY SCHOOL CHILDREN

Age	n	%
13	85	22.20%
14	77	20.10%
15	72	18.80%
16	71	18.50%
17	78	20.40%
Total	**383**	**100.00%**

FIGURE 5.1

CHILD CONFIRMATION OF ATTENDING A SECONDARY SCHOOL



*No: Child in grade 7 but 13 years of age, who meets sample inclusion qualification.
n = 383.

EXHIBIT 5.2

SECONDARY SCHOOLS* ATTENDED BY SECONDARY SCHOOL CHILDREN (13-17 YEARS)

ABET; Althea Independent School; Bronkhorstspruit Primary School; Clewer Primary School; Cultura High School; Dan Kutumela Secondary School; DM Motsaosele; Ed-U-College Combined School; Edward Matyeka Primary School; Ekangala Engineering School of Specialisation; Empucukweni Secondary School; Fundisisa Primary School; Hlangu Phala Primary School; Hoërskool Erasmus; Hoërskool Generaal Hertzog; Hoërskool Reynopark; Laerskool du Preez van Wyk; Leonard Ntshuntshe Secondary School; Mabande Comprehensive High School; Mahlenga Secondary School; Makause Combined School; Mehlwana Secondary School; Mpumelelo Secondary School; Mshuluzane Mayisela Primary School; Nancy Shiba Primary School (Vosman); Ogies Combined School; Ogies Police Station; Pretoria Technical High School; Sibongindawo Primary School; Siyathokoza Primary School; Sizanani Special School; Sukumani Primary School; Thanduxolo Specialised School; Tholulwazi Secondary School; Thuthukani Primary School; Vezilwazi Secondary School; Witbank High School; Zithobeni Secondary School.

* List includes primary schools for 13-year-old children.
n = 383. 20.65% of respondents did not indicate the school's name.

5.4 PREVALENCE AND IMPACT OF RESPIRATORY SYMPTOMS AMONG SECONDARY SCHOOL CHILDREN (13-17 YEARS)

5.4.1 Prevalence of doctor-diagnosed asthma and other respiratory diseases in secondary school children

The questions shown in question box 5.1 were used to assess asthma and other respiratory diseases prevalent among secondary school children.

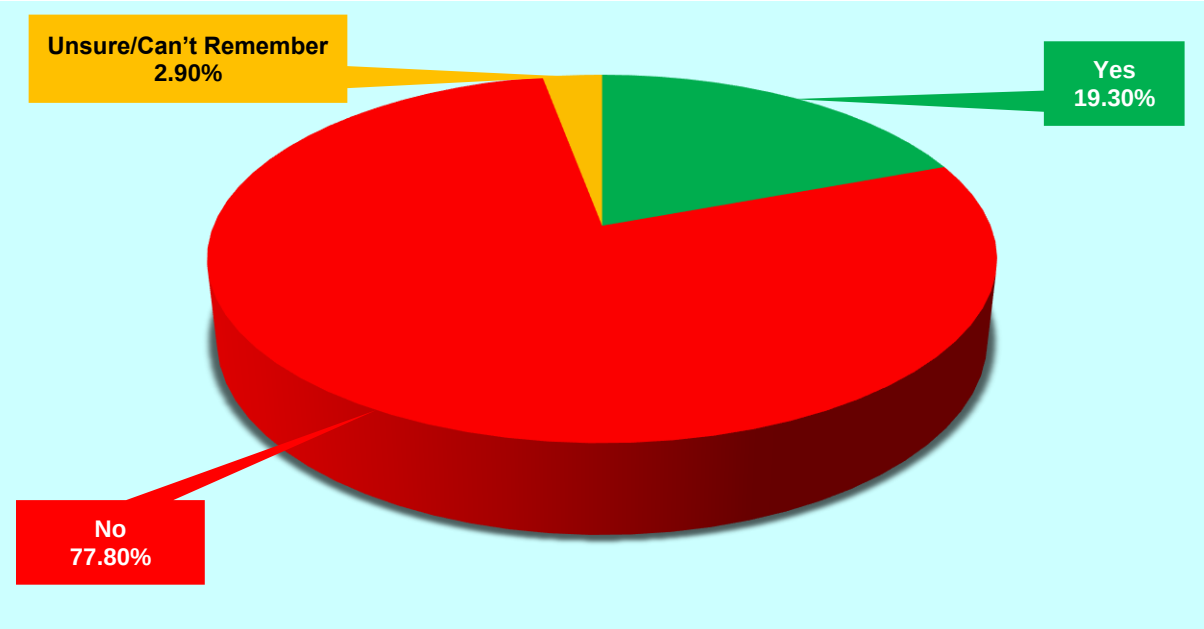
QUESTION BOX 5.1

- *Have you ever had wheezing or whistling in the chest at any time in the past?*
- *Have you had wheezing or whistling in the chest in the past 12 months?*
- *How many attacks of wheezing have you had in the past 12 months?*
- *In the past 12 months, how often, on average, has your sleep been disturbed due to wheezing?*
- *In the past 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?*
- *Has a doctor ever told you that you have asthma?*
- *In the past 12 months, has your chest sounded wheezy during or after exercise?*
- *In the past 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?*
- *In the past 12 months, has your coughing, wheezing or being short of breath caused you difficulty with your usual activities (kept you from the things you usually do during the day)?*
- *Has a doctor ever told you that you have bronchitis?*
- *Has a doctor ever told you that you have pneumonia?*
- *Has a doctor ever told you that you have TB (Tuberculosis)?*

Figures 5.2 to 5.13 and table 5.5 show the outcome of the research findings related to the questions displayed in question box 5.1.

FIGURE 5.2

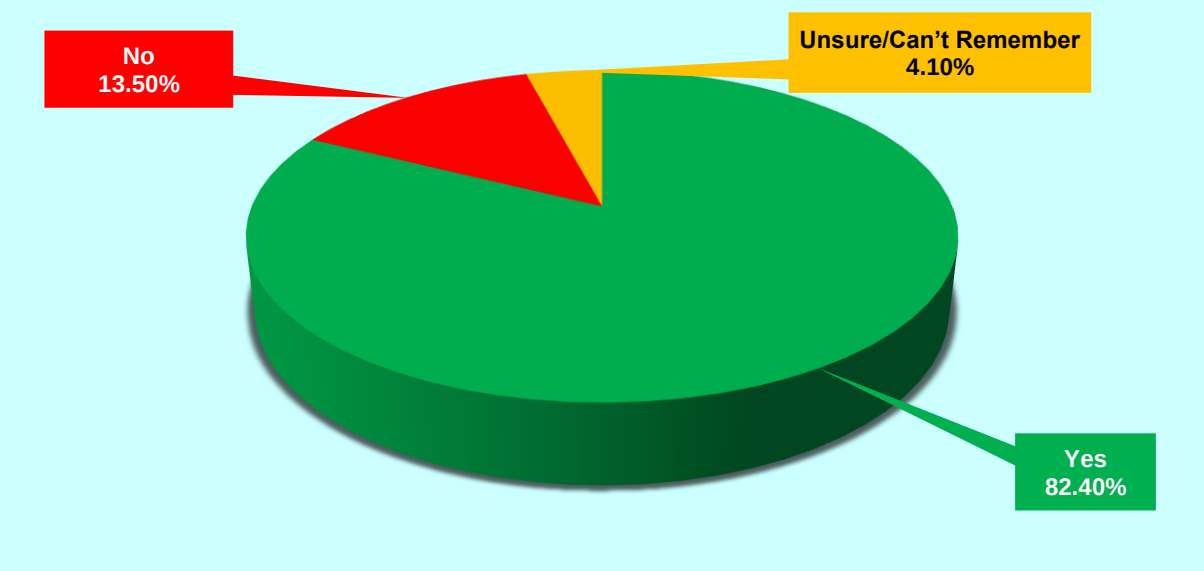
HAVE YOU EVER HAD WHEEZING OR WHISTLING IN THE CHEST AT ANY TIME IN THE PAST?



n = 383.

FIGURE 5.3

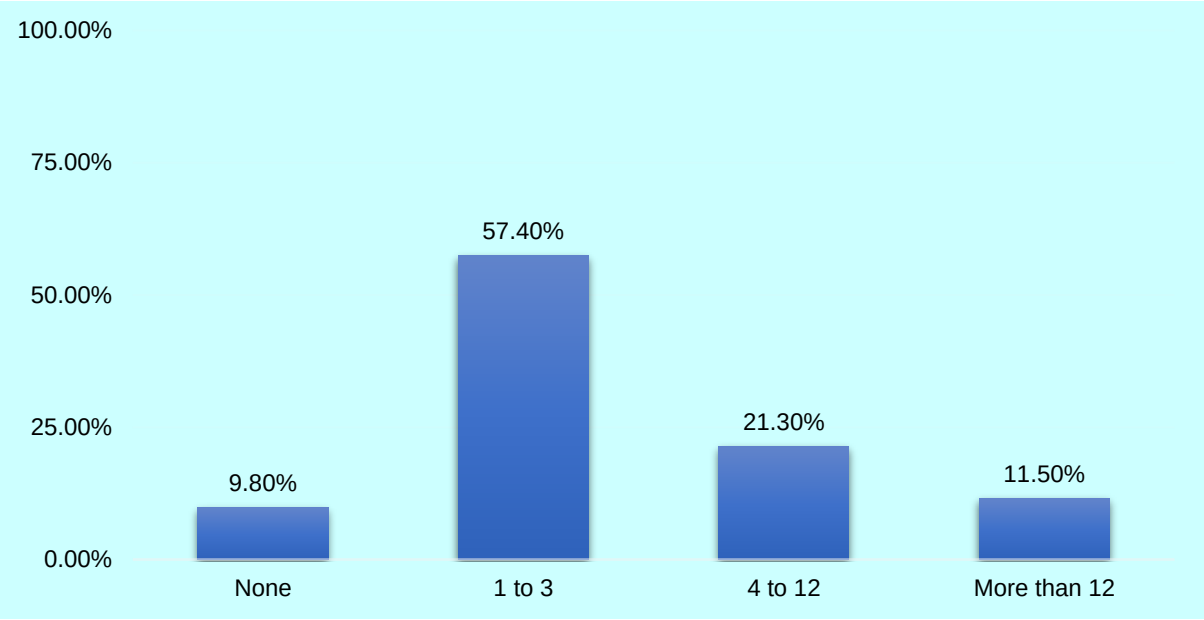
HAVE YOU HAD WHEEZING OR WHISTLING IN THE CHEST IN THE PAST 12 MONTHS?



n = 74.

FIGURE 5.4

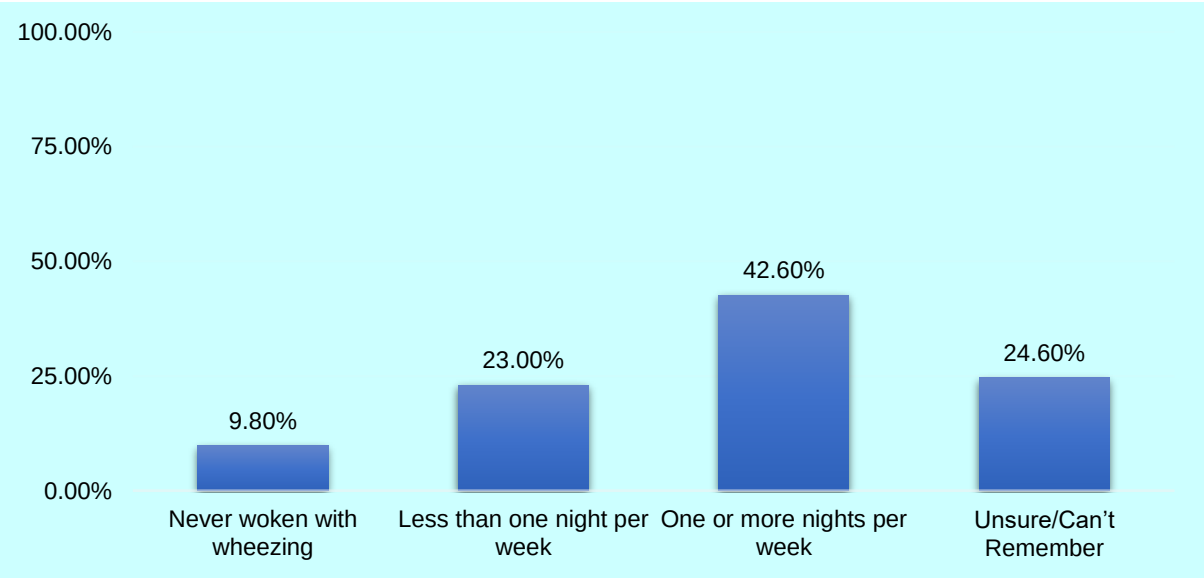
HOW MANY ATTACKS OF WHEEZING HAVE YOU HAD IN THE PAST 12 MONTHS?



n = 61.

FIGURE 5.5

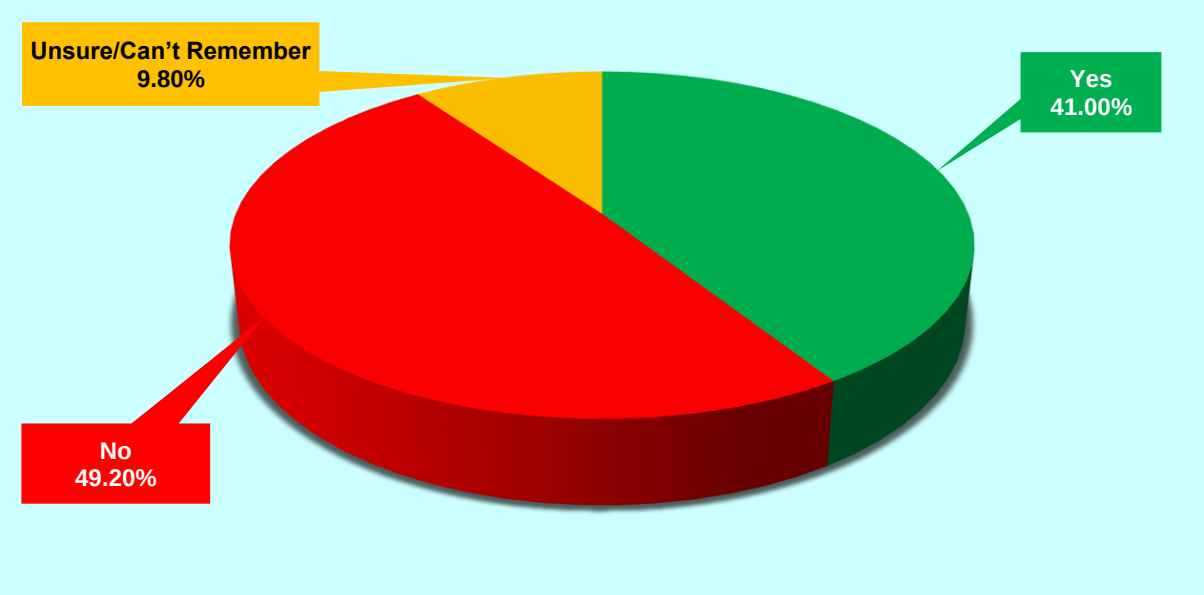
IN THE PAST 12 MONTHS, HOW OFTEN, ON AVERAGE, HAS YOUR SLEEP BEEN DISTURBED DUE TO WHEEZING?



n = 61.

FIGURE 5.6

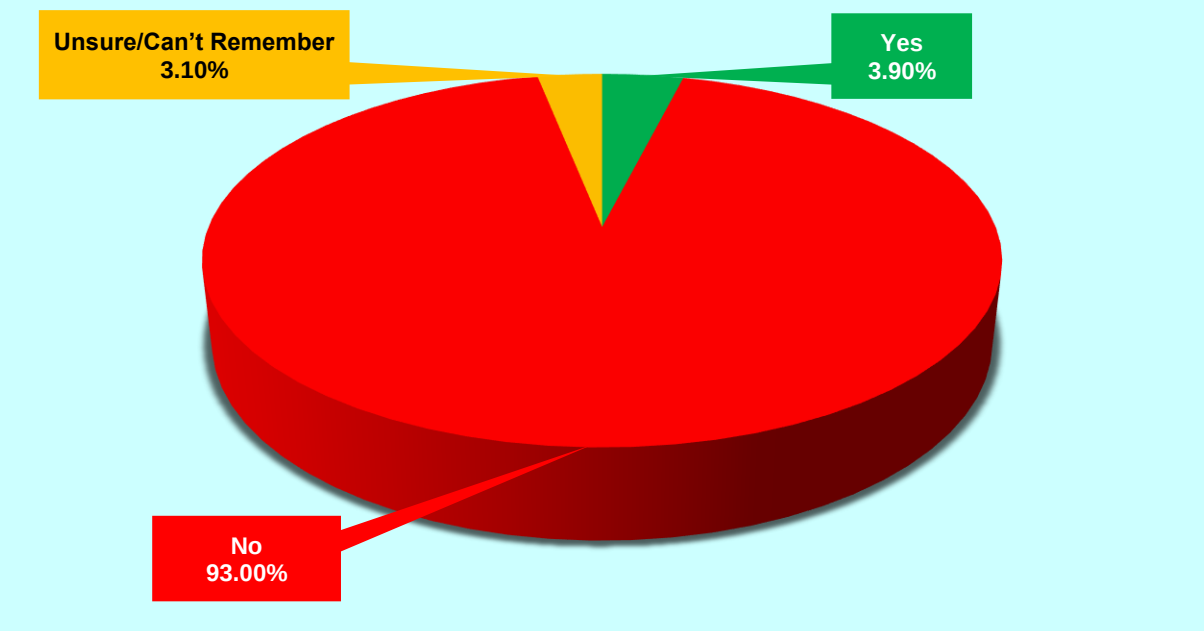
IN THE PAST 12 MONTHS, HAS WHEEZING EVER BEEN SEVERE ENOUGH TO LIMIT YOUR SPEECH TO ONLY ONE OR TWO WORDS AT A TIME BETWEEN BREATHS?



n = 61.

FIGURE 5.7

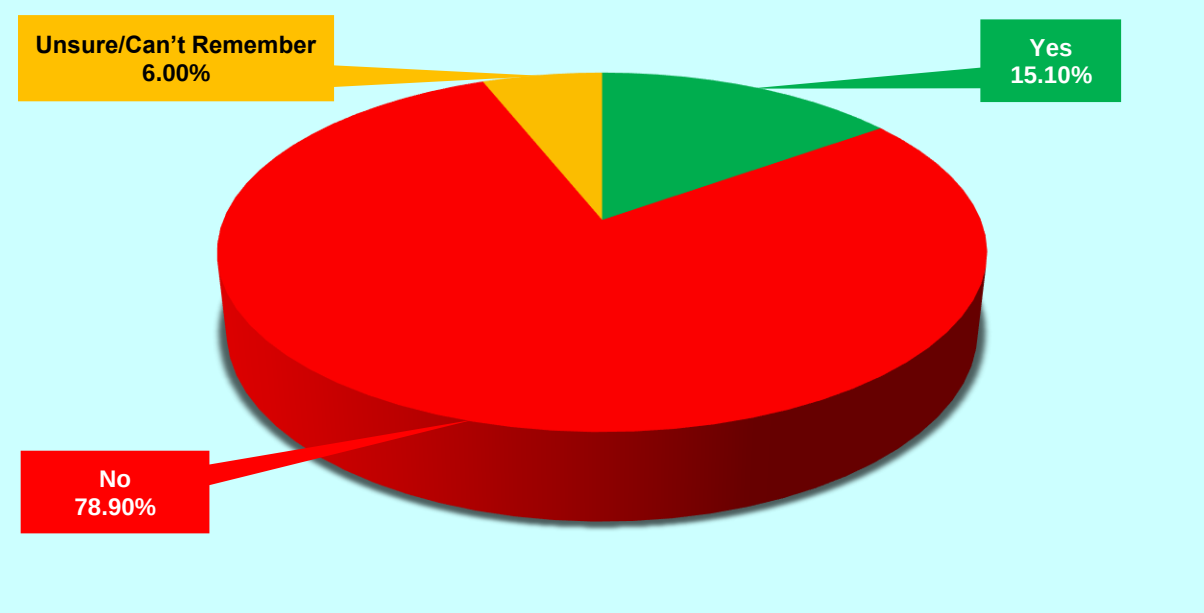
HAS A DOCTOR EVER TOLD YOU THAT YOU HAVE ASTHMA?



n = 383.

FIGURE 5.8

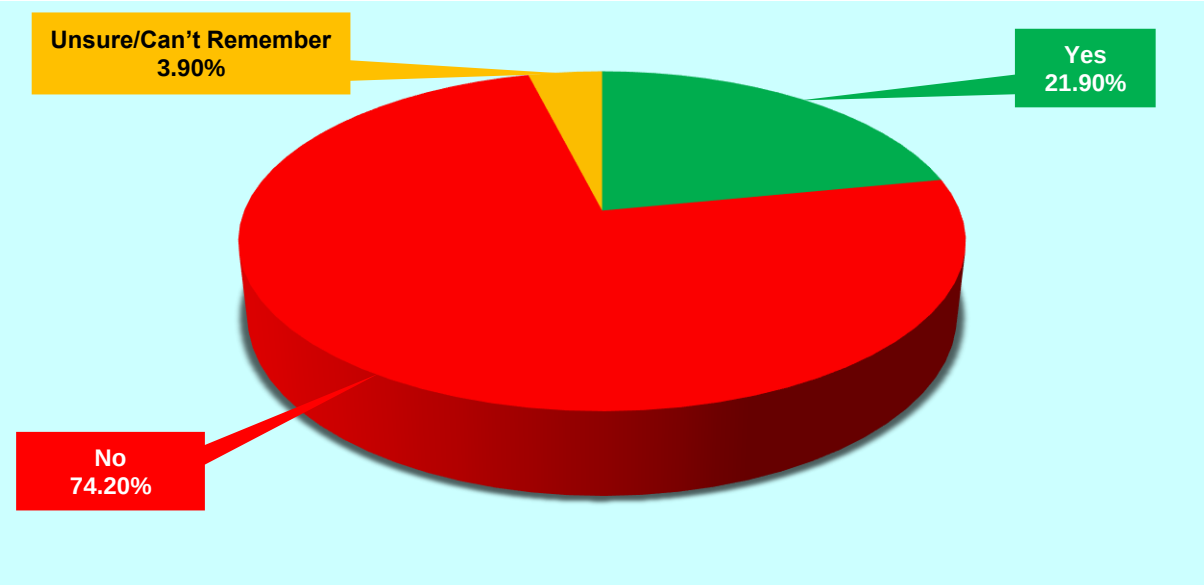
IN THE PAST 12 MONTHS, HAS YOUR CHEST SOUNDED WHEEZY DURING OR AFTER EXERCISE?



n = 383.

FIGURE 5.9

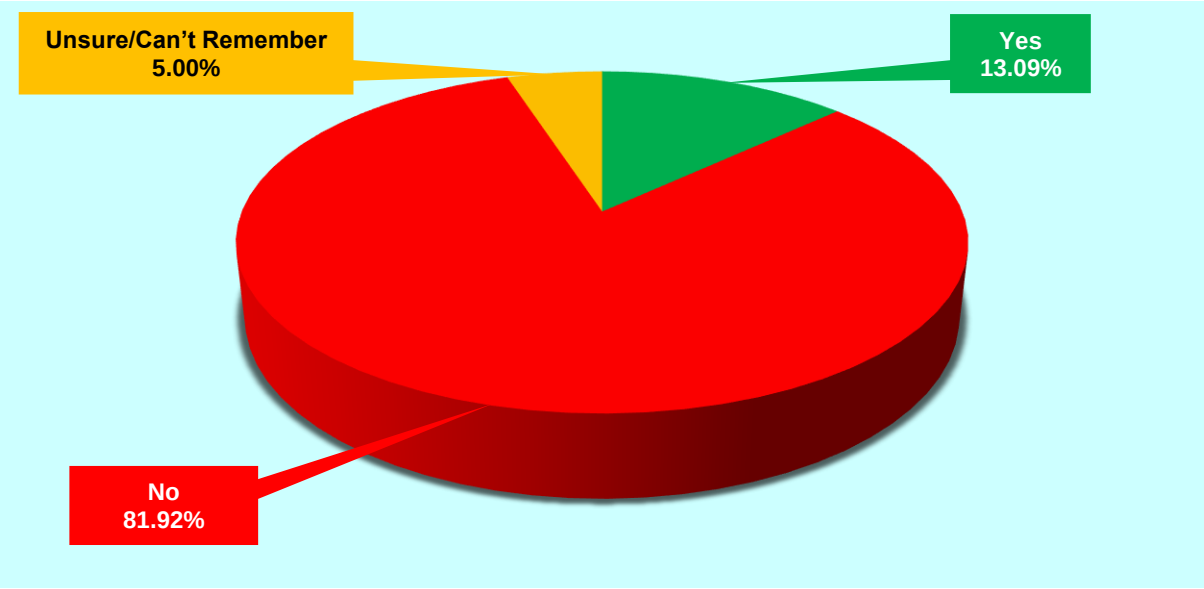
IN THE PAST 12 MONTHS, HAVE YOU HAD A DRY COUGH AT NIGHT, APART FROM A COUGH ASSOCIATED WITH A COLD OR CHEST INFECTION?



n = 383.

