

## Non-Emergency Patient Transport: Rapid Evidence Review

The inability to access healthcare in a timely manner has been found to lead to missed appointments which potentially lead to avoidable morbidity and mortality, as well as inefficiencies in service delivery. In the absence of reliable and affordable public or private transport systems, HealthNET is a non-emergency patient transport (NEPT) service of the Western Cape Department of Health (WCG: HEALTH) that provides free transportation to patients who are referred to and between public healthcare services (e.g. clinics, hospitals) that are outside of their immediate surroundings. The Western Cape Provincial Department of Health (WCG: HEALTH) is seeking published evidence on the efficiency of the HealthNet service in comparison to other non-emergency transport models. In response to a request from the Evaluation Unit in the Health Impact Assessment (HIA) Directorate of the WCG: HEALTH, the Health Systems Research Unit (HSRU) of the South African Medical Research Council (SAMRC) conducted a search of evidence on the efficiency of HealthNet service compared to other non-emergency transport models. No literature was found. In addition, no data was found that compared non-emergency transport models with interventions aimed at providing patients with healthcare services that are outside of their immediate surroundings. The rapid review was reformulated to focus on a review of:

- Efficient and cost-effective strategies to structure and manage NEPT service, and
- Cost-benefit analysis of NEPT services.

This report summarizes the evidence found and the methods used. It includes comments by the HIA on the applicability of the evidence for the WCG: HEALTH (found in blue comment boxes).

### KEY FINDINGS

Evidence on the strategies for efficiency and cost-effectiveness of NEPT are limited; we found a small number of studies and none on local NEPT services. Evidence on the following key findings are summarised here and detailed later in this report.

#### 1. Strategies that affect quality and safety of NEPT

- Communication:** This refers to the importance of consultation and communication amongst healthcare providers and facilities to arrange and facilitate the transfers, and information flow between sending and receiving patient (Telephone calls to arrange transfers, documentation of patient information and standardised transfer protocols). Digital communication technology could improve co-ordination of communication (and can also be a tool for increased access to care closer to home).
- Efficiency and appropriateness:** Efficiency refers to the coordination and operationalizing of the transport service; how well it is organized in relation to the timeliness of the transfer and effective resource utilization. Appropriateness pertains to the planning and management of the service, considering patients' needs, using appropriate staff, and having the right equipment. Four strategies to promote efficiency and appropriateness have been identified:
  - 1) Electronic booking systems, 2) Centralized electronic booking hub, 3) Contracting of private ambulances/transport, 3) Use of a broker model (intermediate agency).

#### 2. Approaches to cost effectiveness analysis

- Mathematical modelling:** Mathematical and computer-based modelling of demand and supply elements, and the coordination and logistics of the local transport context, can help to design a NEPT service that can save costs.
- Cost-effectiveness analysis (CEA)** is an approach to analyse the cost and benefit of providing NEPT services. In the USA it found that cost saving for 12 of the most prevalent infectious and chronic diseases ranged from minor cost-saving to highly cost-effective.

### LIMITATION OF FINDINGS

1. The findings are based on a limited evidence. Only one systematic review was found. All other data was from single studies. Individual studies do not provide a comprehensive picture of the issue, and there is no comparison amongst multiple studies. There was no evidence reviewing NEPT in South Africa or the HealthNET service specifically.
2. None of the studies evaluated the effectiveness and/or the cost-efficiency of NEPT services. We did not assess the studies for methodological quality, nor did we assess the level of certainty (GRADE) for each of the findings.

### CONCLUSION

There is limited evidence on strategies for the efficiency and effectiveness of NEPT systems for the South African and other low-and middle-income countries (LMICs). This rapid review highlights key general strategies identified in the literature, that may be useful for the WCG: HEALTH review of their NEPT system.

## HOW TO READ THIS DOCUMENT

The document is structured into: Introduction, Methods, Results, Appendix, Authors, and References.

