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Discrepancies between clinical and post-mortem diagnoses in Jamaica: An evaluation of clinical overdiagnoses

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Citation

Abstract

We previously documented that, at the University Hospital of the West Indies (UHWI), overdiagnoses (clinical diagnoses uncorroborated at autopsy) comprised a significant proportion of clinical discrepancies. In order to analyze these overdiagnoses and attempt to determine the diseases for which they may have been mistaken, we retrospectively extracted data from consecutive autopsies performed at the UHWI over the period January 1999 - December 2000. The majority of overdiagnoses (69.8%) were made in patients hospitalized for < 2 days, and older patients (>65 years) were more likely to have a major overdiagnosis. Most overdiagnoses (77.1 %) occurred in the cardiovascular or respiratory systems and 78.3% of all overdiagnoses consisted of one of only six diseases, including those with the highest overdiagnosis rates (pneumonia, myocardial infarction and pulmonary thromboembolism). More frequent autopsy requests, particularly in older patients and/or those who die within two days of hospitalization, may assist in reducing overdiagnosis rates.

INTRODUCTION

Previous studies have shown that the rates of discrepancy between clinical and post-mortem diagnoses are fairly high, ranging from 19 to 48% ([1,2,3,4,5,6]), and that these rates have remained relatively unchanged over the past several years, despite advances in medical technology ([2,4,7]). Although most studies analyzing discrepancies between clinical and post-mortem diagnoses have examined primarily those diagnoses that were missed by the clinician (missed diagnoses), a few studies ([4,8,9]) have included amongst the discrepancies, those clinical diagnoses that were uncorroborated at autopsy (overdiagnoses). We previously analyzed the rates of discrepancy between clinical and post-mortem diagnoses at the University Hospital of the West Indies (UHWI) ([5]), and found that overdiagnoses accounted for a significant proportion (36.2%) of discrepancies. Identifying overdiagnoses, and determining the diseases for which they may have been mistaken, may be useful in helping to improve diagnostic accuracy in future clinical practice.

The aim of this study was to analyze the overdiagnoses documented at the UHWI. To the best of our knowledge, this is one of only a few published studies that undertook detailed analysis of overdiagnoses, and it is the first of its kind from the English-speaking Caribbean.

MATERIALS AND METHODS

We retrospectively examined consecutive autopsies performed in the Department of Pathology, University of the West Indies (UWI), during the 2-year period January 1999 to December 2000. The department performs autopsies for deaths occurring at the University Hospital of the West Indies (UHWI) – the 500-bed multidisciplinary teaching hospital attached to the Faculty of Medical Sciences at the UWI in Jamaica. Ethical approval was not necessary for this study under the guidelines issued by the Ethical Committee of the UHWI, which waives such approval in autopsy-based research cases in which the patient is not identified by name or other unique identifiers, such as a hospital registration number, in keeping with the maintenance of patient privacy, dignity and confidentiality, in accordance with the Declaration of Helsinki. Age, sex, admitting service, duration of hospitalization, and clinical and autopsy diagnoses were recorded for each patient. As previously described ([5]), clinical diagnoses were defined as those listed by the clinician on the autopsy request form/patient death card and all diagnoses that were established or assumed, as indicated in the patient records. All diagnoses were classified according to organ system, and cases due to

trauma, other unnatural causes or iatrogenic complications were excluded from further analysis. All autopsies were complete and were performed according to standard methodology including relevant histological assessment. Clinical diagnoses were further classified as being either concordant or discrepant with respect to the autopsy diagnoses. Discrepant diagnoses were described in the previous study ([5]) as being either missed diagnoses or overdiagnoses (clinical diagnoses uncorroborated at autopsy). The current study reports on further analyses of those discrepant clinical diagnoses that were categorized as overdiagnoses.

Overdiagnoses were classified as follows:

Major overdiagnosis: Diagnosis definitely or possibly affecting clinical outcome
Minor overdiagnosis: Diagnosis not likely to affect prognosis

All the study pathologists arrived at a consensus regarding the categorization of overdiagnoses.

The data were used to calculate the overdiagnosis rate – the number of overdiagnoses expressed as a percentage of the number of clinical diagnoses, clinical diagnoses being the sum of concordant diagnoses and overdiagnoses.

