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Networked for change? identifying obstetric opinion leaders and assessing their opinions on caesarean delivery

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Abstract

The objective was to determine whether obstetric opinion leaders can be identified and to characterize them in terms of their demographic and professional characteristics and their attitudes toward caesarean delivery. In late 1998, we surveyed 527 obstetricians, 138 family physicians, and 80 certified nurse midwives (overall response rate, 57.8%) practicing in a stratified random sample of California hospitals with at least 1000 annual deliveries ($n = 52$). Participants reported on demographic and professional characteristics and attitudes towards caesarean delivery; they also checked off those hospital colleagues from whom they had sought or would seek advice on labour and delivery. A composite measure of nomination frequency was used to characterize each respondent's degree of "opinion leadership". All analyses were corrected for the complex survey design. Using a nomination cutoff of 0.4 (0–1 scale), opinion leaders were identified in 31% of California hospitals; they were identified in 81% of hospitals using a cutoff of 0.2. Compared with their peers in the lowest fifth of the nomination distribution, clinicians in the top fifth were younger and more likely to be male, to speak English as a first language, to practice obstetrics, to have a maternal–foetal medicine subspecialty, and to practice in higher volume hospitals ($p < 0.05$). Regardless of discipline, opinion leaders held attitudes concordant with reducing the caesarean delivery rate more often than non-opinion leaders. However, only 48% of obstetrical opinion leaders would support reducing the caesarean delivery rate to levels targeted by Healthy People 2000. In conclusion, obstetric opinion leaders could be identified in many California hospitals. However, they did not consistently support policies designed to reduce the caesarean delivery rate. The results have implications for the generalizability of opinion leader strategies.

Keywords: USA; Caesarean section; Obstetricians; Opinion leaders

Introduction

Physicians are intimately involved in nearly every aspect of medical decision making. Yet considerable evidence suggests that their decisions are not always evidence based, patient-centred, or cost-effective (Nordin-Johansson & Asplund, 2000; Little et al., 2001; Chapman, Stone, Sandberg, Bell, & Neumann, 2000). Getting physicians to alter their practices could have substantial impact on health care quality and costs. However, the usual approaches to changing physician behaviour have shortcomings. Financial incentives are

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effective but blunt, and they tend to encourage changes in volume of care but not necessarily appropriateness or quality (Rogers et al., 1990). Traditional forms of continuing medical education have been disappointing (Davis et al., 1999). Practice guidelines are often ignored (Lomas, 1991). Reminders, audit and feedback, and computerized decision aids have proven useful in some settings but not in others (Thomson O'Brien et al., 2000a; Oxman, Thomson, Davis, & Haynes, 1995). The search continues for ways to improve physician practice at a reasonable cost.

One promising approach to changing physician behaviour is the use of local clinical opinion leaders. According to one definition, opinion leaders are health professionals nominated by their colleagues as "educationally influential" (Hiss, MacDonald, & David, 1978). Their utility as change agents is predicted by social influence theory, which posits that clinicians may be "influenced significantly by colleagues' judgements of the value and significance of [an intervention] and/or by their decisions to use or ignore it" (Mittman, Tonesk, & Jacobson, 1992). In practice, however, use of local opinion leaders has not been uniformly effective: the most comprehensive review to date found that the results were statistically significant and clinically important in only 2 of 8 clinical trials (Thomson O'Brien et al., 2000b).

Locock, Dopson, Chambers, and Gabbay (2001) recently adduced two possible reasons for these mixed results. First, opinion leaders may be difficult to identify, in part because they are not all cut from the same cloth. Some opinion leaders (e.g., "acknowledged experts") may be more valuable during the introduction of an innovation, whereas others (e.g., "respected peers") may be more important during the implementation and consolidation phase. Second, opinion leaders may not always support a practice change or innovation and may in fact be hostile to it. Thus, in attempting to discern whether opinion leaders might successfully influence practice in their clinical communities, it is important to know something of their attitudes and opinions.

Obstetric care is a rich area for investigation of the role of opinion leaders. During the late 1980s, a number of professional organizations, consumer groups, health plans, and the federal government launched initiatives designed to combat what was then termed an "epidemic" of caesarean delivery in the United States. Caesarean rates declined in the early 1990s but have again risen steadily since 1997—a trend that is international in scope (Leung, Lam, Thach, Wan, & Ho, 2001; Murray & Serani Pradenas, 1997). Although the clinical issues are controversial, many experts believe that the current US caesarean section rate of 24% could be safely reduced. Decisions about mode of delivery are known to be influenced by social as well as clinical factors (Hurst & Summey, 1984). The organization of obstetric practice in the United States is such that obstetrical clinicians (including obstetricians, family physicians, and nurse midwives) are likely to encounter one another in the hospital, providing ample opportunity for clinical interaction and mutual influence during rounds, conferences, consultations and informal meetings.

Previous studies and case reports have relied primarily on informal methods to identify opinion leaders. For example, in a trial of educational visits to enhance use of systematic reviews in obstetric units, the investigators visited the "lead obstetrician and midwife on the labour ward... because they had usually been nominated to hold these positions by peers as being the most involved in labour ward management, policy making, and training" (Wyatt et al., 1998). In a trial of education and opinion leaders to improve adherence to dementia guidelines, another research group asked neurologists to list up to three local colleagues who were knowledgeable, compassionate, and skilled as teachers (Gifford et al., 1999; Holloway, Gifford, Frankel, & Vickrey, 1999). The neurologists most frequently mentioned in a given region were asked to serve as project opinion leaders.

