

# Product Characteristics and Smoke Chemistry: Comparisons Across Nine ITC Countries

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## INTRODUCTION

- Little is known about the extent to which cigarette products differ across countries in terms of design.
  - Little information about the characteristics of popular brands is available beyond smoking machine yields.
- Greater knowledge about the product may inform scientists and policymakers involved in tobacco control.
  - Canada has extensive constituent yield reporting requirements but has not required data on design.
  - The EU originally instituted tar caps of 15mg, dropping to 12mg in 1998 and 10mg in 2005.
  - China and Malaysia have tar caps of 15mg.
- We have recently observed that the major change in cigarettes to comply with the EU 10/1/10 policy has been increased filter ventilation

### EU 10/1/10 Policy

Before (1999)	After (2005)
+12 mg ISO tar	+10 mg ISO tar
+5.0% ventilation	+30.9% ventilation
+Filter weighed 0.14 g	+Filter weighed 0.16 g
	+Filter length, tobacco length unchanged

- As part of the RPCI TTURC, we have established an International Tobacco Products Repository, containing leading brands from 10 countries.



## METHODS

### Response measures

- Filter ventilation
- Pressure drop
- Tobacco weight
- Tobacco rod length
- Filter weight & length
- Cigarette diameter & circumference
- Rod and Filter density calculated from weights and lengths.
- ISO Tar, nicotine, and CO yields (from packs and/or government reports and/or testing labs)



### Methodology

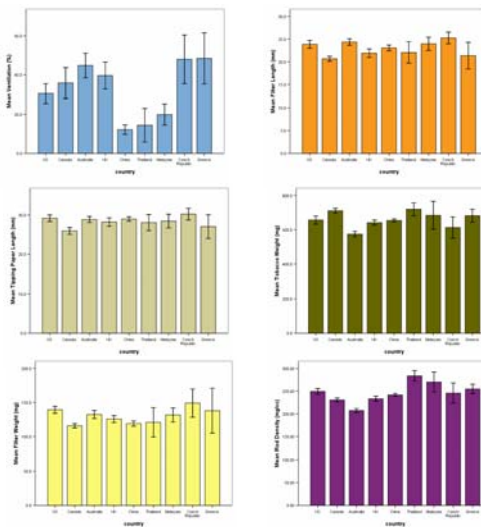
- Pressure Drop and Ventilation measurements were recorded on twenty cigarettes from each pack using the Borgwaldt-KC-3 digital dilution and pressure drop apparatus.
- Five Cigarettes from each of the 20 were then used in order to produce the physicals. Using an electronic digital caliper the total length, circumference, tobacco length, filter length, and tipping length were measured and recorded. The cigarettes were sliced open in order measure tobacco rod length.
- The tobacco from each of the five cigarettes was emptied into a weighing dish and then using a Mettler Toledo digital balance the total weight was recorded. The filters from each of the five cigarettes were placed in a separate weighing dish and the total weight was recorded.

### Data analysis

- Examined 316 brand varieties from 9 countries on panel of design characteristics
- Data assessed using SPSS 14.0

## RESULTS

Figure 1. Comparisons of selected design features and physical parameters across countries. Error bars represent 95% confidence intervals.



- In general, cigarettes from the Asian countries showed lower average filter ventilation than cigarettes from Western countries.
- Cross-country differences in other parameters such as tobacco weight, filter length, and rod density are subtler

Figure 2. Boxplot of Filter Ventilation by Country.

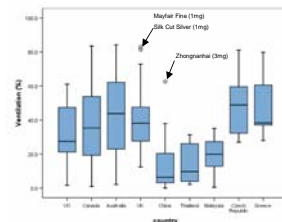
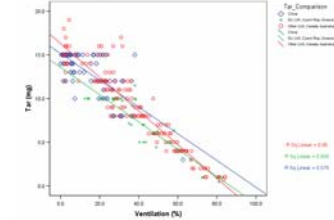


Figure 3. Scatterplot of tar by filter ventilation, by country groups.



