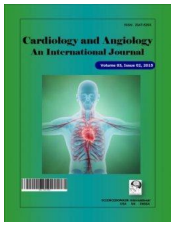

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A Four-year Study of Chronic Patients' Information Integration in Dental and Medical Documentation in a Secondary Care Setting

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Authors' contributions

This work was carried out in collaboration between all authors. Author RMA did the study design, study instruments, data collection forms, data collection and record reviews, conducted statistical analyses, results display and discussion and wrote final report draft. Author AES did literature researches and review, shared data entry and preparation for the analysis, shared data interpretation and discussion. Author SSZ provided access to data sources, wrote the protocol, shared in data entry. Author YA shared field work, records reviews, data entry, shared statistical analyses and data display, handled final report editing. All authors read and approved the final manuscript.

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ABSTRACT

Integrated health documentation captures, imports and exports relevant extract of patient's longitudinal health information record. Especially documenting patients' chronic disease data in dental documentation system is crucial.
Aim: Analyze chronic patients' health information integrity in dental documentation during orodontal procedures and correlates affecting this relationship.
Methods: Dental records of chronic disease patients in Qena University Hospital (QUH) between 2012 and 2015 were compared with paired medical records to achieve study aim. Medical

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information studied included an array of health condition inquiries.
Results: The patients' age averaged 55±15y, (range 21-84=63y); 58.2% (n=189) were male. Most dental examinations were attended by resident/registrar dentists (72.1%). A total of 1644 discordant data representation between dental and medical pair of records has been identified. More than half (53.7%; n=995) of disease items as in medical records were missing, and 0.8% (n=35) of disease items not among the patients' history were "falsely" endorsed in dental records *[χ^2(df=1)= 2385.5 p<0.0001].* Patients' age was associated with proneness to neglecting health data while submitting to orodontal care *[Fisher's exact = 15.2, p<0.0001].* Male dentists tended to report more discordant data incidents (97% vs. 90%) *[χ^2(1)= 7.3, p=0.007].* Less professional staff, and less experienced, tend to report discordantly more frequently than senior peers (96.6% vs. 84.2%, respectively) *[Fisher's exact 8.3, p=0.028].*
Conclusions: This study reveals the presence of miscommunication of health information of chronic disease patients between dental and medical records. Both patients' criteria and the practitioners' data management attitude may be incriminated. A standardized documentation system saves chronic disease patients the health and economic consequences of discordant data representation in records.

Keywords: Chronic patients; dental documentation; health information; integration.

1. INTRODUCTION

Health information should be recorded and transported with each care procedure as a continuum of data, flowing through all healthcare settings. Endorsing patient's data respective to health status, current and past disease history, and results of clinical and laboratory work are principal component of a body of data shared by each health organization's management information system [1]. In the clinical care arena, documenting patients' data both in medical record and dental documentation has traditionally been going as a separate process. In dentistry, absolute knowledge of a patient's health information is an essential aspect of the dentist's responsibility in any common dental-medical care event [2]. When a patient presents with an acute dental problem, a basic assessment for managing the patient's immediate needs should always include reviewing and updating of the patient's medical history [3]. With this respect, there is a body of evidence emphasizing the association between orodontal disease and general disease conditions, such as cardiovascular disease (CVD), diabetes, chronic renal disease, and patients with history of stroke [4,5]. Further, medication history needs to be fully addressed in order to avoid interference with ongoing dental procedures. Failure to balance the probable interaction between these medications and dental procedures often ends catastrophic or fatal complications [6]. In the context of proficient orodontal dental care performance and patient safety, good record keeping underpins the provision of quality patient care [7,8]. The overall patient care is shared among dental team members and between other professionals, therefore, it is important to ensure that all relevant information is available to facilitate the provision of safe, shared care of patients. This might also prove useful in the event of complaints or for medico-legal reasons [3,7].