Sociometry is the use of quantitative approaches to describe relationships within social networks. We employed sociometric techniques to identify local obstetrical opinion leaders in 52 California hospitals. In so doing, we asked three research questions. First, can opinion leaders be identified? If networks of obstetrical providers are so diffuse that clinicians with disproportionate influence cannot be identified in most hospitals, then the generalizability of the opinion-leader approach must be questioned.

Second, what demographic and professional characteristics are associated with high opinion-leader status? We expected that obstetrical opinion leaders would be distinguished by personal and professional characteristics traditionally associated with higher professional status such as (middle) age, (male) gender, and advanced clinical training (i.e., subspecialization). Confirmation of these relationships would support the validity of sociometric methods for identifying opinion leaders. In addition, finding strong associations between clinicians' outward characteristics and opinion leader status might facilitate efficient searches for opinion leaders in future projects aimed at changing clinician behaviour.

Our third research question was how do the attitudes, beliefs, and opinions of obstetrical opinion leaders differ (if at all) from those of their sociometrically less-esteemed colleagues? Even if obstetrical opinion leaders are identifiable in most hospitals, they will not be useful allies for reducing the current caesarean delivery rate safely and appropriately unless they are positively inclined to do so or can be so persuaded (Coleman, Katz, & Menzel, 1957; Coleman et al., 1957).

Methods

Sampling of hospitals

Using data available from the California Office of Statewide Health Planning and Development (OSHPD), we identified 194 California hospitals where at least 1000 infants were delivered in 1995. The sampling frame was limited to these hospitals because hospitals with very low obstetrical volumes were unlikely to have sufficient obstetrical providers for meaningful network analysis.

The 194 hospitals with at least 1000 deliveries in 1995 accounted for 88.7% of all deliveries in California in that year. We divided the 194 hospitals into 4 strata and randomly selected 52 hospitals for possible inclusion in the study: (1) 12 of the 47 with at least 3000 deliveries; (2) 14 of the 58 with 2000–2999 deliveries; (3) 4 of the 6 with 1000–1999 deliveries and a caesarean delivery rate exceeding 30%; and (4) 22 of the 83 with 1000–1999 deliveries and a caesarean delivery rate of 30% or less. All hospitals with more than 3000 annual deliveries had a caesarean rate of less than 30%, as did 56 of 58 hospitals with 2000–2999 deliveries.

In conjunction with OSHPD, we sent letters to the medical staff offices of sampled hospitals, requesting that they provide the research team with the names, addresses, and phone numbers of all obstetricians, family physicians, and certified nurse midwives with obstetrical privileges at their facility. After a follow-up phone call, hospital response rates among the high, medium, and low volume hospitals were 79%, 83%, and 75%, respectively. We replaced each non-responding hospital with another hospital selected at random from the same stratum, repeating the process until sampling quotas (detailed above) were met.

Survey implementation

Using names and addresses obtained from study hospitals, we mailed surveys to potential study clinicians in early summer, 1998. Cover letters were prepared on letterhead supplied by the California Chapter of the American College of Obstetricians and Gynecologists (Cal-ACOG), the California Academy of Family Physicians, and the California Nurse-Midwives Association. Each survey packet included a copy of the questionnaire, a cover letter, and in the case of family physicians and nurse midwives, a $5 cash payment. (Cash payments were not provided to obstetricians on the advice of Cal-ACOG). Non-respondents received follow-up mailings (including an additional copy of the questionnaire) approximately 4 and 8 weeks after the first mailing. In Fall, 1998, we made telephone calls to the offices of all clinicians not responding to one of the three mailings to encourage completion of the survey. The entire protocol was approved by the appropriate human subjects committees at the University of California, Davis, and the California Health and Welfare Agency.

Survey measures

Participants were asked to provide demographic and professional information including year of birth, year of medical school graduation, gender, race/ethnicity, first language, and primary practice setting (solo, single-specialty group, multispecialty group, staff/group model HMO, university, other). They were also asked to identify themselves as obstetricians, family physicians, or certified nurse midwives and to estimate the number of deliveries and caesarean sections performed during the past month and the percentage of deliveries they considered "high risk". (Nurse midwives do not perform caesarean deliveries and were therefore skipped out of this question.) We estimated the proportion of deliveries performed via caesarean section by dividing the number of "deliveries you performed or supervised during your most recent month of uninterrupted professional practice" into the "number of [these] deliveries that were caesarean sections".

Attitudes towards caesarean delivery were assessed with an 8-item Caesarean Opinion Scale. Items tapped respondents' views of the current caesarean rate (e.g., "Reducing caesarean section rates tends to improve patient care.") and their attitudes towards public health initiatives aimed at encouraging vaginal delivery (e.g., "I would support efforts to decrease the caesarean delivery rate in California to 15%."). Items were modified from previous studies (Sonnad, Moyer, & Bernstein, 2000; Kahn KL, personal communication) and consisted of a statement followed by a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Three items had reverse polarity; their scores were subtracted from 6 to generate an 8-item internally reliable scale (Cronbach's alpha = 0.87; range of item-scale correlations, 0.49–0.78). Higher scores on this scale represent a more favourable attitude toward efforts to reduce the current caesarean delivery rate. All items included in the scale are listed in the appendix.