**Results section:** There are 3 sections: (1) Factors that affect the quality and safety of NEPT services; (2) Strategies to improve quality and safety of NEPT; and (3) Cost-benefit analysis of NEPT services.

Each section starts with a summary of the literature, followed by more detailed descriptions of the literature.

In the **blue text box**, labeled *HIA comment*, the Health Impact Assessment (HIA) unit and Emergency services colleagues commented on how this evidence might apply to the WCG: HEALTH.

## INTRODUCTION

The WCG: HEALTH, Emergency Medical Services (EMS) operates a service called HealthNET (Health Non-Emergency Transport), which is non-emergency patient transport service (NEPT)<sup>1,2</sup>.

Transport is critical to the continuity of care, however, the cost of transport is unaffordable for poor households<sup>3</sup>. Furthermore, public transportation is usually ill-equipped to cater for people living with disabilities, the elderly, and frail patients, and those with infectious diseases such as TB. The lack of reliable transport further burdens rural patients. The inability to access healthcare in a timely manner has been found to lead to missed appointments<sup>3</sup>. This can potentially lead to avoidable morbidity and mortality at a population level.

### Non-emergency patient transport HealthNET service

The HealthNET service provides free transportation to patients who are referred from public healthcare to other public healthcare services which are not available in their immediate public health facilities<sup>1</sup>. Patients are transported between their home and facilities, and/or in-between facilities. All transportation is within the Western Cape provincial healthcare system<sup>1</sup>. There is a computer booking system linking hospitals with all the control centers in the metropole and districts, which is meant to appropriately book patients.<sup>2</sup>

### Why is this rapid review relevant to the Western Cape Department of Health?

The Evaluation Unit in the Health Impact Assessment Directorate in the WCG: HEALTH, on request of their Executive Committee (TEXCO), is evaluating the NEPT service, including if and how NEPT services can be delivered in a more efficient and cost-effective way.

## METHODS

A rapid review was conducted to find evidence on the efficiency of the HealthNet service in comparison to other non-emergency transport models

No data was found that comparison HealthNet services to other non-emergency transport models. Furthermore, we found no data that compare other non-emergency transport models with interventions aimed at providing patients with healthcare services that are outside of their immediate surroundings.

We reformulated the question to search data on:

- Efficient and cost-effective strategies to structure and manage NEPT services.
- Cost-benefit analysis of NEPT services.

A rapid review is a type of evidence synthesis in which the methods are designed in a manner that accelerate the process of collating evidence on particular topic<sup>4</sup>, with the aim of producing a final review in 5–12 weeks, as compared to the 18–24 months of a typical evidence synthesis (such as a systematic review)<sup>4</sup>.

For this rapid review, we searched 7 databases and various government websites. There were continued consultations between the HIA unit of WCG: HEALTH, and the HSRU during the drafting of this synthesis. For full methods, see [Appendix](#).

## RESULTS

We present synthesized evidence that speaks to efficient and cost-effective strategies to structure and manage NEPT services, and cost-benefit analysis of NEPT services.

The data is reported under the following three components:

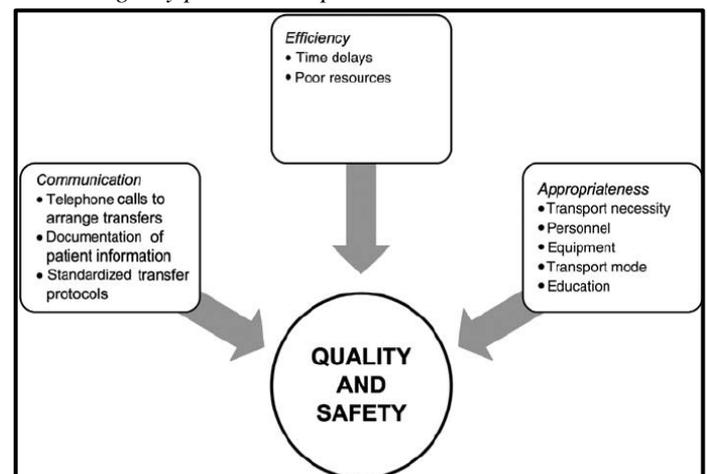
1. Factors that affect the quality and safety of NEPT.
2. Strategies to improve the quality and safety of NEPT services.
3. Cost-benefit analysis of NEPT services.

