*A BRIEF TECHNICAL REPORT ON THE MOBAT: AN INEXPENSIVE
PORTABLE TEST FOR DETERMINING BLOOD
ALCOHOL CONCENTRATION*

Several investigators have reported successfully training alcoholics to control their drinking in an outpatient setting (Ewing and Rouse, 1972; Lovibond and Caddy, 1970; Miller, 1972; Sobell and Sobell, 1973). An important element in such studies is that patients monitor their drinking behavior and its physiological concomitants. Blood alcohol concentration (BAC)¹ is usually measured with commercially available devices, descriptions and comparative evaluations of which are available (Erwin, Greenberg, and Minzer, 1972; Lovell, 1972). In nearly all cases, however, these machines were originally developed to meet the needs of the criminal-justice system in prosecuting persons apprehended while driving under the influence of alcohol. Because of the need for courtroom evidence, these devices are typically sophisticated, nonportable, very accurate, and costly. The absence of portability and high cost tend to make the clinical use of these devices unfeasible. Yet, as the applied behavior analysis of alcohol dependence continues to provide procedures for moderating drinking behaviors, there is an increasing need for inexpensive and portable instruments that can be used to obtain BAC estimates. Only a few such devices are available. The device described in this report was selected because it is less expensive than other screening testers, is portable (*i.e.*, can be administered and read in the field), and is simple to use.

The Mobat²—"mobile breath alcohol test"—was developed in 1970 by Luckey Laboratories, Inc. Displayed in Figure 1, the Mobat is a screening test in which a specified volume (900 ml) of mixed expired breath is passed through a tube containing a dry silica gel treated with a reagent of chromate ions in sulfuric acid. The exact volume passing through the tube is controlled by a re-usable plastic volumetric bag. The reagent is arranged in a series of three discrete yellow rings that turn green as the result of inter-

acting with alcohol in the breath. The rings indicate ranges of BAC from 0.00% to 0.10%, 0.10% to 0.20%, and 0.20% to 0.30% by blood volume, respectively. Thus, the yellow rings progressively turn various shades of green as a function of the amount of alcohol in the breath. Tubes are read in a thermometer-like fashion, observing the highest position reached by the green color. Readings from the tube are usually estimated at gradations of 0.01%. For purposes of comparison with the gas chromatography (see below), readings were estimated at 0.001%. In most states, a BAC of 0.10% is the criterion level above which persons are considered legally intoxicated.

The Mobat is simple to use and is packaged in a small box containing materials for five tests. The cost of a box varies from \$3.00 to \$2.50, depending on the quantity ordered. Thus, the price per test ranges between \$0.60 and \$0.50, a cost so small that it may easily be borne by the patient if necessary. As with all breath tests for alcohol, the Mobat should not be administered within 15 min of drinking alcohol (*e.g.*, liquor, mouthwash, *etc.*) in order to avoid contamination by alcohol residuals in the mouth. The tester is first assembled as two units: (1) a balloon is placed over a short plastic tube mouthpiece and, (2) after disposing of dessicant crystals stored in each end of the glass reagent tube, the tube is attached to the plastic tube opening of the volumetric bag. The person to be tested then inflates the balloon to full volume and pinches the end of the balloon so the stored breath cannot escape. The free end of the mouthpiece is then attached to the free end of the reagent tube, thus forming a single unit, as shown in the center of Figure 1. Breath captured in the balloon is then slowly passed through the reagent and into the volumetric bag when the balloon is unpinched. After the volumetric bag has fully expanded, the reagent tube is disconnected from the other apparatus and capped on both ends, thereby maintaining a closed system. The balloon and mouthpiece are discarded, while the volumetric bag is evacuated and saved for re-use. As described above, the tube is then read in a thermometer-like fashion. A technical caution when using the Mobat is that it is most accurate immediately after a test has been completed. While collection tubes can be retained and interpreted at a later time, a slight alcohol-reagent reaction continues for some

¹Blood alcohol concentration is a direct indicant of level of alcohol intoxication. It is usually expressed in terms of milligrams of ethyl alcohol per 100 millimeters of blood, or as a percentage of blood volume. For example, a BAC of 0.10% is the equivalent of 100mg/100ml.

²*Mobat* is the tradename for Sober-Meter kit SM-6 manufactured by Luckey Laboratories, Inc., 7252 Osburn Road, San Bernardino, California 92404.

Fig. 1. The *Mobat*, Sober-Meter kit SM-6.

hours, and delayed Mobat readings will tend to be excessively high.