Participants were provided with a printed list of all the obstetricians, obstetrically active family physicians, and certified nurse midwives at the index hospital. (The "index hospital" is the hospital from which we obtained the clinician's name.) The 52 lists (one for each hospital) contained between 4 and 132 names (median 22). Beside each name, study subjects were asked to check a box in response to the following questions:

- Have you sought advice on labour and delivery from this person in the past 3 months?
- Would you turn to this person for labour and delivery advice in the future?
- Would you go out your way to obtain this person's advice?

The "future advice" item was included to measure behavioural intentions, which have been shown to complement measures of past behaviour in predicting future conduct (Fishbein & Ajzen, 1975). Respondents could also write in the names of clinicians not appearing on the printed list. A sample of the questionnaire is available from the corresponding author on request.

Measurement of opinion leader status. For each respondent we created three sets of nomination scores, each reflecting the number of times the respondent was checked off by his or her colleagues in response to the questions described above (Faust, 1997; Scott, 2000; Wasserman & Faust, 1994).[1] Respondents were allowed to nominate persons outside their profession or specialty (e.g., nurse midwives could nominate obstetricians and vice-versa.). To adjust for hospital size, each nomination score was normalized by dividing the number of nominations received by the total possible number of nominations (equal to the number of responding clinicians in a given hospital, minus 1). Normalized nomination scores could range from 0 to 1, with 0.5 indicating that the respondent was nominated by exactly half of his or her (responding) colleagues.

Fig. 1 depicts data from one hospital. Of 30 responding clinicians, 9 selected clinician #40 (who did not respond to the survey) as someone who they had gone to in the past for labour and delivery advice. The normalized nomination-past score for Clinician #40 is calculated as $9/(30-1)=0.310$.

The three nomination scores (past, future, and out-of-way) were highly correlated (average inter-item correlation = 0.83, Cronbach alpha = 0.94) and so were averaged into a single composite nomination score. This composite had mean 0.11, median 0.059, minimum 0, maximum 0.74, and standard deviation 0.12. To deal with the non-normality of this key measure, clinicians were ranked according to the composite nomination score and divided into fifths. For analyses based on the assumption of multivariate normality, we used the square root of the composite measure, which had better statistical properties than the untransformed measure (namely, mean 0.24, median 0.27, standard deviation 0.18).

Statistical analysis

All analyses were adjusted for the complex sampling design and for survey non-response using the appropriate procedures ("svy") in Stata 6.0 (StataCorp, 1999). Results were weighted to account for different sampling and response probabilities. Standard errors and associated *p*-values and 95% confidence limits were corrected for clustering of physicians by hospital.

[1] Nomination score is known to network analysts as "indegree" or "indegree centrality", which refers to the number of input nodes to each node of a network.

Independent associations between clinicians' personal and professional characteristics and opinion leader status (as measured by the composite nomination score) were assessed using design-corrected multinominal logistic regression. This approach gives the relative risk of being in opinion leader groups 2, 3, 4, or 5 (equal fifths with successively higher nomination scores) relative to group 1 (lowest nomination score) for clinicians with a given characteristic compared to a reference group. Unlike multiple linear regression, multinominal (polytomous) logistic regression is not bound by assumptions about linearity, and it preserves more information than dichotomous logistic regression. The exponentiated coefficients are not odds ratios but rather relative risk ratios (StataCorp, 1999).

Weighted estimates of the percentage of obstetricians and of "other clinicians" who agreed with each of the 8 opinion statements were generated for the five ordered opinion leader groups (defined by quintiles). (Family physicians were grouped with nurse midwives because their attitudes were similar.) Because preliminary graphical analysis showed that the proportion in agreement tended to rise with ascending opinion leadership quintile, we tested the significance of the association between opinion leader status (within specialty) and opinions by regressing the mean scale score for the opinion items on the square root of the composite nomination score. Similar methods were used to assess the overall relationship between opinion leadership and mean Caesarean Opinion Scale score. We also used design-corrected multiple linear regression to assess predictors of obstetricians' self-reported caesarean delivery rates (Eltinge & Scribney, 1996).

Response rates

After 3 mailings and a phone call, the overall adjusted survey response rate was 57.8%. The adjusted rate was calculated as the number of useable responses ($n = 745$) divided by the number of subjects on the mailing list (less the number moved, no longer in obstetrical practice, or dead). Response rates at individual hospitals ranged from 42% to 87%. By comparison, in a recent review of 321 surveys published in medical journals, the mean overall response rate for physician surveys was 54% (Asch, Jedrziewski, & Christakis, 1997).

3. Results

3.1. Respondent characteristics

Seventy-one percent of respondents were obstetrician–gynecologists, 19% were family physicians, and 11%

were certified nurse midwives (Table 1). The mean age was 48 years; 35% were female and 29% were non-white. About 19% were not native speakers of English (data not shown in table). A majority (60%) reported working in solo or single-specialty group practice. The average respondent delivered 16 infants per month, of whom 20% were "high risk". Among obstetricians and family physicians, the average proportion of infants delivered by caesarean section was 20% and 13%, respectively (Table 1). The median composite nomination scores were 0.072 for obstetricians, 0.022 for family physicians, and 0.078 for nurse midwives (Table 1); scores at the 95th percentile were 0.394, 0.120, and 0.305, respectively (data not shown in table).

