Tempos Management in Primary Care: a Key Factor for Classifying Adverse Events, and Improving Quality and Safety

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Summary: For the Webster dictionary, a tempo is primarily a musical term describing the rate or speed of a musical piece; by extension, it is the pace of an action. General practitioners manage various tempos for delivering safe care: the disease's tempo (unexpected rapid evolutions, slow reaction to treatment), the office's tempo (day to day agenda and interruptions), the patient's tempo (time to express symptoms, compliance, emotion), the system's tempo (time for appointments, exams, and feedback) and the time to access to knowledge. Two trained physicians reviewed a sample of 1046 malpractice claims from one liability insurer to determine whether a medical injury had occurred and, if so, whether it was due to one or many tempo-related problems. We analyzed 623 reports of these in greater detail to identify the prevalence and characteristics of claims and related time management errors. The percentages of contributive factors were observed as follows: disease tempo, 37.9%; office tempo, 13.2%; patient tempo, 13.8%; out-office coordination tempo, 22.6%; and GP's access to knowledge tempo, 33.2%.

These results are subject to general discussion. First, although not conceptualized in most error taxonomies, the diseases' and patients' tempo are cornerstones in risk management in primary care. Second, traditional taxonomies describe the events from the analytical perspective of the care at the system level and offer opportunities to improve organisation, process and EBM. The suggested classification describes the events in terms of (unsafe) dynamic control of parallel constraints from the perspective of the carer, namely the GP, and

offers improvement on how to self manage and coordinate different contradictory tempos and day-to-day activity. Further work is needed to test the validity and usefulness of this approach.

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1 – Introduction

We know little on the rate of adverse events in primary care compared to in-hospital data. Estimates of patient safety incidents in primary care vary considerably from 0.004 to 240.0 per 1000 primary care consultations; 45%-76% of all patient safety incidents are considered preventable[i] . Needless to say, initiatives and methods to collect data on quality and safety in primary care are still in debate[ii].

The nature and even the in-depth causes of errors vary significantly between in and out-of-hospital contexts[iii]. GPs' offices are likely to work with limited direct visual and oral contacts with their colleagues and other medical professionals. A second structural difference is patients' greater freedom. It is the patient's decision to choose their medical professionals, see and tell the doctors about any problem they consider important or not, to choose the time for this disclosure, as well as the time of the next visit. Moreover, they are often few complaints of GPs' suggestions (examinations, drugs)[iv].

Of the available taxonomies used to classify ambulatory medical errors, most use the Reason's framework of contributive and causative factors to mark the distinction between person errors (deficiency of knowledge), and system errors (communication, process and organizational problems)[vvi]. Some classifications have attempted to go beyond linking the causes with the impact (outcome)[vii], preferring to asses the type (of activity) and the domain (setting, staff, patient, target)[viii]. However, the design of a unique and consensual international tool, that is really usable and reliable for end users (GP's), providing them with comprehensive opportunities for improvement, is still a challenge, especially for primary care[ix].

There is, nevertheless, a consensus in these taxonomies and in the literature to show three recurrent categories of errors and vulnerabilities, relatively specific to primary care, and all related to time control:

- First, missed and delayed diagnoses[x] are considered as the first cause of claims and allegations in primary care, especially for cancer and cardiac diseases. Although the calculation of the delay is a matter of debate, diagnostic delays may

occur at any point in the disease journey and can be divided into pre-symptomatic delays, patient delays, primary care delays, referral delays, and secondary care delays[xi]. These problems are clearly prevalent in primary care because patients often present with early manifestations of illness, more or less often, with a background of existing psychosocial problems and physical co-morbidities[xii]. Diagnosis in those conditions, and, moreover, during a short consultation, is never easy.

- Second, failure in access and availability of GPs on call, especially when calling GPs after-hours or during consultations[xiii,xiv].
- Third, communication breakdown within the clinic / office (wrong appointment, wrong chart, missing information[xv]) and between office and outside entity (referrals not done, incorrect discharge[xvi]).

The core characteristic of all of these sources of failure is an improper dynamic control of the process (here, the patient disease).

