

# Epidemiology of medico-legal litigations and related medical errors in Central and Northern Saudi Arabia

## A retrospective prevalence study

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### ABSTRACT

**الأهداف:** دراسة القضايا الطبية الشرعية والأخطاء الطبية الصلة في منطقتي القصيم وحائل بالملكة العربية السعودية للتعرف على أنواع وأسباب الأخطاء الطبية والدعاوي، وفهم عيوب الرعاية، وتحديد المرضى والتخصصات الطبية عالية المخاطر، والمساعدة على تطوير التدخلات للحد من الأخطاء الطبية والضرر للمريض.

**الطريقة:** أُجريت هذه الدراسة الاسترجاعية المقطعية خلال الفترة من مايو 2010م إلى ديسمبر 2011م. لقد قمنا بتحليل جميع القضايا الطبية الشرعية التي حققت فيها اللجنة الطبية الشرعية في منطقة القصيم إذ صدرت الأحكام النهائية لها بين عامي 1413 و1430 هجري (1992 و2009م) (العدد=293).

**النتائج:** لقد كان متوسط عمر المرضى 29.5 عاماً، 57% من الإناث و92% من السعوديين. اشتملت أقسام أمراض النساء والولادة على 29.7% من الدعاوى، تليها الجراحة العامة، وطب الأطفال (11.3% لكل منهما). لقد كان 90% من أصل 635 من المدعى عليهم في القضايا الطبية الشرعية من الأطباء، و7.6% من الممرضات، و25% من أطباء النساء والولادة. وقد أظهرت التحقيقات عدم وجود خطأ في 47.1%، وخطأ بلا ضرر في 11.9%، وخطأ أدى إلى ضرر في 39.6% من القضايا. وكانت الأخطاء متمثلة في الإهمال (45.8%)، والتشخيص الخاطئ (14.2%)، والأخطاء الجراحية (10.3%)، والأخطاء الإدارية (5.2%). ولقد كان متوسط المدة الكلية للقضية 13.9 شهراً. وكان نوع «الضرر» أهم مؤشر لتحديد حكم الإدانة ( $p < 0.001$ ).

**خاتمة:** أظهرت الدراسة بأن تخصص النساء والولادة في منطقتي القصيم وحائل بالملكة العربية السعودية، وإهمال مقدمي الخدمة تمثل جزءاً كبيراً من الدعاوى الطبية القانونية، وبالتالي لا بد من المزيد من الدراسات للتعرف على الأسباب المحددة والتدخلات الممكنة. ونوصي بمراجعة وتقييم وإصلاح نظام عمل اللجان الطبية الشرعية لتقصير مدة التقاضي الطويلة.

**Objectives:** To study medico-legal litigations and related medical errors in Central (Al-Qassim), and Northern (Hael) districts in the Kingdom of Saudi Arabia (KSA), and to identify types and causes of errors to reduce medical errors and patient harm.

**Methods:** This retrospective prevalence study was carried out between May 2010 and December 2011 to analyze medico-legal litigations in Al-Qassim and Hael districts that were investigated by the Al-Qassim Medico-Legal Committee, Al-Qassim, KSA. Final verdicts issued between 1992 and 2009 included 293 cases.

**Results:** The patient's mean age was 29.5 years. Fifty-seven percent of the patients were females, and 92% were Saudis. The Obstetric and Gynecology department was involved in 29.7% of litigations followed by General Surgery, and Pediatrics (11.3% each). Of the 635 defendants, 90% were physicians, and 7.6% were nurses. Investigations showed "no error" in 47.1% of cases, "error but no harm" in 11.9%, and "error resulted in harm" in 39.6%. Errors were negligence (45.8%), wrong diagnosis (14.2%), surgical error (10.3%), and administrative error (5.2%). The average total duration of litigations was 13.9 months. "Type of harm" was the most significant predictor to determine a "guilty" decision ( $p < 0.001$ ).

**Conclusion:** Obstetric practice in Al-Qassim and Hael districts and provider negligence contribute to a large portion of medico-legal litigations, and therefore this has to be further studied to recognize the specific causes and possible interventions. A systematic review of the medico-legal committee is needed to shorten the long duration of litigation.