In addition, for the most common overdiagnoses, we examined the autopsy findings in the patients involved to determine whether these findings could explain symptoms and signs that were erroneously attributed to the overdiagnoses.

STATISTICAL ANALYSIS

Data are expressed as frequencies, mean with standard deviation and median, as appropriate. Logistic regression was used to examine the relationship between recorded variables (age, gender, length of hospitalization and organ system) and overdiagnosis. The Stata statistical software for Windows version 8 was used for the analysis (Statacorp, College Station, TX).

RESULTS

We previously analyzed 348 patients with a total of 605 diagnoses (312 were concordant and 293 were discrepant) ([5]). One hundred and ninety seven patients accounted for the 293 discrepant diagnoses, 106 (36.2%) of which were classified as overdiagnoses; 40 (37.7%) were major overdiagnoses and 66 (62.3%) were minor. The sum of

concordant diagnoses and overdiagnoses was 418. Overdiagnoses were distributed among 95 patients (47 males and 48 females, male: female ratio – 1:1.02), ranging in age from less than 1 day to 88 years (Fig. 1), with a median of 49 years and a mean of 46.5 27.4 years (Table 1).

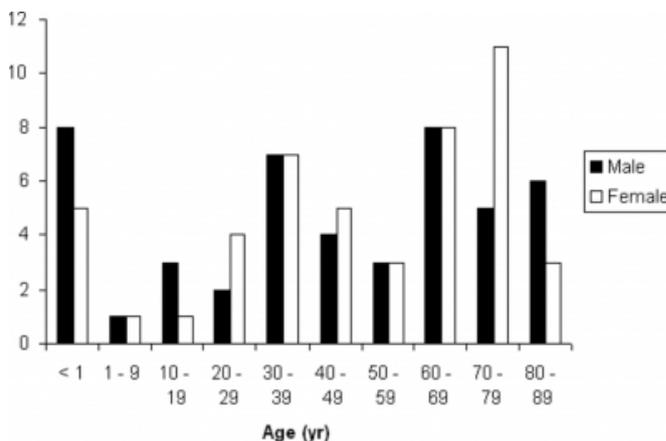**Figure 1**

Figure 1: Age and sex distribution of 95 patients

Figure 2

Table 1: Overdiagnosis rates by age and sex

Age range (years)	No. of clinical diagnoses			No. of overdiagnoses			Overdiagnosis rate (%)		
	M	F	Total	M	F	Total	M	F	Total
< 10	56	44	100	10	7	17	17.6	15.9	17.0
10 – 19	20	7	27	3	1	4	15.0	14.3	14.8
20 – 39	37	50	87	9	11	20	24.3	22.0	23.0
40 – 65	56	50	106	13	13	26	23.2	26.0	24.5
> 65	43	55	98	18	21	39	41.9	38.2	39.8
TOTAL	212	206	418	53	53	106	25.0	25.7	25.4

Older patients were more likely to have a major overdiagnosis – OR 1.02, 95% CI (1.005, 1.04) even after adjusting for gender, number of overdiagnoses, length of hospitalization and organ system.

Table 2 shows overdiagnosis rates according to hospital service. The highest overdiagnosis rates were seen on the Accident & Emergency (43.1%), Obstetrics/Gynaecology (37.5%) and Medicine (26.9%) services, although there was no significant difference in the proportion of overdiagnosis by hospital service.

Figure 3

Table 2: Overdiagnosis rates by service

Service	No. of clinical diagnoses N (%)	No. of overdiagnoses N (%)			Overdiagnosis rate (%)		
		Major	Minor	Total	Major	Minor	Total
Medicine	134 (32.0)	11 (10.4)	25 (23.6)	36 (34.0)	8.2	18.7	26.9
A&E*	72 (17.2)	18 (17.0)	13 (12.3)	31 (29.3)	25.0	18.1	43.1
Child Health	89 (21.3)	3 (2.8)	13 (12.3)	16 (15.1)	3.4	14.6	18.0
Surgery	60 (14.4)	4 (3.8)	6 (5.6)	10 (9.4)	6.7	10.0	16.7
ICU†	55 (13.2)	3 (2.8)	7 (6.6)	10 (9.4)	5.5	12.7	18.2
Ob/Gyn ‡	8 (1.9)	1 (0.9)	2 (1.9)	3 (2.8)	12.5	25.0	37.5
TOTAL	418 (100)	40 (37.7)	66 (62.3)	106 (100)	9.6	15.8	25.4