An evaluative study of the accuracy of the Mobat was conducted at the Orange County (Ca.) Alcoholism Services clinic. Patients entering that clinic are routinely administered a gas chromatography breath analysis (Alco-Analyzer, Luckey Laboratories, Inc.). Gas chromatography breath analysis for ethyl alcohol is a widely used and quite accurate technique (Coldwell, Solomonraj, Trenholm, and Wilberg, 1971; Erwin *et al.*, 1972; Glendenning, Rush, and Duffett, 1971; Lovell, 1972; Luckey, 1971; Roberts and Fletcher, 1969). Those patients who were indicated as having ethyl alcohol in their body by gas chromatography analysis were immediately also administered a Mobat. The Mobat tubes were then independently assessed by two judges. In the majority ($n = 30$) of total cases ($N = 40$), both judges were concurrently present at the clinic when a Mobat was administered. Interjudge reliability, expressed as a Pearson product-moment correlation coefficient, was $+0.81$, and the overall deviation of estimates from the gas chromatography reading was ± 0.039 for both judges combined.

When manufactured, the Mobat is calibrated using a simulator sample of 0.08% to 0.15% alcohol concentration, establishing its maximum accuracy in the range of BACs that most states specify as legally defining alcohol intoxication. Error toward the standard increases as the actual BAC increasingly deviates from this standardizing range. Thus, actual BACs below 0.08% will tend to be overestimated when tested by the Mobat and those above 0.15% will tend to be underestimated. This characteristic was documented in the experimental evaluation. Table 1 indicates the average error of the estimates of each judge, the direction of error, and error as a function of whether the actual BAC was within, less than, or greater than the standardizing range. *While too imprecise for research use*, this degree of relative accuracy is sufficient for most clinical applications, especially when coupled with the knowledge that a very low reading is likely to be overestimated, an extraordinarily high reading will generally be underestimated, and a reading around the criterion of legal drunkenness will be relatively correct. A further consideration is that the screening test is self-contained and needs no laboratory analysis. Should a precise

Table 1

Average error of the Mobat reading estimates of two judges, direction of error, and error as a function of whether the actual BAC was less than, within, or greater than the standardizing range (0.08% to 0.15%).

Direction of Error	Range of Blood Alcohol Concentration (%)							
	0.000 to 0.080		0.081 to 0.150		0.151 to 0.300		Combined	
	n	Mean Deviation	n	Mean Deviation	n	Mean Deviation	n	Mean Deviation
JUDGE 1								
Underestimated	3	-0.011	4	-0.022	10	-0.061	17	-0.043
Overestimated	6	+0.030	8	+0.029	5	+0.032	19	+0.030
Absolute	9	±0.024	12	±0.027	15	±0.051	36	±0.036
JUDGE 2								
Underestimated	0	—	4	-0.007	15	-0.045	19	-0.037
Overestimated	8	+0.063	5	+0.030	2	+0.031	15	+0.048
Absolute	8	±0.063	9	±0.020	17	±0.043	34	±0.042

BAC be required, and if laboratory analysis is available, a number of somewhat more expensive (e.g., \$4.00 to \$10.00) devices can be used to obtain a field sample for further evaluation (see Erwin *et al.*, 1972; Lovell, 1972).

Because of its low cost and portability, the Mobat can be used to provide patients with immediate feedback regarding their level of intoxication. Although its predominant use as a therapeutic tool is in cases where controlled or limited drinking is the treatment objective, the value and use of the Mobat is not restricted to this group of patients. These breath testers can also be used with patients in an outpatient setting in at least the following ways:

1. Testers allow rapid resolution of debates about the occurrence of drinking and/or the relative amount of drinking by an individual.
2. Use of the Mobat allows patients to gain experience at estimating their own BAC. This function would be especially advantageous if the individuals had already received explicit BAC discrimination training, as the Mobat could help maintain a high level of discrimination performance.
3. Should a patient drink to legal intoxication, self use of the Mobat can provide a basis for the patient to decide whether or not to drive.
4. In some cases, simple awareness of one's intoxication level appears to be sufficient to moderate or prevent further alcohol consumption at that time.
5. To date, the use of testers in two cases have reflected individual differences in absorption or metabolism of ethyl alcohol that would not be expected from established norms.

Perhaps the most important value of the Mobat is that it can provide in-the-field corroboration of

patients' self-reports of drinking. Thus, the Mobat provides a means of obtaining treatment outcome information not subject to bias by the patient (for this purpose, the test should not be self-administered). For instance, as part of a treatment outcome evaluation study now in progress, follow-up interviews with patients also include, on randomly scheduled occasions, the administration of a Mobat. When the Mobat reading is positive, a field breath sample is then taken for laboratory analysis using a more costly and accurate tester (Model SM-7, Luckey Laboratories, Inc.). We have never found a false positive reading using the Mobat.

In conclusion, the Mobat is a multifunctional device. Its utility is three-fold: (1) it is a simple and rapid method of estimating blood alcohol concentration; (2) it can be an adjunct to the treatment of drinking problems; and (3) it can be used as a pretest in gathering objective treatment outcome information. Most importantly, these functions are available at a reasonable price.

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