Supplementary Table 1. Seasonal PM2.5 levels calculated from personal mean and median of 1-min readings over 6-hour periods

PM2.5 (µg/m3)			mean	SD	min	median	max
welding	overall	personal shift average	421	360	32	358	2278
		personal shift median	185	180	9	114	1169
	summer	personal shift average	296	213	32	266	1404
		personal shift median	106	104	9	70	496
	winter	personal shift average	612	368	99	560	2279
		personal shift median	303	203	24	295	1169
classroom	overall	personal classroom average	120	60	1	69	570
		personal classroom median	69	107	1	18	408
	summer	personal classroom average	90	103	4	58	427
		personal classroom median	39	54	3	18	340
	winter	personal classroom average	175	191	1	82	569
		personal classroom median	123	143	1	25	408

Supplementary Table 2. Top hits of two-factor factorial ANOVA analysis of day (welding/office area) and time (morning/afternoon)

	$F_{W/N}$	Adj.$p_{W/N}$	$F_{AM/PM}$	Adj.$p_{AM/PM}$	$F_{interaction}$	Adj.$p_{interaction}$
Sphingosine 1-phosphate	16.35	0.09	24.58	<0.01	17.27	0.03
1-myristoylglycerol 140	6.52	1.00	19.05	<0.01	1.04	0.82
4-allylphenol sulfate	5.43	1.00	29.86	<0.01	4.82	0.40
Oleoyl ethanolamide	5.36	1.00	23.19	<0.01	0.74	0.84
Sphinganine-1-phosphate	5.36	1.00	0.58	0.56	23.94	<0.01
Sphingosine	5.20	1.00	13.65	<0.01	2.88	0.57
Arginine	4.67	1.00	48.84	<0.01	2.60	0.57
Citraconate/glutaconate	4.56	1.00	7.78	0.02	0.13	0.93
Prolylglycine	4.12	1.00	130.92	<0.01	0.90	0.84
Oleoylcarnitine C181	4.11	1.00	37.35	<0.01	4.95	0.38

P-values were adjusted for multiple comparisons using the false discovery rate method.

$F_{w/n}$: F value for welding to nonwelding comparison. Adj.$p_{w/n}$: Adjusted *p*-value for welding to nonwelding comparison. $F_{AM/PM}$: F value for morning to afternoon comparison. Adj.$p_{AM/PM}$: Adjusted *p*-value for morning to afternoon comparison.

Supplementary Table 3. Profile of sphingosine-1-phosphate, sphinganine 1-phosphate, and sphingosine over time in a crossover setting (corresponding to Figure 2)

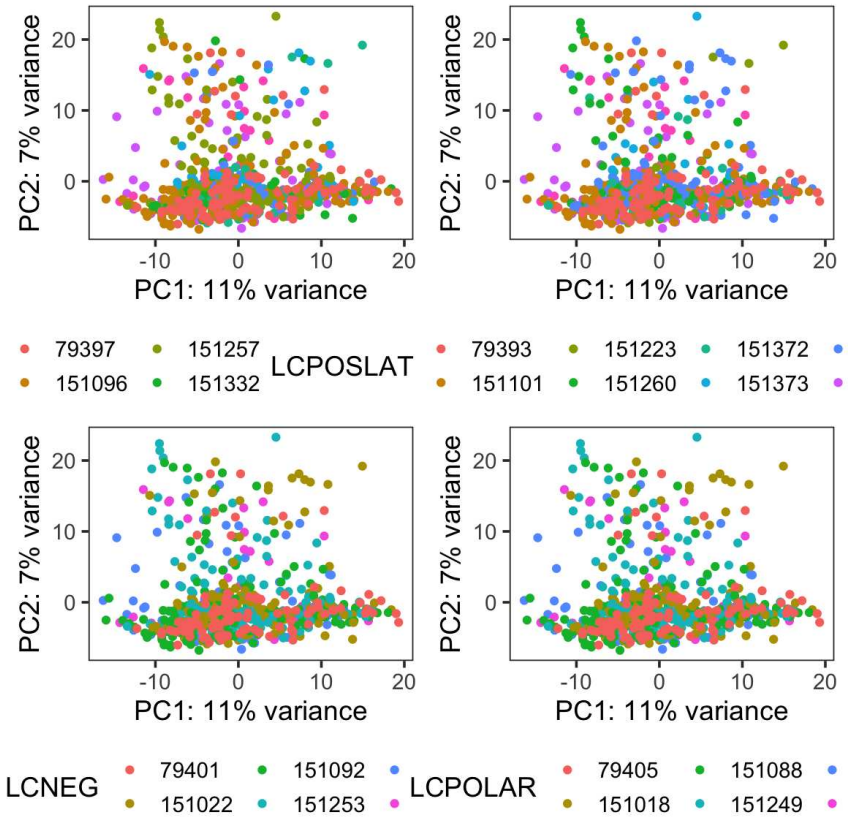
		Classroom – welding (N=36)				Welding – classroom (N=8)			
		Classroom (Day 1)		Welding (Day 2)		Welding (Day 1)		Classroom (Day 7[a])	
		Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
Sphingosine 1-phosphate	AM	0.26 (0.33)[b]	0.34	-0.15 (0.27)	-0.17	-0.2 (0.26)	-0.19	0.24 (0.33)	0.29
	PM	0 (0.34)	0.04	-0.15 (0.36)	-0.18	-0.21 (0.27)	-0.22	-0.2 (0.24)	-0.17
Sphinganine 1-phosphate	AM	0.19 (0.43)	0.29	-0.29 (0.45)	-0.26	-0.16 (0.36)	-0.06	0.13 (0.44)	0.23
	PM	-0.1 (0.52)	0.05	-0.04 (0.55)	-0.14	-0.11 (0.41)	-0.10	-0.31 (0.33)	-0.32
Sphingosine	AM	0.32 (0.61)	0.35	-0.17 (0.43)	-0.08	-0.55 (0.69)	-0.37	0.07 (0.66)	0.15
	PM	-0.06 (0.44)	-0.05	-0.23 (0.66)	-0.19	-0.5 (0.62)	-0.51	-0.38 (0.66)	-0.28

