

Adverse Childhood Experiences and Smoking Persistence in Adults with Smoking-Related Symptoms and Illness

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Abstract

Objectives: Little is known about why people continue to smoke after learning that they have diseases and conditions that contraindicate smoking. Using data from the Adverse Childhood Experiences (ACE) Study, we examined the relation between ACEs and smoking behavior when smoking-related illnesses or conditions are present, both with and without depression as a mediator.

Methods: Participants were more than 17,000 adult HMO members who retrospectively reported on eight categories of ACEs (emotional, physical, and sexual abuse; witnessing interparental violence; parental divorce; and growing up with a substance-abusing, mentally ill, or incarcerated household member). The number of maltreatment categories was summed to form an ordinal variable called the ACE Score. We measured current smoking, conditions that contraindicate smoking (heart disease, chronic lung disease, and diabetes), and symptoms of these illnesses (chronic bronchitis, chronic cough, and shortness of breath). Logistic regression models compared the ACE Score of smokers with smoking-related illnesses to participants who reported these illnesses but were not current smokers ($n = 7483$).

Results: Significant dose—response relations between the ACE Score and smoking persistence were found (odds ratio = 1.69; confidence interval = 1.34–2.13 for participants with ≥ 4 ACEs). Depression was a significant independent predictor of smoking persistence as well as a mediator. Depression only slightly attenuated the relation between the ACE Score and persistent smoking, however.

Conclusion: Medical practitioners should consider the maltreatment history and depression status of their patients when a smoking-related diagnosis fails to elicit smoking cessation. Programs should be developed that better address the underlying motivations for continuing to smoke in the face of health problems that contraindicate smoking.

Introduction

Although nicotine addiction is a *prima facie* reason for continued smoking, being diagnosed with a smoking-related illness or experiencing smoking-related symptoms are strong motivations for smoking cessation.^{1–3} Even so, practitioners encounter patients who continue to use tobacco despite having conditions that contraindicate smoking. Quit rates among those with cardiovascular disease do not exceed quit rates for the general population.⁴ Similarly, about one-third of patients with cancer continue to smoke after diagnosis.^{5,6} Understanding why some patients seem to have greater diffi-

culty quitting may improve the practice of medicine.

Some researchers refer to persistent smokers as “hard-core” smokers who may never attempt to quit, regardless of their health status.⁷ They have been found to be younger,^{8,9} less well educated,^{10,11} and from less-advantaged socioeconomic groups.^{12,13} In addition, having other smokers in the household,¹⁴ attributing one’s symptoms to aging rather than to smoking,¹⁵ and having weaker self-efficacy beliefs about one’s ability to quit¹⁶ are related to lower rates of smoking cessation. Thus, it appears that health beliefs and demographics, as well as the social environment, may interfere with stop-smoking messages.

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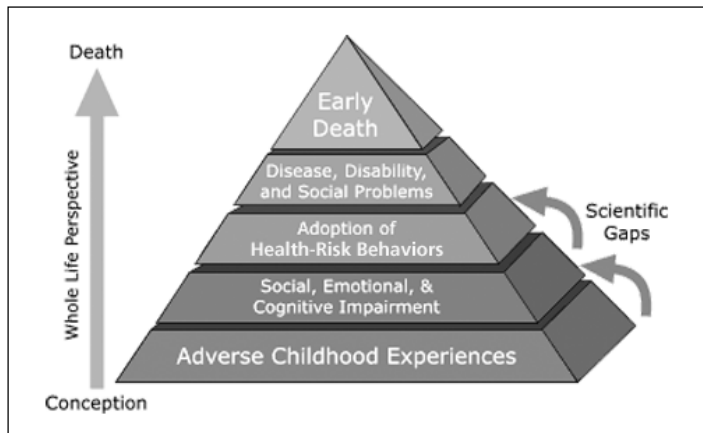


Figure 1. Adverse Childhood Experiences Study conceptual framework.

Reprinted from *The Adverse Childhood Experiences Study*. Centers for Disease Control 2006 Apr 27. Available from: www.cdc.gov/nccdphp/ace/pyramid.htm.

