# Telecommunications

This paper is based on work completed as part of The University of Minnesota's Transportation Futures Project. More information about The Transportation Futures Project can be found on the [project homepage](#).

Innovations in telecommunications capabilities have had significant impacts on many aspects of modern life. Over the last 15 years, major changes in how people shop, communicate, recreate, and in some cases, work have occurred as a result of improved abilities to send and receive data remotely. This in turn has impacted how frequently and far people travel for a variety of purposes. Of primary interest are the impacts of telecommuting, e-shopping, same-day-delivery services, and telemedicine on Minnesotans' transportation behaviors.

BROADBAND ACCESS

It should be noted that the benefits of improved telecommunications capabilities may be limited to those individuals who have consistent access to broadband internet. The Minnesota Department of Employment and Economic Development tracks broadband access for both wired and wireless connections in Minnesota. Figure 1 shows a map of wired broadband connectivity in Minnesota.

Figure 1: Access to wired broadband internet in Minnesota (speeds in download/upload)[1]
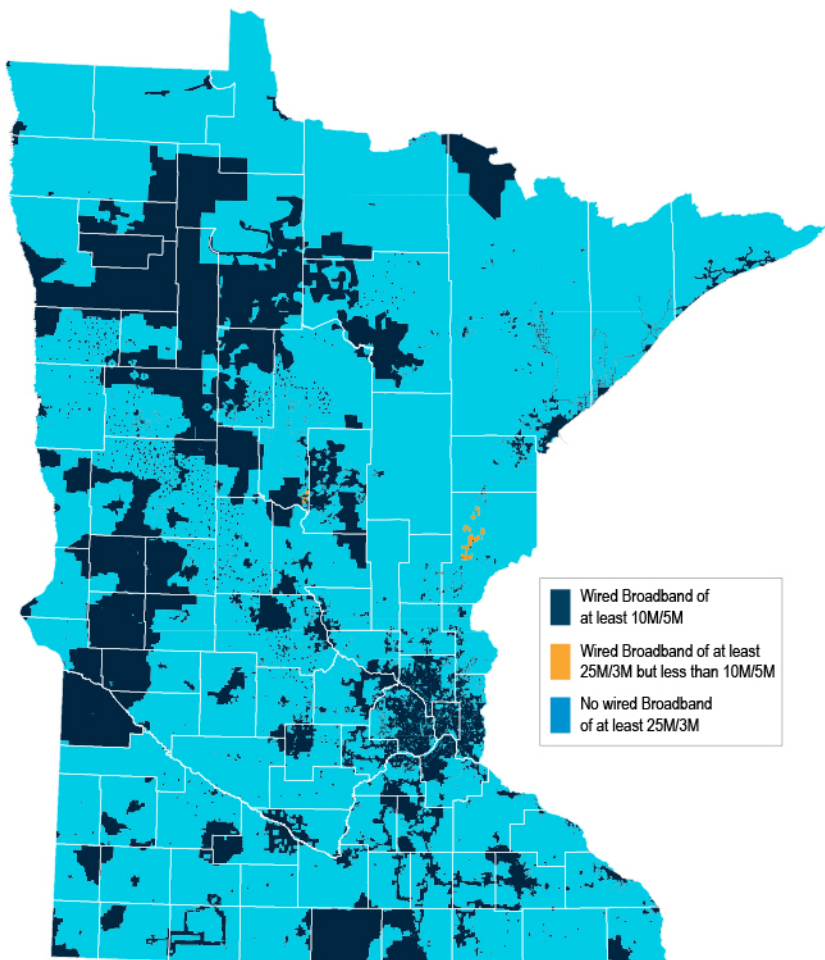
While Figure 1 may look to be a fairly bleak picture regarding wired broadband access in many parts of Minnesota, many of the large swaths of unserved areas are home to very few people. Figure 2 shows the percentage of Minnesota households with high speed broadband access with speeds of at least 10 megabits per second for downloading and 6 megabits per second for uploading.