*Accident & Emergency; †Intensive Care Unit; ‡ Obstetrics/Gynaecology

Tabulation of overdiagnosis rates by organ system is shown in Table 3. The proportion of overdiagnoses in the major category by organ system was 14/48 (29%), 14/22 (64%), 3/13 (23%), 7/14 (50%) and 2/9 (22%) for the respiratory, cardiovascular, multisystemic, central nervous and "other" systems respectively. There was a significant association between overdiagnosis category and organ system category with a greater than expected proportion of major overdiagnoses (64%) occurring in the cardiovascular system (2=10.5, df(4), p=0.03).

Figure 4

Table 3: Overdiagnosis rates by system

System	No. of clinical diagnoses N (%)	No. of overdiagnoses N (%)			Overdiagnosis rate (%)		
		Major	Minor	Total	Major	Minor	Total
Respiratory	119 (28.5)	14 (13.2)	34 (32.1)	48 (45.3)	11.8	28.6	40.3
Cardiovascular	102 (24.4)	14 (13.2)	8 (7.6)	22 (20.8)	13.7	7.8	21.6
Multisystemic	64 (15.3)	3 (2.8)	10 (9.4)	13 (12.3)	4.7	15.6	20.3
Central Nervous	45 (10.8)	7 (6.6)	7 (6.6)	14 (13.2)	15.5	15.5	31.1
Other*	67 (16.0)	2 (1.8)	7 (6.6)	9 (8.4)	3.0	10.4	13.4

* Other = 3 categories/systems: Gastrointestinal, liver, gall bladder & biliary tract; genitourinary system; reticulo-endothelial system

The six commonest overdiagnosed conditions, which together accounted for 78.3% (83 of 106) of all overdiagnoses, are shown in Table 4. Sixty-four of these 83 diagnoses (77.1 %) belonged to the cardiovascular or respiratory systems. The highest overdiagnosis rates were

seen with pneumonia (61.8%), myocardial infarction (57.7%) and pulmonary thromboembolism (54.5%). Among these 83 commonest overdiagnoses, 31 (37.3%) were classified as major and 52 (62.7%) were minor. The highest major overdiagnosis rate was seen with myocardial infarction (38.5%). Twenty-one miscellaneous diseases accounted for the remaining 23 overdiagnoses (there were 2 overdiagnoses each of meningitis and subarachnoid hemorrhage).

Figure 5

Table 4: Commonest overdiagnoses and their overdiagnosis rates

| Diagnosis	Total no. of clinical diagnoses	No. of overdiagnoses N (%)			Overdiagnosis rate (%)		
		Major	Minor	Total	Major	Minor	Total
PTE*	44	7 (6.6)	17 (16.0)	24 (22.6)	15.9	38.6	54.5
Pneumonia	34	6 (5.7)	15 (14.1)	21 (19.8)	17.7	44.1	61.8
Myocardial infarction	26	10 (9.4)	5 (4.7)	15 (14.1)	38.5	19.2	57.7
Sepsis	31	3 (2.8)	9 (8.5)	12 (11.3)	9.7	29.0	38.7
CVA†	14	3 (2.8)	4 (3.8)	7 (6.6)	21.4	28.6	50.0
Infective endocarditis	8	2 (1.9)	2 (1.9)	4 (3.8)	25.0	25.0	50.0

*Pulmonary thromboembolism

†Cerebrovascular accident (intracerebral hemorrhage or infarction)

Figure 2 shows all 106 overdiagnoses according to length of hospitalization. The distribution of length of hospitalization was right skewed with a range of <1 hour to 90 days. The median length of hospitalization was 1 day and the mean (sd) was 6.6 (14.7) days. The distribution was normalized by Napier log transformation. The majority of overdiagnoses (74 of 106 [69.8%]) were made in patients hospitalized for 2 days or less (54 [50.9%] were hospitalized for less than 24 hours).