[a] Based on approximate time interval.

[b] Interaction effects of all metabolites in the two-factor factorial design were significant (p<0.05), except for sphingosine in the classroom-welding group. The lack of significance here was possibly due to an outlier, and the interaction term was significant after removing the outlier sample.

Supplementary Material – Principal Component Analysis

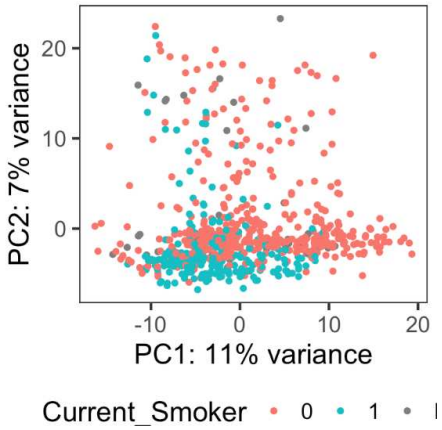
Supplementary Figure 1. PCA plots colored by instrumental batches



Platforms used to quantify metabolites: LCPOSLAT: LC/MS Pos Late, LCNEG: LC/MS Neg, LCPOLAR: LC/MS Polar.

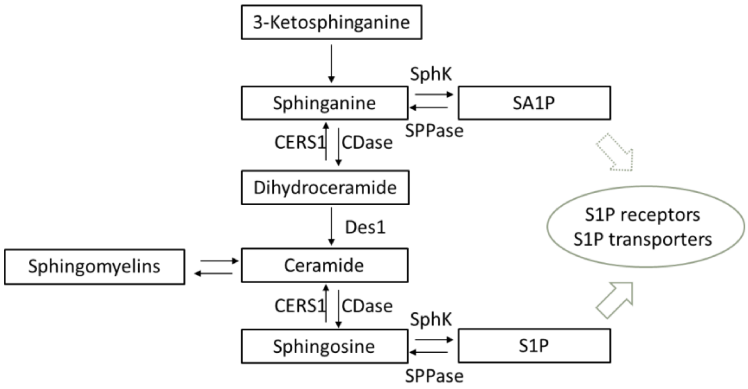
Instrumental batch was defined as batches run by different platforms in different dates (e.g. 79397, 131257, 151096, and 151332 represent four batches that were run on LCPOSLAT platform).

Supplementary Figure 2. PCA plot colored by smoking status



The grey dots indicate 'unknown' smoking status.