Dynamic situations, such as industrial, aviation, or traffic process control, in uncertain environments, have long been one of the major study targets for safety improvements[xvii,xviii,xix,xx].

In these situations, the human operator only partially controls the technical process or the environment. For example, the actions of a ship's helmsman do not fully determine the route taken by that ship. The combined effects of the steering of the ship, the current, the wind, and the inertia of the ship must also be taken into account. The operator is subject to time constants and time constraints. Operators are confronted with uncertainties, in particular because of their partial control of the situation. These uncertainties add significant risks to the basic (yet complex) nature of the task[xxi].

Time can assist cognition and lead to errors in two ways. On the one hand, time is encoded in the representation of the activity, and is used as an internal clock to organize tasks. De Keyser[xxii] introduces the notion of *time reference* systems to demonstrate the existence of different time scales in human and professional tasks requiring parallel processing. Some tasks are managed on a time scale measured in seconds, others are measured in months. For example, time to get a referral in primary care is measured in days, time to educate a patient is measured in minutes, and certain therapeutics effects are measured in seconds while others are in months. The operator

usually uses deadlines as milestones around which shared activities can be organized. The large number of these deadlines is sometimes misleading, but in most cases, operators manage parallel time scales extremely well, and use them as natural markers to distribute their activity throughout the day.

On the other hand, time is what drives transformation in the world; it has its own problem and error solving potential. Situations are dynamic and, therefore, a problem encountered at one moment in time will not be the same as another encountered later. Sometimes, not doing anything is the best way to solve difficulties. Furthermore, time changes situations. As information stacks up over time; this can sometimes turn a complex problem into a much simpler one. Human beings are well aware of the fact, and often use this property of time. For example, Hoc and colleagues[xxiii] show that air-traffic controllers only trigger a conflict solving mechanism when all conflict elements are on the screen, and all possible means of action are available. Most of time, controllers have been aware of the conflict for a fair amount of time, but cannot pinpoint it finely enough, because only partial conditions are known. At that point in time, simple methods cannot help solve the conflict, and there is no point in jumping the gun. Waiting becomes the best decision to make, including decisions in terms of workload management. Renewed theories on natural decision-making[xxiv] provide numerous inputs into the idea of 'suffisance' in the control of time[xxv]. This school of thought collected data in a great number of high risk situations (aviation, military, and industry). Authors showed that most biases found in the classical theories on decision-making[xxvi] are in fact irrelevant and unimportant in complex and dynamic real-life situations. Decision-making is an ongoing process, coupled to the environment. This process is made up of a flow of more or less relevant partial decisions, which eventually lead to an acceptable result, given the margins available in real situations. Operators often have an adequate knowledge of the "worlds" to which their decisions will be applied. For better or worse, operators have an in-depth expertise of what gaps they can fill, therefore, they can afford to make decisions already known as being hardly valid, as long as they believe that this decision will not place them in a situation exceeding their level of expertise. It is self evident that general practitioners use waiting strategies when symptoms are unclear. For example, a young and busy patient voicing a recent, severe but isolated fatigue would probably *be prescribed a symptom relief medication,* with suggestion for a new appointment in case of persistence of the fatigue.

Error control usually follows this route. Time is a precious error detection instrument and often helps to alleviate consequences of errors, but it is also the source of many errors in dynamic situation control.

All taxonomies cite time as a type of error (delays in diagnosis, therapy, referral, admission to hospital[7.8.9]) and/or as a cause of errors (time pressure, etc.[9]). They describe the events from an analytical perspective of the care at the system level and offer opportunities to improve organisation, process and EBM. Time is one of the identified problems, and remedies are usually given by recommending new protocols and new organizations.

However, these taxonomies are less effective to address the events in terms of (unsafe) dynamic control of parallel dimensions of the patient journey from the perspective of the carer. Learning to read medical case stories from this actor centred point of view may offer additional remedies to reduce adverse events, aiding doctors to adopt a safe personal cognitive organization of patient pathway in complement to the recommended technical and systemic organization of the care.

This paper is an attempt to fill this gap describing the strategies and failures to control the various times that doctors must manage to deliver safe care. We expect that this complementary contribution to existing taxonomies would lead to a comprehensive and causative framework of failures in the day-to-day practice of GPs with direct implications for additional learning and improvements (Figure 1).