Identifiability of opinion leaders within hospitals

To determine which of our 52 hospitals had identifiable opinion leaders, we selected two arbitrary composite nomination score cut-offs: 0.20 and 0.40. These scores are equivalent to receiving nominations from 20% and 40%, respectively, of participating peers. In studies of organizations, normalized nomination scores rarely rise much above 0.5. Twenty percent is taken to mean substantial peer respect/support and 40% is taken to imply decisive support. Using the 0.20 cut-off, more than four-fifths of hospitals (including 11 of 12 high obstetrical volume hospitals) had at least one identifiable opinion leader (Table 2). Using the more stringent 0.40

Table 1
Demographic and professional characteristics of respondents to a survey of all obstetric providers at 52 randomly selected California hospitals

Characteristic	All respondents	Obstetrician–gynecologists	Family physicians	Certified Nurse Midwives
	$N = 745$ (100%)	$N = 527$ (70.9%)	$N = 138$ (18.6%)	$N = 80$ (10.5%)
Age, mean years (SE)	47.8 (0.45)	48.8 (0.49)	43.0 (0.65)	45.8 (1.1)
Female (percent)	34.8	29.4	33.2	97.6
Ethnicity (percent)				
White, not Hispanic	70.6	68.6	73.6	86.8
Black, not Hispanic	4.6	4.9	3.5	2.7
Hispanic	6.3	5.7	9.4	7.2
Asian or Pacific Islander	14.4	16.4	9.6	2.3
Other	4.1	4.4	4.0	1.1
Practice setting (percent)				
Solo	34.1	39.6	18.3	3.7
Single-specialty group	25.6	23.9	31.9	31.7
Multispecialty group	13.5	12.4	23.3	6.4
Staff or group model HMO	15.0	15.0	4.3	36.9
Academic	7.1	6.3	12.6	4.9
Other	4.7	2.8	9.6	16.4
Maternal–fetal medicine/peri-natology subspecialty (percent)	—	7.6	—	—
Number of deliveries per month, mean (SE)	15.9 (0.96)	18.1 (0.99)	4.5 (0.52)	14.6 (2.34)
Estimated percentage of deliveries considered "high-risk", mean (SE)	20.0 (1.47)	22.7 (1.62)	9.56 (2.24)	10.2 (3.56)
Number of cesarean sections per month, mean (SE)	—	3.74 (0.22)	0.67 (0.12)	—
Percentage of infants delivered by cesarean section (mean %)[a]	—	20.3 (0.61)	13.3 (1.98)	—
Sociometric measures				
Normalized nomination score—"past," mean (SE)	0.106 (0.012)	0.117 (0.015)	0.042 (0.015)	0.097 (0.018)
Normalized nomination score—"future," mean (SE)	0.131 (0.013)	0.143 (0.16)	0.059 (0.015)	0.130 (0.02)
Normalized nomination score—"out of way," mean (SE)	0.092 (0.010)	0.104 (0.013)	0.037 (0.016)	0.068 (0.013)
Composite nomination score, median	0.059	0.072	0.022	0.078

[a]Number of estimated cesarean deliveries past month divided by number of estimated total deliveries × 100.

Table 2
Hospitals with at least one identifiable opinion leader using different cut-points

Hospital volume category	Number of hospitals in category	Number of survey participants[a]	Number of hospitals (percent) with at least one opinion leader using two different cutoffs	
			Nomination score cutoff $\geqslant 0.20$	Nomination score cutoff $\geqslant 0.40$
High volume (greater than 3000 annual deliveries)	12	261	11 (91.7%)	4 (33.0%)
Medium volume (2000–2999)	14	237	9 (64.3%)	5 (35.7%)
Low volume (1000–1999)	36	272	23 (88.5%)	8 (30.8%)
Total	52	770	81.1%[b]	31.1%[b]

[a] Includes 25 individuals who provided demographic and practice information but did not complete the sociometric portion of the questionnaire.
[b] Weighted average.

criterion, the proportion was much lower (just above 30%) but quite consistent across hospital strata (Table 2).

Factors associated with opinion leadership status

Using design-corrected multinominal logistic regression, we assessed the relationship between opinion leadership status and: (a) clinical discipline (obstetrics, family medicine, midwifery), (b) gender, (c) ethnicity, (d) first language, (e) years in practice, (f) subspecialization, (g) personal delivery volume, and (h) hospital delivery volume. Compared with clinicians in the lowest of the 5 opinion leader groupings (composite nomination score < 0.0145), clinicians in the top fifth (composite nomination score > 0.177) had been in practice significantly fewer years and were more likely to be male and to speak English as a first language. They were also significantly more likely to practice obstetrics (as opposed to family medicine) and to subspecialize in maternal–foetal medicine and less likely to practice in lower volume hospitals (Table 3). Differences among some subgroups were striking. For example, among the 24 male obstetricians whose first language was English, 61% had composite nomination scores placing them in the upper fifth of all clinicians. In contrast, only 3% of family physicians (but 15% of nurse midwives) were in the upper fifth.

Opinions of opinion leaders compared with their peers

Obstetricians were less positively disposed towards reducing the caesarean delivery rate than were family physicians and nurse midwives (Fig. 2). However, regardless of specialty, higher opinion leader status was associated with more favourable attitudes towards reducing caesarean sections. Among obstetricians, the mean Caesarean Opinion Scale Score was 2.96 (close to neutral) for those in the lowest opinion leadership fifth, compared with 3.47 (between somewhat and strongly supportive) for those in the highest fifth (p-value for trend, 0.001, Fig. 2). Among family physicians and nurse midwives, Caesarean Opinion Scores ranged from 3.80 within the lowest opinion leadership category to 4.26 within the highest ($p = 0.023$).

