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## The Canary System<sup>®</sup>

□Pulses of laser light (660 nm) are shone on the tooth and the laser light is converted to four signals during a 5 second scan: 1) The strength of the converted heat (PTR Amplitude); 2) The time delay of the converted heat to reach the surface (PTR Phase); 3)The strength of the converted luminescent light (LUM Amplitude); 4) The time delay of the converted luminescent light (LUM phase).

□The Canary Number is created from an algorithm combining these four signals and is directly linked to the status of the enamel or root surface crystal structure. Changes in the tooth microstructure, due to caries, causes corresponding changes in the optical and thermal properties of the tooth and the resultant PTR-LUM response.



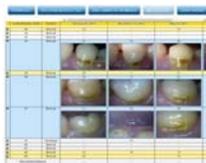
## The Canary Cloud (www.thecanarycloud.com)

□The Canary Cloud is a HIPAA- and PIPEDA-compliant, secured, cloud-based environment that stores de-identified scan data collected by The Canary System.

□Epidemiological data on caries rates across populations is essential to understanding and developing policy for better oral care.

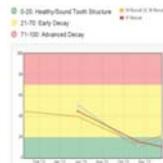
### View patient data

Canary Scan data can be viewed for each patient by tooth number and surface over a given time period.



### Monitor patient progress

Canary Numbers can be visualized in graphical format to visualize how they changed over time.



**Monitor Canary Scan Activity**  
Select any time period and see instantly how many scans were performed.



## Objective

□To demonstrate that data globally-generated by The Canary System can be collected, mined, analyzed and converted into clinical insights and trends on caries rates across populations.

## Materials & Methods

□The Canary Cloud was mined for Canary- and demographic-related data collected between June 2011 and Sept 2014.

□Data in the form of Canary Numbers and de-identified patient information were collected and accessed from 123 clinics in North America, who used the "Detail Scan" feature in The Canary System, representing over 167,000 scan data-points.

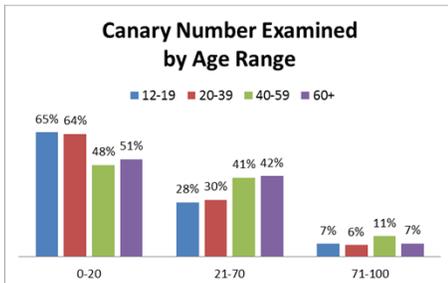
□Descriptive analysis was performed on the data.

□Canary Numbers (CNs) were displayed by zone (0-20, 21-70, and 71-100; per Canary Scale)



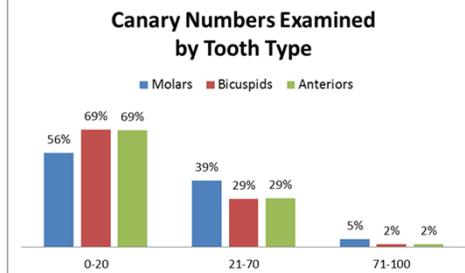
## Results

**Figure 1.** When examining Canary Numbers by age group, Canary Numbers (CN) were lower among younger age groups, indicating healthier teeth, whereas older age groups tended to have higher Canary Numbers indicating more caries lesions.



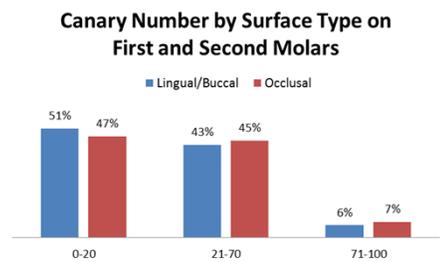
Sample Size for Data Collection	Age Range			
	12-19	20-39	40-59	60+
Number of Represented Offices	63	105	93	50
Number of Patient Sessions	644	967	1,013	277
Number of Canary Scans	12,997	12,647	10,022	4,500

**Figure 2.** When segmenting data by tooth type, bicusps and anterior teeth exhibited lower CNs compared to molars.



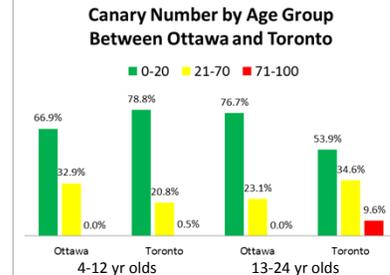
Sample Size for Data Collection	Tooth Type		
	Molars	Bicusps	Anteriors
Number of Represented Offices	140	81	70
Number of Patient Sessions	2,582	1,199	905
Number of Canary Scans	22,142	11,735	8,043

**Figure 3.** Examining molars by tooth surface indicated that a greater proportion of Canary Scans had higher CNs on occlusal surfaces compared to lingual/buccal surfaces.



Sample Size for Data Collection	Surface Type	
	Lingual/Buccal	Occlusal
Number of Represented Offices	117	128
Number of Patient Sessions	1,166	1,832
Number of Canary Scans	4,757	8,679

**Figure 4.** A comparison was made between 4-12 and 13-24 year-olds in Ottawa and Toronto. In the 4-12 age group, a greater proportion of patients (32.9%) in Ottawa exhibited Canary Numbers between 21-70 (range for caries lesion = 21-100) compared to Toronto (20.8%). In the 13-24 age group, a greater proportion of patients, 34.6% and 9.6% in Toronto exhibited Canary Numbers between 21-70 and 71-100 respectively, compared to Ottawa, 21.1% and 0%, respectively.



Sample Size for Data Collection	Ottawa	Ottawa	Toronto	Toronto
	4-12	13-24	4-12	13-24
Number of Represented Offices	2	3	7	17
Number of Patient Sessions	18	145	110	303
Number of Canary Scans	420	6,160	3,501	6,024

## Limitations

□Limitations of this study include: Data associated with specific tooth surfaces and tooth numbers assumes that the operator is correctly scanning that surface; at the time of this study, data only represented ~20% of all Canary Scan data because it is data collecting from offices that used Detail Scan (not Quick Scan). CN is associated with age.

## Discussion

□As the patient ages, Canary Numbers increase confirming that tooth health deteriorates with age.

□Approximately 50% of all scans have Canary Numbers <20.

□Patients aged 13-24 in Ottawa have healthier teeth than their counterparts in Toronto.

## Conclusion

□This data examination demonstrated the power of combining cloud computing and caries detection tools to provide epidemiological data and trends on caries prevalence among populations, age groups, geographies, and tooth type and surface.