INSERT FIGURE 1

2 – METHOD

MATERIAL

We reviewed a sample of 1046 malpractice claims from one liability insurer to determine whether a medical injury had occurred and, if so, whether it was due to one or many tempo-related problems. The 1046 files represented the total claims gathered in general practice in this insurance company for the period 2004 to 2006. This insurance company provides cover to about 60% of all French GPs.

We considered all claims during this three year period, whether they were closed or not (we considered that working with only closed claims meant selecting only old files with lesser relevance for present practice; moreover the agreement between preliminary expertise and final litigation outcome is better than 90%). All claims included a thorough medical analysis, and the findings of one or two independent medical appraisals. They also contained a 3 to 4 pages extended summary of the medical observation written by the insurance medical committee.

ANALYSIS

The reviews included independent assessments of whether the claim involved injury due to time-related problems.

Reviews were conducted at insurers' offices by the two authors of the paper. Reviews lasted 15 minutes per file on average and were conducted by one reviewer. Reviewers were not blinded to the litigation outcomes but were instructed to ignore them and rely on their own clinical judgment in making decisions about errors. To test the reliability of the process, we systematically submitted this first expert judgement to the second expert, summarizing the case and searching for consensus in the notation. On the basis of the literature review and preliminary work on a random selection of claims, we decided to consider five types of time-related causes of incidents— access to knowledge, office, patient, disease, and out-office coordination— and applied a uniform definition of each in all cases.

Each issue amounts to a specific time-related aspect of risk that can be termed a *'tempo'*. The Webster dictionary defines tempo as "primarily a musical term describing the rate of speed of a musical piece". By extension, it is a pace of an action, a rate of performance or delivery. The art of the doctor is not only to control the tempo of each situation, but to manage the five tempos simultaneously, in a consistent manner. It is hypothesized that any poor control of one or many of these tempos may result in poor quality of care and adverse events. Based on these observations, a draft taxonomy is presented in figure 2.

INSERT FIGURE 2

The five tempos can be described as follows:

- The disease's tempo: GPs have a gross estimate of the average profile of temporal evolution of standard diseases. For instance, they know that a standard flu will last about six days for a healthy adult and a rhinopharingitis about three days in same conditions. They have also a gross estimate of the time of expected effects of drugs. However, these estimates of time may lead to errors. The disease can escalate, the patient may respond to drugs slowly, and elements can easily combine to produce an unexpected situation. We have coded this tempo as being at risk anytime the evolution of the disease does not obey the usual standard evolution of equivalent pathologies, whether it is too fast, has unanticipated complications or is atypically slow.

- The office's tempo: physicians, as any professional, must organize consultations, visits, administration in a consistent manner, manage interruptions and calls, and make all these activities compatible with other personal, family and private needs. In the following, we have noted this tempo as being at risk anytime the availability of a GP to take care of a patient (whether directly or by telephone) has been reduced or made impossible due to competitive duties.

- The patient's tempo: patients are often emotionally impacted by their symptoms; they may fear describing their symptoms, or exaggerate them. They can be chatty, demanding, silent or aggressive, easing or slowing interactions and doctors' search for relevant history. They can be rapid or slow to comply with doctors' requests for exams or future appointments. We have coded this tempo as being at risk anytime patients have contributed, by their behavior, to delay the access to diagnosis and treatment.

- The out-of-office coordination's tempo: the medical system outside the hospital is difficult to coordinate. Doctors prescribe examinations, radiology/imaging, or specialist consultations, but there is no guarantee that results will be available within a fix period of time. We have coded this tempo as being at risk anytime referrals with other medical professionals and feedback of information have exceeded standard delays

- The time to access to knowledge is the last category of tempo, clearly different from previous tempos since it relates to biases in cognitive access to memory. External peer judgments and most error taxonomies ([6.7.8.9]) consider that errors in patient examination, deficiency in investigation, or undertaking procedures signal a deficiency in knowledge and skills. Such situations, however, are not that simple. Ergonomics [(18)] makes a distinction between competence and performance models. The competence model refers to the knowledge owned by the professionals; the performance model refers to the contextual activation of such knowledge, required to carry out the job. The cognitive and medical literature on diagnosis [[xxvii xxviii]] abounds with situations where operators/doctors have been contextually attracted by a set of apparently obvious or misleading symptoms and jumped to an incorrect diagnosis, although they prove having the knowledge of the right diagnosis. We have coded this tempo as being at risk whenever the GP has misinterpreted the initial situation and symptoms, or was unable to access the right knowledge during consultation, but showed consistent recovery actions in subsequent events, evidencing that the knowledge was not missing. Conversely, when the knowledge was clearly missing, we excluded the report from the analysis.