As members of the professional group that actually performs caesarean deliveries, obstetricians have the most direct influence over caesarean delivery rates. Looking at the obstetricians' responses to the eight individual opinion items, there was a statistically significant opinion gradient by opinion leader status for five of eight items (higher opinion leader status associated with more positive attitudes towards caesarean delivery rate reduction). For example, obstetricians whose composite nomination scores placed them in the highest fifth among all clinicians were more likely than those in the lowest fifth to strongly or somewhat agree that "reducing caesarean section rates tends to improve patient care" (39% vs. 20%, p-value for trend, 0.001). On the other hand, obstetrical opinion leaders were only marginally more inclined to "support efforts to decrease the caesarean delivery rate in California to 15%" (48% support among obstetricians in the top fifth compared with 43% support in the bottom fifth, $p = 0.16$) (Fig. 2).

Opinions, opinion leadership, and self-reported caesarean delivery rates

Using design-corrected multiple regression, we examined the effects of opinion leadership scores and of opinions themselves on obstetricians' self-reported caesarean delivery rates. The coefficients in Table 4

Table 3
Design-corrected multinomial logistic regression predicting membership in five opinion leadership groups, evenly divided according to composite nomination score ($n = 690$ due to missing values)[a]

Characteristic	2nd Fifth ($n = 149$)	3rd Fifth ($n = 149$)	4th Fifth ($n = 149$)	5th (Top) Fifth ($n = 149$)
	RRR (95% CI)	RRR (95% CI)	RRR (95% CI)	RRR (95% CI)
Clinical discipline				
Obstetrics–gynecology	1.0	1.0	1.0	1.0
Family medicine	0.80 (0.29, 2.21)	0.62 (0.22, 1.74)	0.15 (0.39, 0.56**)	0.40 (0.005, 0.29**)
Nurse–midwifery	1.96 (0.37, 10.3)	2.31 (0.37, 14.3)	3.36 (0.47, 24.2)	0.76 (0.11, 5.46)
Gender				
Male	1.0	1.0	1.0	1.0
Female	0.54 (0.28, 1.03)	0.73 (0.33, 1.59)	0.46 (0.22, 0.98*)	0.29 (0.14, 0.61**)
Ethnicity				
Non-white	1.0	1.0	1.0	1.0
White, not Hispanic	1.31 (0.84, 2.03)	1.88 (0.96, 3.66)	1.06 (0.55, 2.05)	1.78 (0.90, 3.52)
First language				
Other than English	1.0	1.0	1.0	1.0
English	1.87 (0.99, 3.53)	2.14 (0.91, 5.04)	1.50 (0.74, 3.04)	2.36 (1.24, 4.51**)
Years in practice	1.00 (0.97, 1.02)	1.01 (0.99, 1.04)	0.98 (0.95, 1.02)	0.96 (0.94, 0.99*)
Subspecialization				
None	1.0	1.0	1.0	1.0
Perinatology	0.44 (0.66, 2.90)	4.35 (0.52, 36.6)	2.51 (0.22, 28.4)	14.4 (2.06, 101.0)
Average number of deliveries per month	1.02 (0.98, 1.06)	1.04 (1.00, 1.08*)	1.03 (0.99, 1.08)	1.05 (0.99, 1.10)
Hospital Obstetrical Volume				
⩾3000 deliveries per year	1.0	1.0	1.0	1.0
2000–2999 deliveries per year	0.89 (0.40, 1.98)	0.61 (0.25, 1.44)	0.36 (0.11, 1.13)	0.12 (0.03, 0.51**)
1000–1999 deliveries per year	0.94 (0.39, 2.28)	0.90 (0.25, 3.28)	3.36 (0.47, 24.2)	0.11 (0.02, 0.61*)

*$p<0.05$, **$p\leqslant0.01$, ***$p\leqslant0.001$.

[a] Clinicians ranked by composite nomination score and divided into 5 equal groups. Relative risk estimates give probability of being in the specified opinion leadership fifth relative to the lowest fifth for clinicians with the stated characteristic compared with the index group (denoted by a relative risk of 1.0).

represent the estimated percentage point increase in caesarean delivery rate (on a scale ranging from 0% to 100%) associated with a 1-unit change in each independent variable. A one-point increase along the caesarean opinion scale (indicating a predisposition to reduce the current caesarean section rate) was associated with a 2.15 percentage point decrease in self-reported c-section rate ($p = 0.0001$, Table 4). Other significant variables in the model were practicing in a staff or group model health maintenance organization (coefficient $= -3.59$, $p = 0.026$); higher obstetrical volume (coefficient $= -0.12$, $p = 0.003$); and reporting more high-risk deliveries (coefficient $= 0.10$, $p = 0.005$). Opinion leadership (represented by the square root transformation of the composite nomination score) was not independently associated with caesarean delivery rate ($p = 0.67$, Table 4); the lack of association persisted after controlling for hospital obstetric volume (data not shown). When the caesarean opinion scale score was removed from the model, opinion leadership remained non-significant ($p = 0.94$).

