Comparison of self-reported and observed prevalence of safety belt and helmet use in Florence


Key words: Surveillance systems, safety belt, helmet, over-reporting factor
Parole chiave: Sistemi di sorveglianza, cinture di sicurezza, casco, over-reporting factor

Abstract

Introduction: The use of safety devices (front and rear seat belts for car, helmet for motorcycle) has proven to be highly effective in reducing the prevalence of serious injuries or deaths caused by road accidents. For the safety of all road users it is fundamental to assess the use of safety devices over time and to promote programs aimed at increasing usage rates. In Italy there are two surveillance systems which monitor safety belt and helmet usage by road users: the “PASSI” system (Progressi delle Aziende Sanitarie per la Salute in Italia) based on self-reported data, and the “Ulisse” system, based on the direct observation of the phenomenon. The aim of this study is to compare data collected through direct observation (“Ulisse” system) with self-reported behaviours (PASSI) in the Local Health Unit (LHU) of Florence over the period 2008-2012, so as to assess the level of agreement between the two methods and understand whether they measure the phenomenon differently.

Methods: Safety belt and helmet use was estimated from PASSI data and measured through Ulisse observations. Between 2008 and 2012 a total of 2,081 cars and motorcycle users were interviewed in the LHU of Florence and a total of 59,787 drivers (11,870 front passengers, 1,129 rear passengers and 16,816 motorcyclists) were observed. The comparison between self-reported and observed prevalences was performed by calculating the over-reporting factor (ORF), defined as the ratio of the self-reported to the observed prevalence of seat belt or helmet use. The time trend of the prevalence (both from self-reported and observed data) and of the ORF was assessed by using linear regression and Poisson's regression, respectively.

Results: The correlation between self-reported and observed prevalence is high, with a Pearson’s correlation coefficient of 0.95 (p <0.05). Regarding front seat belt use rates, the difference between self-reported and observed data increases over time and the ORF range varies from 1.12 to 1.32. Rear seat belt data show a great variability, and the ORF varies from 0.67 to 1.37. In 2011 and 2012, the observed prevalence was higher than the self-reported one (ORF <1). Helmet use rates are very high, close to 100% with both methods; ORF has very small oscillations and ranges from 0.98 to 1, showing a good correlation between self-reported and observational data. There are no significant temporal variations both for the prevalences of use and for the ORF.

Conclusions: The reasonable accuracy of self-reported data makes this method fit in the routinary assessment of safety belts and helmet usage, in order to limit the observations of the Ulisse system at predetermined time intervals. However, self-reported estimates need to be adjusted using an appropriate over-reporting factor.

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Introduction

Road traffic injuries are among the major public health problems: they represent the eighth leading cause of death globally among adults, and the leading cause of death for young people aged 15-29 (1). In 2012 in Italy, road accidents killed more than 3,600 people, with 265,000 injured persons; young people aged 20-24 are the most affected category (2).

The UN General Assembly and the European Commission proclaimed in 2010 a new Decade of Action toward Road Safety. The main objective is to stabilize and reduce the increasing trend in road traffic injuries in Europe and in the world and reduce the number of serious injuries, as well as sensitizing road users to adopt correct behaviours while driving (2).

The use of safety devices (front and rear seat belts for car, helmet for motorcycle) has proven highly effective in reducing the prevalence of serious injuries or deaths caused by road accidents. Wearing a seat-belt reduces the risk of a fatal injury by 40-50% for drivers and front seat occupants, and between 25-75% for rear seat occupants. Seat-belt wearing rates greatly vary between countries, and to a large extent are governed by the existence of mandatory seat-belt laws. In many countries drivers and front seat passengers are obliged by law to use seat belts, but this is not true for the rear seat occupants as well.

In the European Countries, head injuries are responsible for about 75% of deaths among motorcycle users; this percentage rises up to 88% in some low or middle income countries. Wearing a good quality motorcycle helmet can reduce the risk of death by 40% and the risk of serious injury by over 70%.

Just under half of all countries collect data on seat-belt wearing rates, with this number disproportionately lower in low- and middle-income countries (6% and 43%, respectively) compared to high-income countries (80%).