Mental illness is another potential barrier to smoking cessation. A recent study found that adults with psychiatric disorders are almost twice as likely as those without such disorders to be smokers.¹⁷ The interference of depression with quitting attempts has been well documented.¹⁸⁻²¹ Depressed smokers are more likely than nondepressed smokers to relapse.^{22,23} In addition, depression has been found to maximize withdrawal-related symptoms and discomfort.²⁴

Maltreatment in childhood may lead adults to adopt risky behaviors in a variety of domains, including smoking,²⁵ alcohol abuse,^{26,27} illicit drug use,^{28,29} and sexual behavior.^{30,31} Although child abuse has been shown to lead to higher rates of medical care use,^{32,33} survivors of abuse use preventive medical services such as Pap tests and other examinations less frequently.³⁴⁻³⁶ In addition, abuse survivors are less likely than adults who were not abused to follow medical regimens appropriately.^{37,38} Because a history of trauma is often antecedent to depression³⁹⁻⁴¹ and other forms of psychological impairment,⁴²⁻⁴⁴ we investigated whether continuing to smoke cigarettes despite the presence of illness or symptoms often caused by smoking or conditions that are exacerbated by smoking is associated with retrospective reports of childhood trauma.

Using data from the Adverse Childhood Experiences (ACE) Study, we hypothesized that people with smoking-related illness or symptoms who persist in smoking would be substantially more likely to report childhood trauma than people with the same illnesses who are not current smokers. Furthermore, we hypothesized that depression is both directly related to smoking persistence and that it reduces the strength of association

between ACEs and smoking persistence. Current thought in psychology links violence and other traumatic experiences in childhood to poorer socioemotional functioning and indeed to neurobiologic changes.^{45,46} The ACE Study was undertaken to assess how these experiences lead to the development of risk factors that in turn affect disease, disability, and early mortality. The conceptual framework of the study is depicted in Figure 1.

Methods

ACE Study participants were members of a large, metropolitan health maintenance organization (HMO) who were undergoing a comprehensive physical examination. A more detailed description of the ACE Study design and methods can be found elsewhere.⁴⁷ The ACE Study was approved by the institutional review boards of the Southern California Permanente Medical Group, Emory University, and the National Institutes of Health Office of Protection from Research Risks.

We mailed a questionnaire to HMO members asking for sensitive information on childhood abuse and family dysfunction, as well as current health behaviors related to smoking, alcohol, and exercise (the Family Health History) after they had undergone their clinical examination. Information on their present health status, including their experience of a wide range of chronic diseases and disease-related symptoms, was obtained from a separate self-report previously completed by each patient (the Health Appraisal Questionnaire). During two survey periods (August to March 1996 and June to October 1997), 18,175 of 26,824 patients returned a Family Health History, for a composite response rate of 68%. Bias due to nonresponse was explored in the first survey wave⁴⁸ and did not negatively impact the study's validity. We eliminated data for 280 respondents who did not provide complete demographic information and purged the second response data set for an additional 658 study subjects who participated in both survey waves. The analysis sample was a subset from this pool of 17,337 unique observations with complete demographic information and consisted of only those respondents who reported at least one of the ten smoking-related diseases or symptoms described in more detail below ($n = 7483$).

Definition of Persistent Smoking

We obtained current smoking status by asking, "Do you smoke cigarettes now?" (with the response being yes or no), and we determined the number of cigarettes smoked per day by asking, "If 'yes,' on average,

Maltreatment in childhood may lead adults to adopt risky behaviors in a variety of domains ...

Questions asked of respondent	N (%) ^a		
	Men	Women	Total
Have you ever been told you have asthma? ^b	701 (8.8)	1079 (11.6)	1780 (10.3)
Have you ever been told you have <i>chronic</i> bronchitis or emphysema? ^c	324 (4.6)	457 (5.5)	781 (5.0)
Do you have a frequent cough for any reason? ^b	824 (10.4)	1217 (13.1)	2041 (11.9)
Do you have shortness of breath?	1180 (15.1)	1767 (19.2)	2947 (17.3)
Have you ever had lung cancer?	24 (0.3)	22 (0.2)	46 (0.3)
Have you ever had or ever been told you had high blood pressure? ^b	2335 (29.6)	2328 (25.0)	4663 (27.1)
Have you ever had or ever been told you had a heart attack (coronary)? ^b	374 (4.7)	100 (1.1)	474 (2.8)
Have you had or ever been told you had to take medicine to lower your cholesterol? ^b	866 (11.0)	596 (6.4)	1462 (8.5)
Have you ever had a stroke or a “small stroke”?	271 (3.4)	246 (2.7)	517 (3.0)
Has a doctor ever treated you for or said you had diabetes? ^a	421 (5.3)	361 (3.9)	782 (4.5)

^aTotal N value for each question varies due to missing responses.