FIGURE 5.10

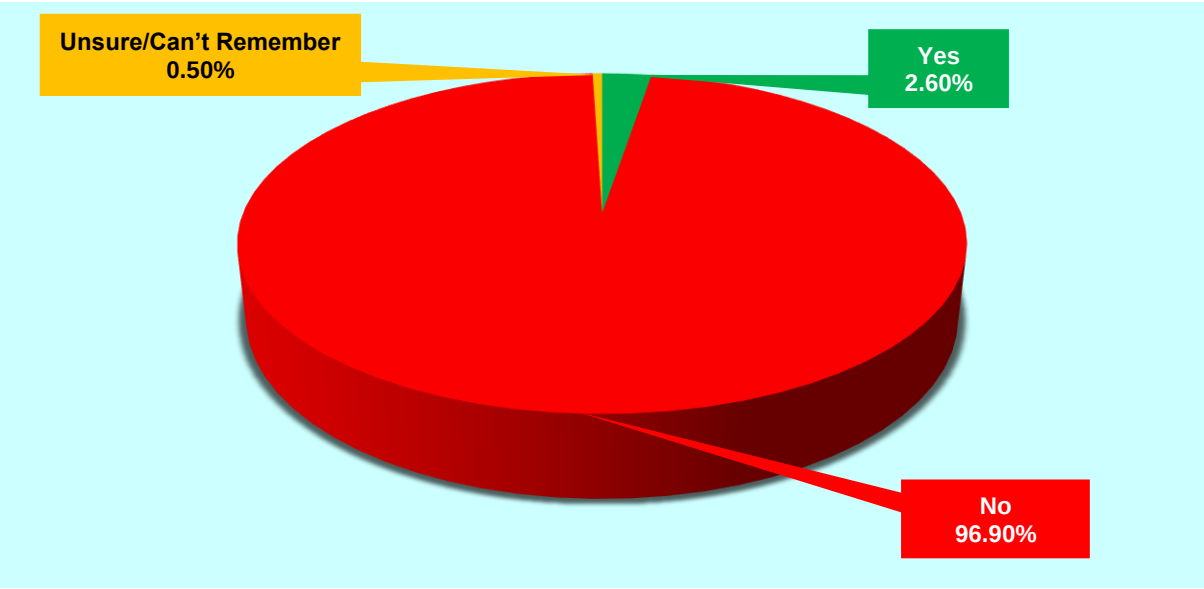
IN THE PAST 12 MONTHS, HAS YOUR COUGHING, WHEEZING OR BEING SHORT OF BREATH CAUSED YOU DIFFICULTY WITH YOUR USUAL ACTIVITIES (KEPT YOU FROM THE THINGS YOU USUALLY DO DURING THE DAY)?



n = 383.

FIGURE 5.11

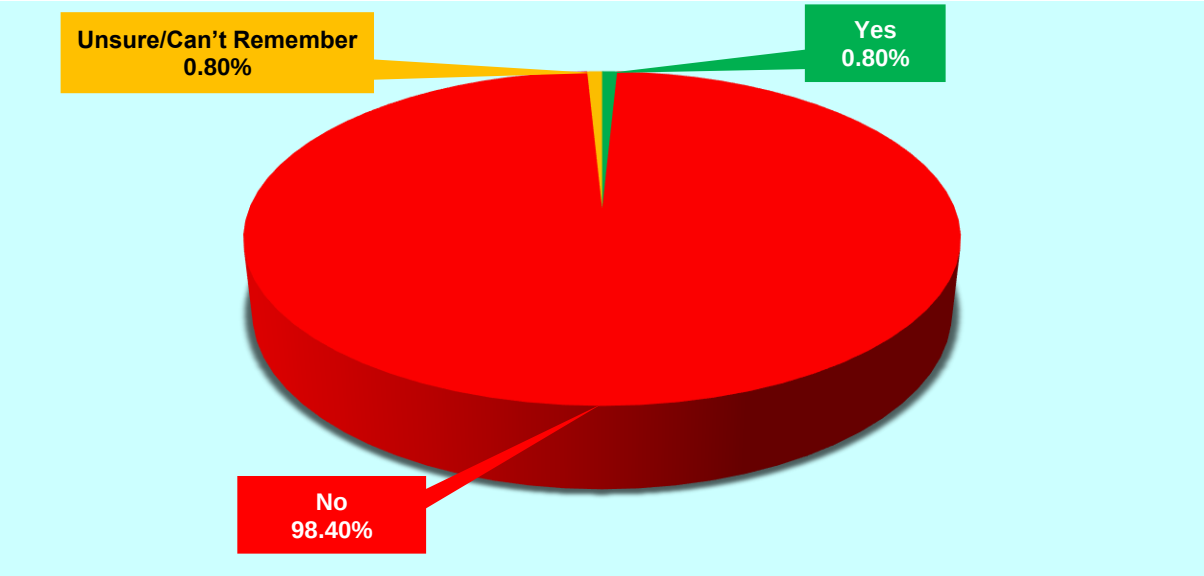
HAS A DOCTOR EVER TOLD YOU THAT YOU HAVE BRONCHITIS?



n = 383.

FIGURE 5.12

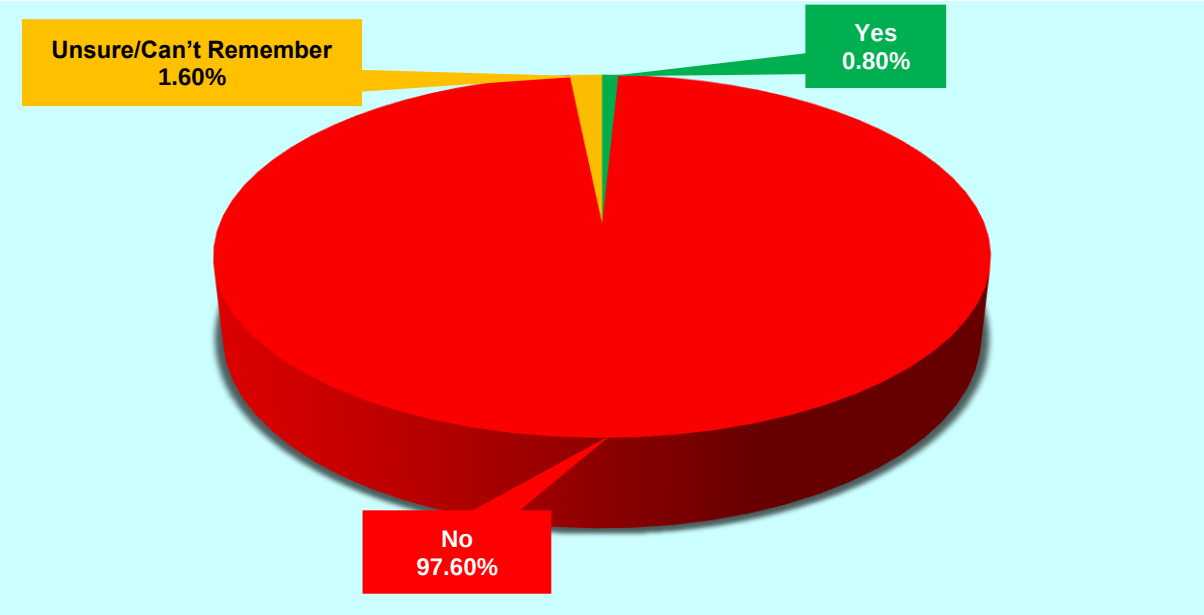
HAS A DOCTOR EVER TOLD YOU THAT YOU HAVE PNEUMONIA?



n = 383.

FIGURE 5.13

HAS A DOCTOR EVER TOLD YOU THAT YOU HAVE TB (TUBERCULOSIS)?



n = 383.

TABLE 5.5

SUMMARY - RESPIRATORY SYMPTOMS AND IMPACT ON SECONDARY SCHOOL CHILDREN (13-17 YEARS)

Respiratory symptoms	**YES**
Have you ever had wheezing or whistling in the chest at any time in the past?	19.30%
Have you had wheezing or whistling in the chest in the past 12 months?	82.40%
Did you have at least one attack of wheezing in the past 12 months?	78.70%
In the past 12 months, how often, on average, has your sleep been disturbed for at least one night per week due to wheezing?	65.60%
In the past 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?	41.00%
Has a doctor ever told you that you have asthma?	3.90%
In the past 12 months, has your chest sounded wheezy during or after exercise?	15.10%
In the past 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?	21.90%
In the past 12 months, has your coughing, wheezing or being short of breath caused you difficulty with your usual activities (kept you from the things you usually do during the day)?	13.1%
Has a doctor ever told you that you have bronchitis?	2.60%
Has a doctor ever told you that you have pneumonia?	0.80%
Has a doctor ever told you that you have TB (Tuberculosis)?	0.80%

Table 5.5 captures the prevalence and impact of respiratory symptoms on secondary school children. From the analyses it is clear that about a fifth (19.30%) of secondary school children **ever** had wheezing or whistling in the chest at any time in the past. The corresponding statistic for the past **12-month** experience was as high as 82.40%.

Significantly, about eight in every 10 secondary school children (78.70%) had at least one attack of wheezing in the past 12 months, while about two-thirds (65.60%) of children's sleep has been disturbed in the 12 months prior to the study due to wheezing occurring for at least one night per week.

For four in every 10 secondary school children (41.00%), wheezing during the 12 months prior to the study has been severe enough to limit the child's speech to only one or two words at a time between breaths. Likewise, 15.10% of secondary school children's chests sounded wheezy during or after exercise during the 12 months prior to the study.

During the 12 months prior to the study, about a fifth (21.90%) of secondary school children had a dry cough at night, apart from a cough associated with a cold or chest infection.

Secondary school children's coughing, wheezing or being short of breath during the 12 months prior to the study has caused difficulty for one in every ten children (13.10%) to continue with usual activities.

Finally, the analysis in table 4.5 reveals prevalence rates of below 5% for children diagnosed by a medical practitioner for asthma (3.9%), bronchitis (2.6%), pneumonia (0.8%) and TB (0.8%).

5.4.2 **Prevalence of rhinitis and allergies in secondary school children**

Seven questions have been included in the secondary school child questionnaire to determine the self-reported prevalence of rhinitis and allergies among secondary school children. To clarify the meaning, "rhinitis" has been carefully explained in the survey questionnaire and was described to include any of the following symptoms: blocked, runny, or itching nose, or sneezing. Likewise, "eczema" or "atopic dermatitis" was included in the survey questionnaire and was described as an inflammatory condition that causes itchy, rough, and cracked patches of skin.

The questions displayed in question box 5.2 were used to determine the prevalence and impact of rhinitis and allergies in secondary school children.

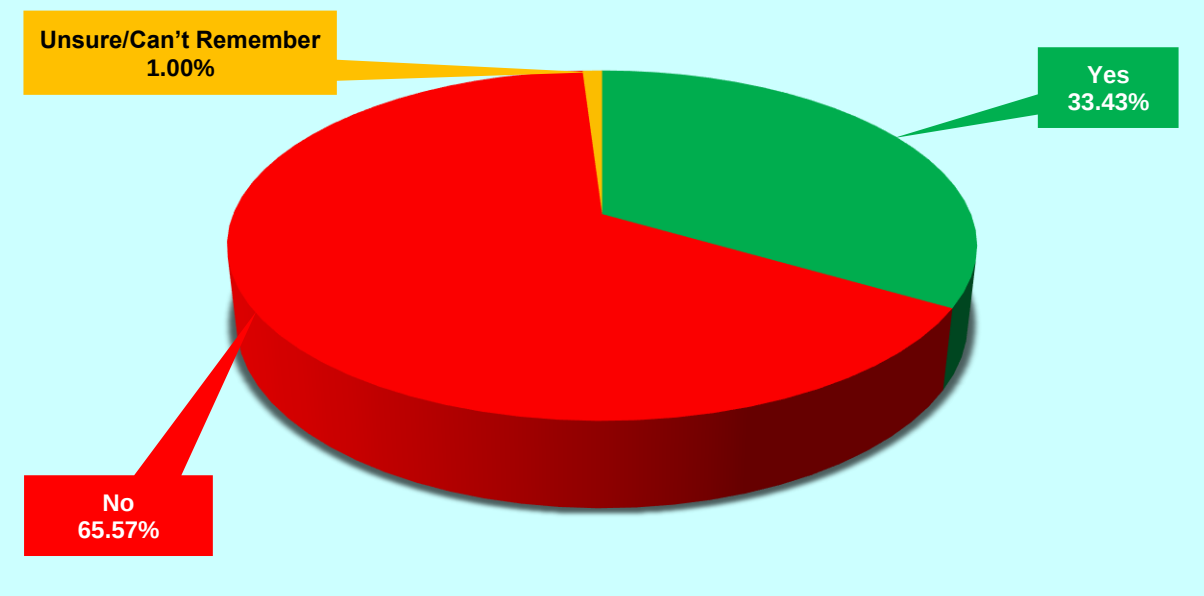
QUESTION BOX 5.2

- *Have you ever had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or flu?*
- *In the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or flu?*
- *In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?*
- *In which month(s) did this nose problem occur?*
- *In the past 12 months, how much did the nose problem interfere with your daily activities?*
- *Has a doctor ever told you that you have hay fever?*
- *Has a doctor ever told you that you have atopic dermatitis or eczema?*

Figures 5.14 to 5.20 and table 5.6 show the outcome of the research findings related to the questions displayed in question box 5.2.

FIGURE 5.14

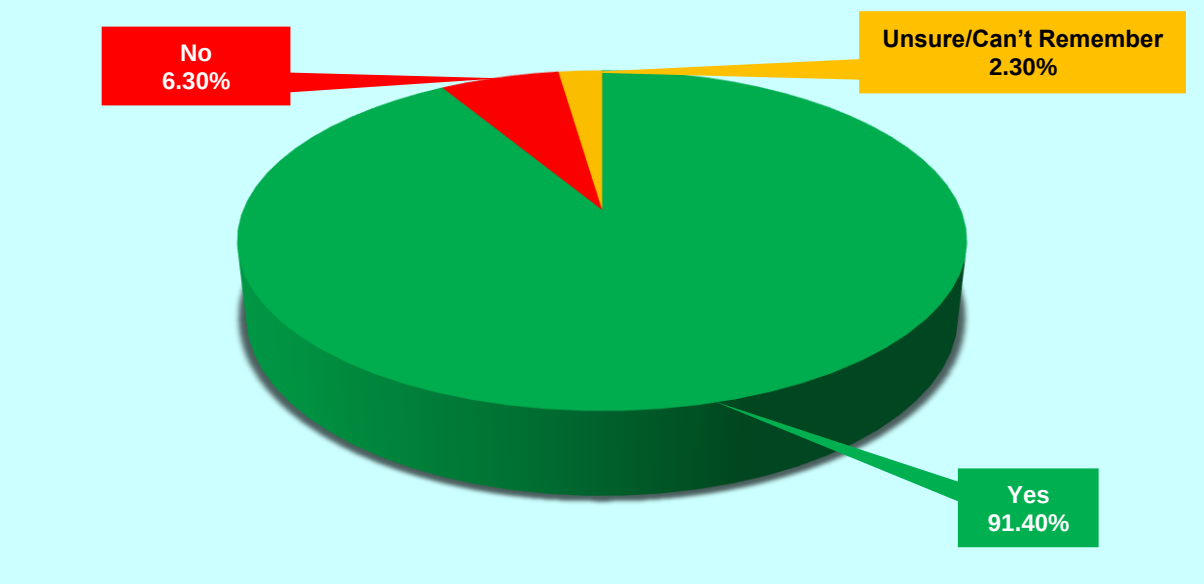
HAVE YOU EVER HAD A PROBLEM WITH SNEEZING, OR A RUNNY, OR BLOCKED NOSE WHEN YOU DID NOT HAVE A COLD OR FLU?



n = 383.

FIGURE 5.15

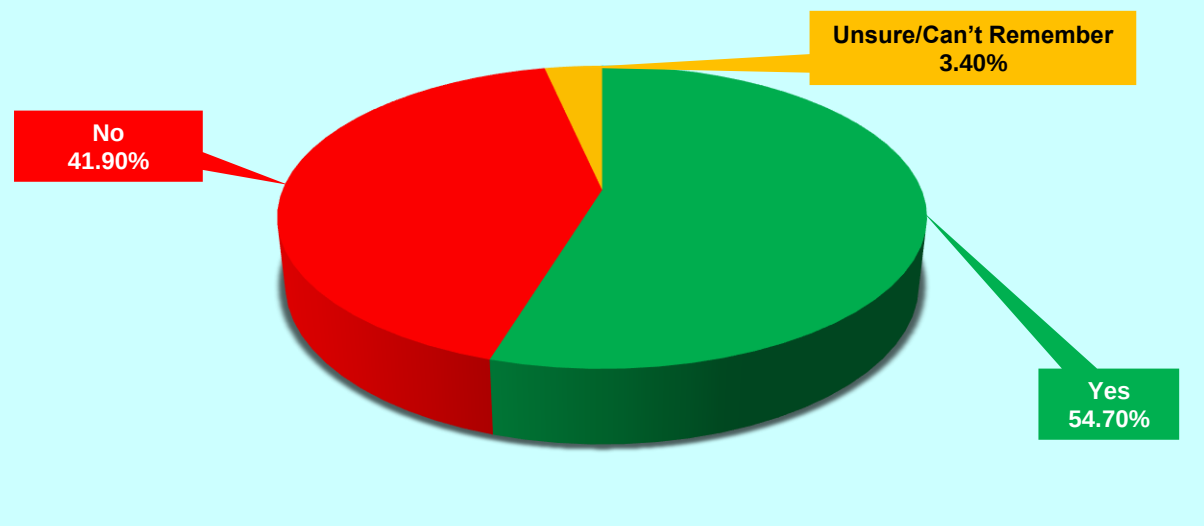
IN THE PAST 12 MONTHS, HAVE YOU HAD A PROBLEM WITH SNEEZING, OR A RUNNY, OR BLOCKED NOSE WHEN YOU DID NOT HAVE A COLD OR FLU?



n = 128.

FIGURE 5.16

IN THE PAST 12 MONTHS, HAS THIS NOSE PROBLEM BEEN ACCOMPANIED BY ITCHY-WATERY EYES?

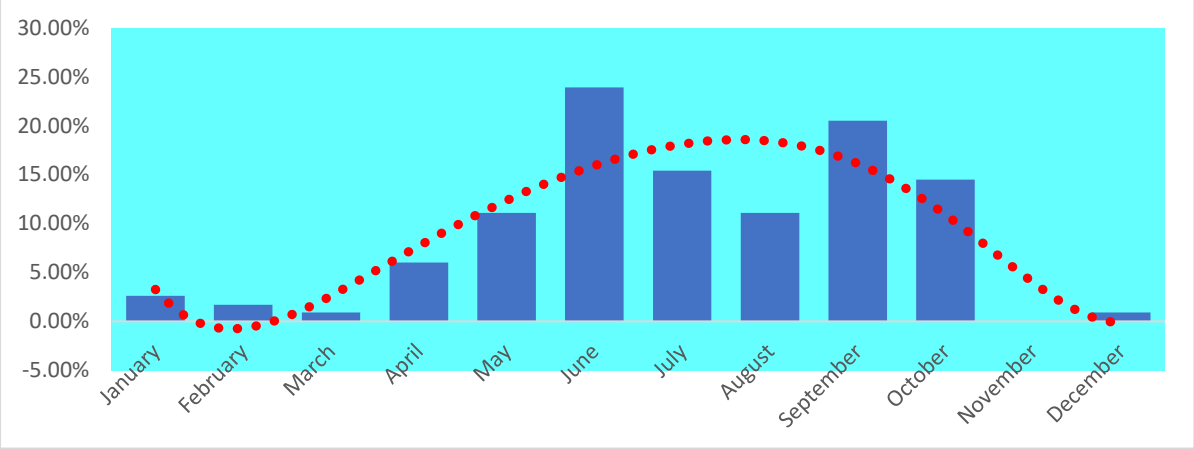


n = 117.

FIGURE 5.17

IN WHICH MONTH(S) DID THIS NOSE PROBLEM OCCUR?

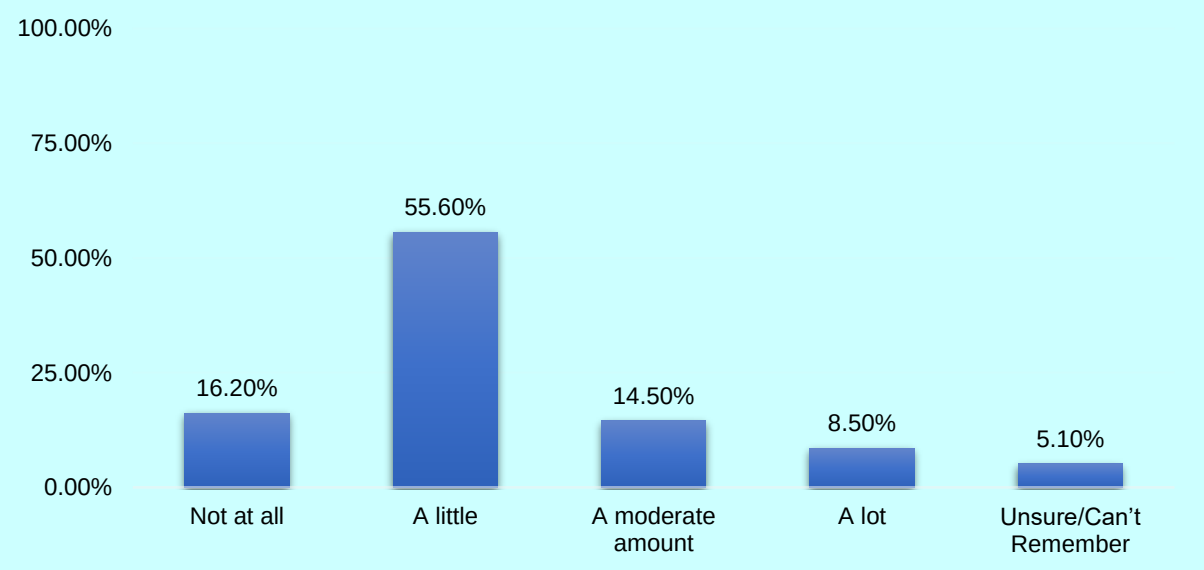
January	2.60%	July	15.40%
February	1.70%	August	11.10%
March	0.90%	September	20.50%
April	6.00%	October	14.50%
May	11.10%	November	0.00%
June	23.90%	December	0.90%
Unsure/Can't Remember			36.80%



n = 383.