That communication is the backbone on which successful medical information and patient data can be safely transported, channels for sharing this information among health practitioners on an ongoing basis should be established and evaluated, diligently. Nevertheless, concerns have arisen about informational discrepancy regarding the handling of this information, as well as other technical arrangements. According to the American Dental Association (ADA), dental records (also referred to as patient's chart), involve the official office document which reports all of the treatment done and all patient-related communications that occur in dental office [9]. The design and validity of the forms used to document patient information in dental documentation have been a research focus. A number of techniques have been used to gather relevant information that constitutes the medical history including, self-administered pre-printed forms filled out by the patient, direct interview of the patient by the clinician or a combination of both. Despite the commonality of this understanding within the medical and dental care professions community, up to one-tenth of dental records still could have disagreement with the corresponding medical record of the same patient in a significant number of medical data fields [10,11]. To assure timely availability of patients' health data in a climate of continuum of patient care, efficient and secure approaches,

such as electronic medical record (EMR), and often referred to as electronic health record (EHR) and digital communication technology represent a superb solution [1]. On the other hand, patient-administered health questionnaires of variable designs and complexities are still in common use in many dental care facilities. Although some studied provide positive results regarding the validity of self-reported questionnaires a medical history taken by a physician, such as the "European Medical Risk Related History" questionnaire (EMRRH), [12] there still is a concern about depending on patient using their own memory and understanding responding to questionnaire items, despite some guidance or assistance from attending dental staff [13]. Some patients do not report their medical history because they believe it is not important for dental procedures or they are not even aware of their systemic conditions [14]. In fact, direct questioning and reviewing about the patient's medical history is essential to gather up-to-date data, especially that there is always room for a change in the health condition of chronic patients in between dental visits.

In the Middle East and North Africa (MENA) region, chronic diseases such as coronary heart disease (CHD) (up by 44%), HTH (up 59%), diabetes (up by 87%), stroke (up by 35%), dylipidemias (up 51- 66%), musculoskletal disease (MSKL) and low back pain (LBP) (up 77%), neurological and bipolar disorder (up 58%), Iron deficiency (up 7%), all have been growing to alarming figures between 1990 and 2010 [15]. In Egypt, too, ischemic heart disease (IHD) and stroke were the second and fourth common causes of death during the same time period after which they have shifted to be the first and second cause respectively [16,17]. Many of these ailments constitute risk upon the health patients subject to dental care intervention, particularly in the absence of adequate medical control [18]. Thereby, dental care providers frequently have to modify treatment or procedures for these patients to be consistent with the medical constraints of the patient, such as using premeditations, modification of anticoagulant therapy, stress reduction and pain control. In fact, dental care providers must have enough knowledge and training to be able to identify medical emergencies and adopt the opportune measures to avoid or manage critical events. Importantly, dentists need to consult the patient's treating physician prior to treatment planning and treatment initiation. Although it seems to receive a disproportionate amount of emphasis, research continues to show that poor communication between physicians and dentists contributes to many medical errors and is reason for team mishaps and subsequent lawsuits [3,19,20]. With the increasing focus on collaborative care, communicating effectively becomes an even higher priority. The Institute of Medicine's 2012 Core Principles & Values of Effective Team-Based Health Care discussion paper lists communication as one of five major principles guiding new models of care delivery during all steps and settings of the health service providing process [21,22]. The current research was based on the hypothesis that the medical record system pursuant to chronic disease patients at QUH may show disagreement and disintegration in medical information transported in dental record and corresponding medical record. We may also hypothesize that some correlates, e.g., dentists' demographic, credentials, and experience could impact dental patient information completion and integration. Thereby, in this work, we aimed to identify and measure the prevalence incompatibility and incompleteness of reporting medical information of chronic disease patients' in dental record upon submitting to orodontal procedure.

2. METHODS

The study was conducted at a joint setting of dental service and the medical records system (MRS) in QUH. A retrospective design was selected to achieve study aim. The study was conducted in collaboration with medical information department and dental records division. Patients who have visited QUH dental clinics between 2012 and 2015 and those diagnosed with chronic health conditions of interest were retrieved. QUH is a 400 -bed secondary healthcare institution receiving referrals from other institutions in Qena, Red Sea, and South Valley governorates in Upper Egypt. The hospital offers a variety of secondary and some tertiary health services, including inpatient, outpatient, intensive care, operative, and emergency services.