For each case, we coded either one tempo when considering this tempo as the main source of the problem, or two tempos when considering that two or more tempos were contributing to the problem (we coded only the two most important tempos).

3. RESULTS

EXCLUSION

Of the 1046 claims initially reviewed, 623 reports were included in the final review. The main reasons for exclusion were that (a) 174 claims had no independent expert review (having been notified because of potential rather than actual claims), and (b) 249 were found unrelated to problems for GPs (legal certificates, pure technical errors (unambiguous knowledge deficiency), per operative complications, etc). The summary of errors associated with these 249 cases is included in Table 2.

GLOBAL RESULTS

The 623 patients' files included 318 females and 303 males. The mean age of the patients was 48.5 and the median 50. The typology of adverse events in our database has already been published[xxix]. It shows that the top three categories of claims are *missed and delayed diagnosis* (25,6%), *errors managing care* (non-medication)(20,7%), and *adverse drug events* (24,1%). The other categories of errors were Ethics and patient-doctor conflicts (10.4%), delay or refusal to visit at the patient's home (7,2%), device-induced traumas (injections, infiltrations, manipulations, 7,6%), falls in the office (3%) and miscellaneous (1.4%).
The following sections only focus on the five main tempos cited above, which are considered as potential causes of these AEs.

Coder agreement

The concordance amongst coders was measured using the Kappa test. Only one principal tempo per report was included for the test. The initial agreement was fait enough (0.68). The spontaneous convergence was very high for in-office, disease, out-of-office and patient's tempos; and a little less for GP's access to knowledge. Complete disagreement after common reexamination by the two coders fell from over 18% to less than 2% of cases.

Results from the data base

The attribution of tempos for the 623 reports feeds a three tiered distribution (Table 1). The GP's access to knowledge tempo represents the first third, the disease tempo represents the second third, and the office, patient and out-of-office coordination tempos all together represent the last third.

INSERT TABLE 1

The volume of causal implication of GP's access to knowledge echoes the literature on GPs' deficiency of knowledge (a third of reports[1]). This indicates that most deficiencies of knowledge coded in the existing publications are in fact contextual traps in the access to knowledge, rather than complete absence of knowledge.

The other tempos are not coded in existing taxonomies and relate to doctors' ability to cognitively control the various time pressures.

The estimate of the disease tempo is the cornerstone of the time management process since it determines the margins of regulation available for other tempos. For instance, a 50 year old man with episodes of diarrhea lasting for two months, no past history, will trigger a series of routine schemas based on expectation that the most threatening diagnosis to eliminate is cancer. With that idea in mind, the GP will consider an estimate of the safest available time for the first examinations (probably about a month for colonoscopy and blood levels) and a trimester for planning surgery if needed. The GP will therefore put this patient into a class of 'semi urgent' priority, tolerating some small delays in out-of-office tempo but not much, and will be ready to accept this patient at the office at short notice. Of course the reality can follow a different path, with either unexpected complications (disease-related, or organizational), or with side effects (accepting all interruptions from this patient calling during a consultation may paradoxically induce distraction and generate risk for other patients present in the office). Typically a cascade effect of time constraints and time management arbitrations are faced. These can feed and enrich the paradigm of cascade analysis[xxx].

Regarding the relation between tempos and errors (see Table 3)

We consider in this section the correspondence between the immediate cause of adverse events and the most frequently uncontrolled tempos. For that purpose, we have grouped all the incidents into 5 main categories (discussed below): missed or delayed diagnosis, adverse drug events, poor strategic care, ethics and care-induced traumas.