### 1. FACTORS THAT AFFECT THE QUALITY AND SAFETY OF NEPT SERVICES

A systematic review by Hains and colleagues<sup>5</sup> synthesized 12 articles from seven countries to find key factors associated with the quality and safety of NEPT services<sup>5</sup>. The key factors are illustrated in Figure 1 and explained below:

- **Communication:** This refers to the consultation and communication amongst healthcare providers and facilities to arrange and facilitate the transfers, and information flow between sending and receiving patients.
- **Efficiency:** This refers to the coordination and operationalizing of the transport service; how well it is organized in relation to the timeliness of the transfer and effective resource utilization.
- **Appropriateness:** This pertains to the planning and management of the service, considering patients' needs, using appropriate staff, and having the right equipment.

Figure 1: Key factors impacting on the quality and safety of non-emergency patient transport<sup>5</sup>



### 2. STRATEGIES TO IMPROVE QUALITY AND SAFETY OF NEPT SERVICES

#### 3.1. Communication

This refers to the importance of consultation and communication amongst healthcare providers and facilities to

arrange and facilitate the transfers, and information flow between sending and receiving patient (Telephone calls to arrange transfers, documentation of patient information and standardised transfer protocols). Examples of electronic systems that can facilitate good communication, include electronic booking systems and centralized booking hubs (described under section on Efficiency and appropriateness). Though no literature was found that specifically refer to the use of mobile health (mHealth) to support NEPT services, there is a plethora of data reporting how mHealth is used to facilitate (i) patients' communication with healthcare workers, and (ii) between health care workers. mHealth refers to medical and public healthcare practices supported by mobile devices such as mobile and smart phones<sup>6</sup>.

mHealth interventions can involve issuing healthcare workers with a mobile device, providing them with airtime, and so allowing them to contact each other, as well as two-way communication with patients. In more sophisticated mHealth platforms, lower level healthcare workers send images, for instance on wound care, to specialists, who in turn advice the lower level cadres on how to proceed with the wound care<sup>7</sup>. Use of mHealth as a tool to support provider-to-provider communication and clinical support (virtual or tele-medicine approaches) and for provider to patient communication, could potentially result in providers treating patients closer to home. It is thus potentially an indirect tool for promoting patient access to care close to home- and thus reducing the demand for transporting patients in far-off places.

*HIA Comment: The WCDoh, uses the 'electronic continuity of care record' (ECCR) which is a web application that is used to create and share patients discharge summaries. Furthermore, the VULA application, has been recently acquired to facilitate communication on patient referrals, however, there is no indication as to what extent VULA has been implemented, its effectiveness and its potential impact on improving communication between clinicians and the eventual patient outcomes of rural patients requiring specialized, tertiary care.*

*The issue of communication is important and would not only apply to communication with the NEPT provider but across the health systems platform. A more accurate description would be access to information. The provision of the right level of services and its location is at the heart of the decision to use HealthNET. This is a clinical services process not a NEPT process and thus communication and information must be focused appropriately*

### 3.2. Efficiency and appropriateness

Four strategies were suggested in the literature: (1) electronic booking, (2) central electronic booking hub, (3) contracting of private ambulances/vehicles and (4) broker model (explained below), were identified as organizational arrangements that can improve the efficiency of NEPT services. Efficient NEPT services can have an impact on the productivity of the service from the providers side, the quality & safety of the service from the patient side and the service can run cost-effectively from the health system side<sup>5,8-11</sup>.

Two studies conducted in the New South Wales<sup>9</sup>, Australia<sup>10</sup>, showed that an electronic booking system has the potential to

facilitate communication, and led to efficient NEPT services<sup>9</sup>.<sup>10</sup>. Furthermore, it was found that booking NEPT services from a central hub is more effective and efficient in terms of resource utilization when compared to booking from individual electronic systems<sup>9, 10</sup>.