^bp < .005.

^cp < .01.

about how many cigarettes a day do you smoke?” Persistent smokers were defined as those participants who indicated that they were current smokers *and* who self-identified as having at least one of ten diseases or symptoms that are exacerbated by smoking. Seven of the ten are directly related to or often caused by smoking: chronic bronchitis or emphysema, asthma or wheezing, chronic cough, shortness of breath, heart attack, lung cancer, or stroke. The remaining three conditions are contraindications to smoking rather than illnesses that are a result of smoking per se: diabetes mellitus, high blood pressure, and currently taking cholesterol-lowering medication. The exact questions used to elicit the presence or absence of these diseases and conditions are listed in Table 1.

Adverse Childhood Experiences

The Family Health History asked respondents about a variety of experiences in two broad domains: child abuse and family dysfunction. Specifically, we asked participants whether they had experienced physical, sexual, or emotional abuse; if they had witnessed interparental violence; whether their parents had separated or divorced; whether they had grown up with drug- or alcohol-abusing family members; had a family member go to prison; or had a family member who was mentally ill. In Table 2, we list the questions used to measure each of the eight domains and the response necessary to meet criterion for that category. Respondents who did not report an ACE were considered not to have had that experience. This most likely biases our results toward the null, by potentially misclassifying those who may have been exposed to an ACE as unexposed.

Because these experiences tend to cluster rather than to occur independently,^{49,50} we summed the number of

ACEs that each person reported (range, 0 to 8) to form an ordinal variable referred to here as the ACE Score. We combined the upper end of the distribution to ensure adequate group size so that the ACE Score contained five levels (0, 1, 2, 3, and ≥ 4).

Depression

Because of the known association between depression and smoking, we investigated whether depression would mediate the relation between ACEs and smoking persistence. Respondents were considered depressed if they answered affirmatively to the question “Have you ever had or do you now have depression or feel ‘down in the dumps’?”

Statistical Analysis

We used the Statistical Package for the Social Sciences (SPSS; Chicago, IL) for all analyses. Logistic regression was used to compute adjusted odds ratios (ORs) and 95% confidence intervals (CIs) to assess the association between ACEs and smoking among people with a smoking-related illness or condition. We tested for trend in the ORs by using the summed ACE Score as an ordinal variable with five levels (0, 1, 2, 3, and ≥ 4 ACEs). We also modeled the relation of depression to persistent smoking, and then constructed a model including both the ACE Score and presence or history of depression to test for mediation. An analysis of variance was calculated using the ACE Score as a predictor, and the number of reported smoking-related symptoms or illnesses as the dependent measure.

Results

The ACE Study sample was composed of 9367 women (54%) and 7970 men (46%) with a mean age of 54.8

Persistent smokers were defined as those participants who indicated that they were current smokers *and* who self-identified as having at least one of ten diseases or symptoms that are exacerbated by smoking.

years (standard deviation [SD] = 15.7) among women and 57.5 years (SD = 14.6) among men. More than three-quarters of the participants (78.5% of the women and 81.6% of the men) described themselves as white; 34.5% of women and 45% of men were college graduates; another 37.5% of the women and 34% of the men had some college education.

The current smoking prevalence was 8.8%; men were slightly but not significantly more likely to be current smokers than were women (9.1% vs 8.6%, $\chi^2 [1, 17, 160] = 1.47$, not significant). On average, smokers smoked 15 cigarettes per day (SD = 10.3). Of the 1518 current smokers in the sample, 51.2% (776) reported one or more of the tobacco-related illnesses or symptoms.

Table 1 lists the prevalence of each of the selected disease conditions and symptoms by sex, of which one or more were reported by 43.6% (7554) of the sample. The most frequently reported condition was high blood pressure, reported by >27% of the sample. Lung cancer was the rarest condition reported, having an overall prevalence of 0.3%.

ACEs were common among participants (Table 3). Only 36.1% of individuals reported no ACEs. In contrast, 37.9% of all respondents reported ≥ 2 ACEs. For all ACEs except physical abuse, female respondents reported significantly higher prevalences than did men.