Discussion

Our findings indicate that clinicians nominated by their peers as a source of credible obstetrical advice are identifiable in many hospitals and are distinguishable from their colleagues along plausible demographic and professional dimensions. These obstetric opinion leaders

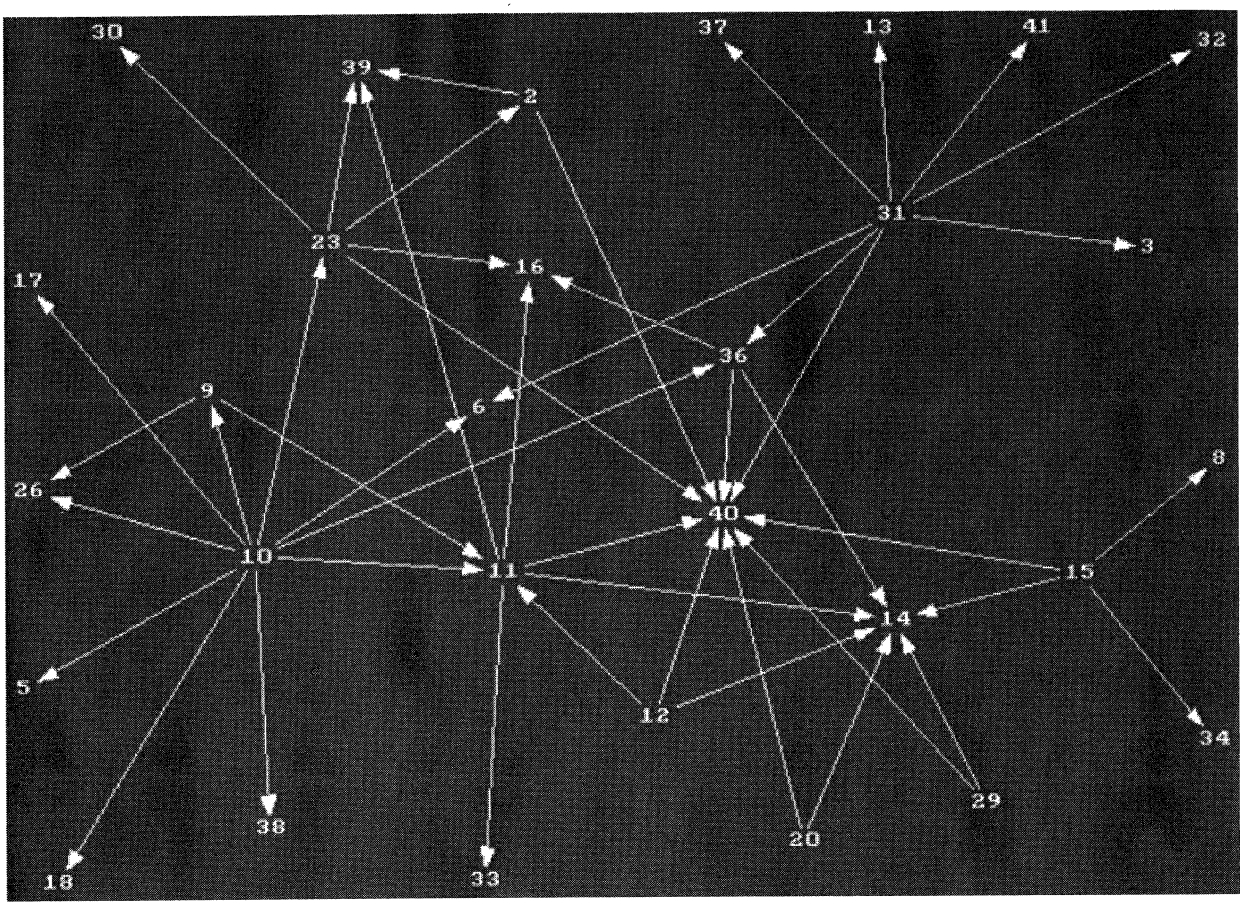

Fig. 1. Obstetrical opinion leader sociogram.

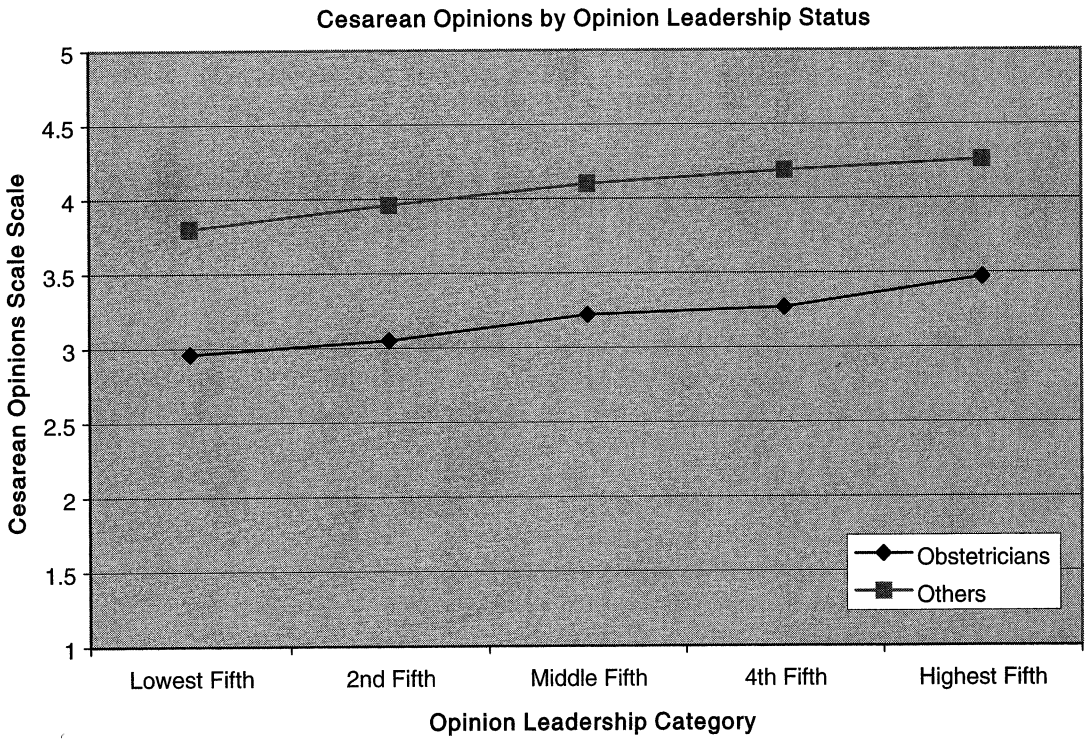

Fig. 2. Opinions of obstetrical clinicians according to opinion leader status. Note: Higher opinion scale scores indicate stronger agreement with initiatives designed to reduce the current caesarean delivery rate.