A study from Victoria, Australia<sup>10</sup>, and another one from the United States of America (USA)<sup>11</sup>, found that the contracting of private ambulances/vehicles allowed for the expansion of NEPT services especially to rural areas. Also, it allowed for the NEPT service to provide appropriate equipment and staff to ensure patients' needs during transportation.<sup>10,11</sup>. It is not clear to what extent a distinction is made in these studies, between emergency and non-emergency patient transport.

A study from USA<sup>11</sup>, showed that NEPT services can be contracted to brokers, who can be other government agencies (e.g. the department of social development) or the private sector<sup>11</sup>. The study found that contracting the service to brokers was thought to provide efficient NEPT services because the broker was given economic incentives for improved NEPT performance<sup>11</sup>.

#### *Electronic booking system*

Hains and colleagues (2010)<sup>8</sup>, conducted a study to determine if an electronic ordering system addresses key factors that impact on the quality and safety of NEPT services<sup>8</sup>. The electronic ordering system was used in a case study of a health service which provides healthcare for 20% of the population of New South Wales<sup>8</sup>. The study found that the electronic ordering system significantly improved the quality and safety of non-emergency transport system<sup>8</sup>. Electronic ordering facilitated communication between facilities, and between facilities and the transport service. The system also reduced errors associated with miscommunication. The system allowed for more efficiency due to the faster ordering process. Furthermore, patients were provided with appropriate transport services, such as suitable personnel to accompany them, and have appropriate resources allocate for the trip<sup>8</sup>.

However, the effectiveness of the electronic ordering system is dependent on all the multiple facilities and transport services using the same electronic ordering system<sup>8</sup>. The system was found to be less efficient when individual facilities organized their own transport, as this limited communication between the transferring and receiving facility and transport services did not always receive full patient details<sup>8</sup>.

#### *Central electronic booking hub*

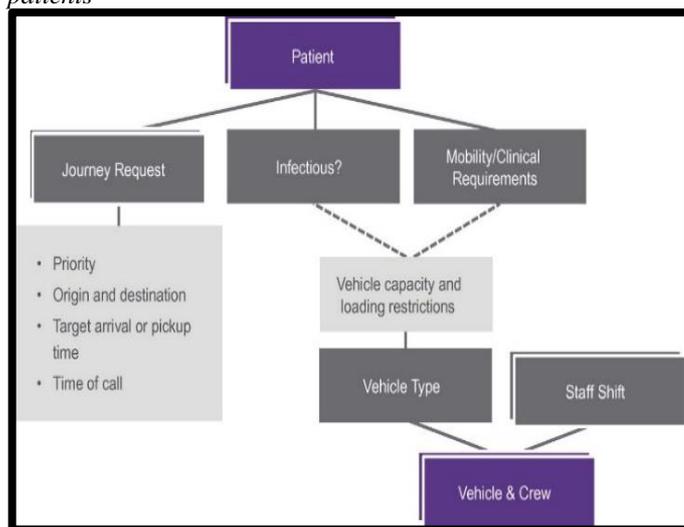
Boness and colleagues (2018)<sup>9</sup>, conducted a study in New South Wales, to show that a central electronic booking hub can facilitate communication between multiple facilities, and strike a balance between timeliness of service and efficient utilization of resources for orders coming from widely dispersed healthcare facilities<sup>9</sup>.

In this study, a mathematical algorithm was used to predict real-world patient transport services which, operate over dispersed geographical areas, carry large numbers of passengers, use a range of vehicle types and require multi crew. This mathematical algorithm was used to plan efficient routes for vehicles to carry out pre-booked transport requests, made before the day of transport, and then simulates the impact of changes to these plans due to certain events and interruptions such as short-notice and/or same-day transport requests<sup>9</sup>. (See Figure 2).