To examine the relation between ACEs and smoking persistence, we performed a series of analyses among

Table 2. ACE questions and response categories				
ACE category	Question		Response options	Criterion
Physical abuse	Did a parent or other adult in the household:	Push, grab, shove, or slap you?	Never, once or twice, sometimes, often, very often	Sometimes or often
		Hit you so hard that you had marks or were injured?	Never, once or twice, sometimes, often, very often	Once or twice
Psychological abuse	Did a parent or other adult in the household ever:	Swear at, insult, or put you down?	Never, once or twice, sometimes, often, very often	Often
		Act in a way that made you afraid you would be physically hurt?	Never, once or twice, sometimes, often, very often	Often
Sexual abuse	Did an adult five years older than you:	Touch or fondle you in a sexual way?	Yes/no	Yes
		Have you touch his/her body in a sexual way?	Yes/no	Yes
		Attempt intercourse (oral, vaginal, or anal) with you?	Yes/no	Yes
		Have intercourse (oral, vaginal, or anal) with you?	Yes/no	Yes
Witnessing maternal battering	Did your father or stepfather or mother's boyfriend ever:	Push, grab, slap, or throw something at your mother or step mother?	Never, once or twice, sometimes, often, very often	Sometimes or often
		Kick, bite, or hit her with a fist or something hard?	Never, once or twice, sometimes, often, very often	Sometimes or often
		Repeatedly hit her over at least a few minutes?	Never, once or twice, sometimes, often, very often	Once or twice
		Threaten or hurt her with a knife or gun?	Never, once or twice, sometimes, often, very often	Once or twice
Household mental illness	Was someone in your household:	Depressed or mentally ill?	Yes/no	Yes
		Did someone in your household attempt suicide?	Yes/no	Yes
Household substance abuse	Was someone in your household:	A problem drinker or alcoholic?	Yes/no	Yes
		Did you live with anyone who used street drugs?	Yes/no	Yes
Household criminal activity		Did a household member ever go to prison?	Yes/no	Yes
Parental divorce or separation		Were your parents ever divorced or separated?	Yes/no	Yes

ACE = adverse childhood experience.

those participants who reported any of the diseases or symptoms listed in Table 1 and whose smoking status we knew ($n = 7483$). Within this group, the smoking prevalence was somewhat higher ($n = 776$; 10.4%) than in the total ACE sample. In addition, respondents in this group were significantly more likely to report physical, sexual, or emotional abuse (29.2% vs 27.0%, $\chi^2 [1, 14,643] = 3.97$; 21.7% vs 19.6%, $\chi^2 [1, 14,643] = 9.72$; and 11.3% vs 9.8%, $\chi^2 [1, 14,643] = 9.38$, respectively) at the .05 level. However, they did not report statistically higher prevalences of the other ACEs.

We first constructed a logistic model with the ACE Score as an ordinal predictor, adjusting for sex and age (Table 4) and current smoking as the dependent variable. The ORs and 95% CI for smoking are displayed in Table 3, under the "Separate Model" heading. The overall test for trend was significant ($p < .001$). Strong, graded relations were found between the ACE Score and the likelihood of continuing to smoke despite having health problems that contraindicated smoking. The adjusted likelihood of being a current, persistent smoker rose from 1.08 in individuals reporting one ACE to 1.69 in individuals reporting ≥ 4 ACEs. The prevalence of persistent smoking rose in a dose-response fashion as the number of reported ACEs increased, rising from 7.8% in participants with no ACEs to 16.6% in those reporting ≥ 4 ACEs.

Next, we tested the relation between past or current depression and persistent smoking among those with smoking-related diseases and conditions. The adjusted odds ratio (OR) is also shown in Table 4 in the column labeled "Separate Model." Those who reported past or current depressed affect were 1.59 times more likely to be persistent smokers than those who did not affirm past or current depression ($p < .001$).

Finally, we constructed a model with both the ACE Score and past or current depression as predictors. These results are shown in Table 4 under the column labeled "Single Model." The χ -square value for the difference in the log likelihood ratios between the two models was significant ($\chi^2 = 86.71$, degrees of freedom = 1; $p < .001$); however, the addition of this variable only slightly attenuated the relation between the ACE Score and the odds of persistent smoking.