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Medical errors (MEs) are potential causes of morbidity and mortality in all health care settings worldwide. The World Health Organization estimates that MEs affect one in every 10 patients around the world, and describes the situation as “an endemic concern”.<sup>1</sup> The ME is defined as an incorrect action or plan that may, or may not cause harm to a patient.<sup>2</sup> The American Institute of Medicine (AIM) extended the definition of ME to include “maybe an act of commission or an act of omission”.<sup>3</sup> The MEs may occur as a result of flaws in the medical system (system errors) including poor communication, or because of deficiencies in the physician’s knowledge, skills, or attentiveness (human errors).<sup>4,5</sup> There is limited information regarding the extent of MEs worldwide. Meanwhile, a reputable report by AIM has estimated that between 44,000 and 98,000 Americans die each year in American hospitals as a result of medical errors.<sup>2</sup> The Canadian Adverse Events Study found that adverse events occurred in more than 7% of hospital admissions, and estimated that 9,000 - 24,000 Canadians die annually due to avoidable MEs.<sup>6</sup> In the Kingdom of Saudi Arabia (KSA), 8 regionally distributed Medico-Legal Committees (MLCs) are responsible for investigating medico-legal litigations (MLLs) for alleged MEs that result in morbidity and mortality. When a complaint is forwarded to the MLC, it opens an investigation that starts with interviewing the plaintiff. Then, the committee reviews the patient’s medical files, interviews the accused medical and paramedical staff (defendants), consults experts, and finally reaches a verdict (decision). Decisions made by the MLC become final after 60 days, during which decisions can be challenged and overturned.<sup>7</sup> However, the MLCs in KSA are facing repeated criticism claiming that the investigation process is too slow, and justice is delayed. Non-Saudi defendants are subject to precautionary order “prevention from travel” when a complaint is referred to the MLC without conducting an initial investigation, and until the verdict is issued. The extent of MEs in KSA is unknown, however, evaluation of the types, frequency, effects, and causes of litigations referred to the MLCs can help in understanding defects in the processes of medical care, identifying root causes, know high-risk patients, and developing interventions aimed at their reduction and prevention.<sup>8,9</sup> This study aims to research and analyze all MLLs investigated by the Central KSA (Al-Qassim) MLC if decisions were carried out from 1992 to 2009 (1413 to 1430 Hijri), and to recognize causes of medical errors, high-risk patients, and medical specialists. We also aim to identify factors associated with guilt decisions, and investigate the duration of medico-legal litigations.

**Methods.** This is a retrospective prevalence (cross-sectional) study. All files of MLLs archived in Al-Qassim MLC in Buraidah, Al-Qassim district were put in a chronological order and re-labeled. Cases were included in the study if the MLC reached a verdict during the period 1992 to 2009. In cases where verdicts were overturned or modified, the initial verdicts were discarded, and only final verdicts were extracted and recorded. In addition to Al-Qassim litigations, Al-Qassim MLC also investigated the Hael’s (Northern KSA) litigations from 1992 to 2003 before a separate MLC was assigned for Hael’s litigations in 2003. The study procedures started on May 2010 and ended on December 2011. We extracted and entered the data in a database in Microsoft Excel (Microsoft Corporation, Washington, USA) where claim number and year were the case identifiers. The collected data covers information on: district; governorates (districts); affiliation and type of medical institution; type of error and harm; place of MEs; patient demographics; defendants’ demographics and specialties; final verdicts; amount of monetary penalties; and duration of litigations.

Data was imported to Stata version 9 statistical package (Stata Corporation, Texas, USA). A descriptive analysis was used to describe the collected data. Then, a statistical analysis was performed to test relationships between predictors and the guilt decision, and to estimate the strength of the relationships if present. Chi-square test was used when appropriate. Relative risks were estimated by calculating crude and adjusted odds ratios (ORs), however, only adjusted ORs will be presented. Logistic regression models were used to estimate ORs, *p*-values, and 95% confidence intervals (95% CI). A *p*<0.05 was considered statistically significant. The form of the logistic regression model is shown in this equation:

$$P(Y) = \frac{1}{1 + e^{-f(x)}} \quad \text{where} \quad f(x) = \sum \alpha + \beta_i x_i$$

Where  $Y(x)$  is the outcome variable,  $x_i$  are the predictor variables and  $\alpha$  and  $\beta_i$  are model coefficients. The study proposal acquired an approval from Al-Qassim Regional Research Ethics Committee. Additional measures were taken to maintain the confidentiality of parties involved in litigations such as: 1. Re-numbering the files in the MLC archive, and referring to cases by number and year

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without trading any identifiable information; 2. Files were examined at the archive room of the MLC while maintaining complete confidentiality of data during extraction and handling; 3. Store digital databases in a password-protected computer that is only accessed by the study principal investigator; 4. No documents (copies or originals) were allowed to circulate outside the MLC archive.