The mathematical algorithm used transport request forms to simulate the appropriate vehicle, staff, and movements of vehicles. These forms included<sup>9</sup>;

- A target time at which the transport should start and finish the patient drop-off to and from the health facility;
- A schedule detailing the availability of staff and vehicles and the locations at which they are deployed;
- Geographical information, including the locations of health facilities, pick-up and drop-off locations for each patient, and a calibrated set of travel times based on the road network;
- Patients' special needs such as mobility and clinical needs, i.e. children that must be accompanied by parents, and infectious patients that cannot share transport with other patients.

Figure 2: Prediction of the appropriate vehicle and crew for patients<sup>9</sup>



**HIA Comment:** In the-Western Cape there is a central booking system that is operated on the Call and Dispatch System (CAD system). The above proposed mathematical algorithm can be integrated into the computer aided dispatch (CAD) system, which is the electronic system through which bookings are made. Furthermore, the health net booking system is not integrated into the hospital or primary care health information system which could potentially be used to monitor this programme.

There is a need to design a monitoring and evaluation framework which can be used by both district/ clinic/ referring institution to monitor the use of the NEPT service

Using a mathematical algorithm could certainly be useful – although in the current rural service the routes are finite. That said we have never done a formal analysis (by a transport expert) of this. It would certainly be useful to do so.

### Contracting of private ambulances/transport

The value of the NEPT service is dependent on having adequate resources to ensure the appropriateness of the transport. Occasionally, this may require public health services buying/contracting NEPT services to expand their services, especially to rural areas. In the context of the USA and Australian studies, this can also reduce unnecessary costs without cutting any crucial benefits. To ensure the quality of

contracted services, the government can have strict and standardized regulatory rules that contracted service providers have to adhere to<sup>10,11</sup>.

In Victoria, Australia<sup>10</sup>, and the (USA)<sup>11</sup>, NEPT services are provided by both the state, and contracted private ambulances/vehicles<sup>10,11</sup>. To ensure the quality of contracted services in Australia, the State Parliament passed the *Non-Emergency Patient Transport Act 2003*<sup>10</sup>. Under this act all private ambulances/vehicles providing NEPT services need to be registered and accredited. In addition, within the Act there is a regulatory framework which guides private NEPT providers on the kind of care needed for various clients using the service (specialized clinical care, appropriate staff numbers), and equipment (stretchers, wheelchairs) required by different patients during transportation<sup>10</sup>. In the USA model, it is up to the individual states or facility to stipulate a set of rules that the contracted service provider must adhere to<sup>11</sup>.

### Broker model

In the USA, they also use a brokerage model to manage NEPT services<sup>11</sup>. In this model, the individual state contracts with brokers (private companies or other government agencies) to manage their NEPT service.

The brokers are responsible for:

- Confirming the eligibility of transportation providers and authorizing and arranging trips
- Overseeing of all NEPT services, both by government and private ambulances

The government can have a legal contact with the broker which require the broker to ensure that: both government and private NEPT services meet standard requirements; All NEPT services meet certain benchmarks regarding pick-up and drop-off wait-times; NEPT services use real-time GPS to track every trip; and the broker must report all customer complaints on a regular basis to the government. This allows the government to monitor to ensure quality and safety of services, ensure that there is no fraud, and that there is no conflicts of interest or self-referrals by the broker<sup>11</sup>. Furthermore, the broker can be paid per patient per month, as a way of ensuring that patients are provided with a service.

### 3. COST-BENEFIT ANALYSIS OF NEPT SERVICES

**HIA Comment:** In South Africa, the NEPT service is not standardized and there are no policies or implementation guidelines to manage the programmes. This highlights a policy gap.

The City of Cape Town has Dial a Ride system and the Drakenstein Municipality is currently doing research on how to provide a similar service in their area. If a broker service is deemed feasible, adequate internal resources for contract and project management will need to be put in place to manage the contract.

Also note there are very few options for private transport services within the rural sector. Members of the public often pay exorbitant fees for very short distances due to the poor availability. Outsourcing is certainly possible but areas will be limited.