are more favourably inclined towards policies that would reduce the overall c-section rate than are their less influential colleagues. However, they are by no means solidly behind such policies.

Before discussing these conclusions and their implications, it is important to consider the policy context motivating this study (Centers for Disease Control, 2002; Martin, Hamilton, & Ventura, 2001). The clinical issues underlying the debate over caesarean delivery are complex. Caesarean section is a surgical procedure that entails morbidity and a small risk of complications; it is also at least marginally more costly than vaginal delivery (Chung et al., 2001). On the other hand, women undergoing a trial of labour after a prior caesarean experience a substantial risk of uterine rupture (perhaps up to 1%) (Lydon-Rochelle, Holt, Easterling, & Martin, 2001; McMahon, Luther, Bowes, & Olshan, 1996) and operative vaginal delivery (use of forceps or suction) as an alternative to caesarean section subjects the foetus to an increased risk of serious complications (Sachs, Kobelin, Castro, & Frigoletto, 1999). Nevertheless, based on the experience in some staff-model HMOs (Flamm, Newman, Thomas, Fallon, & Yoshida, 1990), most experts believe current caesarean rates could still be safely reduced, perhaps to levels proposed in new US guidelines. (Healthy People 2010 targets are 15% among women giving birth for the first time and 63% among those who have a prior caesarean birth.)

It is in this context that we evaluated one possible approach to encouraging a safe reduction in caesarean delivery rates. Local opinion leaders may affect practice by shaping colleagues' judgements, being the first to adopt new techniques, facilitating the application of general practice guidelines to the local environment, or influencing organizational culture (Mittman et al., 1992; Thomson O'Brien et al., 2000b; Locock et al., 2001).

Three issues threaten the utility of opinion leaders in effecting clinical change. First, opinion leaders may not exist or may be difficult to identify within a particular clinical setting. Our results suggest that obstetrical opinion leaders—defined somewhat arbitrarily as those garnering 20% of possible nominations within their own facility—can be found in more than 90% of high-obstetrical-volume hospitals (> 3000 deliveries/year). As measured by our techniques, social networks appear less robust in smaller hospitals. However, high volume hospitals are responsible for a disproportionate number of deliveries.

In our study we used quantitative sociometric methods to identify clinicians likely to be educationally influential. We focused on the concept of *clinical respect* by identifying clinicians whom others claim to have sought out (or would seek out) for advice on labour and delivery. In other contexts, psychologists and management scientists have focused on different dimensions, including dependence, power, social acceptance, and support, trust, competence, and congeniality (Molm, 1994; Whitmeyer, 1994). Our composite (3-item) measure of normalized nomination has good internal consistency and face validity. On the other hand, "nomination" is a relatively crude summary of an individual's social influence in hospital settings. Future work should assess the value of other measures, including "betweenness centrality"—an index of the extent to which a person is connected to otherwise *non*-connected parts of a social network (Krackhardt, 1992). An obstetrician with high "betweenness centrality" might play a key role in bridging the gap between a cluster of doctors who favour efforts to reduce the caesarean rate and those who oppose such efforts.

The observed associations between opinion leader status and clinicians' personal and professional characteristics are consistent with expectations and support the measure's construct validity. For example, maternal–foetal medicine specialists had relatively high composite nomination scores. On a practical level, the observed associations may be useful in planning future trials or demonstration projects by targeting specific groups of clinicians (e.g., high-volume practitioners, rinatologists) who are most likely to wield significant educational influence. Organizers of such trials should bear in mind, however, the importance of demographic, social, and organizational context. Clinicians with high opinion leadership status based on the vote of a plurality of clinicians in their hospital may still have difficulty persuading individuals who differ from themselves, whether by ethnicity, gender, specialty, or deeply held opinions.

The problem of converting those with firmly held and opposite opinions is a traditional barrier to the diffusion of innovation. It poses the second threat to the effectiveness of opinion leader strategies for promoting clinical change. In his pathbreaking book, Rogers identifies five adopter categories, defined on the basis of their willingness to incorporate new ideas or technologies into their lifestyle or practice (Rogers, 1995). The five categories are innovators (first 2.5%), early adopters (next 13.5%), the early majority (next 34%), the late majority (next 34%), and laggards (last 16%). In our 1998 survey, somewhat less than 50% of obstetricians agreed with Healthy People 2000 caesarean delivery targets, and "opinion leaders" were not far out front on this issue. Part of the reason may be Rogers' conclusion that opinion leaders (generally found within the category of early adopters) can only remain leaders if they adhere to the norms of their local peers. "The early adopter knows that to continue to earn [the] esteem of colleagues and to maintain a central position in the communication networks of the system, he or she must make *judicious* innovation-decisions." [italics added] (Rogers & Scott, 1997).