2.1 Sampling Technique and Sample Size

The study sample size was determined using sample size proportion calculation based on the following assumptions: a) a source population size of 30,000 (above least number a reasonably large sample size to allows generalizability of results, b) tolerable error 5%, d) confidence level 95%, and c) DEFF (design effect for complex sample surveys) =1. *[n = DEFF*Np(1-p)/ (d^2/Z^2_{1-}*

$_{\alpha/2}$*(N-1)+p*(1-p)]* [23]. A sample size (*n*) of 322 records was calculated, which was increased to 350 to make up for the probability of missing data or entry errors. Admittance into the analysis required completing ≥80% of screened fields of the medical records, ending up with 323 records (92.3% inclusion rate). Now we have 323 pairs of documents, each consists of one dental record of one patient and one medical record belongs to the same patient, alongside with dental staff information who had attended the patient the day of the visit. Thereby it is quite possible that one dentist had seen a number of patients during 4 years of study period, depending on dental clinic schedule at the time. Inclusion criteria encompassed records of patient falling under any of the following underlying chronic disease groups: *a)* cardiovascular and circulatory diseases, [including coronary heart disease (CHD), angiopathy, hypertension (HTN), other]; *b)* respiratory diseases, (e.g., chronic bronchitis, chronic obstructive pulmonary disease, bronchial asthma, atopic, other), *c)* blood diseases, (e.g., anemia, bleeding disorders, other); *d)* dyslipidemias; *e)* kidney and urological disorders, [e.g., nephropathies, renal failure, stones, other); endocrinal and metabolic disorders, (e.g., diabetes, thyroid disease, infertility, pregnancy, other); *f)* Autoimmune, allergic, infectious diseases (AI), and malignancy, (e.g., rheumatoid arthritis, ulcerative colitis, all malignancies, other), *g)* gastrointestinal and liver diseases (peptic ulcer, hepatitis B, C, liver cell failure, irritable bowel disease, other); *h)* neurological and mental disorders, (e.g., stroke, seizures, multiple sclerosis, bipolar disease, other). Additionally, treatment agents' history, procedures, (e.g., drugs, antiplatelets, chemotherapy, protocols) were also included with disease condition. Also to be included in the study, participants must be 21 years old or above, have both a medical and dental record with QUH; and was seen at least once in the dental clinics of QUH or affiliated dental care facilities during the study duration. Exclusion criteria include patients who do not have either dental record or medical record (or both) with QUH, and also records outside the study duration years. Otherwise, no patient record would be excluded because of demographic, professional, not having a specific chronic disease. The study sample frame included chronic disease patients who had at least one dental visit at QUH during the study duration, from which study sample could be selected. The number of sample frame found in each year out of 2396 chronic patient records was: 2012: 575 (24.0%); 2013: 527 (22.0%); 2014: 541 (26.3%); 2015: 571 (27.7%). In order to reflect the proportionality between the number of selected records per year (n_i) and the number of records in each of the study years, stratification was done by multiplying 323 (sample size) times the proportion of sample frame respective to each year. Medical records in each year were given serial numbers and a proportionate number of records for that year (n_i) were collected. Randomization of the study sample strata was done using online free random number generators. Out of total 323 sample records, the following sample strata were collected: a) n_{2012}: 78 (24.0%), b) n_{2013}: 71 (22.0%), c) n_{2014}: 85 (26.3%), d) n_{2015}: 89 (27.7%). In parallel, the dental records belonging to each patient whose medical record has been selected were retrieved. Reviewed medical information and co-morbidity items under investigation include detailed diagnoses and symptoms pursuant to each disease condition as above. ["International Classification of Diseases- version IV (ICD-IV) (WHO, 1992) [23] was used to specify diagnosis conditions in the collected dataset for this research purpose only].

2.2 Data Collection Tool and Study Variables

The basic form used for proving patient information in dental record was a form of health history questionnaire form adapted from a verity of available models, and mostly best practice considered in QUH data documentation system. The form contains lists of medical and surgical data to fill up by the patients in their first visit. The form may be reviewed by charge nurse for appropriate completion of required fields, and to be finally overseen by the attending dentist. In addition, progress notes form is regularly attached to the patient's file with every visit, and which contains a field about medical information in which the dentist may endorse her or his client's medical history. On our part, each pair of patient records (medical record and dental record) was compared for disagreement/ agreement, item by item over the whole record fields. (In this work, the terms discordance, unmatched, and discrepancy may be used interchangeably to describe data disagreement; likewise, the antonyms, i.e., concordance, matched may also be used to describe data agreement). Data for the analysis were collated on a proforma adapted from *"health history form."* [9] (Included fields consist of both dentist and patient demographics, source of patient; medical

information). Independent variables include demographic and professional criteria of dentists, e.g., job title (consultant/professor, senior registrar- SR/specialist, registrar/resident), and experience duration (y). The study outcome variable was to decide whether or not there was any disagreement either in quantity, quality, or both of patient medical information in dental record as originally reported in corresponding medical record. That said; we then had 323 patient records in the form of 323 pairs of dental and medical records, 323 attending dentists, 323 attending clinicians, and 323 lists of chronic disease items. Collected data were entered to a Microsoft program with adequate backup lines. Data were analyzed using statistical package for the social sciences (SPSS) software version 18 (SPSS, Inc., Chicago, IL, USA).