INSERT TABLE 3

Missed or delayed diagnoses are primarily associated with the disease tempo (52%). This is clear indication of a repetitive conflicting pattern of tempos for making diagnosis. Although the taxonomies usually consider missed or delayed diagnoses as pointing to knowledge deficiencies[3,xxxi,xxxii], the roles of disease and external triggering factors appear to be even more important. Most errors come first from

incorrect estimates by GPs of the safe window of time of the critical evolution of the disease, during which GPs consider they can ask and wait safely for further information.
Adverse drug events (ADEs) are most commonly associated with access to knowledge and out-of-office coordination tempos (88% at total). 56% of the ADEs are related to the incorrect mistimed administering of anticoagulants before or after discharge from hospital, with poor communication between the in-hospital specialist, the GP and the patient.
Falls relate mainly to the office tempo. For instance doctors rush writing prescription just after patients' examinations, leaving patients to stand up from the examination table without assistance.
Ethics and conflict management are typical issues of the office's tempo. Doctors are interrupted, give imprudent answers on the telephone, refuse or delay home visits.

4-DISCUSSION

Our study identifies four main results. First, the unsafe control of tempo is present in 71% of the total files (623 of 872 records containing relevant data). Second, although not cited frequently in taxonomies, the unsafe control of disease tempos is present in 37,9% of the files, while patient tempos account for 11,8 %. Third, difficult access to knowledge is present in 33,2% of the cases. Fourth, the poor control of competing tempos (poor synchrony) is present in 419 files on 623 (67,2%) .

The disease tempo appears to be a cornerstone in managing risk. It is also the case for the patient tempo, which may create opportunity for numerous GP's errors[xxxiii]. In both cases, the reasons under consideration are probably a miscomprehension of the safety paradigm, searching for errors with a micro-vision focused on the sequence of care under consideration. This disregards the other competing demands of the episode of care (workload, personal time to devote to the patient, outside pressures, patients' time), the dynamics of the situation, including its past and future, and the capacity of recovery from errors.

The suggested draft taxonomy highlights overlaps with current taxonomies, though this does not include non-identical parts of the safety problem and, as such, seems to

offer new opportunities for improvement. Classical taxonomies classify events in terms of error, causes, and consequences and lead to opportunities of improvement in terms of organisation, process and EBM. The suggested classification describes events in terms of unsafe dynamic control of care from the point of view of the carer, namely the GP, and, therefore, may lead to specific education and design improvements. At present, we must acknowledge that education provided to primary care physicians on time management of encounters is highly variable across the world. Emphasis on tracking time sensitive events, such as referrals, testing results or disease progression also varies greatly from setting to setting both in educational venues and clinical practice. This framework may help standardize training, designing a safer agenda of day-to-day activity, and may even be inspirational for GPs' self-safety audit on personal strategies to cope with risk when reporting and analysing adverse events.

Limitations

We acknowledge some limitations in relation to this study. First, claims data have limitations and research based on other data (reported incidents, chart audits, etc.) is needed. Second, the source of data is monocentric with only two judges who are co-authors of the paper, and had limited or no capacity to go beyond reviewers' report to obtain further medical information about the patients' history.

The problem of potential divergent coding amongst reviewers for the access to knowledge tempo requires further comment. Reports are factual, describing visible actions and reflecting poorly the context and GPs' hesitations. Moreover, the specific context of an insurance claim gives emphasis to non-compliance with EBM, which is cited in over 80% of the reports and may lead to overvalue some causes.

A final issue is generalization which may be limited by a focus on French GPs, but has the potential to be much of much broader focus than France or general practice. The study could prove a relevant contribution for all non-acute healthcare, not just general practice but also outpatient hospital care. At that stage, it should therefore be considered only as a promising preliminary tool requiring further tests to determine validity and usefulness in different settings.

5. CONCLUSION

The process control industry has long invested in the role of time, as well as success or failure. Training courses have been developed in the aviation and nuclear industry, with explicit recommendations and guidelines on good practices. Conversely, in medicine, with some exceptions[5,6], time has not usually been conceptualized as a main entry for error analysis, nor for safety culture, quality approaches, or even WHO curricula for patient safety[xxxiv]. However, there is mounting evidence that tempos are at the core of successful and safe medical practice, especially in primary care.