FIGURE 5.18

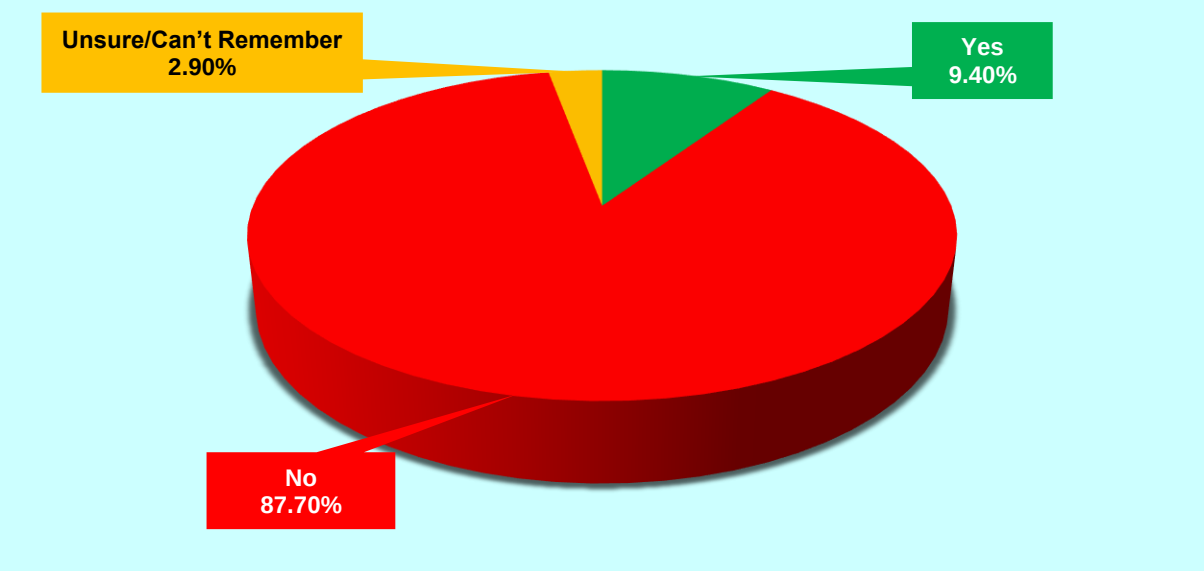
IN THE PAST 12 MONTHS, HOW MUCH DID THE NOSE PROBLEM INTERFERE WITH YOUR DAILY ACTIVITIES?



n = 117.

FIGURE 5.19

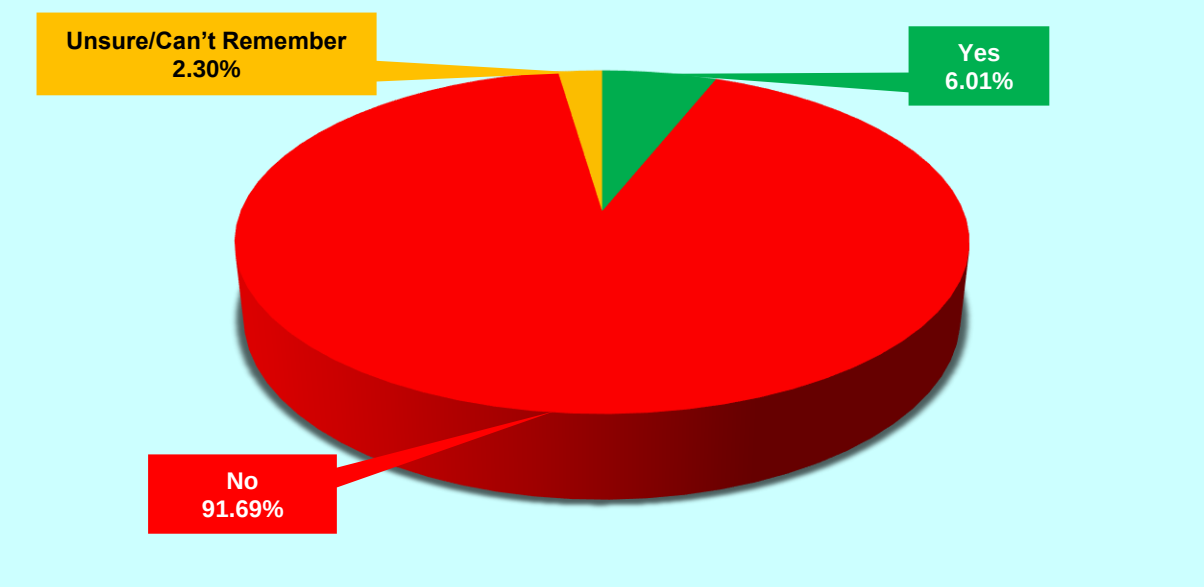
HAS A DOCTOR EVER TOLD YOU THAT YOU HAVE HAY FEVER?



n = 383.

FIGURE 5.20

HAS A DOCTOR EVER TOLD YOU THAT YOU HAVE ATOPIC DERMATITIS OR ECZEMA?



n = 383.

TABLE 5.6

SUMMARY: PREVALENCE OF RHINITIS AND ALLERGIES IN SECONDARY SCHOOL CHILDREN

Respiratory symptoms experienced during the day	**YES**
Have you ever had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or flu?	33.40%
In the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or flu?	91.40%
In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?	54.70%
In the past 12 months, how much did the nose problem interfere at least a little with your daily activities?	78.60%
Has a doctor ever told you that you have hay fever?	9.40%
Has a doctor ever told you that you have atopic dermatitis or eczema?	6.00%

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The analyses displayed in table 5.6 show that during the past three months prior to the study, about a third (33.40%) of secondary school children experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. The corresponding statistic for the past 12 months prior to the study was significantly high at 91.40% for those children who ever experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. For approximately half (54.70%) of the children, nose problems have been accompanied by itchy-watery eyes. Likewise, for eight in every 10 (78.60%) of these children, the nose problem interfered at least a little with their daily activities.

For one in every 10 secondary school children, a doctor ever told the child that he/she has hay fever (9.40%) or atopic dermatitis or eczema (6.00%).

Finally, it is important to note from the survey outcomes that nose problems among secondary school children mainly occur between the months of June to October. In the month of June, most nose problems occur among secondary school children. This period is typically associated with seasonal changes (winter and spring) which could contribute to respiratory symptoms, especially nose problems due to fluctuating temperatures and environmental conditions.

5.5 IDENTIFICATION OF SENSITIVE SECONDARY SCHOOL CHILDREN (13-17 YEARS)

Similar to the health screening adult, preschool, and primary school child surveys (see section 2.5 of chapter 2, section 3.5 of chapter 3 and section 4.5 of chapter 4), the health screening secondary school (13-17 years) child survey was also consciously designed to measure the level of sensitivity among secondary school children to air pollutants, such as SO_2. To support this goal, a statistical assessment of secondary school child health conditions and information reported in the study was conducted to determine the scale of sensitivity or vulnerability of secondary school children to ambient air pollution. In applying the criteria for interpretation of risk, the four risk classes displayed in figure 2.5 (see chapter 2) were again used to classify sensitive secondary school children.

As indicated in chapters 2, 3 and 4, part of the study objectives was to identify sensitive individuals who would be vulnerable to the health effects of SO_2, of which the main impact is on the respiratory system. As mentioned, the effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath, depending on the sensitivity of the exposed individual, and on the exposure conditions, such as the period and concentration of exposure. Considering these insights, the outcomes of the health screening survey results of secondary school children, as reported by children, have been used to determine the proportion of secondary school children whose respiratory health may be at increased risk and who are sensitive to exposure to higher SO_2 levels.

Using examples in applying the sensitivity theory, exhibit 5.3 presents interpretations on the four levels of risks being associated with the prevalence of specific respiratory conditions related to each risk category. More specifically, the exhibit applies the respiratory conditions explored in the secondary school health screening questionnaire.

EXHIBIT 5.3

RISK CRITERIA FOR RESPIRATORY HEALTH CONDITIONS TO CLASSIFY SENSITIVE SECONDARY SCHOOL CHILDREN

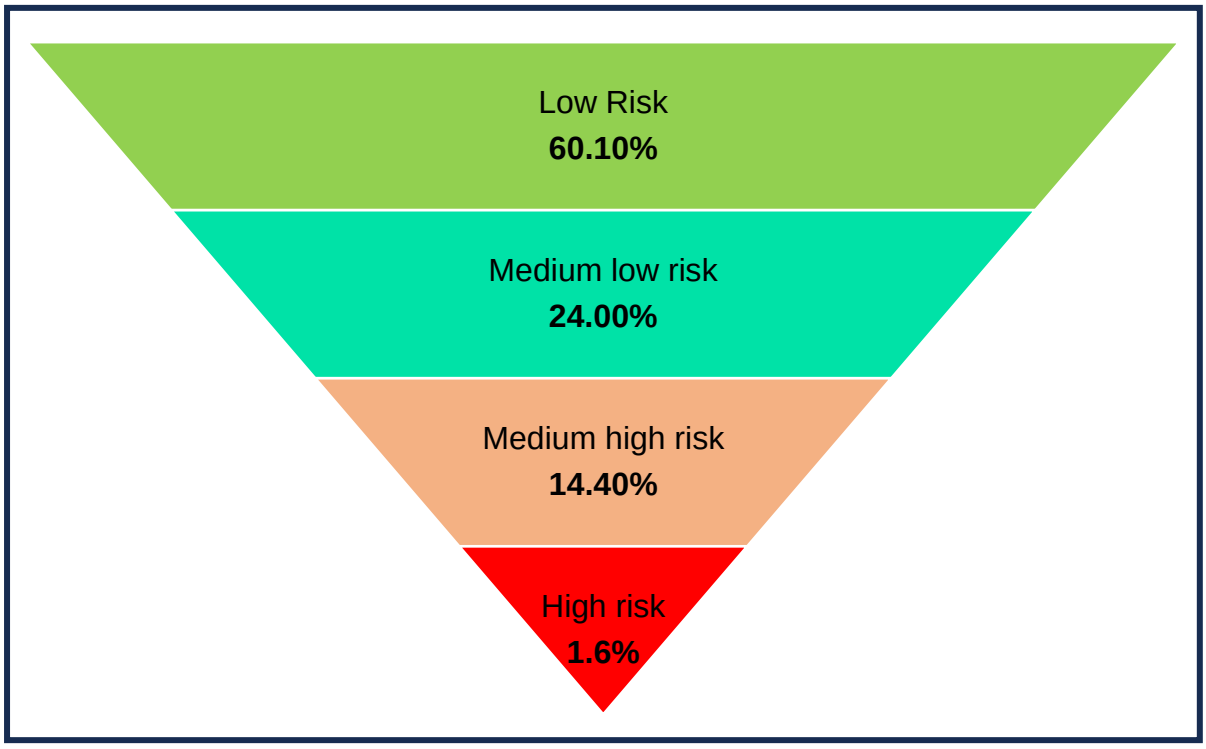
High risk	A secondary school child (13-17 years) that responds affirmative to the following question: • Have you ever had wheezing or whistling in the chest at any time in the past? AND A secondary school child (13-17 years) that responds affirmative to the following question: • Have you had wheezing or whistling in the chest in the past 12 months? AND A secondary school child (13-17 years) affirming that: • Wheezing has ever been severe enough in the past 12 months to limit his/her speech to only one or two words at a time between breaths. • A doctor ever told him/her that he/she has asthma. • His/her chest sounded wheezy during or after exercise in the past 12 months. • He/she had a dry cough at night, apart from a cough associated with a cold or chest infection in the past 12 months. • Coughing, wheezing or being short of breath have caused him/her difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day). A secondary school child (13-17 years) affirming that: • He/she had at least 4 attacks of wheezing in the past 12 months.
Medium High risk	A secondary school child (13-17 years) that responds affirmative to the following question: • Have you ever had wheezing or whistling in the chest at any time in the past? AND A secondary school child (13-17 years) that responds affirmative to the following question: • Have you had wheezing or whistling in the chest in the past 12 months? AND A secondary school child (13-17 years) disagreeing with at least one of the following statements: • Wheezing has ever been severe enough in the past 12 months to limit his/her speech to only one or two words at a time between breaths. • A doctor ever told him/her that he/she has asthma. • His/her chest sounded wheezy during or after exercise in the past 12 months. • He/she had a dry cough at night, apart from a cough associated with a cold or chest infection in the past 12 months. • Coughing, wheezing or being short of breath have caused him/her difficulty with his/her usual activities (kept him/her from the things he/she usually does during the day). A secondary school child (13-17 years) affirming that: • He/she had at least one attack of wheezing in the past 12 months.

Medium low risk	A secondary school child (13-17 years) that responds affirmatively to the following question: • Have you ever had wheezing or whistling in the chest at any time in the past? AND A secondary school child (13-17 years) that disagrees with the following question: • Have you had wheezing or whistling in the chest in the past 12 months? OR A secondary school child (13-17 years) affirming that: • He/she ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?
Low Risk	A secondary school child (13-17 years) that disagrees with the following question: • Have you ever had wheezing or whistling in the chest at any time in the past? AND A secondary school child (13-17 years) disagrees that: • He/she ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu?

In applying the criteria in exhibit 5.3, the respiratory conditions of secondary school children reported by the 383 children (13-17 years) respondents were classified according to the varied risk and sensitivity levels. The outcome of this analysis is displayed in figure 5.21. From the analysis it seems that the respiratory health of about 15% of secondary school children is at increased risk due to ambient air pollutants and that they may be more sensitive to exposure at higher concentrations of SO_2.

FIGURE 5.21

SECONDARY SCHOOL CHILDREN @ RISK CLASSIFICATION



n = 389.

More confined sensitivity analyses also showcased that households located in the Gauteng receptor communities are less sensitive and at lower risk than those who are in the Mpumalanga cluster (i.e. the Arbor/Kendal, Kwa-Guqa/Vosman and Clewer receptor communities show the highest levels of sensitivity and the highest level of risk).

5.6 SUMMARY AND CONCLUSION

This chapter presented an analyses and interpretation of the research results emanating from the personal face-to-face interviews with 383 secondary school children between the ages 13 to 17 years, who reside in households located in the receptor communities in proximity to the Kusile Power Station (within a 50 km distance of the Kusile Power Station). The sample distribution ratio between the Gauteng and Mpumalanga clusters for the secondary school children survey was about 40:60, while the gender participation was slightly biased towards females, with most child participants being Black Africans.

Salient findings from the secondary school child health screening survey includes the following:

- About a fifth (19.30%) of secondary school children **ever** had wheezing or whistling in the chest at any time in the past. The corresponding statistic for the past **12-month** experience was as high as 82.40%.
- Significantly, about eight in every 10 secondary school children (78.70%) had at least one attack of wheezing in the past 12 months, while about two-thirds (65.60%) of childrens' sleep has been disturbed in the 12 months prior to the study due to wheezing occurring for at least one night per week.
- For four in every 10 secondary school children (41.00%), wheezing during the 12 months prior to the study has been severe enough to limit the child's speech to only one or two words at a time between breaths. Likewise, 15.10% of secondary school childrens' chests sounded wheezy during or after exercise during the 12 months prior to the study.
- During the 12 months prior to the study, about a fifth (21.90%) of secondary school children had a dry cough at night, apart from a cough associated with a cold or chest infection.
- Secondary school childrens' coughing, wheezing or being short of breath during the 12 months prior to the study has caused difficulty for one in every ten children (13.10%) to continue with usual activities.
- Doctor-diagnosed prevalence rates of below 5% were recorded for asthma (3.9%), bronchitis (2.6%), pneumonia (0.8%) and TB (0.8%) among secondary school children.
- During the past three months prior to the study, about a third (33.40%) of secondary school children experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. The corresponding statistic for the past 12 months prior to the study was significantly high at 91.40% of those children who ever experienced problems with sneezing, or a runny, or blocked nose when they did not have a cold or flu. For approximately half (54.70%) of the children, nose problems have been accompanied by itchy-watery eyes. Likewise, for

eight in every 10 (78.60%) of these children, the nose problem interfered at least a little with their daily activities.

- For one in every 10 primary school children, a doctor ever told the child that he/she has hay fever (9.40%) or atopic dermatitis or eczema (6.00%).
- Most nose problems among secondary school children mainly occur between the months of June to October. In the month of June, most nose problems occur among secondary school children which falls within the South African winter season.

CHAPTER 6

RESPIRATORY HEALTH SCREENING SURVEY SUMMARY AND RECOMMENDATIONS

6.1 INTRODUCTION

This study was initiated from the failure of Kusile's west stack (chimneys) in October 2022, which halted the operations of three of its generating units (Units 1, 2 and 3). As a precondition for operating temporary stacks, the Minister of Forestry, Fisheries, and the Environment (DFFE) commanded the undertaking of a health screening study in receptor communities in proximity of the Kusile Power Station. This rationale is derived from the exemption granted to Eskom by the DFFE to operate temporary stacks for the next 12 months without complying with national air quality regulations. Consequently, Kusile will operate Units 1, 2 and 3 until December 2024 without abatement of SO_2 resulting in potentially higher concentrations of SO_2 in ambient air. This is concerning as it poses a medium to long-term health risk to the respiratory system, and particularly the lungs, of sensitive individuals. These operational circumstances triggered the need for a health screening survey during October and November 2023, which was conducted among 1 203 adults (18 years and older) and 1 162 children (0-17 years) who are all inhabitants of households located within a 50 km distance of the Kusile Power Station. More specifically, the health screening survey is set to identify sensitive groups whose respiratory health may be at increased risk in the event of an elevation of SO_2 concentrations in ambient air. Sensitive or vulnerable groups comprise individuals such as children, females and the elderly, or individuals with existing health or medical conditions like asthma or chronic lung disease, who are more sensitive to health effects associated with elevated levels of SO_2. SO_2 is a harmful air pollutant that can have adverse effects on human health. Within this context, it is important for regulatory agencies, healthcare professionals, and communities to monitor air quality levels, especially for pollutants like SO_2, and take measures to protect vulnerable populations when elevated levels are anticipated. This may include issuing health advisories, implementing air quality management strategies, and providing guidance for individuals to reduce exposure. Therefore, as a complementary study goal, the Eskom health

screening study was designed to also identify and register adult household members to act as Community Health Ambassadors, who will serve as communication agents for Eskom to share vital health information with household members, families, and friend networks during the next 12 months and at times when the emissions of SO_2 from the Kusile temporary stacks are higher than usual. This nuance has added a social responsibility approach to the project which aims to protect the health of especially sensitive people who will be educated and informed by Eskom regarding the steps they can take to protect their respiratory health when there is more SO_2 in ambient air than usual. As a complementary project deliverable, a systematized Community Health Ambassador Register has been compiled, which includes the personal information of those adult household members (18 years and older) who voluntarily registered as envoys for the Eskom Health Screening and Communications campaign. This plan is also rooted in the Eskom Communications and Emergency Preparedness Plan. In line with Protection of Personal Information Act (POPIA) regulations, registered adults who resides within a 50 km distance of the Kusile Power Station consented that their personal information may be used by Eskom for the purpose of the project. Eskom's obligation will remain to protect the personal information of the Community Health Ambassadors in a secure information technology system. Likewise, it is recommended that Eskom utilize the intellectual property and business intelligence emanating from the health screening study to guide the formulation of precautionary measures targeted at sensitive and vulnerable groups whose respiratory health may be at increased risk in the event of higher levels of SO_2 emissions during the next 12 months. In support of this view, the remainder of the chapter is devoted to a summary of the findings of the health screening study conducted between September and November 2023. The report is concluded with some salient recommendations.

6.2 SUMMARY OF MAIN FINDINGS

The health screening study was conducted in accordance with the sampling plan which included a stratified sample design constituting a geographic area in proximity to the Kusile Power Station located in the Mpumalanga Province of South Africa. A total of eight receptor communities located within a 50 km distance of the Kusile Power Station were guided by the initial project terms of reference and were finally included in the sample plan. The study applied a business-to-consumer (B2C) research approach, which targeted households as sampling units and both adults (18 years and older) and children (0-17 years) as data subjects (respondents). In support of a quantitative research methodology, personal face-to-face interviews were conducted with adults, parents/caregivers/ guardians of children and children (13-17 years). The adult personal household interviews were restricted to residents who are 18 years and older, while parents/caregivers/guardians were sampled to complete the personal face-to-face health screening surveys for preschool (0-5 years) and primary school (6-12 years) children. For the secondary school children (13-17 years) health screening survey, children between the ages of 13 and 17 years were judgementally sampled and personally interviewed at their homes. Only family households were sampled to ensure sample representation across all adult and child age cohorts. Local residents of the study receptor communities were recruited, trained, and managed to conduct personal face-to-face interviews with adults and children. Interviewer selection was based on academic qualification, previous interviewing experience, locality, information technology skills, accessibility and availability. The employment of 40 residents from the receptor communities also supported the social responsibility goal of the study which is set as a priority for the development of the research astuteness and the economic upliftment of vulnerable individuals (i.e. youth and females). The fieldwork was conducted from the last week of September to the first week of November 2023. In support of good project governance, the study was executed in line with the Southern African Market Research Association (SAMRA) code of research conduct and POPIA regulations. A letter of introduction was also issued to communities and households to demonstrate the legitimacy of the project. Collectively, the research project plan and

methodology resulted in the participation of 1 203 adults distributed across the sampled receptor communities as outlined in the consolidated response table (see table 6.1). From table 6.1 it is clear that 1 545 adult household members voluntarily registered as Community Health Ambassadors, while a total of 1 162 children, distributed equally across the children age cohorts, willingly provided valuable health information regarding the respiratory symptoms prevalent among preschool, primary school, and secondary school learners. These respiratory health questionnaires have been developed by INFOTOX and the BMR and originate from valid and reliable measurement instruments which also allowed for quantifying vulnerable and at-risk communities, groups and individuals whose pre-existing respiratory conditions such as asthma, chronic bronchitis, or chronic obstructive pulmonary disease (COPD) may be more susceptible to the respiratory effects of excessive SO_2 exposure. The outcome of these strategic analyses is summarised in figure 6.1, while table 6.2 presents a summary of the respiratory symptoms prevalent across the adult and child sample groups who participated in the independent health screening surveys. The adult questionnaire was completed by judgementally sampled adult household members (18 years and older), while a parent/caregiver/guardian-administrated survey approach was used to complete the preschool and primary school health screening surveys. Secondary school children (13-17 years) self-completed the paper-based questionnaire after obtaining adult consent and child assent to participate.

In support of good project management and administration, field editing was conducted throughout the entire fieldwork period, which was also complemented by rigorous central editing of questionnaires at the BMR research office in Pretoria. The BMR also concluded the data collection process by electronically capturing, editing, and cleaning the data in a Statistics Software Package for Social Sciences (SPSS), which was also used for data analyses purposes.