Supplementary Figure 3. The metabolic pathway of S1P and SA1P



CDase: ceramidase

CERS1: ceramide synthase 1

Des1: dihydroceramide desaturase 1

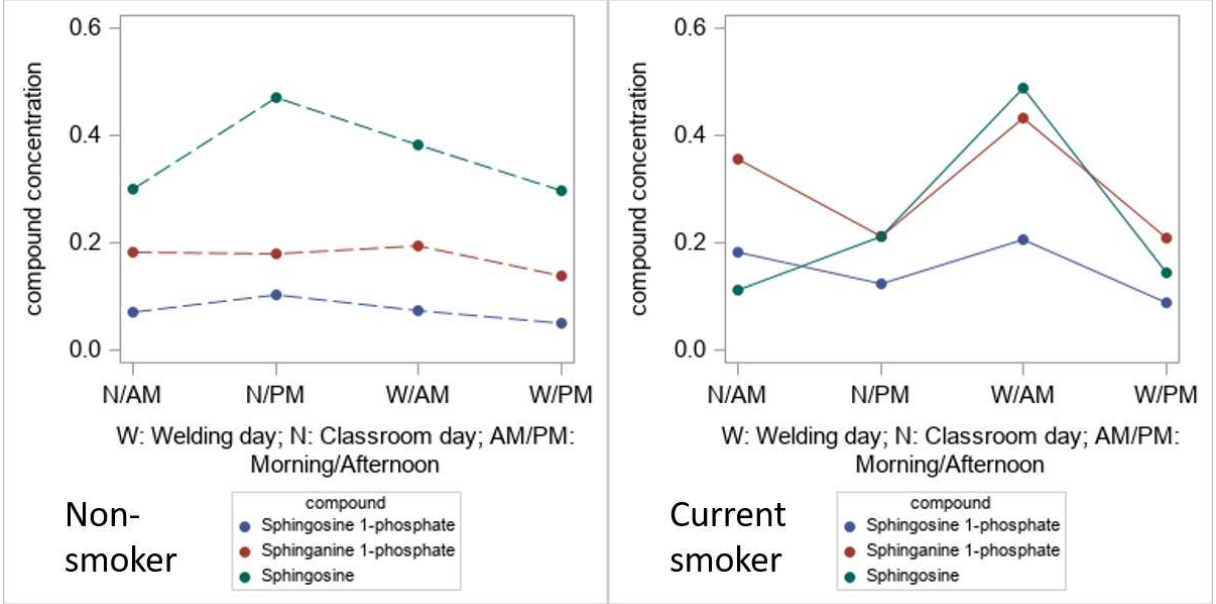
S1P: sphingosine 1-phosphate

SA1P: sphinganine 1-phosphate

SphK: sphingosine kinase

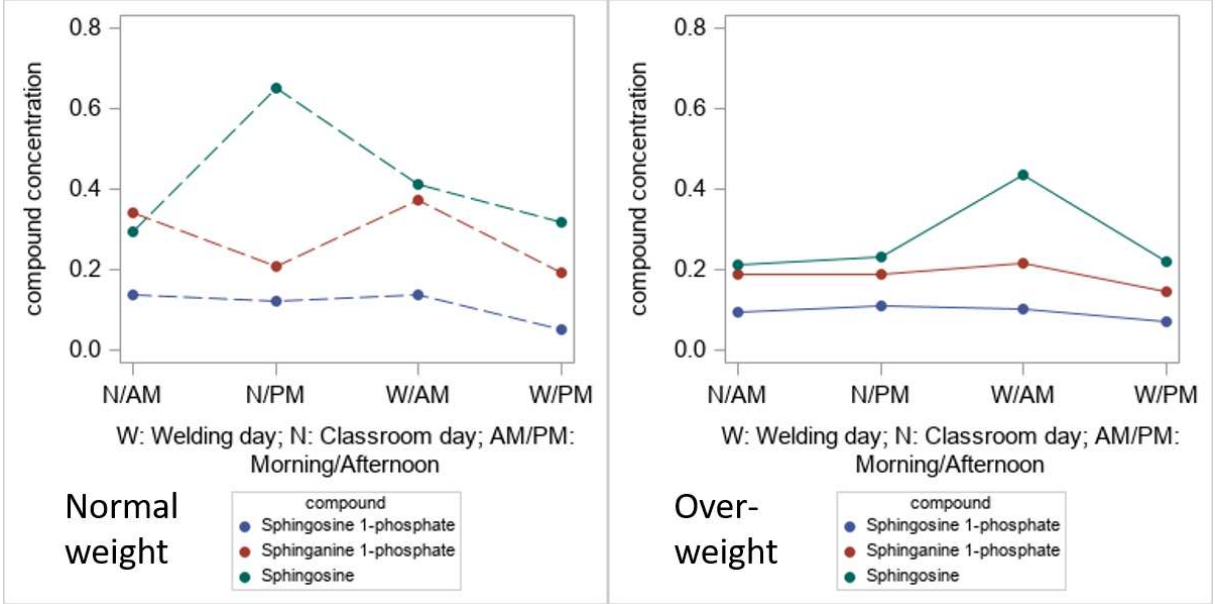
SPPase: sphingosine-1-phosphate phosphatases

Supplementary Figure 4. Profiles of sphingosine 1-phosphate, sphinganine 1-phosphate, and sphingosine over time, by smoking status