**Results.** During the study period, the MLC reached final decisions in 293 litigations, 244 (83.3%) in Al-Qassim and 49 (16.7%) in Hael. The number of final verdicts varied annually with the highest (n=26) in the year 2000 (1421 Hijri). Patients' demographics are shown in Table 1. Most patients (91.8%) were Saudis and 57% were females. Patient's age ranged between a day (or an unborn fetus) to 97 years with a mean of 29.5, and a median of 28 (95% CI; 26.7-32.4) years. Mean age for females was lower (27.9 years) than that for males (31.7 years) ( $p=0.191$ ). Forty-one percent of patients were in the age group 31-60 years with more females in the age group 16-45 years (50.9%) than males (31.8%). The patient's first degree relative (father, husband/wife, son, or brother) initiated 70% of cases, while 10% of the patient himself/herself initiated, and 14.7% from the health prosecutor. The aims of the litigations were either to claim *Diea* (23.6%), which is compensation for unintentional causing of death as per Islamic laws (Sharia), or a compensation for suffering, or loss of an organ or its functionality (23.6%), general (state) rights (21.8%), private rights (10.9%), or both

**Table 1** - Patients' demographics included in the study that was investigated by the Al-Qassim Medico-Legal Committee, Al-Qassim, Kingdom of Saudi Arabia (n=293).

Characteristics	Male	Female	Total
		n (%)	
Gender	126 (43.0)	167 (57.0)	293 (100.0)
Age*, year	120 (41.0)	157 (53.6)	277 (94.5)
Mean age ± SD	31.7 ± 27.2	27.9 ± 21.2	29.5 ± 24.0
<b>Age group, years</b>			
0-1	20 (15.9)	31 (18.6)	51 (17.4)
2-5	7 (5.6)	8 (4.8)	15 (5.1)
6-15	17 (13.5)	6 (3.6)	6 (7.9)
16-30	21 (16.7)	46 (27.5)	67 (22.9)
31-45	19 (15.1)	39 (23.4)	58 (29.8)
46-60	18 (14.3)	15 (9.0)	33 (11.3)
> 60	18 (14.3)	12 (7.2)	30 (10.2)
Unknown	6 (4.8)	10 (6.0)	16 (5.5)
<b>Nationality</b>			
Saudi	110 (87.3)	159 (95.2)	269 (91.8)
Non-Saudi	16 (12.7)	8 (4.8)	24 (8.2)
Egyptian	6 (4.8)	5 (3.0)	11 (3.8)
Indian	3 (2.4)	1 (0.6)	4 (1.4)
Bangladeshi	3 (2.4)	0 (0.0)	3 (1.0)
Filipino	2 (1.6)	0 (0.0)	2 (0.7)
Others	2 (1.6)	2 (0.9)	4 (1.3)

\*The age of 16 patients (6 males and 10 females) was unknown

general and private rights (20.1%). Most of the alleged MEs (80.2%) took place in the Ministry of Health (MoH) institutions (75.8% in hospitals, and 4.4% in primary health care centers) compared to 19.1% in private health sector (12.6% in private clinics complex, 5.1% in a private hospital, and 1.4% in private clinics) and 0.6% in other settings. Approximately, 50% of the cases took place in Buraidah (Al-Qassim district's capital), and 17% in Unaizah governorate. Almost 43% of the MLLs occurred in 4 major MoH hospitals; King Fahd Specialist Hospital in Buraidah (n=45), King Saud Hospital in Unaizah (n=34), Mother and Child Health Hospital in Buraidah (n=29), and Buraidah Central Hospital (n=17). Eighty percent of the litigations involved one medical department, while the rest involved 2 departments. The Obstetric and Gynecology department (ObGyn) was involved in 29.7% of the litigations, followed by General Surgery, and Pediatrics (11.3% for each), Internal Medicine and Emergency Medicine (10.6% for each), and Orthopedics (5.1%). The rest of the departments all together was involved in 20% cases. As shown in Table 2, 635 defendants were questioned by the MLC with an average of 2.2 defendants per case. There was one defendant per case in 43%, and 2 or more in the rest of cases. Seventy-