2.3 Statistical Analyses

Nomino-ordinal data, e.g., sex, and educational level, would be summarized in Tables as counts and proportions. (*NB.* Because more than one patient- often many patients, could be attended by the same dentist, the total number of dentists across the study does not equal the total number of records). Interval ratio scale data, as age and dentist's experience years, would be summarized as mean ± standard deviation (SD) or the median and interquartile range (IQR), where appropriate (based on normality distribution, which in turn could be assessed, e.g., by one-sample Kolmogorov-Smirnov test). (Age also could be categorized and stratified as 21-40y, 41-60y, >60y, and dentist's experience as <3y, 3-5y, 6-9y, and ≥10y). Inferential statistics would be tackled mainly using non-parametric techniques, since the outcome variable is categorical. And for the most research, the strength of association between the study correlates categories, e.g., gender or work experience category and the outcome variable could be assessed using chi-square test (χ^2) calculation (or Fisher's exact alternative, where appropriate). Often, such association may be assessed in terms of odds ratio (OR) (and the 95% confidence interval) (CI). Our tolerable level for alpha error (α) is 0.05; results with *p*-values <0.05 are deemed statistically significant. (Likewise, significance is also assured if a 95% CI, where appropriate, not containing one).

2.4 Ethical Consideration

The research project and methodology were approved by institutional review board (IRB) in QUH. Approval to lookup un-identified data in dental and medical records from medical information and dental records divisions was granted. All data related to patients, dentists, and other data generated by the research, including data analysis and retention were kept confidential; only grouped data would be displayed.

3. RESULTS

As in Table 1, the patients' age average 55±15 years, (range 21 to 84y =63). More than half of the patients (58.5%, n=189) were males. Also, the majority of patients are above 60 (44%). Most dentists (72.1%, n= 233) were residents/ registrars, while 19 (5.9%) were consultants/ professors. Most were males (63.1%, n = 204). Less experienced dentist predominated (46.4% had <3y, 7.7% had ≥10y experience). Further, dental records of all patients disagreed with corresponding medical records in the medical history information.

In Table 2, total 1644 (66%) discordant reporting incidents out of 2492 health-related conditions counted over the reviewed records affecting study subjects were reported (average= 5.1/record), while matched reporting incidents accounted 776 (46.7), (average 2.6/ record). Disease items reviewed in the CVD, dyslipidemia, blood disease group had the majority of unmatched reporting (40%, n=657), followed by treatment and medical procedures group items (34.7%, n=570), followed by endocrinal and metabolic disease item group (10.3%, n=170); (these groups together account 85.0% of discordant reporting load.

Table 3 shows that 995 (53.7%) medical items reviewed were missing in dental records. Less (855 = 46.2%) items were matched in records. Further, 35 (0.8%) items not in medical records were "falsely" reported in dental records. Otherwise, most disease items not truly diagnosed in examined patients were not misreported in dental records (accurately not reported) (4288/4323 = 99.1%). This relationships was statistically significant *[χ^2(df=1)=2385.5, p<0.0001].*

As in Table 4, only age significantly impacted the association in disagreement in the examined pairs of records; gender did not. The vast majority of records (98.6%, n = 140) belonging to patients >60y reported discordance in reviewed

items; least was for patients 21- 4 0y old (83.6, n=51) *[Fisher's exact=15.2, p<0.0001].* The source of patient referral to dental examination whether from different inpatient, outpatient departments or directly presenting to dental clinics did not have a significant effect on disagreement of data in examined records *[χ^2(df 4)=1.989, p=0.738].* (Table 4 footnote) Also, another chi-square analysis showed no significant difference in disagreement rate throughout the study years *[Fisher's exact = 7.9, p=0.38].*

Table 5 shows that gender influenced dental care providers' data transportability behavior, where male dentists tended to report more discordantly than female peers (97% vs. 90%, respectively) *[χ^2(1)= 7.3, p=0.007].* On the other hand, both professional seniority and experience duration were associated with less discordant patient data reporting in records, e.g., 96.6% registrar vs. 84.2% consultant [Fisher's exact 8.3, p=0.028]; and 83.3% in case <3y experience vs. 96.3% ≥10y experience, [Fisher's exact 9.6, p=0.025].