We therefore recommend four main strategic skills to be taught to GPs in relation to time control:

- Learning how to develop a safe control of time during the consultation
- Learning coping strategies in relation to multiple parallel activities, especially telephone calls: how to answer, what to answer, how to deal with a range of issues.
- Learning about realistic margins when prescribing diagnostic tests or examination, or requesting referrals : keeping expected delays compatible with the disease evolution
- Learning about instructions given to patients in relation to the expected time effects of prescription, and what to do if he/she is not proceeding as expected.

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Figures and captions

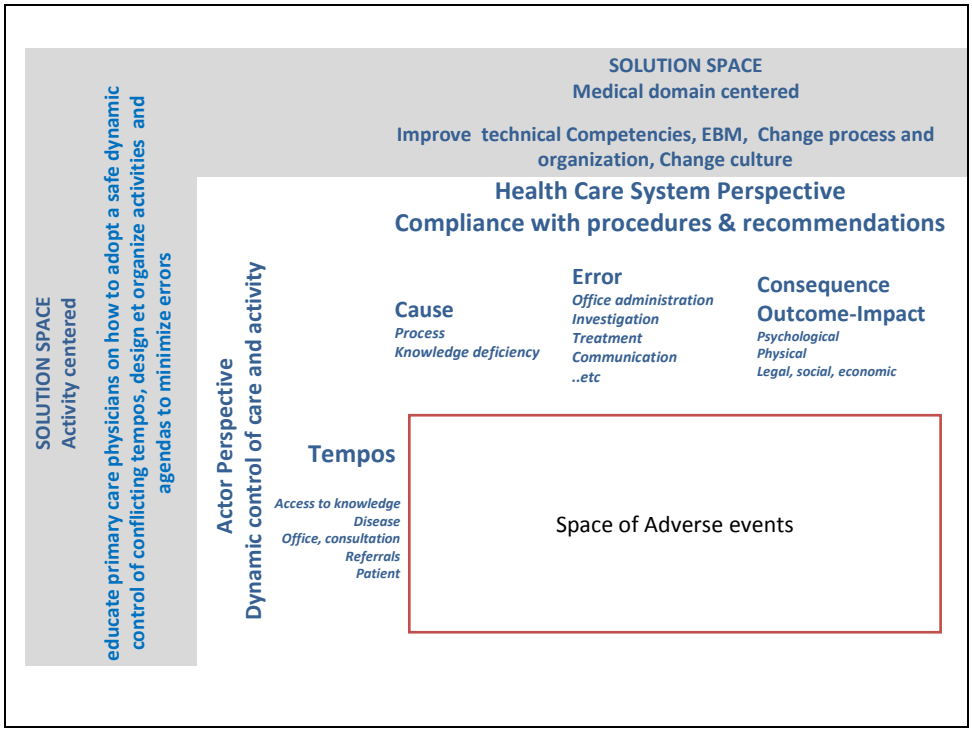

Figure 1: Health-care centered taxonomies of medical adverse event and related space of improvement Vs Doctor centered taxonomy of unsafe dynamic control of medical tempos (leading to medical adverse event) and related space of improvement