**Table 2** - Defendants' demographics and guilt decision (n=635 defendants).

Characteristic	n	(%)	Found guilty (%)	df	$\chi^2$	P-value
<b>Gender</b>				2	0.076	0.963
Male	476	(75.0)	(40.6)			
Female	159	(25.0)	(40.3)			
<b>Number of defendants per case</b>				6	3.554	0.737
1	126	(43.0)	(40.1)			
2	71	(24.2)	(41.0)			
3	49	(16.7)	(39.3)			
>3	47	(16.0)	(42.7)			
<b>Nationality</b>				44	48.002	0.314
Egyptian	249	(39.2)	(45.8)			
Indian	94	(14.8)	(42.6)			
Pakistani	54	(8.5)	(37.0)			
Syrian	49	(7.7)	(38.8)			
Filipino	28	(4.4)	(21.4)			
Sudanese	25	(3.9)	(48.0)			
Saudi	20	(3.1)	(55.0)			
Jordanian	19	(3.0)	(42.1)			
Nigerian	18	(2.8)	(44.4)			
Bangladeshi	15	(2.4)	(20.0)			
Others	27	(4.3)	(40.7)			
Unknown	37	(5.8)	(18.9)			
<b>Profession</b>				8	68.662	<0.001
Physician	565	(89.0)	(41.1)			
Nurse/midwife	49	(7.7)	(27.1)			
Dentist	13	(2.5)	(76.9)			
Technician	6	(0.9)	(16.7)			
Ambulance driver	2	(0.3)	(100.0)			

df - degrees of freedom

five percent of defendants were males and physicians comprised the majority of defendants (89%). Nearly 39.2% of the defendants were Egyptians, and 14.8% were Indians. However, defendants with the highest conviction rates were from KSA (55%), Sudan (48%), and Egypt (45.8%). Obstetricians and gynecologists were the specialty more often involved in litigations (28.1%), followed by internists (14.3%), pediatricians (12%), general surgeons (9%), and anesthesiologists (7.6%) (Table 3). The MLC decided “no error” in 47.1% of cases, “error that did not result in harm” in 12%, and “error resulted in harm” in 39.5%. Error could not be decided in 4 cases (1.4%). Out of the identified errors (n=155), the main type of error was negligence in form of delayed or no evaluation of patients, or no diagnosis or no treatment at all (45.8%). Other types of errors were wrong diagnosis (14.2%), selecting inappropriate surgical procedure (10.3%), technical errors during applying surgical procedure (9.7%), administrative error, such as improper, or non-documentation in patient medical file (5.2%), inappropriate therapeutic technique (5.2%), exceeding permission and violation of the granted authorizations, such as not consulting the superior attending or the consultant (4.5%), and inappropriate medication (3.9%). Almost a fifth of all MEs took place in the operating rooms, 16.1% in delivery rooms (DR), in-patient rooms, out-patient clinics, and emergency rooms (ERs)(14.8% for each) (Table 4). Out of the 46 detected medical errors in litigations involved ObGyn departments, only half (54.4%) took place in DRs, while the rest occurred in the operating rooms (15.2%), in-patient rooms (13.0%), and out-patient

**Table 3** - Physicians' specialties of those included in the study (n=565).

Specialty	n	(%)	Found guilty (%)
Obstetric/Gynecology	159	(28.1)	(44.0)
Internal Medicine	81	(14.3)	(38.3)
Pediatrics	68	(12.0)	(48.5)
General Surgery	51	(9.0)	(45.1)
Anesthesia	43	(7.6)	(47.7)
Orthopedics	28	(4.9)	(31.0)
Emergency Medicine	26	(4.6)	(38.5)
General Practice	22	(3.9)	(22.7)
Pneumology (Pulmonology)	13	(2.3)	(23.1)
Cardiology	12	(2.1)	(50.0)
Neurosurgery	10	(1.8)	(10.0)
Intensive Care	10	(1.8)	(40.0)
Ear, Nose and Throat	9	(1.6)	(33.3)
Ophthalmology	7	(1.2)	(42.9)
Vascular Surgery	6	(1.1)	(16.7)
Urology	5	(0.9)	(20.0)
Others	13	(2.2)	(46.2)
Unknown speciality	2	(0.3)	(100.0)
All physicians	565	(100.0)	(41.1)