Table 1. Patients' demographic criteria of patients and dentists (n=323 records)

	Characteristic	Category	n	%
Patient	Age (years)	21-40	61	18.8
		41-60	120	37.1
		>60	142	44.0
		Range: 21- to – 84 = 63	-----	-----
		Mean ± SD: 55±15	-----	-----
		Median: 50	-----	-----
	Gender	Male	189	58.5
		Female	134	41.5
Dentist	Job title	Prof/consultant	19	5.9
		Senior registrar/specialist	71	22.0
		Registrar/ resident	233	72.1
	Gender	Male	204	63.1
		Female	119	36.9
	Experience (y)	<3	150	46.4
		3-5	85	26.3
		6-9	63	19.5
		≥10	25	7.7

Table 2. Transportability of patients' information by disease group

Disease group	Discordance [a]		% (column)	Concordance [b]		Total reported
	n	% (raw)		n	% (raw)	
Cardiovascular & circulatory, dyslipidemia, hematological disorders*	657	62.0	40.0	403	38.0	1060
Respiratory, AI, allergic, ID, diseases	81	77.1	5.0	24	32.9	105
Gastrointestinal and liver disorders	69	85.2	4.2	12	14.8	81
Hormonal, metabolic disorders	170	62.5	10.3	102	37.5	272
Renal & urological diseases	55	78.5	3.3	15	21.4	70
Neurological, mental, psychological disorders	42	70	2.5	18	30	60
Treatment, medical procedures, protocols	570	67.5	34.7	274	32.5	844
Total reported	1644	66.0	100	848	34.0	2492

[a] Mean discordance: 1644/323=5.1/patient; [b] Mean concordance: 848/323= 2.6/patient)

** Cumulative effect of discordant data reporting adds up to 79%*

Table 3. Medical data matching of dental and medical records

		Concordance (n, % in row)	Discordance (n, % in row)	Total row (n, % in row)
Medical record	Data present (n, % in row)	855 (46.2)* (Accurately documented)	995 (53.7)** (Falsely omitted)	1850 (100)
	Data absent (n, % in row)	35 (0.8)† (Falsely reported)	4288 (99.1)†† (Accurately not reported)	4323 (100)
Total		890 (14.4)	5283 (85.6)	6173 (100)
Test statistic p-value	$\chi^2(df=1) = 2385.5, p<0.0001$ (OR=105.3, 95% CI 75-148)			

**Present in medical & dental records (true +ve); **In medical but not dental record (false -ve); †Not in medical but in dental record (false +ve); ††Not in both records (true -ve)*

Table 4. Transportability of data by patient's criteria (n = 323 record pairs)

Characteristic*		Discordance (n, % in row)	Concordance (n, % in row)	*Total row*	*Test statistic, p-value*
Gender	Male	178 (94.1)	11 (5.9)		$\chi^2(df\ 1)=0.419$
	Female	127 (94.8)	7 (5.2)		$p = 0.78$
	Total	305 (94.4)	18 (5.6)	323	*Fisher's*
Age	21- 40	51 (83.6%)	10 (16.4)	61	*exact=15.2*
	41- 60	112 (93.3)	8 (6.7)	120	*p<0.0001*
	> 60	140 (98.6)	2 (1.4)	142	
	Total	303 (93.8)	20 (6.2)	323	

**Source of referral: $\chi^2(df\ 4) = 1.989$, p = 0.738; Study duration: Fisher's exact = 7.9, p=0.38*

Table 5. Transportability medical data by dentists' criteria (n = 323 record pairs)[a]

Criterion	Category	Discordance (n, % in raw)	Concordance (n, % in raw)	Total raw	*Test statistic, p -value*
Gender	Male	198 (97.0)	6 (3.0)	204	$\chi^2(1)= 7.3$
	Female	107 (90.0)	12 (10.0)	119	*p=0.007*
	Total	305 (96.5)	18 (3.5)	323 [a]	
Professional title*	Prof/consultant	16 (84.2)	3 (15.8)	19	*Fisher's*
	SR/ specialist	64 (90.2)	7 (9.8)	71	*exact = 8.3*
	Registrar/ resident	225 (96.6)	8 (3.4)	233	*p= 0.028*
	Total	305 (96.5)	18 (3.5)	323 [a]	
Experience**	<3	146 (93.3)	10 (6.7)	150	*Fisher's*
	3-5	84 (95.5)	4 (4.5)	88	*exact = 9.6*
	6-9	60 (98.4)	1 (1.6)	61	*p= 0.025*
	≥10	15 (83.3)	3 (16.7)	18	
	Total	305 (96.5)	18 (3.5)	323 [a]	