### Tar and Ventilation

- As found in previous studies, ventilation is a consistent and strong predictor of Tar.
- Relationship less strong in China than in EU or North America
  - China has narrower range of tar yields

### Multivariate analysis

- Which cigarette characteristics define cigarettes in different countries or groups of countries?
- Multivariate Logistic Regression: Asia vs. EU vs. Others
  - Ventilation entered first as 'known' difference
  - Other features entered via forward stepwise selection

Asia EU Other	Variable	B		Wald	df	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio	
		Lower Bound	Upper Bound						
Asia vs. EU	Intercept	28.221	14.237	18.218	1	.000			
	Vent	-.003	.015	38.821	1	.000	.911	.885	.938
	Chem	-.002	1.450	27.821	1	.000	.999	.989	.999
	TipLen	.000	.121	5.504	1	.019	1.003	1.003	1.003
	FilterWght	-.001	.000	1.460	1	.230	.991	.992	1.019
EU vs. Other	Intercept	23.192	11.209	4.293	1	.038			
	Vent	.007	.011	2.335	1	.126	1.017	.994	1.033
	Chem	-.124	1.210	11.829	1	.001	.916	.892	.972
	TipLen	.193	.168	2.213	1	.033	1.195	.987	1.473
	FilterWght	-.001	.013	9.208	1	.002	.983	.968	.997

- 5 design features (including filter ventilation) are reliably different between the groups of countries
  - Fewer features discriminate between EU and Other categories
- Nagelkerke pseudo R<sup>2</sup> = 0.64
  - Other design features not measured may explain additional differences (e.g., paper porosity, rod nicotine, fiber denier)

### Smoke Chemistry Testing

- 20 brands from China and 19 brands from Greece and Czech Republic smoked under 2 smoking conditions:
  - ISO conditions (35mL puffs, 60 sec interval, 0% vent blocking)
  - Health Canada conditions (55mL puffs, 30 sec interval, 100% vent blocking)
- Is there a difference in how brands from China or EU countries perform under both conditions?
  - Implications for FCTC Article 9 regulations?
  - TobReg has proposed using the Health Canada regimen as the standard for product regulation and emissions testing
    - Set limits on constituents using Constituent : Nicotine ratios
  - But, do brands from different countries perform the same under HC conditions?

- Smoke volumes drawn under both conditions similar

- Because of lower ventilation in China, HC and ISO yields are linearly related, while quadratically related in EU

Figure 4. Volume of smoke drawn from cigarettes in each condition.

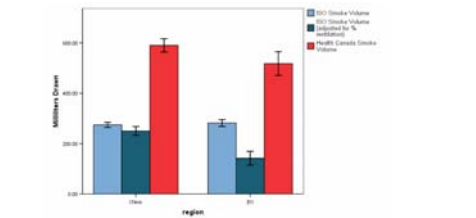


Figure 5. Ratio of HC tar to ISO tar, plotted against % ventilation

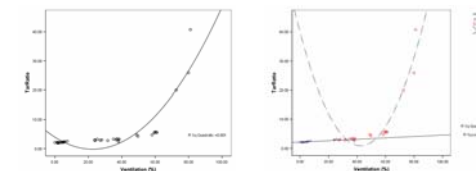
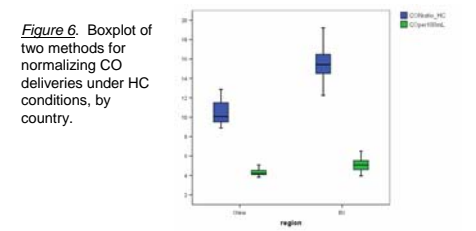


Figure 6. Boxplot of two methods for normalizing CO deliveries under HC conditions, by country.



## DISCUSSION

- Country differences in cigarette design are subtle
- Filter ventilation is clearly the predominant design feature driving standard ISO tar, nicotine, and CO yields on major brands in nine countries

### LIMITATIONS

- We did not have equipment available to measure paper porosity, nor could we control room humidity.
- Brands were selected from major brand families, and not based on market share.

### CONCLUSIONS

- Filter ventilation is the most significant determinant of standard tar, nicotine, and CO yields
- A limited number of design features, including filter ventilation, captures between-country differences in cigarette construction.
- Chinese cigarettes perform differently under Canadian Intense conditions relative to EU cigarettes.
  - Implications for using HC regimen as a worldwide standard

### REFERENCES

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