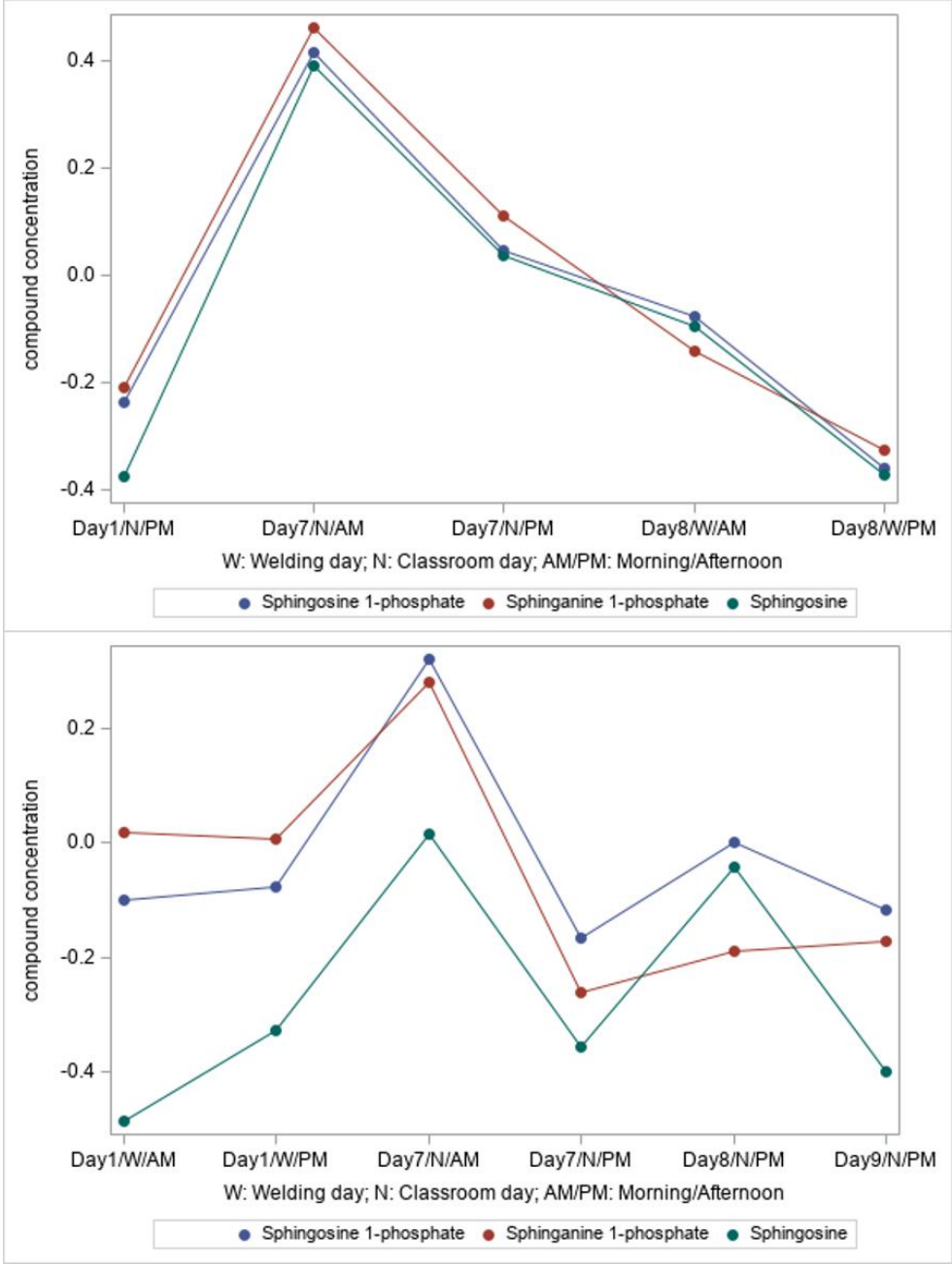
The left plot shows the average levels of the indicated compounds on welding day and non-welding day of non-smokers (29 participants). The right plot shows the average levels of the indicated compounds on the welding day and non-welding day of current smokers (15 participants).

Supplementary Figure 5. Profiles of sphingosine 1-phosphate, sphinganine 1-phosphate, and sphingosine over time, by normal weight/overweight participants



The left plot shows the average levels of the indicated compounds on welding day and non-welding day of normal weight participants (16 participants). The right plot shows the average levels of the indicated compounds on the welding day and non-welding day of overweight participants (28 participants).

Supplementary Figure 6. Profile of sphingosine 1-phosphate, sphinganine 1-phosphate, and sphingosine over time (five or six samples within about two weeks).The approximate day numbers show the average interval between days of measurements.



The two plots show the profile of sphingosine 1-phosphate, sphinganine 1-phosphate, and sphingosine in two study settings. Each trajectory stands for one metabolite. In the upper plot, welding day was after the classroom day; in the lower plot, welding day was before the classroom day.