Three studies analyzed the cost of providing NEPT services. Two were conducted in Portugal by Oliveira (2014 & 2015)<sup>12,13</sup> and one study was conducted in the USA by Wallace (2005)<sup>14</sup>. Olivera (2015) presents a model that can be used to reduce the cost of NEPT services<sup>12</sup>. While the study by Wallace (2005) presents a cost-effectiveness analysis which shows that NEPT services for certain diseases/conditions can have different levels of cost saving; from range be cost saving to cost-effectiveness<sup>14</sup>. Of the Oliveira studies, one study was published in Portuguese, the quality of translation to English through google did not allow for further data extracting. None of the studies compared the cost of providing NEPT services with other interventions/services for improving access to healthcare services.

### Model to reduce the cost of NEPT services

Oliveira and colleagues presents a mathematical and computer-based model to reduce the costs of providing the NEPT service<sup>12</sup>. The model shows how a team of health professionals can work together to establish the best sets of patients to be transported together, thus reducing costs when compared with individual transportation<sup>12</sup>. Due to limited resources data from this study was not accessible. This information requires a technical team to interpret the applicability of this approach to WCG: HEALTH.

### Cost-effectiveness analysis (CEA) of NEPT services

Wallace (2005)<sup>14</sup> used cost-effectiveness analysis (CEA) methods to evaluate the benefits of improved access to healthcare through NEPT services in the US. "The CEA method measures the effectiveness-per-unit cost"<sup>14</sup>. The study analysed the cost and benefit of providing NEPT services for 12 of the most prevalent infectious and chronic diseases found in a nationally representative healthcare dataset of 3.6 million Americans who had missed or delayed non-emergency medical care each year because of transportation issues<sup>14</sup>. The study found that it is cost saving to provide NEPT services for prenatal care, asthma, heart disease and diabetes. It was found to be highly-cost effective to provide NEPT services for influenza vaccinations, dental care, chronic obstructive pulmonary disease, hypertension, mental health and end-stage renal disease<sup>14</sup>. It was found to be moderately cost-effective to provide NEPT services for screening for either breast cancer or colorectal cancer<sup>14</sup> (See Table 1).

Table 1: Condition-specific results highlighting the most likely estimates<sup>14</sup>.

Condition	Type	Result
Influenza Vaccinations	Preventive	Highly Cost-Effective
Prenatal Care	Preventive	<b>Cost Saving</b>
Breast Cancer Screening	Preventive	Moderately Cost-Effective
Colorectal Cancer Screening	Preventive	Moderately Cost-Effective
Dental Care	Preventive	Highly Cost-Effective
Asthma	Chronic	<b>Cost Saving</b>
Heart Disease (Congestive Heart Failure, CHF)	Chronic	<b>Cost Saving</b>
Chronic Obstructive Pulmonary Disease (COPD)	Chronic	Highly Cost-Effective
Hypertension (HTN)	Chronic	Highly Cost-Effective
Diabetes	Chronic	<b>Cost Saving</b>
Depression / Mental Health	Chronic	Highly Cost-Effective
End-Stage Renal Disease (ESRD)	Chronic	Highly Cost-Effective

*HIA Comment: Limited human resources and systems result in low coverage of ICD coding, therefore, disease or health condition data is not always recorded and accessible to inform cost-benefit decision making.*

*The NEPT service is merely part of a larger entangled service delivery issue and cannot be examined in isolation. Any meaningful solutions must examine the drivers (root cause) of the service need and identify alternative measures as part of a broader service design.*

## APPENDIX Methods

### Search strategy

To find relevant literature, a search strategy was developed using key words related to Transport for non-emergency patients. (see Table 1). The search strategy was appropriately amended to be relevant to other databases. The search was not limited to any setting nor any patients.