Table 4
Design corrected multiple linear regression predicting self-reported cesarean section rates among obstetrician-gynecologists only ($n = 461$)

Characteristic	Coefficient (95% Confidence Interval)	p-Value
Constant (Baseline C-Section Rate, percent)	28.1 (20.8,35.4)	0.0001
Cesarean opinion scale (1–5 scale)	−2.15 (−3.28,−1.02)	0.0001
Opinion leadership (square root transformation of composite nomination score)	1.83 (−6.65,10.3)	0.67
Female gender	−2.97 (−6.37,0.43)	0.08
Years in practice	−0.038 (−0.21,0.13)	0.66
Practice Setting		
Solo (reference group)	—	—
Single specialty group	0.70 (−1.72,3.12)	0.58
Multispecialty group	−0.82 (−3.95,2.31)	0.60
Staff model or Kaiser model HMO	−3.59 (−6.74,−0.45)	0.026
Academic/faculty practice	5.79 (−4.33,15.9)	0.26
Other	7.73 (−4.89,20.3)	0.22
Perinatology subspecialty	1.90 (−5.37,9.17)	0.60
Number deliveries past month	−0.12 (−0.19,−0.04)	0.003
Proportion of deliveries considered "high risk"	0.10 (0.031,0.18)	0.005

It is interesting that nurse midwives had higher average nomination scores than family physicians. The most likely explanation is that nurse midwives tended to nominate both themselves and obstetricians, whereas family physicians tended to nominate only obstetricians. Across a broad range of clinical settings, requests for consultation and advice flow much more often from generalists to specialists and from specialists to subspecialists than from specialists to generalists (Kuo, Gifford & Stein, 1998). In addition, nurse midwives and obstetricians enjoy a formal professional relationship (Roberts, 2001), whereas midwives and family physicians do not.

The third threat to the broad use of opinion leaders is that they may not be inclined to lead in the direction policymakers would like. In this regard the distinction between opinion leaders and "product champions" is critical (Locock et al., 2001). The latter are enthusiastic about a program or product but do not necessarily have a following. The former have a following but are not necessarily enthusiastic about the product. The results of this study indicate that obstetrical opinion leaders in California are marginally more inclined to work towards a reduction of the aggregate caesarean delivery rate than their less sociometrically favoured colleagues. However, they are by no means uniformly committed to such a program. Nearly 40% of obstetricians in the highest nomination group (i.e., the top fifth) believe that "the current caesarean section rate in California is justifiable" and that most efforts to reduce caesarean delivery rates are "really about reducing costs, not improving care" (data not shown in results). Most tellingly, only 48% would support efforts to decrease the caesarean delivery rate in California to 15%.

Despite these limitations, the use of local network analysis may have important applications in changing clinician behaviour. Other organizations have successfully used these methods to glimpse "behind the organizational chart" and identify individuals with real leverage (Krackhardt & Hanson, 1993). Hospitals could potentially use these methods to identify individual opinion leaders for quality improvement initiatives. However, they would still have to ascertain whether the identified individuals were willing to provide energetic support.

The results must be interpreted in light of our study's limitations. Although clinicians' opinions were related to caesarean delivery rates (thus speaking to their validity), all data were self-reported. The survey response rate was far from optimal despite vigorous measures (including a financial incentive, multiple mailings, and telephone follow-up). It is possible that non-respondents were less integrated into local social networks than respondents. We measured only one aspect of opinion leadership, namely whether fellow clinicians had sought, would seek, or would go out of their way to obtain advice from that professional. Some minor misclassification may have resulted from our failure to consider clinicians who practiced in more than one hospital. We did not examine whether our approach is superior, equivalent, or inferior to other less formal methods of identifying opinion leaders. Finally, the results were obtained from only one state and excluded hospitals with fewer than 1000 deliveries per year as well as out-of-hospital deliveries.

In summary, within many hospitals, a simple nomination form can identify clinicians who may wield disproportionate clinical influence. However, simply

identifying opinion leaders is of little avail if they are reluctant to endorse the innovations being introduced. At least half of obstetrician opinion leaders and about one-fourth of family physician and nurse midwife opinion leaders are unlikely to take up the cause of lowering caesarean section rates. In this sense our results are both tantalizing and cautionary. Previous trials indicate that opinion leaders *can* influence their colleagues' knowledge, attitudes and behaviours under the right circumstances. A major question for future research is whether opinion leaders who are initially sceptical of desired clinical policies can be persuaded to embrace new approaches and bring their fellow clinicians along.

Appendix

Caesarean opinion scale

All items scored on a 1–5 scale where 1 = strongly agree, 2 = somewhat agree, 3 = neither agree nor disagree, 4 = somewhat disagree, 5 = strongly disagree. R = reverse polarity (scoring reversed so that a higher score always indicates more favourable attitudes towards reducing the caesarean delivery rate).

1. The current caesarean section rate in California (22%) is medically justified.
2. Reducing caesarean section rates below what they are now will increase perinatal morbidity.
3. Reducing caesarean section rates below what they are now will increase maternal morbidity.
4. Reducing caesarean section rates tends to improve patient care (R).
5. Vaginal births after caesarean section could be more common than they are presently (R).
6. Most efforts to reduce caesarean delivery rates are really about reducing costs, not improving quality of care.
7. Reducing the caesarean section rate at my hospital any lower than it is now will create unacceptable risks.
8. I would support efforts to decrease the caesarean delivery rate in California to 15% (R).

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