**Table 4** - Errors and harm, type and place of errors (number of errors=155).

Variable	n	(%)
<b>Error and harm</b>		
No error	138	(47.1)
Error but no harm	35	(12.0)
Error and harm	116	(39.5)
Cannot decide	4	(1.4)
<b>Type of error</b>		
Negligence	71	(45.8)
Diagnosis error	22	(14.2)
Electing inappropriate surgical procedure	16	(10.3)
Technical error during surgical procedure	15	(9.7)
Administrative error	8	(5.2)
Exceeding permission	7	(4.5)
Inappropriate medicine	6	(3.9)
Unknown	4	(2.6)
Lack of follow up	3	(1.9)
Misunderstanding / mistreat patients	2	(1.4)
Failure to obtain a consent	1	(0.7)
<b>Place of error</b>		
Operating room	33	(21.3)
Delivery room	25	(16.1)
In-patient room	23	(14.8)
Emergency room	23	(14.8)
Out-patient clinic	23	(14.8)
Intensive care unit	11	(7.1)
Dental clinic	7	(4.5)
Unidentified	5	(3.2)
Patient home	2	(1.3)
Ambulance vehicle	2	(1.3)
Neonatal incubator	1	(0.7)

**Table 5** - Defendants' classification\* and guilt decision.

Classification	Guilty	Not guilty	No decision	Total
Physicians	232 (41.1)	316 (55.9)	17 (3.5)	565 (89.0)
Specialist	105 (41.8)	135 (53.8)	11 (4.4)	251 (39.5)
Consultant	66 (39.3)	101 (60.1)	1 (0.6)	168 (26.5)
Resident	61 (41.8)	80 (54.8)	5 (3.4)	146 (23.0)
Nurse	13 (29.6)	29 (65.9)	2 (4.5)	44 (6.9)
Dentist	10 (76.9)	3 (23.1)	0 (0.0)	13 (2.0)
Midwife	1 (20.0)	3 (60.0)	1 (20.0)	5 (0.8)
Technician	1 (16.7)	5 (83.3)	0 (0.0)	6 (0.9)
Driver	0 (0.0)	0 (0.0)	2 (100.0)	2 (0.3)
<b>Total</b>	<b>257 (40.5)</b>	<b>356 (56.1)</b>	<b>22 (3.5)<sup>†</sup></b>	<b>635 (100.0)</b>

Data are expressed as number and percentage (%). \*Defendant classification is according to the Saudi Commission for Health Specialties. <sup>†</sup>No verdict was reported for 22 defendants due to travel of the accused, the plaintiff did not attend the hearing or the accused was not a health specialist

**Table 6** - Monetary penalties (Saudi Riyal)\* per medico-legal case.

Monetary penalties per case, SR	n	(%)	CF (%)
No monetary penalty	176	(60.1)	(60.1)
≤1,000	37	(12.6)	(72.7)
>1,000 - ≤50,000	41	(14.0)	(86.7)
>50,000 - ≤100,000	24	(8.2)	(94.9)
>100,000 - ≤150,000	8	(2.7)	(97.6)
>150,000 - ≤200,000	6	(2.1)	(99.7)
>200,000 - ≤250,000	1	(0.3)	(100.0)

SR - Saudi Riyal, CF - cumulative frequency. \*One US dollar is equivalent to 3.75 Saudi Riyals based on a fixed currency conversion rate

**Table 7** - Monetary penalties (Saudi Riyal)\* by defendant's gender, profession, and specialty.

Variable	n	Mean ± SD	Range		Total
			Minimum	Maximum	
<b>Gender</b>					
Male	154	13,364 ± 16,580	167	90,000	2,057,990
Female	54	14,356 ± 15,167	600	60,000	775,225
Total	208	13,621 ± 16,194	167	90,000	2,833,215
<b>Profession</b>					
Specialist	92	14,305 ± 13,923	167	60,000	1,316,057
Consultant	51	14,855 ± 17,537	333	80,000	757,583
Resident	47	12,265 ± 18,917	500	90,000	576,475
Nurse	11	10,509 ± 15,737	600	55,000	115,600
Dentist	5	11,900 ± 21,326	1,000	50,000	59,500
Midwife	1	5,000 ± N/A	5,000	5,000	5,000
Technician	1	3,000 ± N/A	3,000	3,000	3,000
Total	208	13,621 ± 16,194	167	90,000	2,833,215
<b>Specialty</b>					
Obstetric/Gynecology	16	17,328 ± 15,990	2,000	60,000	277,250
Internal Medicine	26	11,308 ± 14,930	1,000	70,000	294,000
Pediatrics	30	17,390 ± 19,190	1,000	80,000	521,700
General Surgery	15	15,211 ± 11,784	3,000	46,660	228,160
Anesthesia	16	17,328 ± 15,599	2,000	60,000	277,250
Nursing	12	10,050 ± 15,089	600	55,000	120,600
Orthopedics	9	5,556 ± 5,059	500	15,000	50,000
Emergency Medicine	8	22,531 ± 30,314	750	90,000	180,250
General Practice	3	30,333 ± 43,247	1,000	80,000	91,000
Dental	9	8,151 ± 15,765	855	50,000	73,355
Pneumology	1	10,000 ± N/A	10,000	10,000	10,000
Cardiology	5	14,100 ± 8,310	5,000	25,000	70,500
Neurosurgery	1	2,000 ± N/A	2,000	2,000	2,000
Intensive Care Unit	1	3,000 ± N/A	3,000	3,000	3,000
Ear, Nose, and Throat	3	15,500 ± 17,414	1,500	35,000	46,500
Ophthalmology	2	3,250 ± 2,475	1,500	5,000	6,500
Technician	1	3,000 ± N/A	3,000	3,000	3,000
Vascular Surgery	1	2,000 ± N/A	2,000	2,000	2,000
Plastic Surgery	1	15,000 ± N/A	15,000	15,000	15,000
Dermatology	1	1,500 ± N/A	1,500	1,500	1,500
Unknown speciality	2	3,000 ± 2,828	1,000	5,000	6,000