TABLE 6.1

ADULT AND CHILD PARTCIPATION IN ESKOM HEALTH SCREENING SURVEYS BY COMMUNITY RECEPTOR AREA

	Adults (18 years and older)		Health Ambassadors (18 years and older)		Preschool children (0-5 years)		Primary school children (6-12 years)		Secondary school children (13-17 years)	
Receptor community	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Gauteng Cluster	**500**	**41.56%**	**593**	**38.38%**	**161**	**41.30%**	**156**	**40.10%**	**156**	**40.73%**
Bronkhorstspruit	204	17.00%	249	16.12%	60	15.40%	65	16.70%	68	17.80%
Zithobeni	296	24.60%	344	22.27%	101	25.90%	91	23.40%	88	23.00%
Mpumalanga Cluster	**703**	**58.44%**	**952**	**61.62%**	**216**	**58.60%**	**233**	**59.90%**	**227**	**59.27%**
Balmoral/Wilge	53	4.40%	72	4.66%	17	4.40%	22	5.70%	11	2.90%
Phola	409	34.00%	556	35.99%	130	33.30%	127	32.60%	143	37.30%
Ogies/Blesboklaagte	153	12.70%	219	14.17%	48	12.30%	55	14.10%	50	13.10%
Arbor/Kendal	15	1.20%	15	0.97%	6	1.50%	4	1.00%	4	1.00%
Clewer	34	2.80%	37	2.39%	15	3.80%	12	3.10%	9	2.30%
Kwa-Guqa/Vosman	39	3.20%	53	3.43%	13	3.30%	13	3.30%	10	2.60%
Total	**1 203**	**100.00%**	**1 545**	**100.00%**	**390**	**100.00%**	**389**	**100.00%**	**383**	**100.00%**

6.2.1 Summary of health risk sensitivity analyses

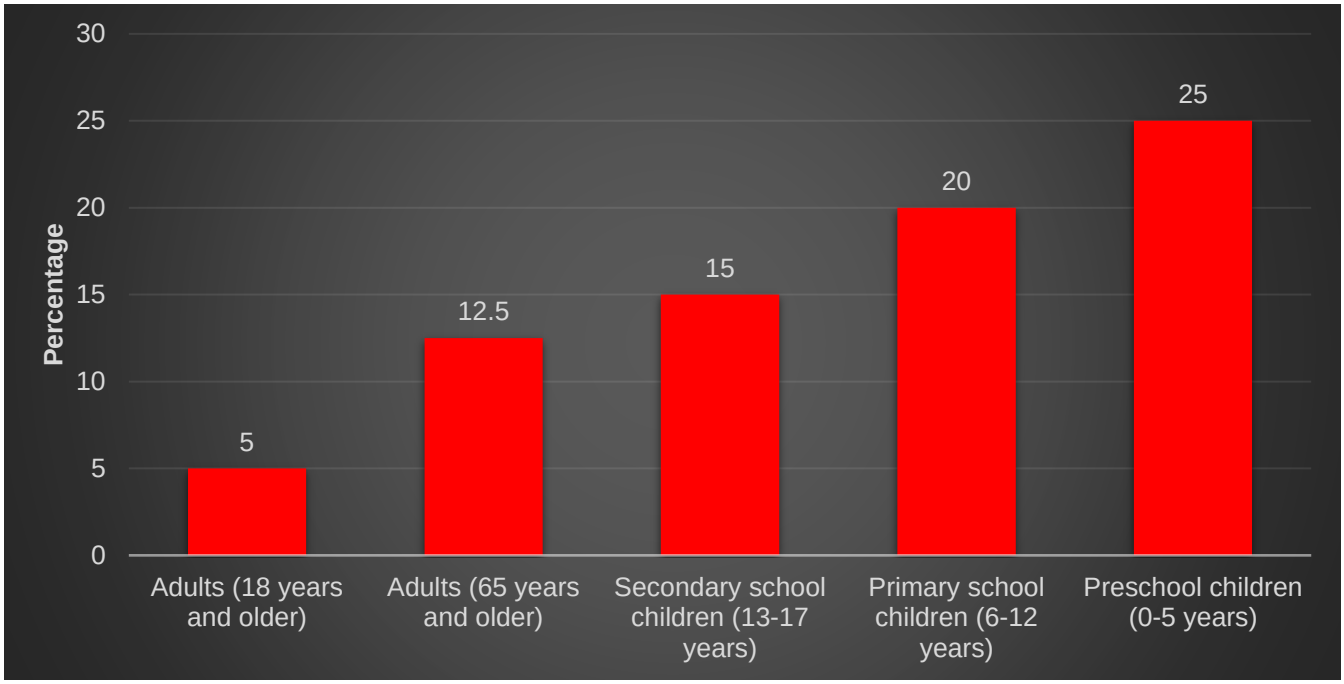
It is clear from table 6.1 that a total of 1 203 households and 1 545 adults registered as Community Health Ambassadors. From the information collected from households, it was determined that approximately 90 000 people could potentially be reached through household, family, and friend network structures through those adults who registered as Community Health Ambassadors.

The analysis in figure 6.1 expands the overview of the health screening survey findings by identifying sensitive or vulnerable groups whose pre-existing respiratory conditions such as asthma, chronic bronchitis, or chronic obstructive pulmonary disease (COPD), may be more susceptible to the respiratory effects of excessive SO_2 exposure.

A key objective of the health screening study was to use the information culminating from the surveys among 1 203 adults (18 years and older) and 1 162 children (0-17 years), to quantify sensitive groups whose respiratory health may be at increased risk in the event of potentially higher concentrations of SO_2 within the receptor communities during the time needed to repair the damaged stacks. Figure 6.1 presents these risk classifications for adults (18 years and older), preschool (0-5 years), primary school (6-12 years) and secondary school (13-17 years) children. From the analyses, the health risk levels are significantly higher for preschool learners (0-5 years), when compared to adults. One of the most critical stages of human development and learning is from birth to five years old and harmful effects on physical health in the first five years of life can have life-long consequences. Other salient findings emerging from the analysis show that females, older adults (65 years and older), and receptor communities in Mpumalanga are at a higher health risk. In conclusion, children in the preschool age groups, especially those with developing respiratory systems, may be more vulnerable to the health effects of SO_2. Exposure to elevated levels of SO_2 can exacerbate respiratory symptoms and impair lung function in these preschool children.

FIGURE 6.1

RESPIRATORY HEALTH AT INCREASED RISK* BY HOUSEHOLD COHORT



** Include High and Medium-High Risk Classifications*.

Based on the survey evidence, it is important to note that exposure to higher levels of SO_2 can have more severe health effects, including damage to the respiratory system. Long-term exposure may contribute to chronic respiratory conditions. Vulnerable populations, such as those with pre-existing respiratory conditions, children (especially preschool children), and the elderly (65 years and older) are particularly at increased risk.

6.2.2 Summary of prevalence and impact of respiratory symptoms

Although the health survey questionnaires for adults, preschool, primary, and secondary school children were not 100% aligned, certain trends regarding the respiratory symptoms, prevalent across the four cohorts, can be deduced when grouping the tested statements for respiratory symptoms together. The outcome of this captivating analysis is shown in table 6.2. The analyses are presented by grouping the respiratory symptoms separately. The rationale for the summary is supported by the view that exposure to elevated levels of SO_2 can lead to a range of respiratory symptoms. The most common respiratory symptoms associated with SO_2 exposure were analysed and summarised in table 6.2 include:

(i) **Wheezing:** SO_2 can cause constriction of the airways, leading to wheezing. This is a high-pitched whistling sound that occurs when breathing, often indicative of narrowed or inflamed air passages.

(ii) **Coughing:** Irritation of the respiratory tract caused by SO_2 can lead to coughing. This is a common response as the body tries to clear the airways of irritants.

(iii) **Shortness of Breath:** Inhalation of SO_2 can result in a feeling of breathlessness or shortness of breath. This can be particularly pronounced in individuals with pre-existing respiratory conditions.

(iv) **Chest Tightness:** Exposure to SO_2 may cause a sensation of tightness or discomfort in the chest. This can be due to irritation of the airways or constriction of the bronchial tubes,

(v) **Asthma:** Individuals with asthma may experience an exacerbation of symptoms, including increased frequency and severity of asthma attacks. SO_2 can act as a trigger for asthma in susceptible individuals.

It is important to note that exposure to high levels of SO_2 can have more severe health effects, including damage to the respiratory system. Long-term exposure may contribute to chronic respiratory conditions. Vulnerable populations, such as those with pre-existing respiratory conditions, children (preschool 0-5 years), and the elderly (65 years and older), are particularly at increased risk.

Respiratory symptoms can vary in severity depending on the duration and intensity of exposure, as well as individual susceptibility. The common respiratory symptoms emanating from the self-assessment by the four household survey cohorts are summarised in table 6.2. Table 6.3 also reviews the impact of respiratory symptoms by household cohort.

TABLE 6.2

SELF-ASSESSED RESPIRATORY SYMPTOM MATRIX BY HOUSEHOLD COHORT AND SURVEY TYPE

Respiratory symptoms indicators	Adults 18 years and older Adult Administrated	Preschool children 0-5 years Parent Administrated	Primary school children 6-12 years Parent Administrated	Secondary school children 13-17 years Child Administrated
Shortness of breath, **wheezing**, **coughing** and/or **chest tightness**				
Experienced shortness of breath, wheezing, coughing and/or chest tightness at least one or two days per week.	29.20%	-	-	-
Used a rescue inhaler (quick relief inhaler, puffer, or asthma pump) at least one or two days a week to relieve shortness of breath, wheezing, coughing and/or chest tightness.	8.90%	-	-	-
Wheezing | Chest Tightness				
Has your child / you ever had wheezing or whistling in the chest at any time in the past?	-	25.40	28.00%	19.30%
Has your child / you had wheezing or whistling in the chest in the past 12 months?	-	-	21.30%	82.40%
In the past 12 months, has your child's / your chest sounded wheezy during or after exercise?	-	-	15.90%	15.10%
During the past 12 months, did your child have at least one episode of wheezing or whistling in the chest?	-	30.00%	-	-
Has your child / you had at least one attack of wheezing in the past 12 months?	-	-	69.90%	78.70%
During the past 3 months, has your child been wheezy during the day for at least a few days?	-	34.80%	-	-
During the past 3 months, when NOT having a cold, has your child been wheezy for at least a few days?	-	28.20%	-	-
During the past 3 months, when your child was active, has your child been wheezy for at least a few days?	-	21.20%	-	-
During the past 3 months, has your child been wheezy at night for at least a few nights?	-	30.00%	-	-

TABLE 6.2 (CONTINUED)

SELF-ASSESSED RESPIRATORY SYMPTOM MATRIX BY HOUSEHOLD COHORT AND SURVEY TYPE

Respiratory symptoms indicators	Adults 18 years and older Adult Administrated	Preschool children 0-5 years Parent Administrated	Primary school children 6-12 years Parent Administrated	Secondary school children 13-17 years Child Administrated
Coughing				
During the past 3 months, has your child coughed during the day for at least a few days?	-	64.70%	-	-
During the past 3 months, when NOT having a cold, has your child coughed during the day for at least a few days?	-	47.70%	-	-
During the past 3 months, when your child is active, has your child coughed for at least a few days?	-	48.50%	-	-
During the past 3 months, has your child coughed during the night for at least a few nights?	-	53.90%	-	-
In the past 12 months, has your child / you had a dry cough at night, apart from a cough associated with a cold or chest infection?	-	-	30.90%	21.90%
Rattly chest				
During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the day for at least a few days?	-	34.10%	-	-
During the past 3 months, when NOT having a cold, has your child had a rattly chest (rattling sound when breathing) during the day for at least a few days?	-	22.30%	-	-
During the past 3 months, when your child is active, has your child had a rattly chest (rattling sound when breathing) for at least a few days?	-	18.70%	-	-
During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the night for at least a few nights?	-	24.70%	-	-
Shortness of Breath				
During the past 3 months, has your child been short of breath or complained of being short of breath during the day for at least a few days?	-	20.80%	-	-
During the past 3 months, when NOT having a cold, has your child been short of breath or complained of being short of breath during the day for at least a few days?	-	15.20%	-	-
During the past 3 months, when your child is active, has your child been short of breath or complained of being short of breath for at least a few days?	-	12.80%	-	-
During the past 3 months, has your child been short of breath or complained of being short of breath during the night for at least a few nights?	-	15.40%	-	-

TABLE 6.2 (CONTINUED)

SELF-ASSESSED RESPIRATORY SYMPTOM MATRIX BY HOUSEHOLD COHORT AND SURVEY TYPE

Respiratory symptoms indicators	Adults 18 years and older Adult Administrated	Preschool children 0-5 years Parent Administrated	Primary school children 6-12 years Parent Administrated	Secondary school children 13-17 years Child Administrated
Rhinitis and allergies				
Has your child / you ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or the flu?	-	-	39.80%	33.40%
In the past 12 months, has your child / you had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or the flu?	-	-	87.70%	91.40%
In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?	-	-	62.50%	54.70%
In the past 12 months, did this nose problem interfere at least a little with your child's / your daily activities?	-	-	73.60%	78.60%
Respiratory diseases | allergies confirmed by medical doctor				
Asthma	5.00%	2.80%	4.60%	3.90%
Bronchitis	3.50%	-	3.30%	2.60%
Pneumonia	1.20%	-	2.30%	0.80%
Tuberculosis (TB)	1.00%	-	0.80%	0.80%
Emphysema	0.50%	-	-	-
Silicosis	0.30%	-	-	-
Atopic dermatitis or eczema	-	5.40	10.80%	6.00%
Hay fever	-	-	15.40%	9.40%

TABLE 6.3

SELF-ASSESSED IMPACT OF RESPIRATORY SYMPTOM MATRIX BY HOUSEHOLD COHORT AND SURVEY TYPE

	Adults 18 years and older Adult Administrated	Preschool children 0-5 years Parent Administrated	Primary school children 6-12 years Parent Administrated	Secondary school children 13-17 years Child Administrated
During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to have trouble drinking or eating for at least a few days?	-	35.80%	-	-
During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to wake up during the night for at least a few nights?	-	39.80%	-	-
During the past 3 months, has your child's coughing, wheezing or being short of breath disturbed the family's sleep for at least a few nights?	-	39.00%	-	-
Woke up at least one or two nights in the past four weeks due to shortness of breath, wheezing, coughing and/or chest tightness.	24.00%	-	-	-
In the past 12 months, on average, has your child's / your sleep been disturbed due to wheezing for at least one night per week?	-	-	67.50%	65.60%
During the past 3 months has your child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day) for at least a few days?	-	32.30%		
In the past 12 months, has your child's / your coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day)?	-	-	20.80%	13.1%
During the past 3 months, has your child's coughing, wheezing or being short of breath caused you or your child's other parent to not go to work, or to stay at home instead of going out to your usually activities for at least a few days?	-	31.30%	-	-
During the past 3 months, has your child's coughing, wheezing or being short of breath caused your family to make adjustments, such as cancelling or changing plans for visits, family outings or holidays for at least a few days?	-	27.20%	-	-
Limited (to varied degrees) activities as a result of shortness of breath, wheezing, coughing and/or chest tightness.	21.30%	-	-	-
During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to be more tired than usual for at least a few days?	-	27.70%	-	-
During the past 3 months, has your child's coughing, wheezing or being short of breath caused your family to worry about the child for at least a few days?	-	42.30%	-	-
In the past 12 months, has wheezing ever been severe enough to limit your child's / your speech to only one or two words at a time between breaths?	-	-	41.00%	41.00%

The salient findings forthcoming from the analyses in tables 6.2 and 6.3 can be summarised as follows:

Wheezing	*Prevalent among one in every three preschool (0-5 year) children and is more prevalent during the day and less prevalent when a preschool child is active and does not have a cold or flu.*
Coughing	*Prevalent among six in every ten preschool (0-5 year) children and is more prevalent during the day and less prevalent when a preschool child is active and does not have a cold or flu. About one in four primary and secondary school children had a dry cough at night during the 12 months prior to the survey.*
Rattly chest	*Prevalent among one in every three preschool (0-5 year) children and is more prevalent during the day and less prevalent when a preschool child is active and does not have a cold or flu.*
Shortness of Breath	*Prevalent among one in every five preschool (0-5 year) children and is more prevalent during the day and less prevalent when a preschool child is active and does not have a cold or flu.*
Rhinitis and allergies	*Prevalent among about nine in every 10 primary and secondary school children who had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or flu during the 12 months prior to the study.*
Asthma	*Prevalent among 5% of adults with slightly lower prevalence rates notable among child (younger aged) cohorts.*

Impact of respiratory symptoms on children and families

Impact on eating, drinking, and sleeping patterns
☐ Past three-month coughing, wheezing or shortness of breath has caused problems for about a third of preschool childrens' drinking, eating, and sleeping habits and has also disturbed about one in every three families' sleep patterns for at least a few nights.
☐ About a quarter of adults (18 years and older) woke up at night at least once or twice during the past four weeks due to shortness of breath, wheezing, coughing and/or chest tightness.
☐ Significantly, during the past 12 months, about seven in every 10 primary and secondary school childrens' sleeping habits have been disturbed due to wheezing experienced for at least one night per week.
☐ **Summary**: *Respiratory diseases (wheezing) disrupt the sleep of about a third of preschool children and up to 70% of primary and secondary school children and is causing sleep deprivation among about a third of families.*
Impact on daily activities
☐ For about one in every three preschool children, coughing, wheezing or shortness of breath interfered with their usual activities, which kept them away from the things they usually do during the day. Such an impact is slightly lower on primary and secondary learners, ranging from 10% of the primary school children to 20% of the secondary school children who, during the past 12 months, have faced difficulty to continue with their normal daily activities due to coughing, wheezing or shortness of breath.
☐ About a third of preschool parents are restricted from going to work or need to adjust (such as cancelling or changing plans for visits, family outings or holidays) due to coughing, wheezing or shortness of breath being experienced by preschool learners during the past 12-months for at least a few days per week.
☐ **Summary**: *Respiratory diseases (wheezing) reduce the quality of life of about a third of children and parents - Persistent sleep disruptions can contribute to a reduced quality of life for both the child and the family, affecting their ability to engage in daily activities and routines.*
Physical exhaustion and behavioural symptoms
☐ **Fatigue** is prevalent among approximately three in every 10 preschool learners who have been coughing, wheezing or being short of breath for at least a few days per week during the past 12 months. Likewise, such regular respiratory symptoms among preschool children have also caused about four in every 10 families to **stress** about the preschool child.
☐ Severe wheezing by primary and secondary school children during the past 12-months has limited the **speech** of four in every 10 children to only one or two words at a time between breaths.
☐ **Summary**: *Respiratory diseases (wheezing) contribute to parental stress: Parents or caregivers of children with respiratory diseases may experience heightened stress and anxiety, particularly during the night when they are responsible for managing the child's symptoms and ensuring their well-being.*
☐ **Summary**: *Respiratory diseases (wheezing) contribute to speech limitations in children and has impacted the speech and language development of four in every 10 children - Respiratory diseases that compromise lung function may affect the child's ability to generate the necessary breath support for clear and audible speech.*

Most nose problems among primary and secondary school children mainly occur between **June** to **October**. In the month of **June**, most nose problems occur among primary and secondary school children which falls within the South Africa winter season.

6.2.3 Summary: Communication channel preference and awareness of the Eskom Communications and Emergency Preparedness Plan

With reference to the preferred communication channel to be used by Eskom when sharing vital health information with households (Community Health Ambassadors) - if the emissions of SO_2 from the Kusile temporary stacks are higher than usual, SMS/Text messaging topped the list of media choices by adult households. To ensure that most households are reached with vital health information, it is important that Eskom aligns their communication campaign with the preferred communication channels.

The survey findings confirmed low levels of awareness of the Eskom Communications and Emergency Preparedness Plan. Onlyone in every five adult household members affirmed that they are aware of the Eskom Communications and Emergency Preparedness Plan. This finding highlighted the importance of increasing awareness and knowledge about pertinent environmental issues impacting on the health of individuals within the receptor communities.

6.3 PROJECT DELIVERABLES, RECOMMENDATIONS AND CONCLUSION

In conclusion, the Eskom health screening study has secured the following deliverables:

- Performing a health screening study as a precondition for starting the temporary stacks (chimneys) at the Kusile Power Station. The health screening study secured 1 203 households and 1 545 Community Health Ambassadors who volunteered to support Eskom in executing its Communications and Emergency Preparedness Plan. In total, 1 203 adults and 1 162 children health screening paper-based questionnaires were completed. Strategically, the health screening study profiles population

cohorts whose respiratory health may be at increased risk due to elevated SO_2 levels in ambient air. It is important for regulatory agencies and public health officials to monitor air quality levels, especially for pollutants like SO_2, and take measures to protect vulnerable populations when elevated levels are identified. It is crucial to take steps to reduce the level of exposure to air pollutants, including SO_2, to especially children and the elderly. This can involve implementing air quality regulations and raising awareness regarding the importance of air quality for childrens' health. Additionally, vigilant monitoring and managing respiratory symptoms are necessary to mitigate the potential long-term impacts on respiratory health. The health screening surveys provided ideal business intelligence to guide this recommended strategic venture. To build on this study over the medium to long term, it is recommended that the health screening study be repeated in 2025 to measure any changes in the respiratory symptoms of the varied population cohorts targeted by the 2023 surveys. Such a longitudinal study may be beneficial to track changes in respiratory conditions of adults and children over time and to concurrently measure the successful implementation of the Eskom Communications and Emergency Preparedness Plan.

- Constructing a Community Health Ambassador Register, which contains the personal and contact information of adult household members who voluntarily registered as communication agents and who will serve as recipients of vital health information from Eskom at times when SO_2 in ambient air reaches critical levels during the temporary operations of the Kusile Power Station up to December 2024. As a study deliverable, Eskom agreed to issue certificates to the Community Health Ambassadors and carefully monitor the air quality in receptor communities. Air Quality Index (AQI) values regularly measured by Eskom should guide the development of precautionary measures and secure timely health protection guidelines to be shared with Community Health Ambassadors via primarily SMS communication - being cited as the most preferred household communication medium in the 2023 adult health screening study. From the 2023 adult health screening study it was calculated that the communication reach of the founded Community Health Ambassadors network is

potentially 90 000 citizens (adults and children). To guide Eskom in formulating precautionary measures when excessive SO_2 reaches critical levels in ambient air, exhibit 6.1 provides a prototype of health protection guidelines directed at certain sensitive groups which may be more vulnerable to the health risks associated with elevated levels of SO_2. The example defines the Air Quality Index scale as outlined by the US-EPA 2016 standard (see https://aqicn.org/scale/). Comparable AQI scales are customary in countries such as Thailand and Malaysia, India, China, Hong Kong/Canada, South America, Australia, Quebec and Montreal, Singapore, Poland, and Indonesia. The Singapore Ministry of Health has been most innovative and creative by publishing pictorials on the AQI, which is shared in exhibit 6.2 to inspire similar approaches by Eskom. Captivating from the Singapore pictorial is the very good explanation, in many languages, of the health advisories for the different AQI ranges (PSI=AQI).

EXHIBIT 6.1

EXEMPLAR OF AQI SCALES WITH HEALTH IMPLICATIONS AND GUIDED CAUTIONARY STATEMENTS

AQI	Air Pollution Level	Health Implications	Cautionary Statement (for PM2.5)
0 - 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk	None
51 -100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
151-200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion
201-300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.
300+	Hazardous	Health alert: everyone may experience more serious health effects	Everyone should avoid all outdoor exertion

Source: https://aqicn.org/scale/

EXHIBIT 6.2

EXEMPLAR OF HEALTH ADVISORIES FOR DIFFERENT AQI RANGES USED IN SINGAPORE

Given the strategic value of the Community Health Ambassador Register, Eskom must take ownership of the intellectual property and personal information contained in the Community Health Ambassador Register. Whereas the Register will be delivered to Eskom in a password protected Microsoft worksheet, it will be the responsibility of Eskom to prevent any unauthorised access to the Register and to protect the personal information in line with POPIA regulations. This presupposes that the data protection management system of Eskom must secure the protection of the personal information of the Community Health Ambassador from any damage, loss, or corruption to avoid any loss of reputation, citizen trust and legal liability due to data breach or loss.

The Community Health Ambassador Register can further be strengthened with an Institutional Health Ambassador Register which has also been compiled to support the 2023 Eskom health screening study. The initial plan was to include institutions (i.e. schools, clinics, hospitals, retirement villages, local municipalities and civil society agencies - collectively referred to as institutional influentials or key-informants) who operate in the receptor communities of the Kusile Power Station in the study. Disappointingly the uptake of institutions to register as Community Health Ambassadors was rather poor (one creche and one sport club timely registered as Health Ambassadors), although the sample frame constructed by the BMR of 80 institutions operating in the receptor community are being regarded as well suited to support Eskom to distribute vital health and SO_2 information to communities via institutions. Some valuable business intelligence gained from the informal telephonic engagements, during the attempted recruitment process of institutions, was the overwhelming preference of institutions for email correspondence, which can also benefit the Eskom Communications and Emergency Preparedness Plan. The potential reach of citizens via institutions is significant when considering, for example, that one of the churches that were approached to register as a Health Ambassador mentioned that the church has about 1200 congregants and parishioners. The loss of institutional influence as Community Health Ambassador is not regarded as critical, as working individuals and their networks may be reachable via the 1 545 adult citizens who have registered as Community Health Ambassadors. Also, the inclusion of contract workers in the INFOTOX study and the sharing of

vital health information with this worker group, will further strengthen the reach and impact of the Eskom Communications and Emergency Preparedness Plan. The inclusion of worker groups are essential as this group may be at an increased risk of SO_2 exposure, especially if they work in the Kusile area where higher pollution levels are anticipated in the next 12 months due to elevated SO_2 emissions.