Figure 6

Figure 2: Overdiagnoses and overdiagnosis rates, by duration of hospitalization
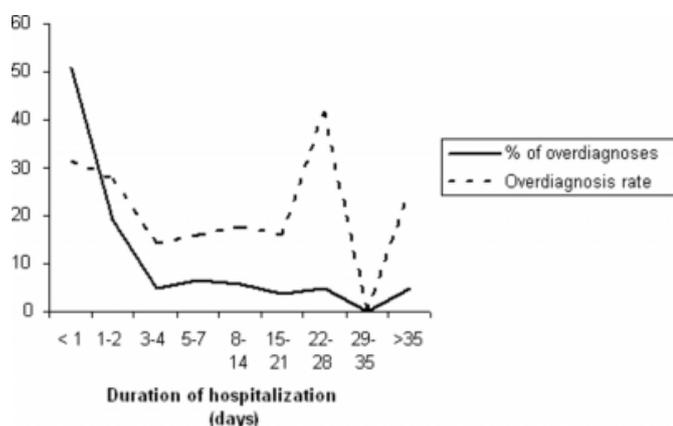
There was a significant relationship between the logarithm of duration of hospitalization and probability of major overdiagnosis as each 1 unit increase in logarithm of duration of hospitalization decreased the probability of major overdiagnosis by 18 % (OR 0.82, 95% CI 0.69,0.98). Of the 36 overdiagnoses made on the Medicine service, 27 (75%) occurred in patients admitted for 2 days or less. All 31 overdiagnoses made on the Accident & Emergency service occurred in patients hospitalized for less than 24 hours.

Forty-nine (59%) of the 83 commonest overdiagnoses were made in patients hospitalized for 2 days or less. Of the 31 common overdiagnoses that were major, 19 (61.3%) were made in patients hospitalized for less than 24 hours, and 25 (80.6%) were made in patients hospitalized for 2 days or less. Seventeen (68%) of these 25 major overdiagnoses were based on clinical findings only. Of the remaining 8, three were overdiagnoses of myocardial infarction based on suggestive electrocardiographic findings, with a positive Troponin I test in one. In two cases, computed tomography scans of the brain failed to support diagnoses of cerebrovascular accident, but the diagnoses were maintained because of seemingly convincing clinical features. The remaining three overdiagnoses included one diagnosis of pneumonia with what appeared to be convincing chest radiographic findings, one overdiagnosis of pulmonary thromboembolism (PTE) with a ventilation/perfusion lung scan that reported high probability for PTE, and one overdiagnosis of sepsis in which blood film findings (smear of peripheral venous blood showing early forms of neutrophils [left-shift] and "toxic granulations' in neutrophils) were presumed to be supportive of the clinical diagnosis.

Significant autopsy findings were found in 68 (81.9%) of the 83 commonest overdiagnoses (Table 5), and the majority of these autopsy findings (62 of 68) (91.2%) were in the cardiovascular or respiratory systems. Congestive cardiac failure (or histologically diagnosed pulmonary congestion & oedema) was a significant autopsy finding in 34 (38.5%) of the commonest overdiagnoses and had been documented ante-mortem in 11 cases.

Figure 7

Table 5: Pathologic findings at necropsy in the six commonest overdiagnoses

Pathologic finding (N)	Overdiagnosis					
	PTE*	Pneumonia	MI¶	Sepsis	CVA†	Infective endocarditis
Cardiovascular (40)						
Congestive cardiac failure	8	12	6	4	2	2
Cor pulmonale	1	-	-	-	-	-
Ruptured abdominal aortic aneurysm	-	-	1	-	-	-
Ischemic heart disease	1	-	-	-	-	-
Aortic dissection	-	-	1	-	-	-
Respiratory (24)						
PTE*	-	4	1	-	1	-
Pneumonia	3	-	1	-	-	-
Lung metastases	3	1	-	-	-	-
Primary lung cancer	1	-	-	-	-	-
Bronchial asthma	1	-	-	-	-	-
Acute pulmonary oedema	1‡	-	-	-	-	-
Thoracic empyema	1	-	-	-	-	-
Neonate in respiratory distress	-	-	-	4	-	-
Pulmonary hemorrhage	-	1	-	-	-	-
Hyaline membrane disease	-	1	-	-	-	-
Gastrointestinal, Liver, Gallbladder & Biliary tract (3)						
Hepatic failure	-	-	-	2	-	-
UGIH§	-	-	-	-	1	-
Massive LGIH**			1			
Genitourinary (1)						
Ruptured ectopic gestation			1			
Multisystemic (1)						
Multiple organ infarcts	-	-	-	1	-	-
No significant findings at necropsy (15)	4	2	3	1	3‖	2
TOTAL (83)	24	21	15	12	7	4