Figure 2: Percentage of households with access to broadband internet of at least 10mbps/6mbps[2]
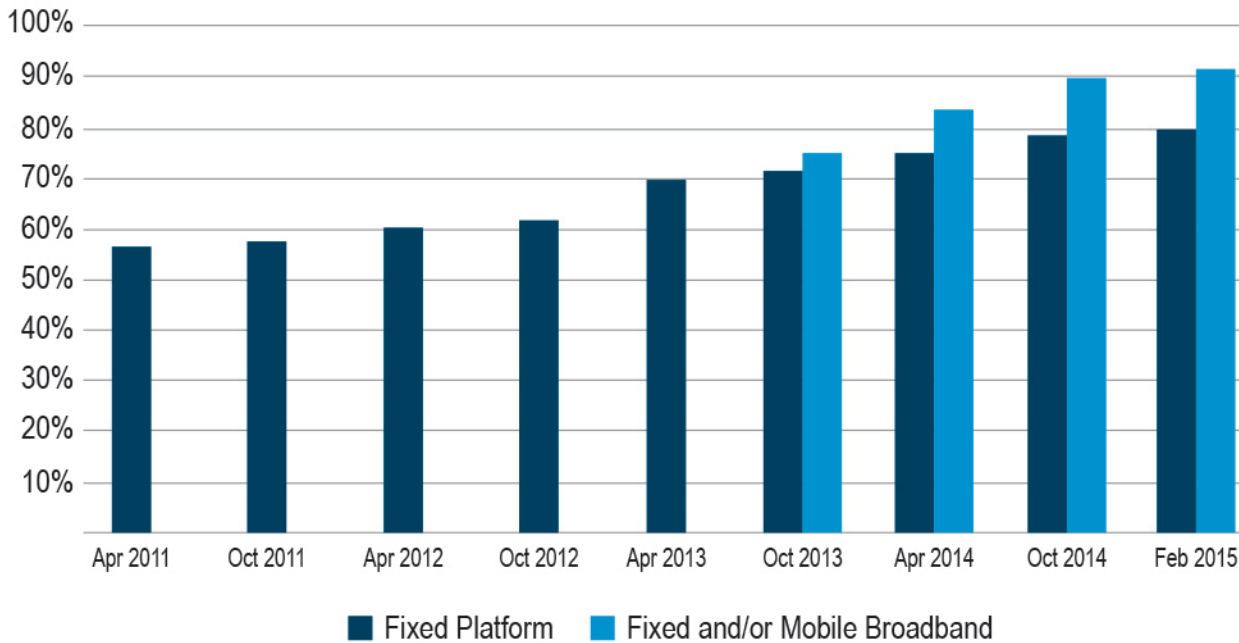
Minnesota is behind on its goal of establishing service of at least 10 Mbps download and 5 Mbps upload for all households and businesses in the state by 2015, though progress has been made. Including wireless or mobile broadband increases the percentage of households and businesses that meet the goal set by statute to just over 90% through February of 2015.[3] According to BroadbandNow, a consumer advocacy organization, 89.9% of Minnesotans had access to wired broadband with download speeds of 25mbps or faster as of 2015.[4] Cook County in the Northeastern part of the state is the least connected county with 19% of people having access to speeds of 25mbps or faster, while Red Lake is the most connected county, with 100% of people having access to this level of service.[5]

TELEWORKING & TELECOMMUTING

Rates of teleworking or telecommuting have long been interesting to transportation planners as working remotely could offer one way to reduce the number of people traveling during peak rush hours and subsequent impacts on air quality and energy consumption.[6] There is some debate as to what exactly qualifies a person as a teleworker; how the definition is framed can significantly change the estimated number of people who telework. On the low end, the American Community Survey estimates that 4.36% of people in the United States work from home at least a majority of the time.[7] Meanwhile, approximately 11% of workers in the United States telecommute at least one day every month.[8] If people who are self-employed and do not have a brick-and-mortar office are included, the number of people in the U.S. who telecommute could be as high as 30%.[9]

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[2] MN Department of Employment and Economic Development
[3] MN Department of Employment and Economic Development, 2015
[4] BroadbandNow, 2015
[5] Ibid.
[6] Levinson et. al., 2015
[7] American Community Survey, 2014 The American Community Survey asks respondents to indicate what their primary means of traveling to work is – worked at home is often equated to someone being a regular teleworker or telecommuter.
[8] Lister & Harnish, 2011
[9] Tugend, 2014

Telework in Minnesota

Rates of teleworking in Minnesota have remained relatively stable over the last 5 years, as is shown in Figure 3. Some increases have occurred particularly in management, business, science, and arts professions, but those gains have largely been offset by declines in other sectors. In total the American Community Survey reports that just over 5% of Minnesota's workforce works from home primarily.