It is finally recommended that the outcome of the health screening study contained in this report be shared with the Eskom Management to implement the Community Health Ambassadors campaign in support of the Eskom Communications and Emergency Preparedness Plan.

ANNEXURE A1

PROGRESS REPORT (23/10/2023)

ESKOM HEALTH SCREENING SURVEY AND COMMUNICATION CAMPAIGN IN SELECTED RECEPTOR COMMUNITIES OF THE KUSILE POWER STATION

1. INTRODUCTION

The Bureau of Market Research (Pty) Ltd (BMR) was appointed by INFOTOX on 18 September 2023 to collect data for the Eskom health screening and communication campaign in selected communities of the Kusile Power Station. This report focuses on the deliverables achieved by the BMR during the period 14 to 20 October 2023 as well as the target dates for deliverables still to be achieved by mid-December 2023.

2. HOUSEHOLD INTERVIEWER RECRUITMENT, SCREENING, ASSESSMENT AND APPOINTMENT

During the first two weeks of October 2023, UNISA students who reside in the receptor communities of the Kusile Power Station were invited by the BMR to apply for a fixed-term contract appointment to function as face-to-face interviewers for the household survey. In close collaboration with ESKOM, individuals registered on the Kusile Power Station Information Hub database were also invited to apply for the face-to-face household interviewer positions. After the expiry application date, a shortlist of candidates was compiled and those candidates who were shortlisted were assessed at a venue-based examination site in Bronkhorstspruit and Phola on 14 and 16 October 2023. The assessment entailed a practical case-study assessment related to the ESKOM Health Screening and Communication Campaign. Skills tested included communication and writing abilities and interviewer skills required to complete a paper-based personal interview. Evidence of the interviewer recruitment, screening and assessment phases is captured in the images below. Prior consent was secured from the individuals displayed in the photo images.

Interviewer recruitment, screening and assessment in Gauteng cluster
Bronkhorstspruit – 14 October 2023


Interviewer recruitment, screening, and assessment in Mpumalanga cluster
Phola – 16 October 2023

The recruitment strategy, which prioritised the use of local residents who live in the receptor communities of the Kusile Power Station, was deliberate and aimed to include vulnerable individuals (young, female, unemployed and students) who are familiar with the geographic settings, language and culture of the receptor communities.

Following the assessment, 40 individuals within the Gauteng (Bronkhorstspruit) and Mpumalanga (Balmoral, Phola, Ogies, Kendal, Clewer and Kwa-Guqa) sample clusters were appointed as fixed-term interviewers for the period 20 to 31 October 2023.

The ESKOM Health Screening and Communication Campaign has created 40 part-time jobs to residents living in receptor communities of the Kusile Power Station and who will function as part-time household interviewers between 20 and 31 October 2023.

3. HOUSEHOLD INTERVIEWER PREPARATIONS AND TRAINING

On 19 October 2023, the 40 interviewers who were appointed as household face-to-face interviewers were trained in Bronkhorstspruit and Phola by senior BMR staff. Preparations for the interviewer training were done by the BMR team from 16 to 18 October 2023. These preparations included the booking of training venues, arranging of attendance of interviewers, and preparing the interviewer packs. Interviewer training packs included the following:

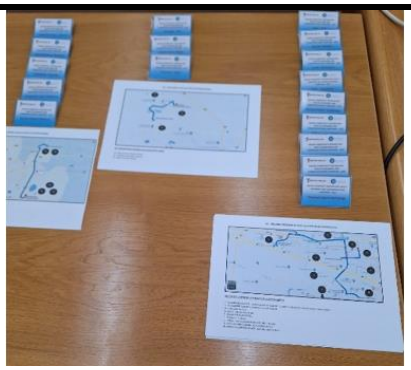
- Letter of Introduction.
- Training questionnaires (adult and child questionnaires).
- Original questionnaire batches to be completed by interviewers.
- Spare copies of questionnaires (3 x adult, 2 x pre-school, 2 x primary school & 2 x secondary school).
- Survey map.
- Showcard.
- ID card and lanyard.
- Stationery: Pencil, rubber and clipboard.
- Performance Agreement Form (Contract).
- Health snack.
- Bottled water.

During the period of 16 to 18 October 2023 the BMR also finalised the fieldwork management, administration and monitoring strategy, which included the compilation of the training manual and BMR training teams and schedules, numbering of household questionnaires, finalising of the interviewer database according to demarcated sample areas, compiling of interviewer spreadsheets according to questionnaire completion and return rates, finalizing and preparing contract forms, purchase of training support materials and resources and batching and packaging of training material. Evidence of the interviewer's preparations and training is captured in the images below. Prior consent was secured from the individuals displayed in the photo images.






BMR Team - Fieldwork preparations for Household interviews
UNISA Main Campus: 16 – 18 October 2023




BMR Team - Fieldwork preparations for Household interviews
UNISA Main Campus: 16 – 18 October 2023






Interviewer Training for Household surveys
Bronkhorstspruit: 19 October 2023







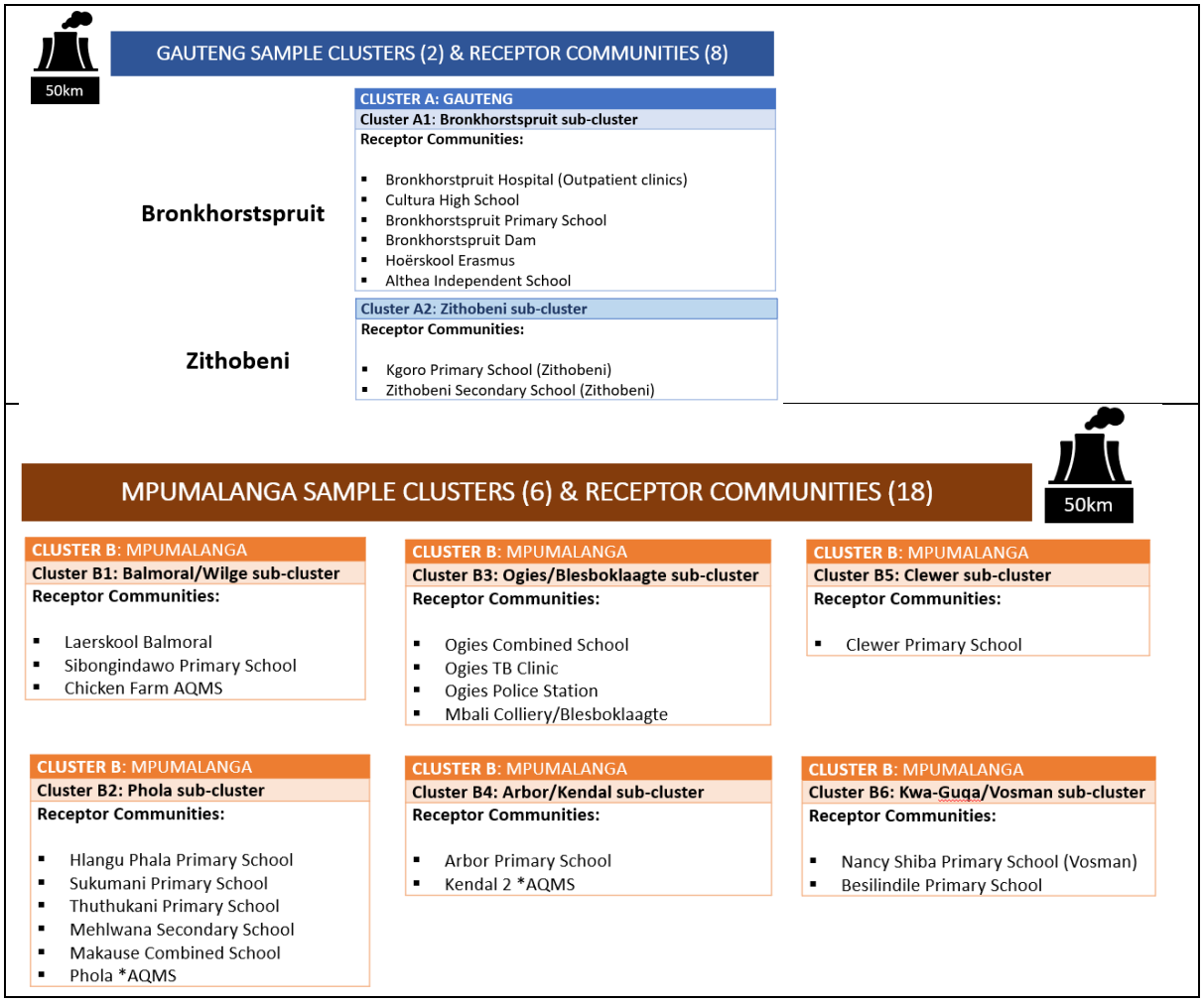


Interviewer Training for Household surveys
Phola: 19 October 2023

3. INSTITUTIONAL INTERVIEWER AND RECRUITMENT PREPARATIONS

On 16 October 2023 two experienced fieldworkers from the BMR Interviewer Database were trained for the institutional computer-aided telephone interviews (CATIs) with institutions located in community receptor areas of the Kusile Power Station.

From 17 to 20 October 2023 sample frames (registers) for the institutions located in the community receptor areas of the Kusile Power Station were compiled. These covered institutions in the following 26 receptor areas:



The Institutional Register compiled by the BMR has also been expanded to include schools, clinics and retirement villages, not listed above, as well as municipalities (ward councillors), and civil society and other organisations (i.e. estate agents, street communities, sports clubs, security companies). The BMR has also approached ESKOM on 20 October 2023 with the request to further expand the institutional database with emergency organisations listed on ESKOMS's database.

The institutional CATI and/or self-administrated institutional survey will commence on 23 October 2023 and will continue until 31 October 2023.

4. TRANSFORMATION OF PAPER-BASED QUESTIONNAIRES INTO ELECTRONIC FORMAT

During 16 – 20 October 2023, the institutional and household questionnaires have been transformed into an electronic format. The following questionnaires have been transformed by the BMR onto the Lime (online) survey platform for data collection and capturing purposes:

- The institutional survey to be completed via an interviewer- and computer-aided telephone survey approach.
- The institutional survey to be completed via a self-administrated web-based survey approach.
- The household survey to be completed by face-to-face personal interviews with sampled adult household members older than 18 years of age.
- The parent-administered household questionnaire to be completed via face-to-face interviews on the respiratory symptoms in preschool children (0 to 5 years).
- The parent-administered household questionnaire to be completed via face-to-face interviews on the respiratory symptoms in primary school children (6 to 12 years).
- The child-administered questionnaire to be completed via face-to-face interviews on respiratory symptoms in secondary school children (13 to 17 years).

The online survey platform will be used for data collection and capturing following field and central editing of questionnaires. The data will be hosted on a secure online platform and will be regularly downloaded and cleaned prior to data analysis and reporting.

5. PROJECT TEAM

INFOTOX

- Dr WCA van Niekerk - PhD QEP(USA) Pr Sci Nat (Environmental Science).
- Dr MH Fourie - PhD MSc Pr Sci Nat (Toxicological Science).

Tony Barbour Consulting

- Mr T Barbour- MSc (Environmental Science).

Bureau of Market Research (Pty) Ltd

- Prof DH Tustin – DCom (Business Management): CEO.
- Dr J Kembo – PhD – Head BMR Demographic Research Division.
- Dr A Basson – DLitt et Phil (Psychology) - Head BMR Youth Research Division.
- Mr A Risenga – MCom – Fieldwork Manager.
- Ms M Goetz – National Diploma Secretarial – BMR Senior Research Administrative Manager.

23 October 2023

ANNEXURE A2

PROGRESS REPORT (06/11/2023)

ESKOM HEALTH SCREENING SURVEY AND COMMUNICATION CAMPAIGN IN SELECTED RECEPTOR COMMUNITIES OF THE KUSILE POWER STATION

1. HOUSEHOLD SURVEY

1.1 Overview of household questionnaires collected

Household questionnaires completed and collected by main cluster up to 31 October 2023

Main Cluster	n
Gauteng	458
Mpumalanga	666
Total (31/11/2023)	**1 124**

Household questionnaires completed, collected and outstanding by sub-cluster up to 6 November 2023

Sub-cluster	Total
Bronkhorstspruit	333
Zithobeni	125
Balmoral/Wilge	150
Phola	277
Ogies/Blesboklaagte	120
Arbor/Kendal	30
Clewer	60
Kwa-Guqa/Vosman	29
Total: 31/11/2023	**1124**
Collected 02/11/2023	**38**
OTSTANDING	
Collection: 06/22/2023	**51**
GRAND TOTAL	**1 213**
Target	**1 200**

1.2 Data capturing – Household questionnaires

BMR Data Capturing Team operating from the BMR Computer Laboratories at the UNISA Main Campus

Number of questionnaires captured up to 6 November 2023

	Total
Adults: 18 years+	439
Children: 0-5 years	125
Children: 6 - 12 years	98
Children: 13 - 17 years	84
Total questionnaires completed	**746**

2. INSTITUTIONAL SURVEY

NUMBER OF INSTITUTIONS INVITED TO REGSITER AS HEALTH AMBASSADORS: **90**

NUMBER OF INSTITUTIONS WHO REGISTERED AS HEALTH AMBASSADORS: **2**
(1 x Sport Club, Creche)

3. JOB OPPORTUNITIES CREATED

A total of 41 job opportunities have been created for the household interviews and data capturing functions.

4. FRAMEWORK FOR HOUSEHOLD HEALTH AMBASSADORS REGISTER

A template has been developed for the household health ambassador register.

5. PROJECT TEAM

INFOTOX

- Dr WCA van Niekerk - PhD QEP(USA) Pr Sci Nat (Environmental Science).
- Dr MH Fourie - PhD MSc Pr Sci Nat (Toxicological Science).

Tony Barbour Consulting

- Mr T Barbour- MSc (Environmental Science).

Bureau of Market Research (Pty) Ltd

- Prof DH Tustin – DCom (Business Management): CEO.
- Dr J Kembo – PhD – Head BMR Demographic Research Division.
- Dr A Basson – DLitt et Phil (Psychology) - Head BMR Youth Research Division.
- Mr A Risenga – MCom – Fieldwork Manager.
- Ms M Goetz – National Diploma Secretarial – BMR Senior Research Administrative Manager.

6 November 2023

ANNEXURE B1

Questionnaire Number				

HOUSEHOLD QUESTIONNAIRE

HOUSEHOLD SUPPORT AND REGISTRATION FOR THE ESKOM COMMUNITY RESPIRATORY HEALTH SCREENING AND COMMUNICATION CAMPAIGN

INTRODUCTION

ESKOM (in partnership with INFOTOX (Pty) Ltd, a company specialising in health sciences), is currently steering a campaign to conduct respiratory health screening in communities near the Kusile Power Station. Respiratory health screening means that people are asked questions about the health of their lungs. The answers to the questions will be used to find out which people are sensitive to the health effects of sulphur dioxide (SO_2). SO_2 is an air pollutant emitted by some industries and also by the Kusile Power Station. Some people are more sensitive than others to higher concentrations of SO_2 in the air, that means when there is more SO_2 in the air than usual. Sensitive people can experience an effect on their respiratory system, that is mostly on their lungs. The effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath.

The ESKOM campaign includes the recruitment of households near the Kusile Power Station to register as Community Health Ambassadors. A Community Health Ambassador is a household that willingly agrees to participate in the Eskom Campaign, which includes communication with household members, family and friends. The Government Department of Forestry, Fisheries and the Environment requires Eskom to communicate with the community if the emissions of SO_2 from the Kusile temporary stacks are higher than usual. In support of the Eskom communication campaign, household representatives will timely distribute Eskom communications advising household members, families and friends regarding steps they can take to protect their respiratory health when there is more SO_2 in the air than usual. The communications will also advise the community (household networks) on what to do if they experience shortness of breath or difficulty breathing.

The Eskom communication campaign is expected to run up to December 2024. Details of households that register as Community Health Ambassadors will be maintained in a secure household register, which will be used only by Eskom and only for campaign communication purposes.

To assist with the execution of the campaign, INFOTOX appointed the Bureau of Market Research (Pty) Ltd (BMR), to directly liaise with households to register as Community Health Ambassadors. Accordingly, your household is invited to register as a Community Health Ambassador and to undertake to distribute respiratory health information provided by Eskom to your household, family and network of friends.

Pending your willingness to register as a Community Health Ambassador, you will be asked questions regarding communication channels used by your household as well as the size of the communication reach of your family and network of friends. Your consent will also be asked to distribute an invitation to all adult stakeholder individuals in your network to also register as Health Ambassadors and to participate in a self-administrated online respiratory health screening survey.

The BMR adheres to strict research ethical guidelines and national legislation, including the Protection of Personal Information Act (also called the POPI Act or POPIA). Therefore, participation in the study is voluntary (of free will) and all household and personal information will be treated as confidential. Your household and personal information will only be used for the purposes of the Eskom Campaign, in which your household will play a vital role as a Community Health Ambassador by sharing health information received from Eskom to your household members, family and network of friends.

For any enquiries regarding the household survey, you can contact Dr J Kembo at Joshua.kembo@bmr.co.za.

Prof DH Tustin
CEO: Bureau of Market Research (Pty) Ltd
University of South Africa

BEFORE YOU PARTICIPATE IN THE HOUSEHOLD SURVEY, YOU NEED TO GIVE CONSENT, MEANING THAT YOU VOLUNTARILY AGREE TO ANSWER QUESTIONS ABOUT YOUR COMMUNICATION CHANNELS AND TO PARTICIPATE IN THE ESKOM CAMPAIGN.

PARTICIPANT CONSENT
Please note: • The participation of your household in this survey is voluntary (of free will), and you can withdraw at any stage before or during the survey. • You don't have to answer any question you don't want to. • There are no foreseeable risks in participating in this household survey. • Your participation will involve the completion of a questionnaire that you will fill in yourself, or with the assistance of a trained BMR interviewer who will help you to understand the questions. • The Bureau of Market Research (BMR) ensures that any household and personal details collected from you will not be revealed to people outside the group of researchers who are involved in this campaign. • Your household and personal information will remain confidential and will not be made public. It will only be used by Eskom to communicate vital health information if SO_2 levels in the air are higher than usual. The Campaign is expected to continue until December 2024.
Please indicate that you <u>agree</u> with the following statements and give consent to participate in the survey. Should you require more information, please contact Dr J Kembo at Joshua.kembo@bmr.co.za

STATEMENT	**AGREE**
I understand what the household survey is about and what participation will involve.	
I understand that participation by the household is voluntary (of free will).	
I understand that the household or its representative can withdraw from the survey at any time without giving any reasons for withdrawal.	
I understand that the information shared will only be used for the purposes of the Eskom respiratory health campaign.	
I have been given the opportunity to ask questions about the household survey.	
I understand that a household database/register will be constructed of all households who willingly register as Community Health Ambassadors and that the register will only be used by Eskom to share vital health information with registered Ambassadors.	
The household hereby agrees to participate in the survey.	

A. REGISTERING AS ESKOM COMMUNITY HEALTH AMBASSADOR			
A1.	Is this household willing to register as a **Community Health Ambassador (CHA)** in support of the Eskom Community Respiratory Health Campaign?	• Yes (Please continue) • No (Please opt-out)	1 2
A2.1	If yes, please state the details of the **<u>adult</u>** household member (18 years and older) who will act as the **primary** contact or liaison person between the household and Eskom.	Name and surname: Relationship in household: Telephone: Email address:	
A2.2	If more than one adult household representative, please state the details of the second adult household member who will act as the contact or liaison person between the household and Eskom.	Name and surname: Relationship in household: Telephone: Email address:	

A2.3	If more than two adult household representatives, please state the details of the third adult household member who will act as the contact or liaison person between the household and Eskom.	Name and surname:
		Relationship in household:
		Telephone:
		Email address:

B. HOUSEHOLD DETAILS* **If agreed to register as a Community Health Ambassador (CHA) for the Eskom Respiratory Health Campaign, please provide details regarding your household which will be used to construct a household register of all registered Community Health Ambassadors for purposes of vital health communication by Eskom:**		
B1. Household address:		
B2. Please indicate in which Kusile receptor community the household is located:	Bronkhorstspruit	1
	Zithobeni	2
	Balmoral/Wilge	3
	Phola	4
	Ogies/Blesboklaagte	5
	Arbor/Kendal	6
	Clewer	7
	Kwa-Guqa/Vosman	8
B3. For each gender and age group specified, please indicate how many people reside in this household:	**Age group**	**Number**
	Female Adults: 18 - 35 years	
	Male Adults: 18 - 35 years	
	Female Adults: 36 - 64 years	
	Male Adults: 36 - 64 years	
	Female Adults: 65 years and older	
	Male Adults: 65 years and older	
	Girls: 0-5 years	
	Boys: 0-5 years	
	Girls: 6-12 years	
	Boys: 6-12 years	
	Girls: 13-17 years	
	Boys: 13-17 years	
	TOTAL:	

* **Household**: A household is a group of individuals who live together and provide themselves jointly with food and/or other essentials for living, or a single person who lives alone. Membership of the household is determined by whether the person usually lived in that household at least four nights a week.

SECTION C: RESPIRATORY SYMPTOMS OF HOUSEHOLD HEALTH AMBASSADOR			
C1.	In the past 4 weeks, how often have you had shortness of breath, wheezing, coughing and/or chest tightness during the day?	• Not at all	0
		• One or two days a week	1
		• Three to six days a week	2
		• Once every day	3
		• More than once every day	4
C2.	In the past 4 weeks, how often did you use a rescue inhaler (quick relief inhaler, puffer, or asthma pump) to relieve your shortness of breath, wheezing, coughing and/or chest tightness?	• Not at all	0
		• One or two days a week	1
		• Three to six days a week	2
		• Once every day	3
		• More than once every day	4
C3.	In the past 4 weeks, how limited were your activities as a result of shortness of breath, wheezing, coughing and/or chest tightness? "Limited" means: kept you from the things you usually do during the day.	• Not at all limited	0
		• Slightly limited	1
		• Moderately limited	2
		• Very limited	3
		• Totally limited	4
C4.	In the past 4 weeks, how often did you wake up at night due to shortness of breath, wheezing, coughing and/or chest tightness?	• Not at all	0
		• One or two nights in the past 4 weeks	1
		• One night a week	2
		• Two or three nights a week	3
		• Four or more nights a week	4
C5.	Has a doctor ever told you that you have asthma?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C6.	Has a doctor ever told you that you have bronchitis?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C7.	Has a doctor ever told you that you have pneumonia?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C8.	Has a doctor ever told you that you have TB?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C9.	Has a doctor ever told you that you have emphysema?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C10.	Has a doctor ever told you that you have silicosis?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3

D. HOUSEHOLD COMMUNICATION CHANNELS AND PREFERENCE			
D1.	Which communication channel(s) does your household currently use when communicating with each other? Select all that apply:	• Face-to-face	1
		• Telephone/Cellphone	2
		• Email	3
		• WhatsApp	4
		• SMS/Text Messaging	5
		• Facebook	6
		• Twitter	7
		• Instagram	8
		• WeChat	9
		• TikTok	10
		• Snapchat	11
		• Video calling / Skype	12
		Other (Please specify)	
D2.	Which communication channel(s) do you prefer Eskom to use to communicate with the household if the emission levels of SO_2 from the Kusile temporary stacks are higher than usual. Select all that apply:	• Face-to-face	1
		• Telephone/Cellphone	2
		• Email	3
		• WhatsApp	4
		• SMS/Text Messaging	5
		• Facebook	6
		• Twitter	7
		• Instagram	8
		• WeChat	9
		• TikTok	10
		• Snapchat	11
		• Video calling / Skype	12
		• Kusile Power Station Information Hubs	13
		Other (Please specify)	

E. GENERAL

E1. Prior to this household survey, have you been aware of the **Eskom Communications and Emergency Preparedness Plan** which will assist communities near Kusile to prepare for and respond promptly to higher concentrations of SO_2 in the outdoor air?

Yes	1
No	2

E2. Would you be interested in participating in any future research projects conducted by the Bureau of Market Research (Pty) Ltd?