N/A - non-applicable (if a figure cannot be calculated). \*One US dollar is equivalent to 3.75 Saudi Riyals based on a fixed currency conversion rate

clinics (10.9%). There was no harm to patients in 59.1% of the cases. In the rest of cases, harm occurred in the form of patient death (22.9%), complications (10.2%), fetus or newborn death (5.5%), or organ loss (1%). All errors in ICU resulted in harm compared to 96% in DR, 86% in dental clinics, and 82% in operating rooms. Meanwhile, only 65% of errors in in-patient rooms and outpatient clinics resulted in patients harm. Negligence was the most common type of error in all places, and ranged between 34.8% (in out-patient clinics) and 100% (in ambulances and neonatal incubators). Final verdicts show that 56.1% of the defendants found not guilty. Conviction rate was the highest for dentists (76.9%), while it was 41.1% for all physicians with statistically insignificant minor differences among specialists, residents, and consultants ( $p=0.218$ ) (Table 5). Also, the estimated ORs of being guilty comparing specialists and consultants to residents (the reference group) showed that both ORs

were not statistically significant; OR=1.03 ( $p=0.903$ ), and OR=0.86 ( $p=0.506$ ). In 86% of cases, there was a single verdict (including not guilty in 47.1% of cases), while in 14% there were more than one verdict per case. Collectively, the final verdict included fine in 18.2%, Diea in 16.1%, warning in 15.7%, compensation in 6.8%, and revoke license in 5.5% of cases. There was no MPs in 60.1% of cases, and less than 1000 Saudi riyals (SR) in 12.6% (Table 6). The MPs ranged from 167 - 90,000 SR, and the sum of MPs (Dieas, compensations, or fines) was 2,833,215 SR (equivalent to \$755,524 US). This amount was paid by 208 defendants with an average of 13,621 SR and a median of 8,000 SR. In average, male defendants paid almost 1000 SR less than female defendants ( $p=0.403$ ). Consultants paid the highest average MPs (14,855 SR) followed by specialists (14,305 SR), and residents (12,265 SR). However, calculating the average MPs by medical specialty showed that general practitioners (GP) paid

**Table 8** - Results of logistic regression model testing the effect of several variables on guilt decision.

Covariate	Odds ratio	P-value	95% confidence interval
Patient age	1.01	0.158	0.99-1.03
<i>Patient gender</i>	0.46	0.056	0.20-1.02
Male (0)			
Female (1)			
<i>Patient nationality</i>	1.23	0.78	0.29-5.33
Saudi (0)			
Non-Saudi (1)			
<i>Harm</i>	-	-	-
No harm (reference)			
Complications or organ loss	68.90	<0.001	17.38-273.13
Patient death	72.70	<0.001	24.62-214.60
Fetus or baby death	134.48	<0.001	15.85-1141.17
Number of defendants per case	0.94	0.713	0.69-1.29
<i>Defendant's gender</i>	0.99	0.982	0.37-2.65
Male (0)			
Female (1)			
<i>Defendant's nationality</i>	0.37	0.391	0.04-3.53
Saudi (0)			
Non-Saudi (1)			
<i>Defendant's profession</i>	1.38	0.710	0.25-7.48
Physician (0)			
Other (1)			