We also examined the ACE Score as a predictor of the number of smoking-related diseases and symptoms reported among smokers. We performed an analysis of variance with the number of smoking-related symptoms and diseases as the dependent variable (range, 0 to 10), controlling for age and sex. The ACE Score was statistically significant ($F [1, 4] = 4.79$; $p < .001$). A similar dose-response pattern of results

was noted, wherein the average number of smoking-related symptoms and diseases increased as the number of reported ACEs rose (Figure 2).

Discussion

Earlier research has demonstrated that childhood abuse is related to smoking initiation.^{25,51-52} Our research suggests that ACEs may play a role in the *maintenance* of smoking behavior in the presence of illness and poor health. These results extend our understanding of the impact of child maltreatment on adult health behavior. Furthermore, the association of ACEs with smoking persistence was sustained even after accounting for the presence of past or current depression, a condition that other researchers have related to continued smoking among patients with diabetes^{53,54} and patients with heart disease.^{55,56} Although we cannot

Strong, graded relations were found between the ACE Score and the likelihood of continuing to smoke ...

Table 3. Prevalence of individual ACEs and ACE score by sex

ACE	N (%)		
	Men	Women	Total
Parental separation or divorce	1738 (21.8)	2293 (24.5)	4031 (23.3)
Household substance abuse	1896 (23.8)	2759 (29.5)	4655 (26.9)
Household mental illness/suicide	1179 (14.9)	2180 (23.3)	3359 (19.4)
Mother/stepmother treated violently	920 (11.2)	1281 (13.7)	2201 (12.7)
Family member went to prison	324 (4.1)	485 (5.2)	809 (4.7)
Psychological abuse	602 (7.6)	1227 (13.7)	1829 (10.5)
Physical abuse	2382 (29.9)	2530 (27.0)	4912 (28.3)
Sexual abuse	1276 (16.0)	2310 (24.7)	3586 (20.7)
ACE score			
0	3027 (38.0)	3228 (34.5)	6255 (36.1)
1	2221 (27.9)	2293 (24.5)	4514 (26.0)
2	1308 (16.4)	1450 (15.5)	2758 (15.9)
3	682 (8.6)	968 (10.3)	1650 (9.5)
≥ 4	732 (9.2)	1428 (15.2)	2160 (12.5)

ACE = adverse childhood experience.

Table 4. ACEs and the prevalence and risk^a (adjusted OR) of smoking among adults with smoking-related diseases or symptoms

Predictor	Prevalence (%)	Separate model adjusted OR (CI)	Single model adjusted OR (CI)
ACE score			
0 (referent)	211 (7.8)	1.00	1.00
1	175 (9.1)	1.08 (0.89–1.36)	1.05 (0.85–1.31)
2	129 (10.9)	1.26 (1.00–1.60)	1.19 (0.93–1.50)
3	103 (14.3)	1.61 (1.24–2.10)	1.49 (1.15–1.93)
≥ 4	158 (16.6)	1.69 (1.34–2.13)	1.52 (1.19–1.92)
Past or current depression			
No (referent)	429 (8.5)	1.00	1.00
Yes	337 (14.3)	1.59 (1.36–1.87)	1.49 (1.27–1.76)

ACE = adverse childhood experience; CI = confidence interval; OR = odds ratio.

^aAdjusted for age and sex.

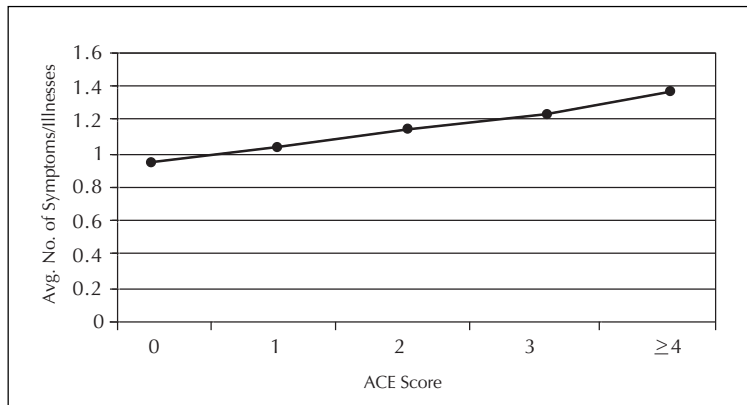


Figure 2. Average number of diseases/symptoms by adverse childhood experiences score (ACE), adjusted for age and sex.