Yes	1
No	2

F. DEMOGRAPHIC INFORMATION ABOUT HEALTH AMBASSADOR			
F1.	Gender of respondent	• Male	1
		• Female	2
		• Other/Prefer not to answer	3
F2.	How old are you?	**Years:**	
F3.	What population group do you identify with?	• Black/African	1
		• Indian/Asian	2
		• Coloured	3
		• White	4
		• Other (Specify)	

G. GENERAL COMMENTS:

Date:	

BMR INTERVIEWER DETAILS	
Name of interviewer:	
Date of interview:	

THANK YOU FOR PARTICIPATING IN THE HOUSEHOLD SURVEY IN SUPPORT OF THE ESKOM COMMUNITY RESPIRATORY HEALTH SCREENING AND COMMUNICATION CAMPAIGN.

Please note that household representative(s) will receive communication from the BMR to distribute an invitation to all adults (18 years and older) within your network to also register as Community Health Ambassadors. This collective effort will secure the availability and sharing of health information from Eskom at times when SO_2 emission levels in the air are higher than usual. It is vital that this information is shared among communities near Kusile to prepare for and respond promptly to higher-than-usual concentrations of SO_2 in the air.

NOTE: This adult household questionnaire was formulated by INFOTOX (Pty) Ltd and the Bureau of Market Research (Pty) Ltd using the Respiratory Symptoms Questionnaire (RSQ) by Karlsson et al. (2021) with additional questions regarding doctor-diagnosed lung conditions, and other questions tailored to the purposes of the communication campaign.

Reference:

Karlsson N, Atkinson MJ, Müllerová H, et al. Validation of a diagnosis-agnostic symptom questionnaire for asthma and/or COPD. ERJ Open Res. 2021 Feb 1;7(1):00828-2020. doi: 10.1183/23120541.00828-2020. PMID: 33569501; PMCID: PMC7861031.

ANNEXURE B2

Questionnaire Number					

A HEALTH SCREENING SURVEY IN SELECTED RECEPTOR AREAS OF THE KUSILE POWER STATION

PARENT-ADMINISTERED QUESTIONNAIRE ON RESPIRATORY SYMPTOMS IN PRESCHOOL CHILDREN (0 TO 5 YEARS)

INTRODUCTION

ESKOM (in partnership with INFOTOX (Pty) Ltd, a company specialising in health sciences), is currently undertaking a respiratory health screening survey of communities living in the vicinity of the Kusile Power Station. INFOTOX has appointed the Bureau of Market Research (Pty) Ltd, known as the BMR, to assist with the respiratory health screening survey, which includes adults and children (0 to 17 years).

Respiratory health screening means that people are asked questions about the health of their lungs. The answers to the questions will be used to find out which people might be sensitive to the health effects of sulphur dioxide (SO_2) in the air. SO_2 is an air pollutant emitted by some industries and also by the Kusile Power Station. SO_2 affects the respiratory system, that is mostly the lungs. The effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath.

Against this background, you are invited to participate in the respiratory health screening survey. Your participation will involve answering questions about the health of your child (or child in your care) between the ages of 0 to 5 years. The questions will be about his/her respiratory health, including questions about possible symptoms experienced by your child such as coughing and sneezing.

The BMR adheres to strict research ethical guidelines and national legislation, including the Protection of Personal Information Act (also called the POPI Act or POPIA). Therefore, participation in the study is voluntary (of free will) and all personal information will be treated as confidential. Your personal information and that of your child (such as name, ID number etc) will not be made public. The information collected will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.

For any enquiries regarding the institutional survey, you can contact Dr A Basson at abasson@bmr.co.za.

Prof DH Tustin
CEO: Bureau of Market Research (Pty) Ltd
University of South Africa

BEFORE YOU PARTICIPATE, YOU NEED TO GIVE CONSENT (MEANING THAT YOU VOLUNTARILY AGREE TO PARTICIPATE IN THE HEALTH SCREENING SURVEY). PLEASE READ THE FOLLOWING INFORMATION CAREFULLY.

PARTICIPANT CONSENT
• Participation in this survey is voluntary, and you can withdraw at any stage before or during the survey. • There are no foreseeable risks in participating in this health screening survey. Your participation will involve the completion of a questionnaire about the health of your child (or child in your care) between the ages of 0 to 5 years. You will fill in the questionnaire yourself, with the assistance of a trained BMR interviewer who will help you to understand the questions. • The BMR ensures that any personal details collected from you will not be revealed to people outside the group of researchers who are involved in this project. Your personal details will not appear in the study report and will not be made public with any information about the outcome of the study.
Please indicate that you <u>agree</u> with the following statements and give consent to participate in the respiratory health screening survey. Should you require more information, please contact Dr A Basson at abasson@bmr.co.za

STATEMENT	**AGREE**
I have read and understood what the respiratory health screening survey is about and what my participation will involve	
I understand that my participation is voluntary	
I understand that I can withdraw at any time without giving any reasons for why I no longer want to take part in the health screening survey	
I understand my personal details will not be revealed to people outside the group of researchers	
I understand that the information shared will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.	
I have been given the opportunity to ask questions about the respiratory health screening survey	
I hereby agree to participate in the respiratory health screening survey	

PARTICIPANT DETAILS		
Name of participant		
Physical address		
Identified receptor area	Bronkhorstspruit	1
	Zithobeni	2
	Balmoral/Wilge	3
	Phola	4
	Ogies/Blesboklaagte	5
	Arbor/Kendal	6
	Clewer	7
	Kwa-Guqa/Vosman	8
Contact number of participant		
Email address		
Signature		
Date		

A. DEMOGRAPHIC INFORMATION ABOUT YOUR CHILD (OR CHILD IN YOUR CARE)					
A1.	Gender	• Male			1
		• Female			2
		• Other/Prefer not to answer			3
A2.	Population Group	• Black/African			1
		• Indian/Asian			2
		• Coloured			3
		• White			4
		• Other (Specify):			
A3.	How old is your child today?	**Months/Years:**			
A4.	When is your child's birthday?	**Day**	**Month**	**Year**	
A5.	Is your child currently attending a crèche or play school?	• Yes			1
		• No			2

B. INFORMATION ABOUT RESPIRATORY SYMPTOMS			
B1.	Has your child <u>ever</u> had wheezing or whistling in the chest at any time in the past?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
<u>NOTE:</u> By ''wheezing'' we mean breathing that makes a high-pitched whistling or squeaking sound from the chest, not the throat.			
B2.	Has a doctor <u>ever</u> told you that your child has asthma?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B3.	Do your child's parents have asthma?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B4.	Has a doctor ever told you that your child has atopic dermatitis?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
<u>NOTE</u>: Atopic dermatitis, often referred to as eczema, is a chronic (long-lasting) disease that causes inflammation, redness, and irritation of the skin. It is a common condition that usually begins in childhood.			
B5.	During the past 12 months, how many episodes of wheezing or whistling in the chest has your child had?	• None	1
		• One or two	2
		• Three or more	3
		• Unsure/Can't Remember	4
<u>NOTE:</u> By an "episode" we mean wheezing or whistling for 4 days or more at a time.			

C. QUESTIONS ON SYMPTOMS DURING THE DAY			
C1.	During <u>the past 3 months</u>, has your child been wheezy during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't Remember	6

C2.	During the past 3 months, has your child coughed during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't Remember	6
C3.	During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't Remember	6
C4.	During the past 3 months, has your child been short of breath or complained of being short of breath during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't Remember	6

D. QUESTIONS ON SYMPTOMS WHEN YOUR CHILD DOES NOT HAVE A COLD			
D1.	During the past 3 months, when NOT having a cold has your child been wheezy?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
D2.	During the past 3 months, when NOT having a cold has your child coughed during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
D3.	During the past 3 months, when NOT having a cold has your child had a rattly chest (rattling sound when breathing) during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
D4.	During the past 3 months, when NOT having a cold has your child been short of breath or complained of being short of breath during the day?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6

E. QUESTIONS ON SYMPTOMS WHEN YOUR CHILD IS ACTIVE ***<u>Only for children aged 12 months or older</u>. You need NOT answer the questions if your child is younger than 12 months (1 year). If your child is younger than 12 months (1 year) go to section F.***			
<u>NOTE</u>: By active we mean: • *Exercising (playing or running)* • *Laughing, crying or excitement*			
E1.	During <u>the past 3 months</u>, when your child is active has your child been wheezy?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
E2.	During <u>the past 3 months</u>, when your child is active, has your child coughed?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
E3.	During <u>the past 3 months</u>, when your child is active, has your child had a rattly chest (rattling sound when breathing)?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
E4.	During <u>the past 3 months</u>, when your child is active, has your child been short of breath or complained of being short of breath?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6

F. QUESTIONS ON SYMPTOMS AT NIGHT			
F1.	During <u>the past 3 months</u>, has your child been wheezy at night?	• Every night	1
		• Most nights	2
		• Some nights	3
		• A few nights	4
		• Never	5
		• Unsure/Can't remember	6
F2.	During <u>the past 3 months</u>, has your child coughed during the night?	• Every night	1
		• Most nights	2
		• Some nights	3
		• A few nights	4
		• Never	5
		• Unsure/Can't remember	6

F3.	During the past 3 months, has your child had a rattly chest (rattling sound when breathing) during the night?	• Every night	1
		• Most nights	2
		• Some nights	3
		• A few nights	4
		• Never	5
		• Unsure/Can't remember	6
F4.	During the past 3 months, has your child been short of breath or complained of being short of breath during the night?	• Every night	1
		• Most nights	2
		• Some nights	3
		• A few nights	4
		• Never	5
		• Unsure/Can't remember	6

G. QUESTIONS ON THE IMPACT OF SYMPTOMS ON YOUR CHILD			
G1.	During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to have trouble drinking or eating?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
G2.	During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to wake up during the night?	• Every night	1
		• Most nights	2
		• Some nights	3
		• A few nights	4
		• Never	5
		• Unsure/Can't remember	6
G3.	During the past 3 months has your child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day)?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
G4.	During the past 3 months, has your child's coughing, wheezing or being short of breath caused him/her to be more tired than usual?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6

H. QUESTIONS ON THE IMPACT OF YOUR CHILD'S SYMPTOMS ON YOUR FAMILY			
H1.	During the past 3 months, has your child's coughing, wheezing or being short of breath caused you or your child's other parent to not go to work, or to stay at home instead of going out to your usually activities?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
H2.	During the past 3 months, has your child's coughing, wheezing or being short of breath	• Every day	1
		• Most days	2

	caused your family to make adjustments, such as cancelling or changing plans for visits, family outings or holidays?	• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6
H3.	During <u>the past 3 months</u>, has your child's coughing, wheezing or being short of breath disturbed the family's sleep?	• Every night	1
		• Most nights	2
		• Some nights	3
		• A few nights	4
		• Never	5
		• Unsure/Can't remember	6
H4.	During <u>the past 3 months</u>, has your child's coughing, wheezing or being short of breath caused your family to worry about the child?	• Every day	1
		• Most days	2
		• Some days	3
		• A few days	4
		• Never	5
		• Unsure/Can't remember	6

I. GENERAL COMMENTS:

BMR INTERVIEWER DETAILS	
Name of interviewer	
Date of interview	
Signature	

THANK YOU FOR PARTICIPATING IN THE RESPIRATORY HEALTH SCREENING SURVEY.

<u>NOTE</u>: The questionnaire on respiratory symptoms in preschool children (0 to 5 years) was formulated by INFOTOX (Pty) Ltd and the Bureau of Market Research (Pty) Ltd using different sources.

References:

- Castro-Rodriguez JA, Holberg CJ, Wright AL, Martinez FD. A clinical index to define risk of asthma in young children with recurrent wheezing. Am J Respir Crit Care Med. 2000;162:1403. Cited by Dela Bianca et al. (2009).
- Dela Bianca AC, Wandalsen GF, Miyagi K, Camargo L, Cezarin D, Mallol J, Solé D. International Study of Wheezing in Infants (EISL): validation of written questionnaire for children aged below 3 years. J Investig Allergol Clin Immunol. 2009;19(1):35-42. PMID: 19274927. https://pubmed.ncbi.nlm.nih.gov/19274927/
- Powell CV, McNamara P, Solis A, Shaw NJ. A parent completed questionnaire to describe the patterns of wheezing and other respiratory symptoms in infants and preschool children. Arch Dis Child. 2002 Nov;87(5):376-9. doi: 10.1136/adc.87.5.376. PMID: 12390904; PMCID: PMC1763091. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1763091/
- Strippoli MF, Silverman M, Michel G, et al. A parent-completed respiratory questionnaire for 1-year-old children: repeatability. Archives of Disease in Childhood 2007;92:861-865. https://adc.bmj.com/content/92/10/861

Usherwood TP, Scrimgeour A, Barber JH. Questionnaire to measure perceived symptoms and disability in asthma. Arch Dis Child. 1990 Jul;65(7):779-81. doi: 10.1136/adc.65.7.779. PMID: 2143643; PMCID: PMC1792433. Cited by Powell et al. (2002). https://pubmed.ncbi.nlm.nih.gov/2143643/

ANNEXURE B3

Questionnaire Number				

A HEALTH SCREENING SURVEY IN SELECTED RECEPTOR AREAS OF THE KUSILE POWER STATION

PARENT-ADMINISTERED QUESTIONNAIRE ON RESPIRATORY SYMPTOMS IN PRIMARY SCHOOL CHILDREN (6 TO 12 YEARS)

INTRODUCTION

ESKOM (in partnership with INFOTOX (Pty) Ltd, a company specialising in health sciences), is currently undertaking a respiratory health screening survey of communities living close to the Kusile Power Station. INFOTOX has appointed the Bureau of Market Research (Pty) Ltd, known as the BMR, to assist with the respiratory health screening survey, which includes adults and children (0 to 17 years).

Respiratory health screening means that people are asked questions about the health of their lungs. The answers to the questions will be used to find out which people might be sensitive to the health effects of sulphur dioxide (SO_2) in the air. SO_2 is an air pollutant emitted by some industries and also by the Kusile Power Station. SO_2 affects the respiratory system, that is mostly the lungs. The effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath.

Against this background, you are invited to participate in the respiratory health screening survey. Your participation will involve answering questions about the health of your child (or child in your care) between the ages of 6 to 12 years. The questions will be about his/her respiratory health, including questions about possible respiratory symptoms experienced by your child (or child in your care) such as coughing and sneezing.

The BMR adheres to strict research ethical guidelines and national legislation, including the Protection of Personal Information Act (also called the POPI Act or POPIA). Therefore, participation in the study is voluntary (of free will) and all personal information will be treated as confidential. Your personal information and that of your child (such as name, ID number etc) will not be made public. The information collected will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.

For any enquiries regarding the institutional survey, you can contact Dr A Basson at abasson@bmr.co.za.

Prof DH Tustin
CEO: Bureau of Market Research (Pty) Ltd
University of South Africa

BEFORE YOU PARTICIPATE, YOU NEED TO GIVE CONSENT (MEANING THAT YOU VOLUNTARILY AGREE TO PARTICIPATE IN THE HEALTH SCREENING SURVEY). PLEASE READ THE FOLLOWING INFORMATION CAREFULLY.

PARTICIPANT CONSENT	
• Participation in this survey is voluntary, and you can withdraw at any stage before or during the survey. • There are no foreseeable risks in participating in this health screening survey. Your participation will involve the completion of a questionnaire about the health of your child (or child in your care) between the ages of 6 to 12 years. You will fill in the questionnaire yourself, with the assistance of a trained BMR interviewer who will help you to understand the questions. • The BMR ensures that any personal details collected from you will not be revealed to people outside the group of researchers who are involved in this survey. Your personal details will not appear in the survey report and will not be made public with any information about the outcome of the survey.	
Please indicate that you <u>agree</u> with the following statements and give consent to participate in the respiratory health screening survey. Should you require more information, please contact Dr A Basson at abasson@bmr.co.za	
STATEMENT	**AGREE**
I have read and understood what the respiratory health screening survey is about and what my participation will involve.	
I understand that my participation is voluntary.	
I understand that I can withdraw at any time without giving any reasons for why I no longer want to take part in the health screening survey.	
I understand my personal details will not be revealed to people outside the group of researchers.	
I understand that the information shared will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.	
I have been given the opportunity to ask questions about the respiratory health screening survey.	
I hereby agree to participate in the respiratory health screening survey.	

PARTICIPANT DETAILS		
Name of participant		
Physical address		
Identified receptor area	Bronkhorstspruit	1
	Zithobeni	2
	Balmoral/Wilge	3
	Phola	4
	Ogies/Blesboklaagte	5
	Arbor/Kendal	6
	Clewer	7
	Kwa-Guqa/Vosman	8
Contact number of participant		
Email address		
Signature		
Date		

A. DEMOGRAPHIC INFORMATION ABOUT YOUR CHILD (OR CHILD IN YOUR CARE)					
A1.	Gender	• Male			1
		• Female			2
		• Other/Prefer not to answer			3
A2.	Population Group	• Black/African			1
		• Indian/Asian			2
		• Coloured			3
		• White			4
		• Other (Specify):			
A3.	How old is your child today?	**Years:**			
A4.	When is your child's birthday?	**Day**	**Month**	**Year**	
A5.	Is your child currently attending a primary school?	• Yes			1
		• No (Go to section B)			2
A5.1	**If yes in A5:** What is the name of the primary school your child is currently attending?	**Name of school:**			
A5.2	**If yes in A5:** In what grade is your child?	• Grade R			1
		• Grade 1			2
		• Grade 2			3
		• Grade 3			4
		• Grade 4			5
		• Grade 5			6
		• Grade 6			7
		• Grade 7			8
		• Other (Specify):			

B. QUESTIONS ABOUT ASTHMA AND OTHER RESPIRATORY DISEASES			
B1.	Has your child <u>ever</u> had wheezing or whistling in the chest at any time in the past?	• Yes	1
		• No (Go to B6)	2
		• Unsure/Can't Remember (Go to B6)	3
<u>NOTE:</u> By ''wheezing'' we mean breathing that makes a high-pitched whistling or squeaking sound from the chest, not the throat.			
B2.	Has your child had wheezing or whistling in the chest <u>in the past 12 months</u>?	• Yes	1
		• No (Go to B6)	2
		• Unsure/Can't Remember (Go to B6)	3
B3.	How many attacks of wheezing has your child had <u>in the past 12 months</u>?	• None	1
		• 1 to 3	2
		• 4 to 12	3
		• More than 12	4
		• Unsure/Can't Remember	5
B4.	<u>In the past 12 months</u>, how often, on average, has your child's sleep been disturbed due to wheezing?	• Never woken with wheezing	1
		• Less than one night per week	2
		• One or more nights per week	3
		• Unsure/Can't Remember	4

B5.	In the past 12 months, has wheezing ever been severe enough to limit your child's speech to only one or two words at a time between breaths?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B6.	Has a doctor ever told you that your child has asthma?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B7.	In the past 12 months, has your child's chest sounded wheezy during or after exercise?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B8.	In the past 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B9.	In the past 12 months, has your child's coughing, wheezing or being short of breath caused him/her difficulty with his usual activities (kept him/her from the things he/she usually does during the day)?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B10.	Has a doctor ever told you that your child has bronchitis?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B11.	Has a doctor ever told you that your child has pneumonia?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B12.	Has a doctor ever told you that your child has TB (Tuberculosis)?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3

C. QUESTIONS ABOUT RHINITIS AND ALLERGIES ***Note: Rhinitis is any of the following symptoms: blocked, runny, or itching nose, or sneezing.***			
C1.	Has your child ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or the flu?	• Yes	1
		• No (Go to C6)	2
		• Unsure/Can't Remember (Go to C6)	3
C2.	In the past 12 months, has your child had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or the flu?	• Yes	1
		• No (Go to C6)	2
		• Unsure/Can't Remember (Go to C6)	3
C3.	In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3

C4.	In which month(s) did this nose problem occur?	• January	1
		• February	2
		• March	3
		• April	4
		• May	5
		• June	6
		• July	7
		• August	8
		• September	9
		• October	10
		• November	11
		• December	12
		• Unsure/Can't Remember	13
C5.	In the past 12 months, how much did this nose problem interfere with your child's daily activities?	• Not at all	1
		• A little	2
		• A moderate amount	3
		• A lot	4
		• Unsure/Can't Remember	5
C6.	Has a doctor ever told you or your child that your child has hay fever?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C7.	Has a doctor ever told you or your child that your child has atopic dermatitis or eczema?	• Yes	1
		• No	2
		• Unsure/Can't remember	3
NOTE: Eczema, or atopic dermatitis, is an inflammatory condition that causes itchy, rough, and cracked patches of skin.			

D. GENERAL COMMENTS:

BMR INTERVIEWER DETAILS	
Name of interviewer	
Date of interview	
Signature	

THANK YOU FOR PARTICIPATING IN THE RESPIRATORY HEALTH SCREENING SURVEY.

NOTE: The questionnaire on respiratory symptoms in primary school children (6 to 12 years) was formulated by INFOTOX (Pty) Ltd and the Bureau of Market Research (Pty) Ltd using different sources.

References:

- ISAAC Core Questionnaire ages 6-7. The International Study of Asthma and Allergies in Childhood Questionnaires. https://www.thoracic.org/members/assemblies/assemblies/srn/questionaires/isaac.php
- Millar, D.A., Kapwata, T., Kunene, Z. et al. Respiratory health among adolescents living in the Highveld Air Pollution Priority Area in South Africa. BMC Public Health 22, 2136 (2022). https://doi.org/10.1186/s12889-022-14497-8

ANNEXURE B4

Questionnaire Number				

A HEALTH SCREENING SURVEY IN SELECTED RECEPTOR AREAS OF THE KUSILE POWER STATION

CHILD-ADMINISTERED QUESTIONNAIRE ON RESPIRATORY SYMPTOMS IN SECONDARY SCHOOL CHILDREN (13 TO 17 YEARS)

INTRODUCTION

ESKOM (in partnership with INFOTOX (Pty) Ltd, a company specialising in health sciences), is currently undertaking a respiratory health screening survey of communities living close to the Kusile Power Station. INFOTOX has appointed the Bureau of Market Research (Pty) Ltd, known as the BMR, to assist with the respiratory health screening survey, which includes adults and children (0 to 17 years).

Respiratory health screening means that people are asked questions about the health of their lungs. The answers to the questions will be used to find out which people might be sensitive to the health effects of sulphur dioxide (SO_2) in the air. SO_2 is an air pollutant emitted by some industries and also by the Kusile Power Station. SO_2 affects the respiratory system, that is mostly the lungs. The effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath.

Against this background, you are invited to participate in the respiratory health screening survey. Your participation will involve completing a survey questionnaire. The questionnaire includes questions about your respiratory health and possible respiratory symptoms you might experience, such as coughing and sneezing.

The BMR adhere to strict research ethical guidelines and national legislation, including the Protection of Personal Information Act (also called the POPI Act or POPIA). Therefore, participation in the study is voluntary (of free will) and all personal information will be treated as confidential. Your personal information (such as name, ID number etc) will not be made public. The information collected will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.

For any enquiries regarding the institutional survey, you can contact Dr A Basson at abasson@bmr.co.za.

Prof DH Tustin
CEO: Bureau of Market Research (Pty) Ltd
University of South Africa

BEFORE YOU PARTICIPATE IN THE RESPIRATORY HEALTH SCREENING SURVEY, A LEGAL GUARDIAN (SUCH AS A PARENT OR CAREGIVER) NEED TO GIVE CONSENT AND YOU NEED TO AGREE TO GIVE PARTICIPANT ASSENT.

PARTICIPANT ASSENT (Children 13 to 17 years)
• Your participation in the respiratory health screening survey is voluntary and you can withdraw at any stage before or during the survey. • You don't have to answer any question you don't want to. • There are no foreseeable risks in participating in this respiratory health screening survey. Your participation will involve the completion of a questionnaire that you will fill in yourself, with the assistance of a trained BMR interviewer who will help you to understand the questions. • The BMR ensures that any personal details collected from you will not be revealed to people outside the group of researchers who are involved in this survey. Your personal details will not appear in the survey report and will not be made public with any information about the outcome of the survey.
Please indicate that you agree with the following statements and give your assent to participate in the respiratory health screening survey. Should you require more information, please contact Dr A Basson at abasson@bmr.co.za

STATEMENT	**AGREE**
I understand what the respiratory health screening survey is about and what my participation will involve.	
I understand that my participation is voluntary (of free will).	
I understand that I can withdraw at any time without giving any reasons for why I no longer want to take part in the respiratory health screening survey.	
I understand my personal details will not be revealed to people outside the group of researchers.	
I understand that the information shared will only be used to identify members of the community that are potentially sensitive to higher levels of SO_2, and who would need to be contacted if SO_2 levels in the air are higher than usual.	
I have been given the opportunity to ask questions about the respiratory health screening survey.	
I hereby agree to participate in the respiratory health screening survey.	