*Pulmonary thromboembolism

†Cerebrovascular accident (intracerebral hemorrhage or infarction)

‡ Patient with morbid obesity

§Upper gastrointestinal hemorrhage

‖2 patients had metabolic derangements that may explain the central nervous system sym & signs

¶ Myocardial infarction

** Lower gastrointestinal hemorrhage

DISCUSSION

The majority of published studies on discrepancies between clinical and post-mortem diagnoses did not report an overall overdiagnosis rate, and as a result direct comparisons with our study were limited. However, our overdiagnosis rate of 25.4% falls between that of 19% for primary disease diagnoses and 42% for cause of death diagnoses reported by Rossi et al. ([10]).

The finding that overdiagnosis rates were higher in older individuals (> 65 yr) is consistent with previous observations that discrepancies in general are more common in these patients ([1,2,5,7,10,11]), and this is particularly significant as autopsy rates at our institution are lowest in this age group ([12]). Cameron et al. ([13]) reported significant improvements in concordance between clinical and autopsy diagnoses by improving autopsy rates. This suggests that an increase in autopsy rates in elderly patients at our institution may lead to better understanding of disease processes in this age group, and ultimately, to improvement in diagnostic accuracy in such patients.

The respiratory and cardiovascular systems accounted for the greatest proportions of overdiagnoses – 45.3% and 20.8%, respectively, and the respiratory system exhibited the highest overdiagnosis rate (40.3%). Rossi et al. ([10]) categorized diseases into either primary disease, or cause of death, and found that the respiratory system exhibited the highest overdiagnosis rate in both categories – 67% and 50%, respectively, and that the cardiovascular (11% and 41%) and digestive (33% and 44%) systems also exhibited high overdiagnosis rates. Other studies did not report overdiagnosis rates according to organ system but focused on specific diseases instead, and these workers, like us, documented high overdiagnosis rates for respiratory diseases ([4,8,9,14]). However, while we documented the highest overdiagnosis rate for pneumonia, their highest overdiagnosis rates were for pulmonary thromboembolism, which ranked third in our patients.

Myocardial infarction (57.7%) and cerebrovascular accident (50.0%) exhibited high rates of overdiagnosis among our patients. In other studies, the overdiagnosis rate of myocardial infarction was quite variable and ranged from 6% to 29% ([4,8,9,10]). Our overdiagnosis rate for cerebrovascular accident lies in-between the very high rate of 84% documented by Hasuo et al. ([15]) and the 2% to 26.7% range of other studies ([8,9,10]).

Although our data revealed a small number of clinical diagnoses of infective endocarditis, we feel that the high overdiagnosis rate (50%) is still significant. The only other stated overdiagnosis rate for infective endocarditis was the 33% reported by Cameron et al. ([8]).

The majority of overdiagnoses (69.8%) were made in patients hospitalized for two days or less, and there was a significant relationship between increased duration of hospitalization and decreased probability of major overdiagnosis, contrasting with the finding by Mercer et al. ([9]) that overdiagnosis increased with length of hospital stay. Like Rossi et al. ([10]), we did not demonstrate any correlation between overdiagnosis rate and duration of hospitalization, and also like them, our highest overdiagnosis rate was seen in the Accident and Emergency unit.

The role of ancillary investigations in mitigating overdiagnoses is interesting. Approximately two-thirds of the common major overdiagnoses made in our patients who were hospitalized for less than 48 hours were based on clinical findings only, suggesting that such patients might have benefited from investigations that may have disproved provisional clinical diagnoses. It is interesting to note, however, that in 8 (32%) of the 25 major overdiagnoses made in patients hospitalized for 48 hours or less, investigations had been done, and in most instances, the laboratory results appeared to have actually contributed to the overdiagnoses, suggesting that laboratory and radiological investigations are not infallible in this regard. Kirch et al. ([4]) actually documented that diagnostic technology sometimes contributed directly to false-positive diagnoses. It is possible, however, that if our patients had survived for longer, other investigations (such as serial cardiac enzymes, blood culture and sputum culture) may have disproved the provisional clinical diagnoses.