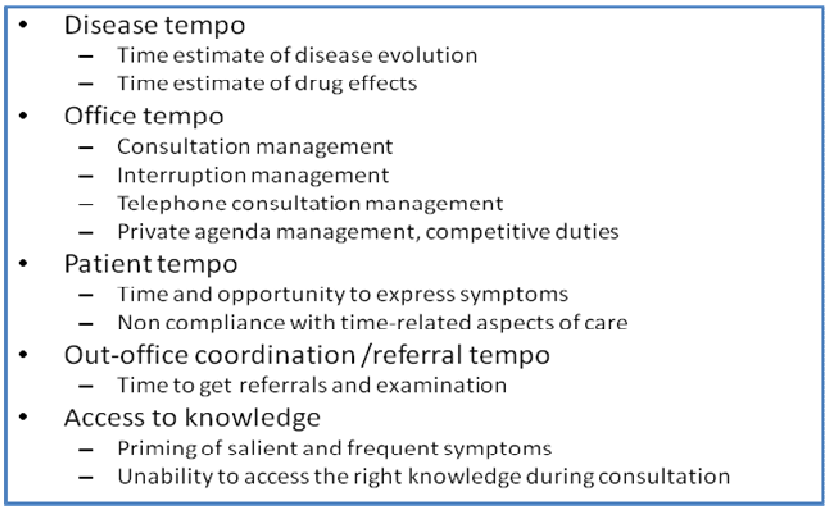

Figure 2 : A preliminary draft taxonomy of tempos

TEMPOS	*Non contributive*	Contributive	Decisive	Percentage *(contributive + decisive)*
Access to knowledge	*416*	124	83	33,2%
Tempo of the disease	*387*	132	104	37,9%
Tempo of the office	*541*	48	34	13,2%
Tempo of the patient	*537*	57	29	13,8%
Tempo of the out-office coordination	*482*	58	83	22,6%

Table 1 Raw count of tempos in the 623 reports

Nature of adverse events	***Series of 249 files of non-tempo related incidents for the GPs***	***Series of 623 files of -tempo related incidents (at least one tempo concerned with the issue)***
Missed or delayed diagnosis	7,2% (18)	25,6 %(160)
Adverse Drug Events	21,7% (54)	24,1% (150)
Poor strategic of care, inadequate treatment, surveillance	20,1% (50)	20,7% (129)
Ethics, Conflict management, and miscellaneous	39,8% (99)	17,2% (107)
Falls/device and care-induced traumas	11,2% (28)	12,4% (77)
Total	100% (249)	100% (623)

Table 2: Contribution of tempo and non-tempo-related incidents to the 5 main classes of adverse events. *Percentages are calculated separately for the series of non tempo-related problems (N=249) and for tempo-related problems (N=623). The total of 1046 files included also 174 claims that had no data or no independent expert review and were excluded from the review(raw data are in brackets)*

	Series of 623 files of tempo related events					
Nature of adverse events	*GPs' access knowl.*	*Disease tempo*	*Office tempo*	*Patient tempo*	*Out office com. tempo*	*Total*
Missed or delayed diagnosis	30,7%	51,9%	4,2%	6,8%	19,7%	113,3
Adverse Drug Events	57,1%	33,3%	6,0%	19,0%	31,0%	146,4
Poor strategic of care, inadequate treatment, surveillance	29,9%	43,3%	7,5%	17,2%	27,6%	125,4
Ethics, Conflict management, and miscellaneous	4,1%	6,8%	50,0%	20,3%	23,0%	104,1
Falls/device and care-induced traumas	52,2%	11,9%	28,4%	20,9%	4,5%	117,9

Table 3 : relative contribution of each tempo to the 5 main classes of adverse events. *Since the coding scheme was permitting the combination of two contributive tempos, the sum of tempos for a given class of adverse event is always more than 100%. The closer the total to 100%, the more the considered adverse event has resulted from only one tempo (for instance the missed or delayed diagnosis). Conversely, the greater the sum, the more the adverse event has resulted from associations of tempos.*

Box 1 : an example of unsafe control of the disease's tempo

- *Dr B.'s Office, 14:30 Full waiting room, Holidays period. Dr ZH.on duty, locum of Doctor B.*
- *Mrs Simone P , 56Yrs, usual patient of the office, very talkative, hard to control, asking for prescription replacement for non severe angina pectoris, type 2 diabetes, and hypercholesterolemia.*
- *Simone says that she had multiple events from the last visit, some diarrhea (her husband also), she felt tired many times, with back pain, now going better… She just put on the table a package of old x-rays and biological results…and start discussing for the past*
- *The patient's file is quite laconic. The three last visits are traced only with mention to treatment replacements*
- *The locum hesitates, records the patient queries in her file, and tries to regain control and conclude the visit…*
- *Entries in the patient file mention the blood pressure and the renewal of prescriptions. The patient was prescribed yeast powder (not mentioned in the file)*

2 months later, Diagnosis of a sigmoid cancer. Simone confirms having had black stools for three months with episodes of diarrhea and constipation

Box Case example: A mix case of patient tempo (attitude) and office's tempo (workload)