PARTICIPANT DETAILS		
Name of participant		
Physical address		
Identified receptor area	Bronkhorstspruit	1
	Zithobeni	2
	Balmoral/Wilge	3
	Phola	4
	Ogies/Blesboklaagte	5
	Arbor/Kendal	6
	Clewer	7
	Kwa-Guqa/Vosman	8
Contact number of participant		
Email address		
Signature		
Date		

DETAILS OF PARENT OR LEGAL GUARDIAN	
Name of parent/legal guardian	
Physical address	
Contact number of parent/legal guardian	

A. DEMOGRAPHIC INFORMATION ABOUT YOU				
A1.	Gender	• Male		1
		• Female		2
		• Other/Prefer not to answer		3
A2.	Population Group	• Black/African		1
		• Indian/Asian		2
		• Coloured		3
		• White		4
		• Other (Specify):		
A3.	How old are you today?	**Years:**		
A4.	When is your birthday?	**Day**	**Month**	**Year**
A5.	Are you currently attending a secondary school?	• Yes		1
		• No (Go to section B)		2
A5.1	**If yes in A5:** What is the name of the secondary school you are currently attending?	**Name of school:**		
A5.2	**If yes in A5:** What grade are you currently completing?	• Grade 8		1
		• Grade 9		2
		• Grade 10		3
		• Grade 11		4
		• Grade 12		5
		• Other (Specify):		

B. QUESTIONS ABOUT ASTHMA AND OTHER RESPIRATORY DISEASES			
B1.	Have you <u>ever</u> had wheezing or whistling in the chest at any time in the past?	• Yes	1
		• No (Go to B6)	2
		• Unsure/Can't Remember (Go to B6)	3
<u>NOTE:</u> By ''wheezing'' we mean breathing that makes a high-pitched whistling or squeaking sound from the chest, not the throat.			
B2.	Have you had wheezing or whistling in the chest <u>in the past 12 months</u>?	• Yes	1
		• No (Go to B6)	2
		• Unsure/Can't Remember (Go to B6)	3
B3.	How many attacks of wheezing have you had <u>in the past 12 months</u>?	• None	1
		• 1 to 3	2
		• 4 to 12	3
		• More than 12	4
B4.	<u>In the past 12 months</u>, how often, on average, has your sleep been disturbed due to wheezing?	• Never woken with wheezing	1
		• Less than one night per week	2

		• One or more nights per week	3
		• Unsure/Can't Remember	4
B5.	In the past 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B6.	Has a doctor ever told you that you have asthma?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
NOTE: Asthma is a condition in which a person's airways become inflamed, narrow, and swell and produce extra mucus, which makes it difficult to breathe.			
B7.	In the past 12 months, have your chest sounded wheezy during or after exercise?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B8.	In the past 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B9.	In the past 12 months, has your coughing, wheezing or being short of breath caused you difficulty with your usual activities (kept you from the things you usually do during the day)?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B10.	Has a doctor ever told you that you have bronchitis?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B11.	Has a doctor ever told you that you have pneumonia?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
B12.	Has a doctor ever told you that you have TB (Tuberculosis)?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3

C. QUESTIONS ABOUT RHINITIS			
NOTE: Rhinitis is any of the following symptoms: blocked, runny or itching nose, or sneezing			
All questions are about problems which occur when you DO NOT have a cold or the flu			
C1.	Have you ever had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu?	• Yes	1
		• No (Go to C6)	2
		• Unsure/Can't Remember (Go to C6)	3
C2.	In the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu?	• Yes	1
		• No (Go to C6)	2
		• Unsure/Can't Remember (Go to C6)	3
C3.	In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3

C4.	In which month(s) did this nose problem occur?	• January	1
		• February	2
		• March	3
		• April	4
		• May	5
		• June	6
		• July	7
		• August	8
		• September	9
		• October	10
		• November	11
		• December	12
		• Unsure/Can't Remember	13
C5.	In the past 12 months, how much did the nose problem interfere with your daily activities?	• Not at all	1
		• A little	2
		• A moderate amount	3
		• A lot	4
		• Unsure/Can't Remember	5
C6.	Has a doctor ever told you that you have hay fever?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
C7.	Has a doctor ever told you that you have atopic dermatitis or eczema?	• Yes	1
		• No	2
		• Unsure/Can't Remember	3
NOTE: Hay fever, or allergic rhinitis, is a common condition with symptoms similar to those of a cold. There may be sneezing, congestion, runny nose, and sinus pressure. *NOTE: Eczema, or atopic dermatitis, is an inflammatory condition that causes itchy, rough, and cracked patches of skin.*			

D. GENERAL COMMENTS:

BMR INTERVIEWER DETAILS	
Name of interviewer	
Date of interview	
Signature	

THANK YOU FOR PARTICIPATING IN THE RESPIRATORY HEALTH SCREENING SURVEY.

NOTE: The questionnaire on respiratory symptoms in secondary school children (13 to 17 years) was formulated by INFOTOX (Pty) Ltd and the Bureau of Market Research (Pty) Ltd using different sources.

References:

- ISAAC Core Questionnaire ages 13-14. The International Study of Asthma and Allergies in Childhood Questionnaires. https://www.thoracic.org/members/assemblies/assemblies/srn/questionaires/isaac.php
- Millar, D.A., Kapwata, T., Kunene, Z. et al. Respiratory health among adolescents living in the Highveld Air Pollution Priority Area in South Africa. BMC Public Health 22, 2136 (2022). https://doi.org/10.1186/s12889-022-14497-8.

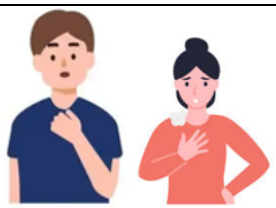
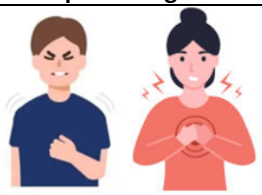
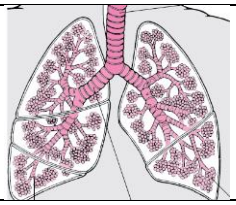
ANNEXURE B5

SHOWCARD
ESKOM COMMUNITY RESPIRATORY HEALTH SCREENING AND COMMUNICATIONS CAMPAIGN

HEALTH TERMINOLOGY

TERM	DEFINITION
Asthma	Asthma is a long-term sickness (does not go away quickly like a cold) of a person's airways. The airways are tubes that carry air in and out of the lungs. The airways become inflamed and narrow at times, and produce extra mucus, which makes it difficult to breathe. The breathing problems may come and go. The inflammation is often caused by an irritation of the airways.
Atopic dermatitis	Or Eczema, is a long-lasting condition where the skin gets irritated, red, dry, bumpy, and itchy. It is a common condition that usually begins in childhood, and many children outgrow it.
Bronchitis	Inflammation of the airways (tubes) in the lungs, causing coughing with mucus or phlegm, and sometimes also wheezing. It may be short-term (acute) and go away after a few days. It can also be long-term (chronic) and last for 3 months or longer, and come back 2 years (or more) in a row. The inflammation is often caused by an infection (a germ).
Chest Pain or Tightness	A feeling of discomfort, pressure, or squeezing in the chest area.
Cold	An infection of the nose and throat. Symptoms may include coughing, sneezing, runny or blocked nose, and a sore or scratchy throat.
Chest Infection	An infection of the airways (tubes that carry air in and out of your lungs) or tiny tubes in the lungs, or of the little air sacs in the lungs. Symptoms may include coughing with or without mucus, chest pain, and difficulty breathing.
Community Health Ambassador (CHA)	An individual in an Institution or Household who is ideally positioned to share vital health and air quality information to stakeholder groups/networks residing in the receptor communities of Kusile.
Dry Cough	A cough that does not produce mucus or phlegm. It often feels like a tickle in the throat and may be irritating or uncomfortable.
Eczema	Or Atopic Dermatitis, a long-lasting condition where the skin gets irritated, red, dry, bumpy, and itchy, sometimes with rough and cracked patches. It is a common condition that usually begins in childhood, and many children outgrow it.
Episode	By an 'episode' we mean wheezing or whistling for 4 days or more at a time.
Hay fever	Hay fever, or Allergic Rhinitis, is a common allergic reaction with symptoms such as sneezing, stuffy or runny nose, sinus pressure and itchy-watery eyes. It is not caused by a germ (such as a cold), but by pollen, dust in the house, or the fur of cats, dogs, and other animals with fur, or feathers.
Itchy-Watery Eyes	Eyes that feel scratchy and irritated, often watery with tears. Usually caused by allergies or something that irritates the eyes.
Pneumonia	An infection of the air sacs in the lungs, causing them to fill with fluid or pus. Symptoms often include cough, fever, and difficulty breathing.
Receptor Community	This is a community that is located close to Kusile. The community may sometimes possibly experience higher levels (more than usual amounts) of Sulfur Dioxide (SO_2) in air, released from the Kusile Power Station by the burning of coal.
Rhinitis	Rhinitis is any of the following symptoms: blocked, runny or itching nose, or sneezing.
Runny, or Blocked Nose	Excess mucus production or stuffiness in the nose, often due to allergies, colds, or other irritants.
Shortness of breath	Difficulty in breathing or the feeling of being unable to take a full breath.
Sulfur Dioxide (SO_2)	A colourless gas commonly produced by the burning of coal by some industries and also by the Kusile Power Station. Breathing SO_2 can affect the respiratory system, that is mostly the lungs. The effects can be mild, such as coughing, or more uncomfortable, such as tightness in the chest, wheezing or being short of breath, particularly in sensitive people or when there are higher levels (more than usual amounts) of SO_2 in air.
TB (Tuberculosis)	A bacterial infection that affects the lungs, causing symptoms like a cough that does not go away, weight loss, and night sweats. It is contagious (can be passed on from one person to the next). To be cured of TB, a person needs to take medicine prescribed by a doctor over a long period of time.
Wet Cough	A cough that produces mucus or phlegm. This type of cough often occurs with infections or conditions that cause more mucus in the airways (tubes that carry air in and out of your lungs) or in the lungs.
Wheezing	Breathing that makes a high-pitched whistling or squeaking sound from the chest, not the throat.
Whistling in the Chest	Or Wheezing is breathing that makes a high-pitched whistling or squeaking sound from the chest, not the throat.

HEALTH SYMPTOM DOMAINS

Shortness of breath	Wheezing	Dry cough	Chest pain or tightness
			
Inhaler, puffer or ashma pump		**Lungs with airway tubes and air sacks** (image from the *Merck Manual Consumer Version*) https://www.msdmanuals.com	

HOUSEHOLD RELATIONSHIP CODES (Household Survey - Questions A2.1, A2.2 & A2.3)

	Relationship	Code
Relationship ***What is (the person)'s relationship to the head or acting head of the household?***	Head/acting head	01
	Husband/wife/partner	02
	Son/daughter	03
	Adopted son/daughter	04
	Stepchild	05
	Brother/sister	06
	Parent (mother/father)	07
	Parent-in-law	08
	Grand/greatgrandchild	09
	Son/daughter-in-law	10
	Brother/sister-in-law	11
	Grandmother/father	12
	Other relative	13
	Non-related person	14

SCHOOL CODES - PRIMARY (Question A5.1) AND SECONDRAY SCHOOLS (Question A5.1)

Schools	Code
Althea Independent School	01
Arbor Primary School	02
Besilindile Primary School	03
Bronkhorstspruit Primary School	04
Clewer Primary School	05
Cultura High School	06
Hlangu Phala Primary School	07
Hoërskool Erasmus	08
Kgoro Primary School (Zithobeni)	09
Laerskool Balmoral	10

	Code
Makause Combined School	11
Mehlwana Secondary School	12
Nancy Shiba Primary School (Vosman)	13
Ogies Combined School	14
Ogies Police Station	15
Ogies TB Clinic	16
Sibongindawo Primary School	17
Sukumani Primary School	18
Thuthukani Primary School	19
Zithobeni Secondary School	20
Other - Please specify:	

References:

US National Institute of Health, National Heart, Lung and Blood Institute. https://www.nhlbi.nih.gov/
Nemours Children's Health. https://www.nemours.org/
Mayo Clinic. https://www.mayoclinic.org/

Kusile Ambient Air Quality Monitoring

January 2024

1. INTRODUCTION

At the request of Environmental Management, Research, Testing and Development Department (RT&D) air quality team initiated an additional ambient air quality monitoring site at Balmoral and Wilge, in the vicinity of Kusile power station. The objective is to assess compliance with national ambient air quality standards, identify potential sources of pollution, protect public health and the environment and establish a baseline for future mitigation measures to enable Eskom to operate temporary stacks at the Kusile power stations at emission levels above the levels authorised in the station's Atmospheric Emission Licence (AEL). The existing air quality monitoring stations (Phola and Chicken Farm) will complement the additional monitoring stations to reduce uncertainties, as each monitoring station has an objective linked to a power station of interest. The Ogies monitoring station will be commissioned in April 2024.

Kendal air quality monitoring data does not form part of the analysis for this reporting since the Kendal monitoring site is solely used for research purposes to assess the worst-case scenario of emissions from the Kendal power station. The monitoring station is located about 2 km from the Kendal power station in the prevailing wind direction. Data recorded at the station reflects the impact of Kendal power station downwind of the station and other sources.

The Balmoral and Wilge monitoring stations are currently equipped to continuously monitor ambient concentrations of sulphur dioxide (SO_2). In addition, meteorological parameters of wind velocity, wind direction and ambient temperature, humidity, ambient pressure and rainfall, amongst others are also recorded.

The following parameters, nitrogen dioxide (NO_2), ozone (O_3) and fine particulate matter of particulate size <10µm and particulate size <2.5µm in diameter (PM_{10} and $PM_{2.5}$) will be monitored from 01 April 2024.

The data for this reporting period (01 – 31 January 2024) were analysed for ambient SO_2 as monitored at Balmoral, Chicken Farm, Phola and Wilge air quality monitoring stations. The Particulate Matter and NO_2 data were further analysed for Chicken Farm and Phola.

This report focuses on the results of the ambient air quality monitoring stations; results from stack monitoring, fugitive dust and animal health are addressed in our reports produced for the station.

2. DATA ACQUISITION AND QUALITY CONTROL

Each monitoring station is visited every two weeks by trained technicians for routine service. Zero and span checks are carried out on each analyser during routine services and any discrepancies are logged and used during data verification at Eskom RT&D Sustainability Department.

Full dynamic calibration audits are carried out on the gas analysers (SO_2, NO_2 and O_3 analysers) quarterly and particulate matter analysers are calibrated every six months. All calibration results and certificates are filed in the laboratory for assessment purposes. Inter-laboratory calibrations are routinely carried out with other accredited laboratories ,to enhance quality control.

Data at the monitoring stations are logged directly using dedicated CR-1000 Campbell Scientific data loggers. Permanent data records of all calculated 10-minutes mean values of all parameters monitored, together with minimum and maximum values, are stored on the

logging device. These are derived from 10-second scans and are also logged and saved in 1-minute intervals. The raw 1-minute average data is also transferred live to the South African Ambient Air Quality Information System (SAAQIS) server since the 14th of December 2023. Recorded data are downloaded remotely from the site through communicators that are connected to the Eskom network and transferred onto a central computer for verification and validation.

3. MONITORING STATION LOCATIONS

Figure 1 below indicates the locations of the air quality monitoring stations in relation to the Kusile power station. The new monitoring stations, Balmoral and Wilge, are denoted by green icons and the pre-existing monitoring stations, Chicken Farm and Phola, by yellow icons.

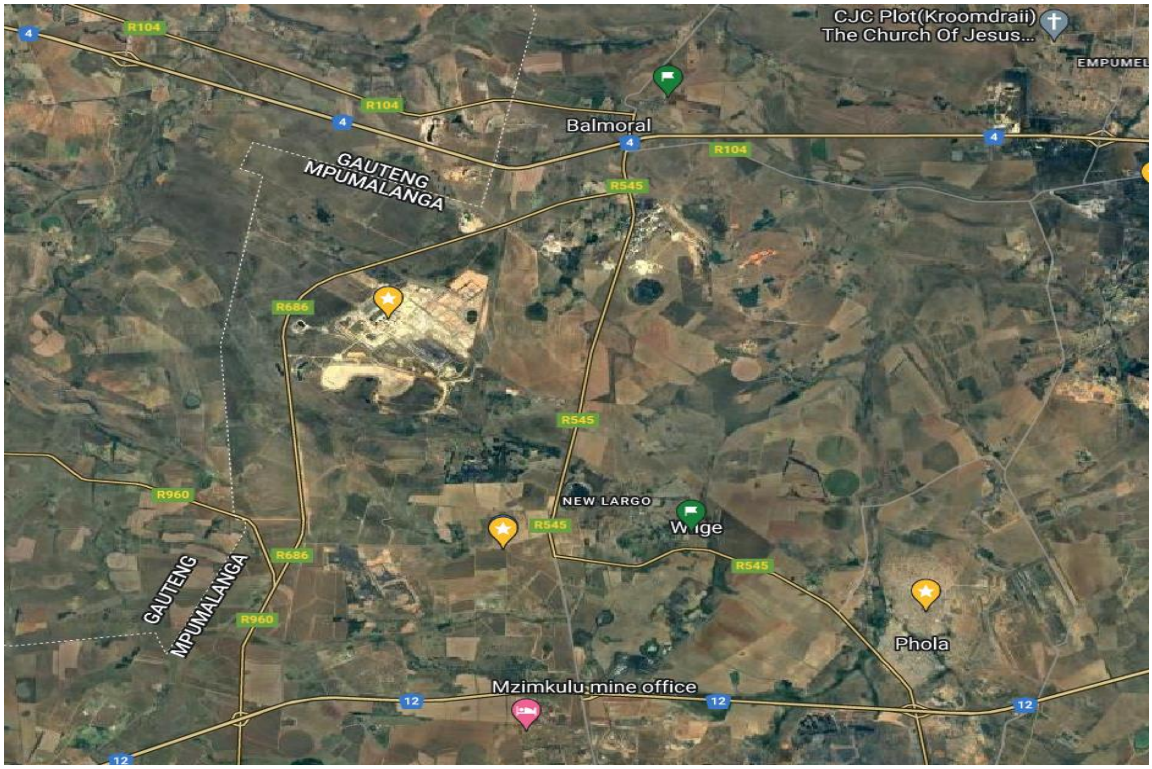


Figure 1: Air Quality Monitoring stations in relation to Kusile power station

4. MONITORING RESULTS AND DISCUSSIONS

The data is statistically analysed to assess the diurnal and monthly variations of the air pollutants, as well as to evaluate it against the current national ambient air quality standards for SO_2, NO_2, O_3, $PM_{2.5}$ and PM_{10}.

4.1. DATA RECOVERY

The SANAS guideline figure of 90% data availability per parameter monitored is used as a standard for representative data capture. This describes the required completeness of data set for the reporting of averages and is based on standard arithmetic calculations. The completeness calculations for data sets exclude zero and span data and times where service and/or maintenance is being conducted on the instruments in question. Station availability is reported as a measure of the percentage of time that electrical power was available to the monitoring station.

Table 1: Percentage data recovery per parameter monitored in January 2024

Stations name	SO_2	NO_2	O_3	$PM_{2.5}$	PM_{10}	WSP	WDR	Station Availability
Balmoral	89.5					99.9	99.9	89.7
Chicken Farm	99.6	96.1	81.5	96.4	63.6	100	100	100
Phola	93.0	0	92.9	44.8	72.2	94.5	94.5	92.9
Wilge	89.0					100	100	89.1

Good representative percentage data was recovered for all the parameters monitored during the monitoring period under review at the monitoring stations with the exceptions at Phola monitoring station. There was no NO_2 analyser at the Phola monitoring station since it got faulty and was removed for repairs. The data for $PM_{2.5}$ and PM_{10} were low at the Phola monitoring station due to a faulty instrument.

4.2. METEOROLOGICAL OBSERVATIONS

The distributions of wind direction and wind speed for daytime and night-time hours for the reporting period are summarised on polar diagrams. The centre of the wind rose depicts the position of the air quality monitoring site. The positions of the spokes in the polar diagram represent directions from which the wind was blowing. The length of the segment indicates the percentage of the time the wind blew from that direction and the speed in the various categories are denoted by colours and width.

4.2.1. BALMORAL AIR QUALITY MONITORING STATION

The wind at Balmoral monitoring station was coming from the northerly to north-easterly directions during the day and from the south-easterly to south-south-easterly directions during the night time. The monitoring station is north-east of Kusile power station.

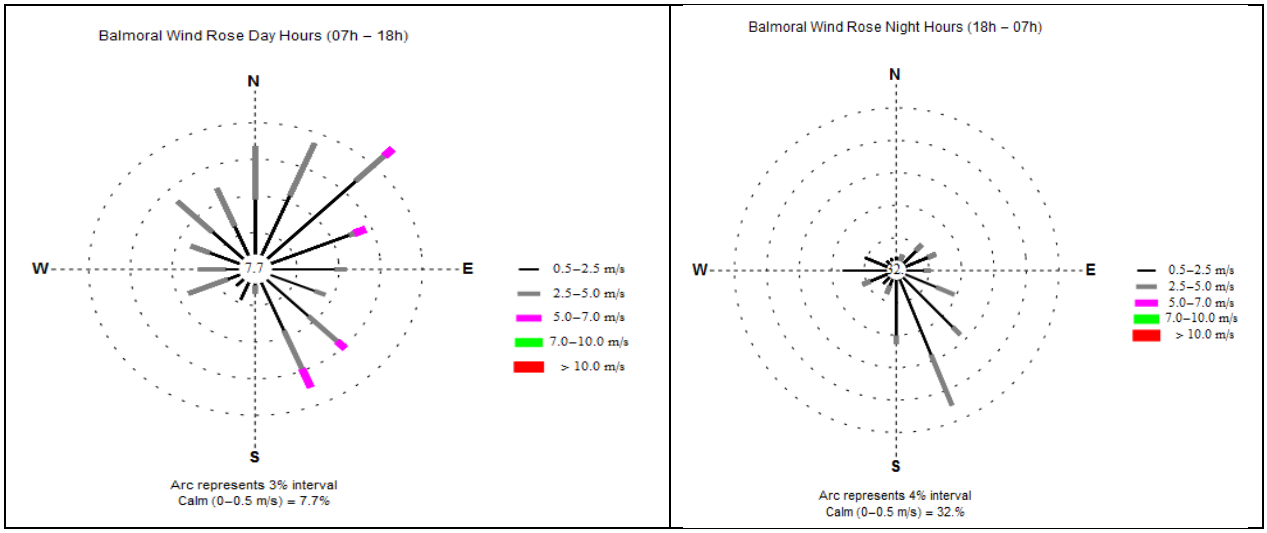


Figure 2: Wind profiles at Balmoral monitoring station

4.2.2. CHICKEN FARM AIR QUALITY MONITORING STATION

The dominant wind directions at Chicken Farm monitoring station during the day were north-west, north-north-west, north and east-south-east. During the night, the dominant wind directions were east, east-south-east and south-east. The monitoring station is south of Kusile power station.