Two methodologies are usually employed for collecting data: the first is the direct observation of the phenomenon on the road, the other is based on self-reported data obtained through interviews or questionnaires (3). The observational study (HES: Health Examination Survey) is considered the gold standard for the investigation of many risk factors but is an expensive method that cannot be applied on a large scale. Measurement based on reported data (HIS: Health Interview Survey), on the contrary, can be applied to a larger sample at a reduced cost (4); the main disadvantage is that it can generate a bias in the frequency rates, owing to the fact that interviewees tend to declare untrue habits, omitting behaviours that might be considered objectionable (social desirability bias).

However, this method has been proven to be effective to estimate the prevalence and assess the time trend of the variables used for public health surveillance, particularly in relation to the health status and risk factors at a population level (5-10).

From a public health perspective, it is fundamental to routinely assess the usage of safety devices over time, so as to evaluate time trends and to promote effective programs.

In Italy there are two surveillance systems to monitor safety belt and helmet usage: the “PASSI” system (Progressi delle Aziende Sanitarie per la Salute in Italia) based on self-reported data, and the “Ulisse” system, based on the direct observation of the phenomenon.

The aim of this study is to compare data collected through direct observation (“Ulisse” system) with self-reported behaviours (PASSI) in the Local Health Unit (LHU) of Florence in the period 2008-2012, so as to build a routinary surveillance system which can be affordable, time and resources saving, easy to be implemented and applicable on a large scale.
Methods

Self-reported data

In 2005 the Italian Ministry of Health provided funding to the National Institute of Public Health (Istituto Superiore di Sanità, ISS) to develop a surveillance system for risk factors, with the aim of estimating the frequency and the temporal trend of the adult behavioural risk factors and preventive measures for NCDs. The project, which became fully operational in 2007, saw the collaboration of all the regions and autonomous provinces.

PASSI has been carried on by the LHUs, through a validated and standardized questionnaire. Each month trained LHU staff members conduct telephone interviews on a random sample of resident adults aged 18 to 69 years. Responses are recorded in an anonymous form in a national archive (11).

For the outcome of interest, participants who use the car or the motorcycle (as drivers or passengers) are asked to answer the following question, “How often do you wear a safety belt and/or helmet?”; possible responses include: “Always”, “Often”, “Sometimes”, “Never”.

Between 2008 and 2012 a total of 2,081 car and motorcycle users were interviewed in the LHU of Florence.

Observed data

The surveillance system “Ulisse”, a collaboration between the National Institute of Health and the Ministry of Infrastructure and Transports, is a nationwide monitoring network established in 2000 to obtain information about the usage of safety belts and helmet by road users.

Between 2009 and 2011 the observations have covered almost all the national territory. For each province, observations were performed from at least three points placed in the central urban area, in the suburban areas and in the peripheral roads of the territory with the exception of highways (12).

In the LHU of Florence, since 2003, operators of the Department of Prevention with the supervision and the coordination of the University of Florence, have carried out two pilot campaigns on seat belt use by drivers and passengers, and since 2005 a monthly surveillance has been introduced together with helmet usage monitoring. As described in previous publications (13-17), in agreement with the methods defined at national level, investigations were conducted in different observation points, with different traffic characteristics (city center, urban expressways, suburbs). Observations were performed by trained personnel.

Between 2008 and 2012 a total of 59,787 drivers, 11,870 front passengers, 1,129 rear passengers and 16,816 motorcyclists (including drivers and passengers) were observed (13).

Data analysis

Seat belt and helmet usage, both from self-reported and observed data, were calculated as annual prevalence. As regards to the PASSI data, the prevalence rates were calculated considering the “always” responses and the total of the respondents.

The relationship between observed and self-reported prevalence was evaluated by means of Pearson’s correlation coefficient. The time trend of the prevalence and the difference between the observed and the reported data was assessed by using simple linear regression.

The comparison between self-reported and observed prevalence was performed by calculating the over-reporting factor (ORF), defined as the ratio of the self-reported to the observed prevalence of seat belt or helmet use (8,10). The more the value moves away from 1, the more different the prevalences are. The association between the ORF and the variables was assessed by using univariate and multivariate Poisson regression.

Data were managed and analyzed using StataIc (version 11). A p-value of less
than 0.05 was considered statistically significant.

Results concerning the seat belts were performed by distinguishing between the front passengers and the rear passengers.