[a] Total = overall record number not dentist number. One dentist usually attended more than one patient.
** % in column: Professor/consultant 16.7%, SR/specialist 38.9, registrar/resident 44.4.*
*** % in column: <3y 55.6%, 3-5y 22.2%, 6-9y 5.5%, >10y 16.7%*

4. DISCUSSION

In the health care arena, there are two streams of care often working independently, dental care and medical or general health care; the former caters for orodontal health and the latter caters for the rest of the body's health. Solo practice of these two health professions has been traditionally going, probably ignoring the fact that the mouth is part of the body [24]. This "siloization" persists despite international recognition of the need for integration of the disciplines. For instance, the World Health Organization (WHO) recommends that *"… oral disease prevention and the promotion of oral health needs to be integrated with chronic disease prevention and general health promotion as the risks to health are linked."* [25]. In this

work, dental records were overly subject to deficient reporting of a plenty of patient information aspects; 5.1 items were missed vs. 2.6 retained on average for each record reviewed. Although it is not the goal of this research to present a comprehensive account on systemic diseases affecting dental health; however identifying the health status of study population helps predict how far an improper data dental documentation can affect the safety and efficacy of the provided service. Given the intimate relationship between oral and systemic health, and the deficient subjects were rather high risk patients, this risk inflates the burden of improper patient health condition reporting in dental documentation at QUH. Whether any malpractice issue reflected by this study could be sign for a larger documentation management problem is a concern. We found that 66.0% medical items were missing in dental records. Similar discrepancy trend between dental and medical records have been documented with variable rates, e.g., 10% [10] up to 86 [26]. The unmatched reporting tendency in our studied records was not consistent over reviewed diseases lists. For instance, five out of more than 5 disease groups, (CVD, dyslipidimias, endocrinal and metabolic, and treatment) (vital few) caused over 80% of discordant reporting in QUH dental/medical information system. Other studies on the integration of health data of chronic disease patients, as n ours, transported between dental and medical records [27] found low concordance rate, too, particularly in conditions HTN, blood disorders and procedures, diabetes, and renal disease. Medication data transportability was also deficient, as in our study, and some dental records included only medication class, such as cardiac medications or antihypertensive. In fact, medication reporting malpractice is not only a major data management malpractice of dental care but many other healthcare fields, globally. The discrepancy between reported data and actual patients' medical history in some primary and emergency medicine settings reached up to 70.4% [28] and 97% [29].

Both varieties of hypothesis testing outcomes at the α-level of error in this research have been obtained. The "no difference" finding of data integration between dental and medical records was often met with, e.g., patient referral source analyses. Time also could not improve data reporting in QUH dentistry service. In either case, rejection of the null and tendency toward the alternative hypothesis would have been most preferable to us. On the other hand, significantly omitting medical data for patients above 60 attending dental care would also not be in our interest, i.e., unfavorable alternative hypothesis scenario. Our practitioners should realize that most chronic patients tend to have older age profile (55±15y) than the general population [30]. In health care, advanced age, if anything, should be motive for more curiosity to do extra work to improve client's health-related quality of life (HRQOL). So, when we first hypothesized for this research, our desire was ultimately in support of no difference in a sense that the data completion in the two versions of patient records would be equal, i.e., a favorable no difference scenario, and so forth. Such no difference here would be to the best of our patient safest and most efficient dental care. Thereby, any hypothesis testing, whether toward the null or against the null; in either direction; which supports this aim would be welcome. For instance, findings that time failed to improve deficient data reporting in dental records (no difference, i.e., accepting the null) was not in our research's best interest. We wished if QUH data reporting practice was improved in more recent years. Speaking of significant differences, the odds of just having data accurately not reported (not volunteer, true negative) in dental records was 105.5 times greater than the accurately documented. The dominance here is limited to the true negative rather than the true positive result. This is favorable at least we are confident that no wrongful or harmful data would be significantly introduced into the records. Yet, failure to endorse important patient health data in records (and this occurred 53.7% of the time) might be more harmful, e.g., omitting a mention of antiplatelets drugs while a dental process such as tooth extraction was underway [4]. Likewise, the dentist's criteria analysis was somehow in favor of significantly less likely "worse" data recording by experienced and senior staff than junior staff. In fact, all staff was in the deficient data reporting zone more frequently that data completion zone. Although both were deficient data reporter, female dentists in QUH tend be less likely discordantly handling their patients' health data than male peers. Similar finding was reported elsewhere [10]. It is important to point out that the patient cohort was consistently seen by the same number of staff assigned to dental service in QUH during the study period, probably why data documentation pattern was almost consistent throughout the study period. Not only dentists' data management attitude across time seems questionable, medical physicians often