rule out genetic influences on smoking persistence, earlier research with the ACE Study sample indicated that parental smoking had no impact on the association between ACEs and smoking initiation in the overall ACE sample.²⁵

Despite the cross-sectional nature of these findings, it is evident that ACEs play a role in the development of health risk behaviors. The psychoactive properties of nicotine and other addictive substances may temporarily ameliorate negative affective states and thereby serve an adaptive function in coping with the aftermath of childhood trauma, regardless of the health risk involved.⁵⁷ Certain psychological outcomes associated with childhood maltreatment, such as poor self-esteem,^{58,59} low self-efficacy,^{60,61} and an external locus of control,^{62,63} may be mechanisms by which these early negative experiences result in maladaptive patterns of health behavior later in life.

The smoking prevalence of 8.8% in this sample was far below the current US prevalence of 22.5% in 2002.⁶⁴ Possible explanations for this include the average age, educational attainment, and geographic location of the sample. Therefore, even though the number of persistent smokers in this sample was small, if we extrapolate these findings to the overall US population, the implications are substantial and indeed disturbing. More than 50% of current smokers in our study reported one or more conditions or symptoms that contraindicated smoking, a result that clinicians as well as smokers should keep in mind. Smoking cessation is the best treatment for reducing mortality among patients with heart disease⁶⁵ and is associated with improved health among patients with other chronic conditions. Our study indicates that many

current smokers are damaging their health by continuing to smoke, and for many, the current smoking-cessation strategies available are no doubt insufficient.

Limitations on these findings must be pointed out. We could not verify that the ACEs reported by participants actually occurred, because they were retrospectively assessed. However, the prevalence of each of the individual ACEs obtained here is similar to that obtained in other large samples with nonclinical populations.^{66,67} In addition, we relied on self-reports for smoking status as well as symptoms and disease conditions; however, the accuracy of this type of data has been established.⁶⁸⁻⁷⁰ Because our measure of smoking did not allow us to compute pack-years (= 20 cigarettes per day, per year), we could not determine smoking history, only current smoking levels. Furthermore, we were unable to determine when an individual quit smoking and whether the timing of their smoking cessation was in some way linked to a smoking-related diagnosis. Finally, our depression measure consisted of a single dichotomous question and cannot be considered a clinical diagnosis. However, sensitivity analyses performed by Dube et al⁷¹ indicated that this item achieved acceptable levels of sensitivity, specificity, and positive predictive value (83%, 60%, and 87%, respectively) when compared with a screening tool developed by the Rand Corporation⁷² to test for lifetime prevalence of major depression or dysthymia.

Current thinking on further reducing smoking rates includes acknowledgement of the need to better tailor smoking-cessation programs to the needs of the remaining smokers who have not yet been reached by traditional stop-smoking messages.^{22,73} Our findings suggest that practitioners may need to consider the abuse history and presence of depression in patients who persist in smoking despite having conditions that contraindicate smoking, when traditional smoking-cessation programs prove ineffective. Programs that address the underlying emotional problems caused by childhood maltreatment may prove more useful than traditional cessation strategies in reaching this difficult-to-treat population. To this end, we believe that universal screening for a history of ACEs as well as for depression should be part of a comprehensive medical record. Available evidence indicates that patients are comfortable with screening for childhood abuse^{74,75} and believe that physicians can assist them in dealing with issues arising from early maltreatment. Addressing the underlying motivations for continued smoking in the face of adverse health consequences may lead to further reductions in smoking-related illness. ❖

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The findings and conclusion in this article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention or of the Kaiser Permanente Medical Care Program.

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The Essential of Medical Practice

The real work of a doctor is only faintly realized by many lay people.

It is not an affair of health centres, or public clinics, of operating theatres, of laboratories, or hospital beds. These techniques have their place in medicine but they are not medicine. The essential unit of medical practice is the occasion when, in the intimacy of the consulting room or sick room, a person who is ill, or believes himself to be ill, seeks the advice of a doctor whom he trusts. This is a consultation and all else in the practice of medicine derives from it. The purpose of a consultation is that the doctor, having gathered his evidence, shall give explanation and advice. ... but the purpose of the consultation is not the diagnosis or the technical treatment, it is the explanation and advice, with the diagnosis acting as a means to those ends.

— Sir James Spence, MD, 1892-1954, British medical philosopher, founder of the Newcastle Babies' Hospital and developer of social pediatrics.