Results

Figure 1 illustrates the correlation between annual self-reported and observed data for the three devices: the higher the prevalence of use in the population, the higher the correlation between the data obtained with the two different systems, as shown by the dispersion of the points that tends to decrease going from the lowest prevalence (rear belt) to the highest prevalence (helmet). The correlation between self-reported and observed prevalence is high, with a Pearson’s correlation coefficient of 0.95 (p <0.05).

Figure 2 shows the observed and self-reported prevalence of seat belt and helmet use, and the ORF.

Regarding front seat belt use rates (Fig. 2a), the observed data show a decreasing trend, although not statistically significant. The difference between self-reported and observed data increases over time, at the same time the ORF moves away from the value of 1. ORF range varies from 1.12 to 1.32: the best level of agreement between the two estimates is in 2008, with an ORF of 1.12.

Rear seat belt data (Fig. 2b) show a great variability, and the ORF varies from 0.67 to 1.37. In 2011 and 2012, the observed prevalence was higher than the self-reported one (ORF <1); the best level of agreement between the two estimates occurs in 2008, with an ORF of 0.95.

Helmet use rates (Fig. 2c) are very high, close to 100% with both methods. ORF shows very little variability, and ranges from 0.98 to 1, so as to assess a good correlation between self-reported and observational data.

Linear regression model shows no significant time variations either for observed or self-reported data (β = 0.320 and 0.633, p = 0.960 and 0.925). With regard to the type of device, observed and self-reported data show a significantly lower prevalence of safety belt usage (both front and rear seat belt) than helmet; this is especially true for the rear seat belt (β = -75.94, p <0.001).

![Fig. 1 - Association between self-reported and observed prevalence, by year (2008-2012).](image-url)
Fig. 2 - Trend of self-reported prevalence, observed prevalence and ORF (2A: front seat belt; 2B: rear seat belt; 2C: helmet)
The difference between observed and self-reported prevalence is shown in Table 1.

Regarding front seat belt, the difference between observed and self-reported data has increased over time, with a mean difference a little less than 18%. Data on rear seat belts show a large variability (with a mean difference of -1.2%), while for helmet use the great consistency between the two types of surveys (mean difference, -0.8%) is confirmed.

The temporal trend of the ORF has been analyzed using a Poisson regression model, and no significant changes has been found ($\beta = -0.01$, $p = 0.944$). Similarly, there is no significant trend in the ORF either in relation to the type of device (front seat belt: $\beta = 0.04$, $p = 0.890$; rear seat belt: $\beta = -0.09$, $p = 0.957$; helmet: $\beta = 0.003$, $p = 0.992$) or in relation to the value of observed prevalence obtained with Ulisse ($\beta = -0.001$, $p = 0.774$).

**Discussion**

The results show a good agreement between the self-reported and the observed prevalence. According with previous studies, this correlation becomes stronger with the increase of the prevalence, especially in terms of helmet usage (9, 10).

Data related to rear seat belt usage show more variability than the other two devices, probably due to the restricted size of the sample (both in case of self-reported and observational data) and to the difficulty in data collecting for the observers, especially in conditions such as poor visibility and high traffic (14).

No significant temporal variation has been reported for seat belt use. On the other hand, during the period of the study in the LHU of Florence various health promotion campaigns were realized, but they probably were not effective in increasing the prevalence of safety belt usage. Similar results were obtained from a previous study performed in the Florence area, during a 5-year observation period (2005-2009): in the absence of new safety laws, seat belt use rates remained constant over time (14).

In the early months of 2014, in Florence, Municipal Police realized selected controls on the road users, aimed at evaluating the respect of road safety laws. These controls led to an intensification in the number of fines, revealing that the behaviour of florentine drivers could be improved.

With regard to the helmet, the prevalence remains constant over time at very high values; this is in line with previous studies carried out in Florence and in other Italian regions, which observed that helmet use is by now a well established behaviour all over Italy (17, 18).

The values of ORF are consistent with the results of previous studies. In particular,
as regards to the front seat belt, the values are similar to those observed in countries where wearing safety belts is compulsory (values between 1.2 and 1.4, compared to a range of 1.2-2 in countries without similar legislation) (8, 11). One limitation in the comparability of the data is due to the different characteristics of the two surveillance systems. PASSI is based on a random sampling in a specific age range: all young people under the age of 18, the over 65s and those who don’t reside in the LHU are therefore excluded. Furthermore, in the present analysis, we calculated the prevalence considering in the numerator only the interviewees who answered they always use seat belt or helmet.