Numbers in parenthesis ( ) are designated codings

the highest average (30,333 SR) followed by specialists in emergency medicine (22,531 SR) and pediatricians (17,390 SR) (Table 7). To test the association between several predictors and guilt decision, a logistic regression model (LRM) was constructed where: Y (the dependant variable) = guilt decision as a function of x1 = patient age; x2 = patient gender; x3 = patient nationality; x4 = harm; x5 = number of defendants; x6 = defendants gender; x7 = defendants nationality; and x8 = defendants profession. The individual categories of the variable "Harm" where this categorical variable was expanded into indicator (dummy) variable sets by creating new variables. Automatically, the category "no harm" was the reference and each other category in this variable was coded 1 if yes, and 0 if else. Results showed that compared to no harm, all harm categories significantly increased the ORs of found guilty, however, the OR of "fetus or baby death" category was the highest (OR = 134.48). Other than "Harm", all variables were not significantly associated with guilt decision (Table 8). The average ( $\pm$  SD) duration of litigations from initiation of a complaint until it reaches the MLC was 5.1 ( $\pm$  4.2) months with a median of 4 months. Meanwhile, the average duration of litigations in MLC (from the time a case reaches the MLC to the final verdict) was 9.1 ( $\pm$  6.4) months with a median of 8 months. The average total duration for litigations was 13.9 ( $\pm$  7.2) months with a median of 13 months. There were 2 outliers with the longest duration of litigations in MLC (34 months

and 48 months). After excluding the outliers, the mean duration did not show significant changes.

**Discussion.** The first rule in practicing medicine and providing health care is "do no harm to patient".<sup>10</sup> Unfortunately, preventable MEs occur, and many of these pass without reporting with no lessons learned for future avoidance.

In KSA, MLL and MEs are underutilized areas in research. After browsing the PubMed database and the search engines, we could find 2 articles on MLL in KSA. These articles shared the lack of in-depth investigation and statistical analysis.<sup>7,11</sup> The most recent discussed an annual report by the Saudi MoH on MLL for the period 1999-2004, and highlighted anesthesia related errors.<sup>7</sup> This study found that more female patients involved in MLL than males and ObGyn was the practice mostly involved in MLL in Al-Qassim. These findings coincide with the Saudi MoH 1427 Hijri annual report during the period 2003-2006 (1424-1427 Hijri).<sup>12</sup> The lower mean age for female patients than that for male patients can be explained by the fact that most female patients were in their child-bearing period, and seeking obstetric health care. Unsurprisingly, most of the patients were Saudis since the Al-Qassim population (1,135,744) consists of 80% Saudis and 20% non-Saudis, and Hael population (580,437) consists of 87% Saudis and 13% non-Saudi.<sup>13</sup>

Although there is an increasing contribution of the private sector in health care in recent years, the MoH facilities still contribute to almost 80% of all health care services in KSA.<sup>13</sup> This explains our finding that 4 out of every 5 MLL took place in the MoH affiliated health institutions. The little contribution of hospital prosecutor or director in initiating the MLLs suggests lack of efficiency of the morbidity and mortality committees in these hospitals. The probability of a defendant who were found guilty did not show significant differences by the number of defendants per case, which propose no receptiveness to distribute guilt by involving more defendants. Also, our finding that defendants from certain nationalities (for example, Egyptians) were more often involved in MLL should be interpreted with caution since the denominators (numbers of health workers by nationality at each claim year) are unknown. The preponderance of Egyptian defendants may translate their high prevalence in Saudi health sector although no exact official figures are available.

As per Saudi MoH statistics of human resources, in 2009 (1430 Hijri), there were 1596 physicians (76% males and 24% females), and 3728 nurses (73% females and 27% males) working in Al-Qassim health sector.<sup>13</sup> Our study showed that 79% of the accused physicians were males. Conversely, 79% of the accused nurses were females. Given the aforementioned gender representation of physicians and nurses in Al-Qassim, results indicate that males and females, physicians and nurses were at almost even likelihood of being involved in MLL. The little percentage of Saudi health workers, especially physicians and dentists who were involved in litigations may be a result to their low employment rate in the health sector, especially during the early years of the study period. The most recent country-wide statistics show that Saudis represent only 22.2% of all physicians and dentists working in KSA, and the rest are expatriates.<sup>13</sup> Most of the defendants were physicians, which is reasonable since physicians are the leading medical staff responsible for diagnosis and treatment, decisions and instruct other staff. Our finding that specialist physicians constituted the highest percentage of all defendants, followed by consultants, and residents matches the reported statistics for Saudi Arabia during the year 2006 (1427 Hijri).<sup>12</sup>