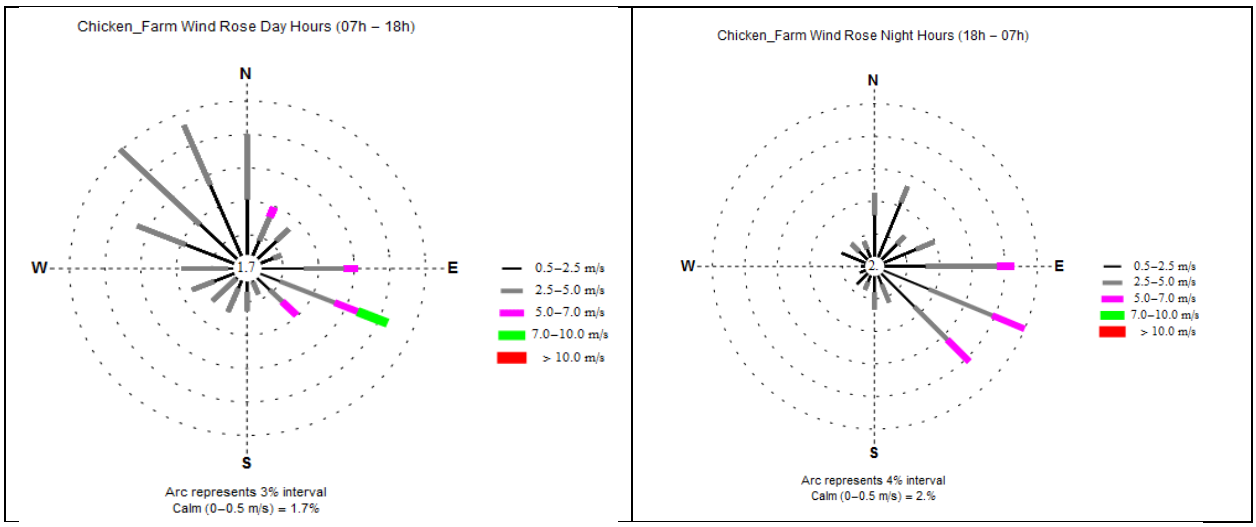


Figure 3: Wind profiles at Chicken Farm monitoring station

4.2.3. PHOLA AIR QUALITY MONITORING STATION

The dominant wind directions at Phola monitoring station during the day were west-north-west, north-west and north-north-west. During the night, the dominant wind directions were east-north-east, east and east-south-east. The monitoring station is south-east of Kusile power station.

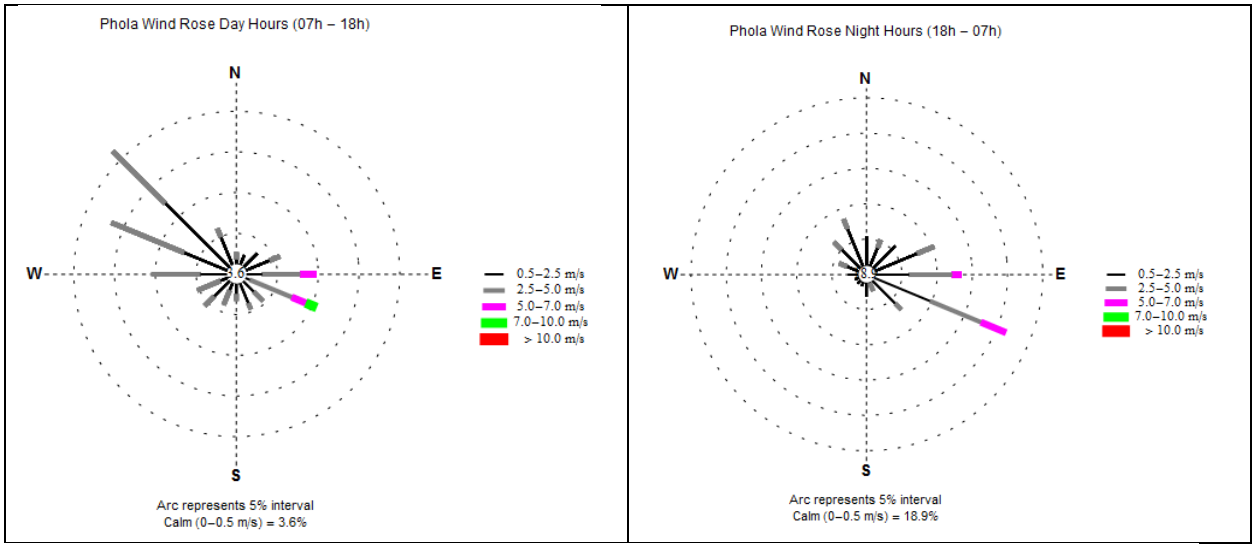


Figure 4: Wind profiles at Phola monitoring station.

4.2.4. WILGE AIR QUALITY MONITORING STATION

The wind at Wilge monitoring station was coming from the north, north-north-east, north-east to south-south-east directions during the day. The dominant wind sectors during the night are east-south-east, south-south-east and south. The monitoring station is south-east of Kusile power station.

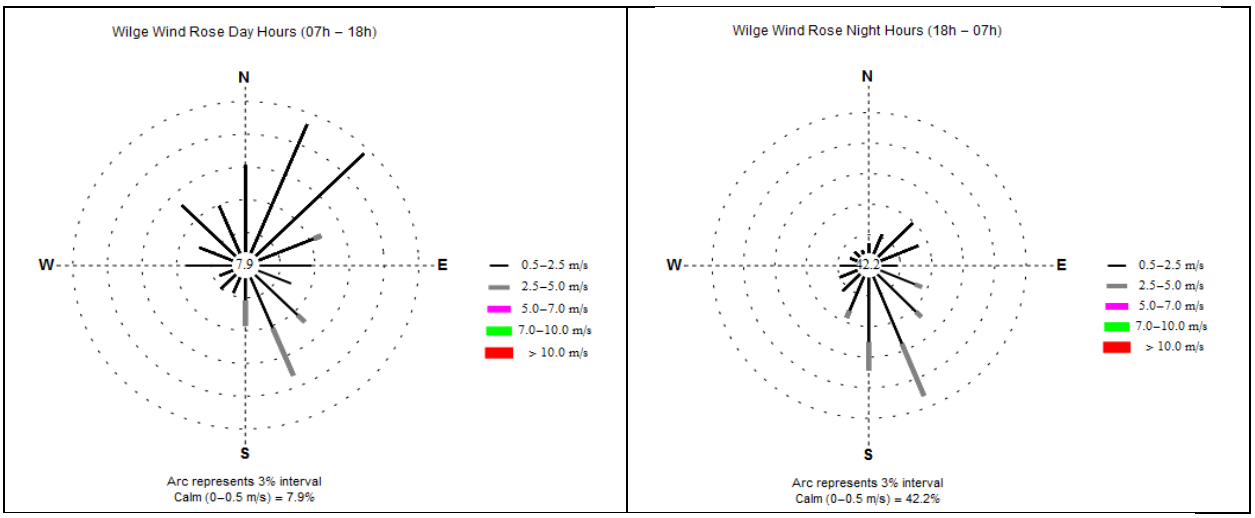


Figure 5: Wind profiles at Wilge monitoring station.

4.3. EXCEEDANCES OF THE NATIONAL AMBIENT AIR QUALITY LIMITS

Table 2: National Ambient Air Quality Standards

Pollutant	Unit	Period	Limit	Number of annual exceedances allowed	Source
Carbon Monoxide	Ppm	1hr	26.	88.	DFFE
Carbon Monoxide	Ppm	8hr	8.7	11.	DFFE
(PM_{10}) by Beta gauge	µg/m^3	24hr	75.	4.	DFFE
(PM_{10}) by Beta gauge	µg/m^3	1year	40.	0.	DFFE
($PM_{2.5}$) by Beta gauge	µg/m^3	24hr	40	4	DFFE
($PM_{2.5}$) by Beta gauge	µg/m^3	1year	20	0	DFFE
Nitrogen dioxide	Ppb	1year	21.	0.	DFFE
Nitrogen dioxide	Ppb	1hr	106.	88.	DFFE
Ozone	Ppb	8hr	61.	11.	DFFE
Sulphur dioxide	Ppb	1hr	134.	88.	DFFE
Sulphur dioxide	Ppb	10min	191.	526.	DFFE
Sulphur dioxide	Ppb	24hr	48.	4.	DFFE
Sulphur dioxide	Ppb	1year	19.	0.	DFFE

The National Department of Forestry, Fisheries and the Environment (DFFE) has set the South African Ambient Air Quality Standards for the criteria pollutants as illustrated in Table 2.

Table 3: Highest SO_2 concentration recorded (in ppb).

Monitoring Stations	10-min average	Date	Hourly average	Date	Daily average	Date
Balmoral	112.5	09/01/2024 14:20	68.5	09/01/2024 03:00	11.6	23/12/2023
Chicken Farm	137.3	10/01/2024 14:50	103.3	10/01/2024 03:00	15.7	01/12/2023
Phola	125.6	11/01/2024 14:30	60.0	11/01/2024 03:00	14.7	28/12/2023
Wilge	198.4	11/01/2024 14:10	57.3	04/01/2024 11:00	17.2	28/12/2023

There was one (1) exceedance of the SO_2 10-minutes limit of 191 ppb recorded during the monitoring period at Wilge air quality monitoring station. No exceedances of the ambient SO_2 limits were recorded for other monitoring stations during the monitoring period under review. The highest SO_2 concentrations recorded at the monitoring stations are indicated in Table 3 and figure 6 to 9 below,

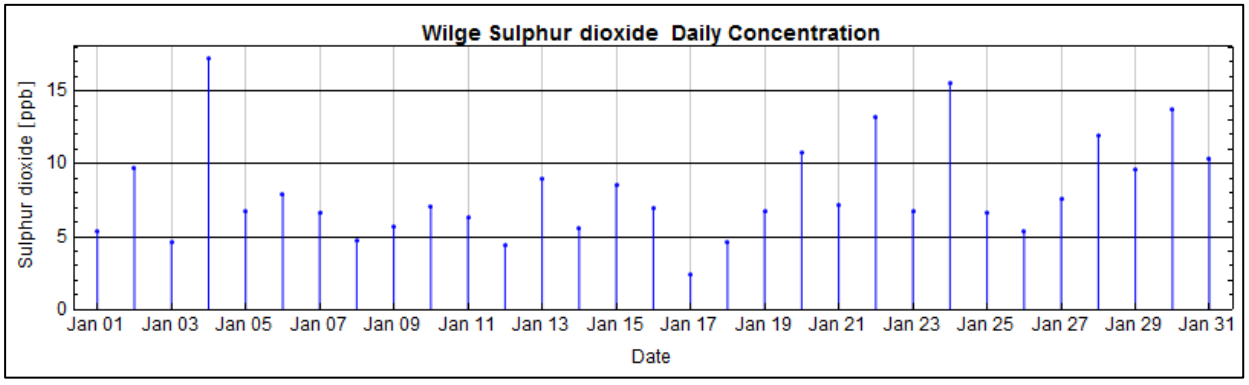


Figure 6: Time series graph for the SO_2 daily mean concentrations at Wilge AQM station

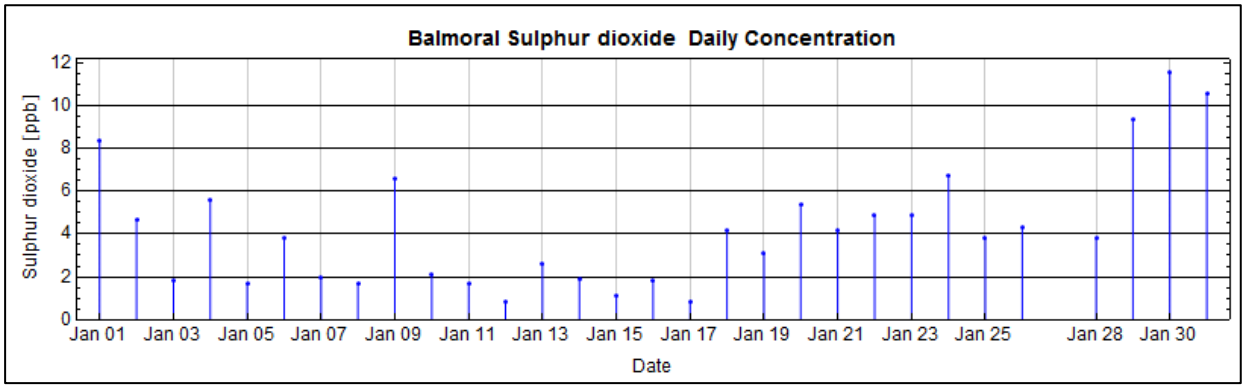


Figure 7: Time series graph for the SO_2 daily mean concentrations at Balmoral AQM station

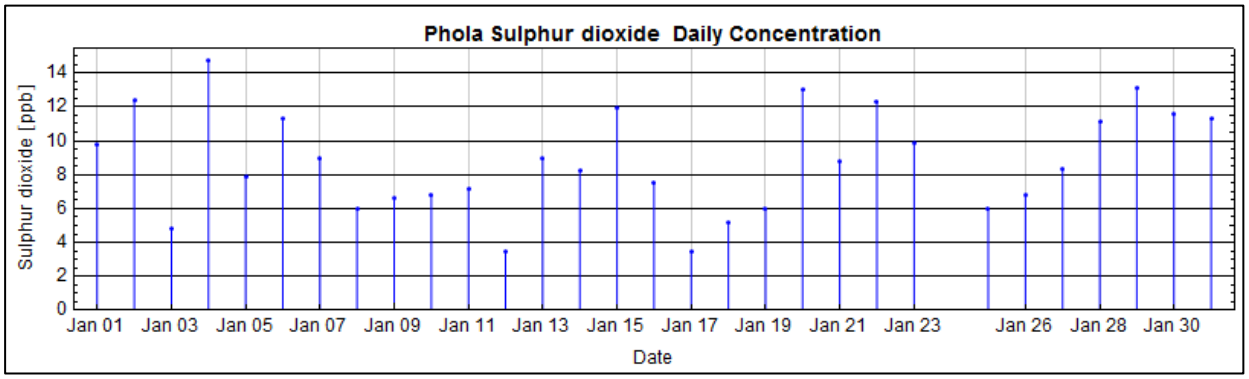


Figure 8: Time series graph for the SO_2 daily mean concentrations at Phola AQM station

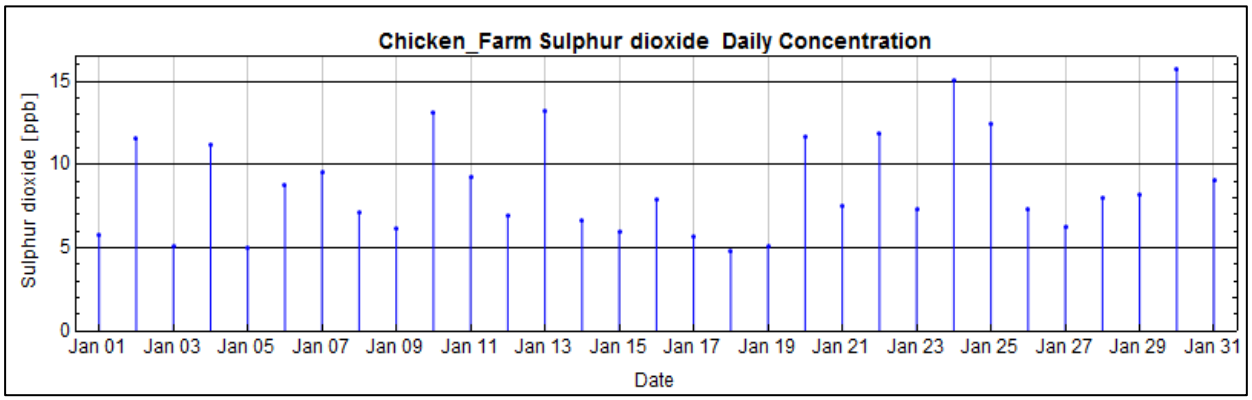


Figure 9: Time series graph for the SO_2 daily mean concentrations at Chicken Farm AQM station

No exceedances of the NO_2 hourly limit of 106 ppb were recorded at the monitoring stations during the January 2024 monitoring period. There were six (6) exceedances of the PM_{10} daily limit of 75 µg/m³ and five (5) exceedances of the $PM_{2.5}$ daily limit of 40 µg/m^3 recorded at the Chicken Farm monitoring station, respectively, and one (1) exceedance of $PM_{2.5}$ daily limit of 40 µg/m^3 recorded at Phola monitoring station. See Figures 10 to 12 below.

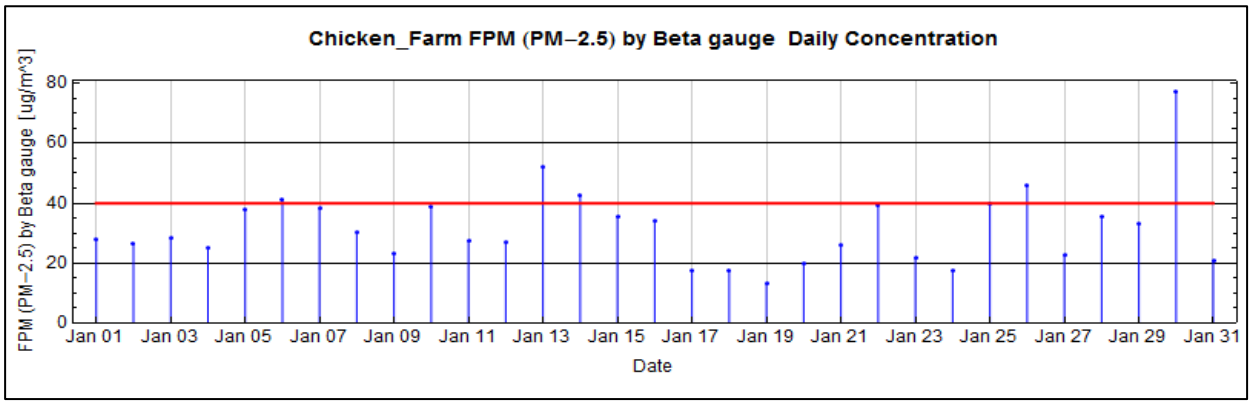


Figure 10: Time series graph for the $PM_{2.5}$ daily mean concentrations at Chicken Farm AQM station

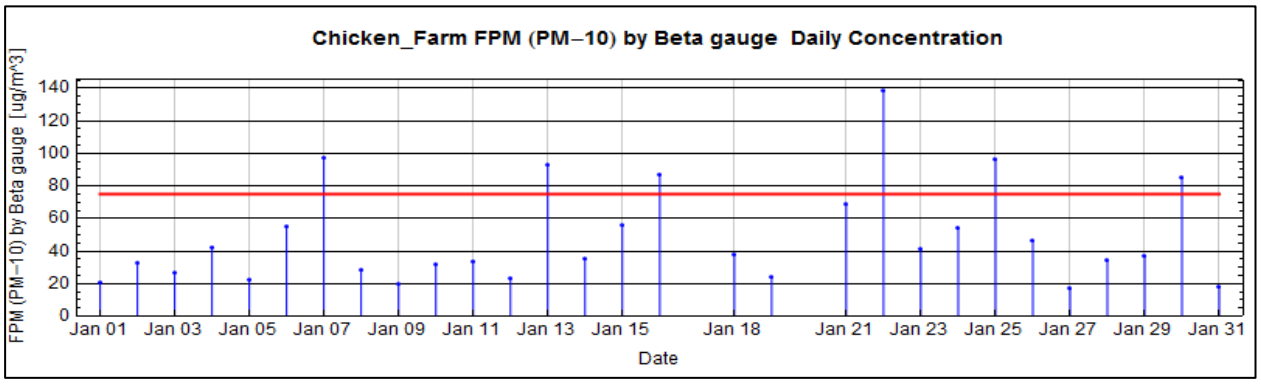


Figure 11: Time series graph for the PM_{10} daily mean concentrations at Chicken Farm AQM station

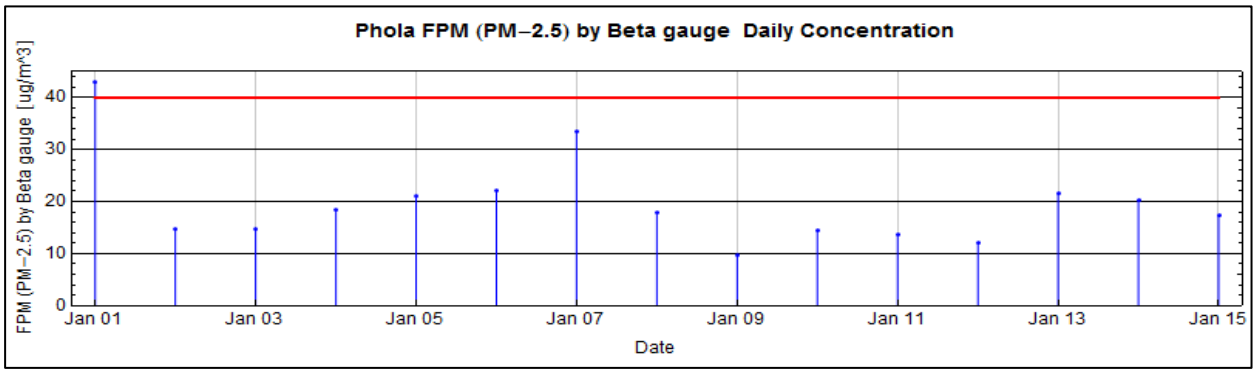


Figure 12: Time series graph for the $PM_{2.5}$ daily mean concentrations at Phola AQM station

Table 4: Exceedances above national ambient air quality limits for Chicken Farm and Phola air quality monitoring station

$PM_{2.5}$ Daily Exceedances (Chicken Farm)					
Pollutant	**Limit**	**Year**	**Month**	**Day**	**Conc. (µg/m³)**
$PM_{2.5}$	40	2024	January	06	41.4
$PM_{2.5}$	40	2024	January	13	51.9
$PM_{2.5}$	40	2024	January	14	42.8
$PM_{2.5}$	40	2024	January	26	45.9
$PM_{2.5}$	40	2024	January	30	77.1
$PM_{2.5}$ Daily Exceedances (Phola)					
$PM_{2.5}$	40	2024	January	01	42.9
PM_{10} Daily Exceedances (Chicken Farm)					
PM_{10}	75	2024	January	07	96.9
PM_{10}	75	2024	January	13	92.8
PM_{10}	75	2024	January	16	86.9
PM_{10}	75	2024	January	22	138.6
PM_{10}	75	2024	January	25	96.4
PM_{10}	75	2024	January	30	85.4

Table 5: Exceedances of the NAAQ Limits per pollutant- January 2024

Averaging Period	**Balmoral**	**Chicken Farm**	**Phola**	**Wilge**
SO_2 10-min	0	0	0	1
SO_2 Hourly	0	0	0	0
SO_2 Daily	0	0	0	0
NO_2 Hourly		0	ND	
O_3 8-hourly		22	7	
$PM_{2.5}$ Daily		5	1	
PM_{10} Daily		6	0	

A summary of all exceedances per pollutant for January 2024 is shown in Table 5.

SO_2 trigger levels or emergency response levels will be based on the United States Acute Exposure Guideline Levels for Hazardous Substances. (AEGL) as amended for South African circumstances. Levels confirmed with the authorities are as follows.

a. AEGL 1 – the cautionary notification level (non-disabling level) - is based on the South African NAAQS limit – for SO_2 this will be 191 ppb over 10-minute for exposure more than 4 hours.

b. AEGL 2 – the warning notification level (disabling level for those with asthma) – is aligned to the US AEGL approach – for SO_2 will be 744 ppb over a 10-minute for exposure up to 8 hours.

c. AEGL – the lethality level – for SO_2, this will be 29 771 ppb over a 10-minute period.

There were no events that triggered the notification of stakeholders in terms of the agreed AEGL recorded in January 2024.

5. DFFE AND SAAQIS REPORTING

The raw monitoring data, downloaded at 1-minute averages is available in real-time to the DFFE-managed South African Air Quality Information System (SAAQIS) since the 14th of December 2023 for all Eskom air quality monitoring stations.

6. CONCLUSIONS

There was one (1) exceedance of the SO_2 10-minutes limit of 191 ppb recorded during the monitoring period at Wilge air quality monitoring station. There were no exceedances of the ambient SO_2 limits recorded for other monitoring stations during the monitoring period under review.

There were no events that triggered the notification of stakeholders in terms of the agreed AEGL recorded in January 2024.