Ulisse, however, is devoted to observe a population sample during specific times of the day, including people of any age and place of residence, and counts all those who are wearing safety devices at the time of the direct observation, independently from the frequency of use.

**Conclusion**

The accuracy of the self-reported data makes this method useful to assess and monitor safety belt and helmet usage, taking into account the values of over-reporting factor; this is crucial for planning effective Public Health interventions, with the aim of increasing the prevalence of use of safety devices.

On the basis of the agreement of the two methods, a standardized surveillance system based on the routinary use of self-reported data can be proposed, in order to limit the observations of the Ulisse system only at predetermined time intervals, exploiting also the possibility that PASSI offers to analyze the data in the enlightenment of other variables, such as the socio-demographic characteristics of the sample.

**Riassunto**

*Confronto fra due diversi sistemi di sorveglianza per la rilevazione dell’utilizzo dei sistemi di sicurezza stradale: l’esperienza dell’azienda sanitaria di Firenze*

**Introduzione:** L’uso della cintura anteriore, della cintura posteriore e del casco ha una dimostrata efficacia nel ridurre la prevalenza delle lesioni gravi o mortali causate dagli incidenti stradali. Monitorarne l’utilizzo e promuovere interventi volti ad aumentarne l’uso è fondamentale in ambito di Sanità Pubblica. In Italia la sorveglianza dei dispositivi di sicurezza è affidata ai sistemi PASSI (Progressi delle Aziende Sanitarie per la Salute in Italia), basato su dati autoriferiti tramite intervista, e Ulisse, basato invece sull’osservazione diretta del fenomeno. Obiettivo del lavoro è effettuare un confronto tra i due differenti sistemi per comprendere se essi producano stime simili, per l’area di riferimento geografica considerata (coincidente con il territorio della Azienda Sanitaria Fiorentina - ASF), nel periodo di osservazione 2008-2012, ovvero misurino in maniera sovrapponibile lo stesso fenomeno.

**Metodi:** La prevalenza di utilizzo dei dispositivi di sicurezza è stata determinata analizzando i dati PASSI e quelli basati sulle rilevazioni di Ulisse, queste ultime relative a conducenti e passeggeri di autoveicoli e motocicli. Tra il 2008 e il 2012 nella ASF sono state effettuate 2081 interviste e sono stati osservati 59787 conducenti di autoveicoli, 11870 passeggeri sui sedili anteriori, 1129 sui sedili posteriori e 16816 motociclisti. Per confrontare le prevalenze ottenute attraverso i due metodi di rilevazione è stato calcolato l’over-reporting factor (ORF), cioè il rapporto tra prevalenza riferita e osservata. L’andamento temporale, nel periodo indagato, della prevalenza di utilizzo dei dispositivi (sia osservata che riferita) e quello dell’ORF è stato valutato rispettivamente con regressione lineare e con regressione di Poisson.

**Risultati:** La correlazione tra prevalenza riferita e osservata è elevata, con un coefficiente di correlazione di Pearson pari a 0,95 (p <0,05). Per la cintura anteriore la differenza tra dati riferiti e osservati tende ad aumentare nel tempo e l’ORF varia da 1,12 a 1,32. I dati relativi all’uso della cintura posteriore mostrano una grande variabilità per entrambi i metodi di rilevazione e l’ORF varia da 0,67 a 1,37. Per il casco si rilevano percentuali di utilizzo molto elevate con entrambi i metodi di rilevazione; l’ORF presenta oscillazioni molto piccole (0,98-1) dimostrando un’ottima concordanza tra dato riferito e osservato. Entrambi i metodi di rilevazione evidenziano una prevalenza di utilizzo della cintura di sicurezza significativamente inferiore rispetto a quella del casco; ciò vale in particolar modo per la cintura posteriore. Non vi sono variazioni temporali significative né per le prevalenze di utilizzo né per l’ORF.
**Conclusioni:** La buona affidabilità dei dati auto-riferiti nello stimare la prevalenza d’uso dei dispositivi di sicurezza e nel monitorarne l’andamento temporale rende tale metodica utilizzabile per l’esecuzione di un monitoraggio di routine, limitando le rilevazioni di Ulisse ad intervalli di tempo prestabiliti, aggiustando le prevalenze auto-riferite secondo fattori di correzione ricavabili attraverso il calcolo dell’ORF.

**References**


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