tend to behave alike; [28,29] and this very practice environment has been a matter of extensive work of international and professional healthcare quality and regulatory organizations [25]. But in the dental health care is study's context, practicing dentists ought to appreciate their patients' general health information background and perceive it a genuine component of any dental care responsibility they undertake. Now that some correlates could not provide valid explanation to the discordant data management trends in this research, factors related to systems not subjects could be argued. In our early search, we realized that medical information was mainly obtained through the health history questionnaire form used in QUH the time of the study. Flaws and untimely updating of the form to meet the changing demographic and health risk demands of QUH need to be investigated. From the communication standpoint, we saw how flow of data between physician and dentist either through referral or when the patients directly walks in to dental clinic resulted in more or less the same level of data discordance. Our search also included looking up referral and consultation notes sent from medical physicians to dentist colleagues. Some of these referrals were so superficial and lacked essential clinical information; others included pieces of medical data believed relevant to the dental procedure, and so forth. The paper-based data collection forms in use in medical documentation seem to be non-standardized over the entire care environment of QUH. Also methods of storing, keeping, disposition, transportability, release or purging of records, duration of retention, all affect the flow of health information management system in the hospital. Now triggered by science and research and the evolution of medical and dental practice, chronic care does demand that medical and dental care and data be fully integrated. Innovative, e.g., advocating digital technology assures comprehensive, efficient, timely, secured, and synchronized communication of the healthcare information data load throughout the entire healthcare system. Investing in EMR applications [1] supports efficient, meanwhile cost-effective communication channel among medical and dental providers, avoids discrepancies between records and information available to authorized providers for the same patient [31]. Systems which are not so integrated are not coherent and are at risk of becoming obsolete. An insurance and claim structure which is not correspondingly integrated into a single coherent approach can no longer effectively support the demands of twenty-first century patient care.

5. STRENGTHS AND LIMITATIONS

The study is purposefully focused on a population category which is already high risk owing to the underlying health condition. Getting exposed to a poorly informed situation as a dental procedure where patient's health status is not fully recognized magnifies that risk. Dental procedures themselves have their own risks, whether or not the patient's health is maintained. Adopting a "common risk factor approach" (CRFA) through a concerted action against such risks helps achieve improvements in a wider spectrum of care with more resource-efficiency than isolated approaches [32]. Further, the sample frame of this patient group actually included all chronic disease individuals who have had any previous dental procedure experience during the study period. This inclusive sample background broadens generalizability and can make up for any unforeseen factors that could compromise it. The sampling strategy in the current work is rather meticulous, so that representing sample strata per year proportional to the actual number of patient records in that year as ascertained. A unified international disease coding system has not yet been in application in the hospital's disease information management system, and this probably limited our ability to release the research with coded diagnoses.

6. CONCLUSIONS

Communicating patients' information in dental documentation system in QUH could be in jeopardy. The current structure of both medical and dental records requires combined efforts to improve the institution's data handling approach. A multitude of factors contribute to this inconvenience, including patients' traits, dentists' perception of links between data completion and patients' safety, and importantly, the underlying hospital's information management setup. Improving the practitioners' data management and risk assessment skills within an integrated communication system environment assures safe and favorable health outcome of our chronic patient population. A dissociated data transportation system exacerbates the risk upon this group of patients and interferes with making concise decisions about their orodontal health, which, in turn interferes and worsens their underlying pathologies. Dental records must

integrate with medical records, and medical records must accommodate the needs of dental providers. Dental care providers should be given the support to realize how to ask the right questions about their clients' health. The production, retention, and release of clear and accurate patient records are an essential part of the dentist's responsibility. Success in this task not only maximizes the patient's health outcome opportunities, but also assists the dental professional and liability position.

CONSENT

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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