Figure 3: Teleworking by profession in Minnesota as a percent of the total workforce[10]
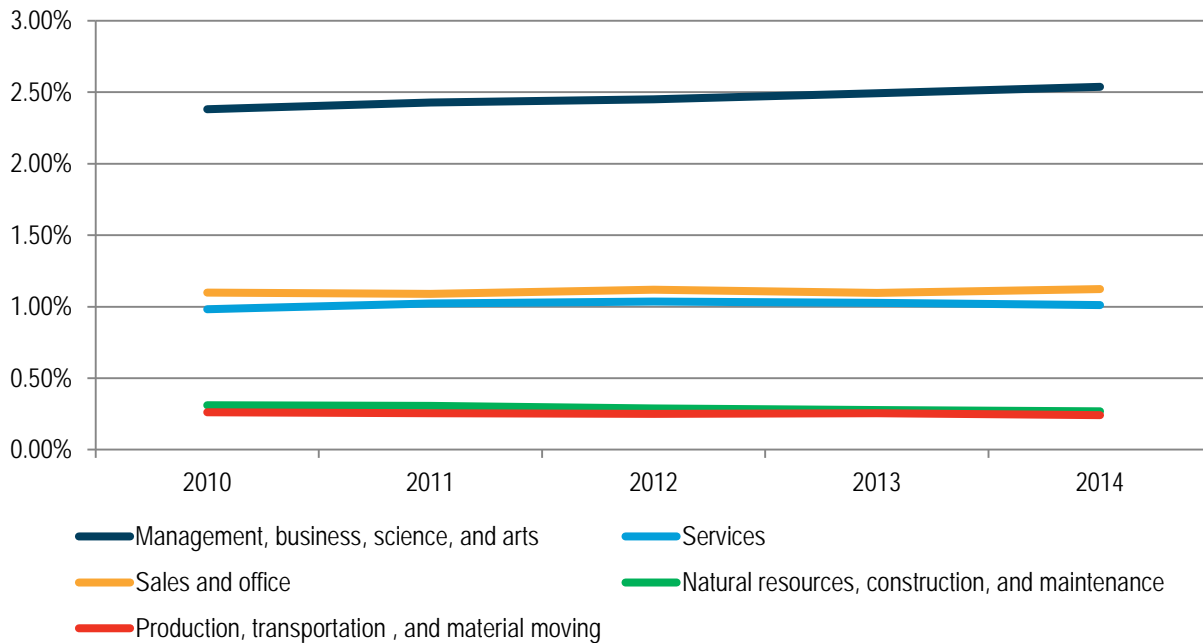
Telework in the Twin Cities

Rates of teleworking in the Twin Cities have grown modestly since 2010, particularly in the fields of management, business, science, and the arts, as is shown in Figure 4.[11] Similarly to the state as a whole, just fewer than 5% of residents in the Twin Cities primarily work from home according to the American Community Survey. The percentage of workers who telecommute grows significantly if the definition is expanded to people who work from home at least once per month, from 5% to 33%.[12] Workers with higher degrees of educational attainment are more likely to telecommute – those with bachelor degrees are 70% more likely to telecommute than the average, while those with post-bachelor degrees are 90% more likely to telecommute than the average worker.[13] Telecommuters are frequently white-collar professionals working in executive/managerial, specialty professional, technical, sales, or administrative positions.[14]
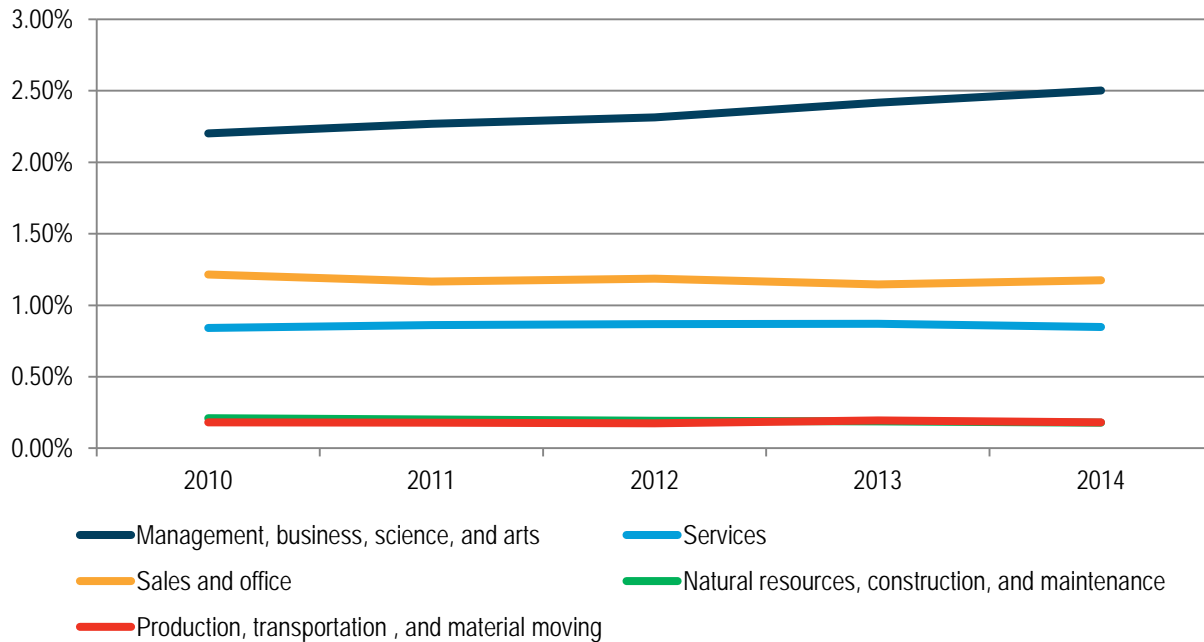
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[10] American Community Survey
[11] American Community Survey
[12] Metropolitan Council, 2013
[13] Ibid
[14] Gallup, 2015