Table 1: Search strategy

"Planned patient transport" OR "planned patients transport"  
OR "Non-Emergency patient transport" OR "Non-Emergency patients transport" OR "Non-emergency transport" OR "Non-Emergency Medical Transportation" OR "HealthNET" OR "NEMT" OR "NEPT"

### Search for literature

The search was conducted on the Epistemonikos, Prospero, Cochrane library and PDQ databases to find systematic review protocols and full systematic reviews applicable to Non-Emergency Medical transportation. Furthermore, the search was conducted in Medline, PubMed, Google scholar and WorldCat library to find primary studies. To find more studies, we hand searched the reference list of all included studies. We also, contacted authors of included for referrals to more studies. Lastly, we search the website of department of health from United Kingdom, Australia, Canada and USA to find any relevant publications.

### Assessment of quality

The included studies were not assessed for quality.

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### How to cite this document:

Moloi H, Odendaal W, Leon N. Non-emergency patient transport: Rapid evidence synthesis. Health Systems Research Unit, Rapid Evidence Synthesis Service, South African Medical Research Council. May 2019.

## REFERENCES

1. Western Cape Government. Medical emergency transport and rescue 2017; <https://www.westerncape.gov.za/service/medical-emergency-transport-and-rescue-metro>. Accessed 18 March, 2019.
2. Mac Mahon A. Non-emergency patient transport: an integral part of accessible comprehensive health care. *SAMJ: South African Medical Journal*. 2011;101(10):684-685.
3. Mubaiwa T, Mokonyama MT. Implications of chronic disease patient travel to healthcare facilities on the design of national health insurance in South Africa-a preliminary review. 2017.
4. World Health Organization. AfHPaSR. *Rapid reviews to strengthen health policy and systems: a practical guide*. 2017.
5. Hains I, Marks A, Georgiou A, Westbrook J. Non-emergency patient transport: what are the quality and safety issues? A systematic review. *International Journal for Quality in Health Care*. 2010;23(1):68-75.
6. Kay M SJ, Takane M. Health: New Horizons for Health through Mobile Technologies: Based on the Findings of the Second Global Survey on eHealth (Global Observatory for eHealth Series, Volume 3). *Healthcare Informatics Research*. 09/30 2011;18(3):231-233.
7. Kolltveit B-CH, Gjengedal E, Graue M, Iversen MM, Thorne S, Kirkevold M. Conditions for success in introducing telemedicine in diabetes foot care: a qualitative inquiry. *BMC Nursing*. 2017/01/13 2017;16(1):2.
8. Hains I, Marks A, Sterrey M, Georgiou A, Westbrook J. Electronic Ordering to Improve Communication, Efficiency and Appropriateness of Non-emergency Patient Transport Services-a Case Study. Paper presented at: HIC 2010: Proceedings; 18th Annual Health Informatics Conference: Informing the Business of Healthcare, 24-26 August 2010, Melbourne Convention and Exhibition Centre 2010.
9. Boness T, Mayes H. Improving Patient Transport in New South Wales. *Impact*. 2018;2018(1):42-45.
10. Huggins C, Shugg D. Non-emergency patient transport in Victoria: An overview. *Australasian Journal of Paramedicine*. 2015;6(4).
11. Pozner CN, Zane R, Nelson SJ, Levine M. International EMS systems: The United States: past, present, and future. *Resuscitation*. 2004;60(3):239-244.
12. Oliveira JA, Ferreira J, Dias L, Figueiredo M, Pereira G. The Non-Emergency Patient Transport Modelled as a Team Orienteering Problem. Paper presented at: International Conference on Operations Research and Enterprise Systems 2015.
13. Oliveira JA, Ferreira J, Figueiredo M, Dias L, Pereira G. Sistema de Apoio à Decisão para o Transporte Não Urgente de Doentes em Veículo Partilhado. *RISTI-Revista Ibérica de Sistemas e Tecnologias de Informação*. 2014(13):17-33.
14. Wallace. Cost-Benefit Analysis of Providing Non-Emergency Medical Transportation. The National Academies Press, Washington, DC. <https://doi.org/10.17226/22055>; 2005.