Errors in obstetric practice can lead to serious harm for pregnant women and their fetuses or newborns. Similar to the findings of a Saudi study,<sup>7</sup> ObGyn departments and obstetricians and gynecologists were more often involved in MLL. The most frequent obstetric errors occurred in management of abortion, diagnosis of

pregnancy, selection of appropriate delivery techniques, management of hemorrhage, and other complications. Similar findings were reported in the Canadian Adverse Events Study.<sup>14</sup> The occurrence of ME during obstetric practice can be due to high volume practice, poor sign-out practices, absence of close monitoring for high-risk patients, lack of teamwork, and proper communication among medical staff, and between the physician and the patient, lack of strong leadership, and inadequate backup and consultation.<sup>15</sup>

Although the departments of general surgery, pediatrics, internal medicine, and general surgery were equally involved in litigations, classification of defendants by their medical specialties indicated that internists came second after ObGyn, then pediatricians, general surgeons, and anesthesiologists. The disparity between involvement of departments and medical specialties in MLLs is because of the uneven average number of defendants per case from each department. Raising litigations to the level of MLC does not necessarily indicate the occurrence of ME or prove the defendants' guilt. Indeed, final verdicts showed that more defendants are found not guilty than guilty. Moreover, there was no harm in more than half of the cases. While negligence was the most frequent error, inappropriate medication was the least frequent with a comparable rate to what Weingart et al<sup>14</sup> reported in an epidemiological review of ME literature.<sup>16</sup> Nevertheless, the rate of medication errors in our study was almost double the rates reported by another meta-analysis study.<sup>17</sup> The different study populations and the unique medico-legal system in KSA make the comparison to the aforementioned studies imprecise.

Errors occurring in ICU and DRs showed the highest probability to cause harm to patients. The reason could be the exceptionally high vulnerability of patients in both situations. Conversely, the least probability of harm was for errors committed in outpatient clinics may be because patients seek medical care in outpatients clinics are usually not severely ill, and can tolerate simple errors. Also, comparable conviction rates for consultants, residents, and specialist is probably because most errors were negligence and not lack of physicians' medical information or capabilities.

The most frequent verdict in cases with confirmed errors was fine. Fine is different from compensation, which came third in order. A fine is paid to the State, and usually as a penalty for committing administrative errors, while compensation is paid to the patient (or his beneficiaries) as a reimbursement for his/her incurred harm in form of injuries, losses, or suffering. The results of statistical analyses showed that the "Harm"

was the most influential indicator in determining guilt decision, while the patient and defendant nationalities were not significant factors. This finding could be a sign of the MLC evenhandedness. It is expected that most of the monetary penalties were paid by the defendants themselves as years ago, having medical liability insurance was optional. However, in 2009, medical liability insurance has become obligatory to all health specialties, and a prerequisite to registration in Saudi Commission for Health Specialties.<sup>18</sup> This study found that GPs paid the highest average monetary penalties as one of the 3 penalized GPs paid the highest monetary penalty (90,000 SR). The average total duration of litigations was noticeably too long. Reasons for the delay should be investigated and system improvements to be considered to avoid negative consequences on defendants and their quality of work.

This study has limitations as it can not imply any conclusions regarding the extent of MEs in Al-Qassim and Hael districts since it examined only cases that reached the MLC. It is expected that more cases did not reach the MLC, and much more errors were not reported, or detected. Other factors that may contribute to the involvement in MLLs, such as defendant's work load, which are missing in case files could not be investigated. Also, comparing our study results with international studies may not be accurate because of the unique medico-litigation system in KSA that applies Islamic laws. The increase in litigations related to ObGyn practice in Al-Qassim must be further studied to identify the specific causes of MEs and the possible interventions. Hospitals' morbidity and mortality committees should improve their capacity, and closely look into suspicious cases with unexpected negative patient outcome. An error reporting system must be established as a part of a regional and/or national policy to define standardized procedures for patient safety components. Special training programs based on the results of this study and future studies need to be developed to provide an understanding of the potential causes of errors in Al-Qassim and Hael districts to avoid preventable common MEs.

Finally, we propose a thorough review into the litigation process and the system of work in the MLC to reduce the litigation periods. We also recommend an initial fast investigation to rule out non-serious allegations to achieve justice for all parties, and to avoid the negative consequences of long litigations on defendants.

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