Did the autopsy findings in patients with the commonest overdiagnoses help to explain the clinical symptoms and signs that led to the overdiagnoses? The majority of the significant autopsy findings were in the cardiovascular and respiratory systems, which also accounted for the majority of overdiagnoses. In other studies that also attempted to explain overdiagnoses ([4,8,14,15]), a significant proportion of the autopsy findings deemed to be responsible for producing the misinterpreted symptoms and signs also belonged to the respiratory and cardiovascular systems. In our study, congestive cardiac failure was found in patients with 34 of the common overdiagnoses, and was a possible explanation

for 32 of these overdiagnoses in that signs produced by congestive cardiac failure could have led to diagnostic confusion with pulmonary thromboembolism and pneumonia, and the consequent poor cerebral perfusion could have resulted in the overdiagnosis of cerebrovascular accidents. It is possible also, that the generalized reduction in perfusion arising from congestive cardiac failure could be mistaken for cardiogenic shock associated with myocardial infarction, or with septic shock. Congestive cardiac failure was not a frequently implicated autopsy finding in patients with overdiagnoses in other studies ([4,8,14,15]).

Pulmonary thromboembolism has been implicated in misleading clinicians into overdiagnoses of pneumonia, myocardial infarction and cerebrovascular accident ([4,8,14]). The signs and symptoms of pulmonary thromboembolism were deemed to possibly be responsible for six of our overdiagnoses – 4 cases of pneumonia, 1 case of myocardial infarction and 1 case of cerebrovascular accident. Kirch et al. ([4]) found pulmonary thromboembolism in all their cases of overdiagnosis of myocardial infarction and Cameron et al. ([8]) found that hypotension due to pulmonary thromboembolism, hemorrhage, myocardial infarction or perforated peptic ulcers, may have contributed to cerebral ischemia, and consequently, to some of their overdiagnoses of cerebrovascular accidents. Thurlbeck et al. ([14]) reported that pulmonary thromboembolism was usually mistaken for pneumonia, and vice versa. We believe that the presence of pneumonia was responsible for three of our cases of overdiagnosis of pulmonary thromboembolism. The symptoms and signs of pneumonia may additionally explain one instance of overdiagnosis of myocardial infarction in our study. Respiratory infections were also believed to be responsible for some cases of overdiagnosis of myocardial infarction in the study by Cameron et al. ([8]).

Metastases to the lung were thought to possibly produce symptoms and signs that were overdiagnosed as representing pulmonary thromboembolism in three cases, and pneumonia in one. Neoplasms were documented in some cases of overdiagnosis of pulmonary thromboembolism in one study ([8]), but there was no elaboration on the location of these tumours, and no documentation as to whether or not they were thought to contribute directly to the overdiagnoses.

Neither this study nor those that preceded it have served to adequately explain the reasons for the prevalence of the high overdiagnosis rates (the number of overdiagnoses expressed as a percentage of the number of clinical diagnoses) that

have been documented. What is obvious is that further studies, preferably well-designed prospective ones, are needed if clinical diagnostic accuracy is to be improved. The findings that clinical/post-mortem discrepancies can be reduced by increasing autopsy rates ([13]), and that low autopsy rates at our institution were shown to be primarily due to low autopsy request rates ([12]), would seem to indicate that in order to improve our diagnostic accuracy, more autopsies must be requested. We have already mentioned the need to improve autopsy request rates in older individuals. However, as the majority of our overdiagnoses occurred in patients hospitalized for two days or less, and consisted predominantly of one of only six diseases (pneumonia, pulmonary thromboembolism, myocardial infarction, cerebrovascular accident, infective endocarditis and sepsis), we feel that in order to reduce overdiagnosis rates, autopsies must also be requested more frequently in patients who die within two days of hospitalization, especially in those with clinical diagnoses of one of the six common overdiagnoses.

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