Figure 4: Teleworking by profession in the Minneapolis-Saint Paul Metropolitan Statistical Area[15]

Impact on Transportation

The impact of telecommuting on transportation has been the subject of extensive research in past decades. Telecommuting typically has one of four effects on travel behavior: substitution, complementarity, modification, and no effect.[16] Substitution occurs when a person replaces their home-to-work trip by working from home. Complementarity means that despite telecommuting and eliminating their home-to-work trip, a person has generated new demands for other non-work trips. Modification occurs when telecommuting doesn't affect the total amount of travel, but changes a person's mode choice, timing, or linking of trips together. In some instances, telecommuting has no impact on travel behavior. The overall impact of telecommuting on transportation is uncertain, though it seems that telecommuters are at least slightly more likely to take longer and more frequent non-work trips.[17] A review of 30 studies into telecommuting's effects on overall travel found that reductions in travel occur over the short-term, but long-term impacts are uncertain depending on whether or not a person moves farther away from other amenities due to the mobile nature of their work commute.[18]

The Future of Teleworking

Looking forward, growth in the number of people in the U.S. who telecommute is likely to continue at a small rate through the mid-2030s. Under theoretical 10%, 20%, and 40% saturation levels for teleworking, researchers from the University of Minnesota anticipate that between 7 and 8% of the total workforce will work from home by the year 2035.[19] This matches projections from the American Community Survey, which estimates that an additional 3 percentage points of the workforce may work from home by 2040.[20] Part-time or occasional telecommuting will likely continue to grow as

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[15] American Community Survey
[16] Levinson, et. al., 2015
[17] Zhu, 2012
[18] Andreev et. al., 2010
[19] Levinson et. al., 2015
[20] Ibid.

remote access to email and online meetings becomes more widespread. As of 2011, 11 percent of the workforce in the United States telecommuted at least once per month.[21]

E-SHOPPING

E-shopping in the United States has seen explosive growth since the early 2000s. As is shown in Figure 5, total sales through e-commerce outlets in 2015 were more than 10 times what was sold online in the year 2000.[22] Preliminary estimates for the year 2015 suggest that online sales increased to $335.9 billion, accounting for just over 7% of total retail sales in the United States.[23]

The line between traditional retailers and those who operate primarily online has become blurred in recent years. The adoption of in-store pickup, free shipping, same-day shipping and other emerging retail practices by traditional retailers like Target and Walmart provides some insight into how both in-person and online shopping will continue to evolve into the future, and the impacts that those changes will have on the transportation system.[24] Increasingly it is likely that traditional retailers will adopt technological innovations that help them to keep pace with their online competitors.

Figure 5: Billions of Dollars in e-shopping sales from 1999 to 2015 in the United States[25]
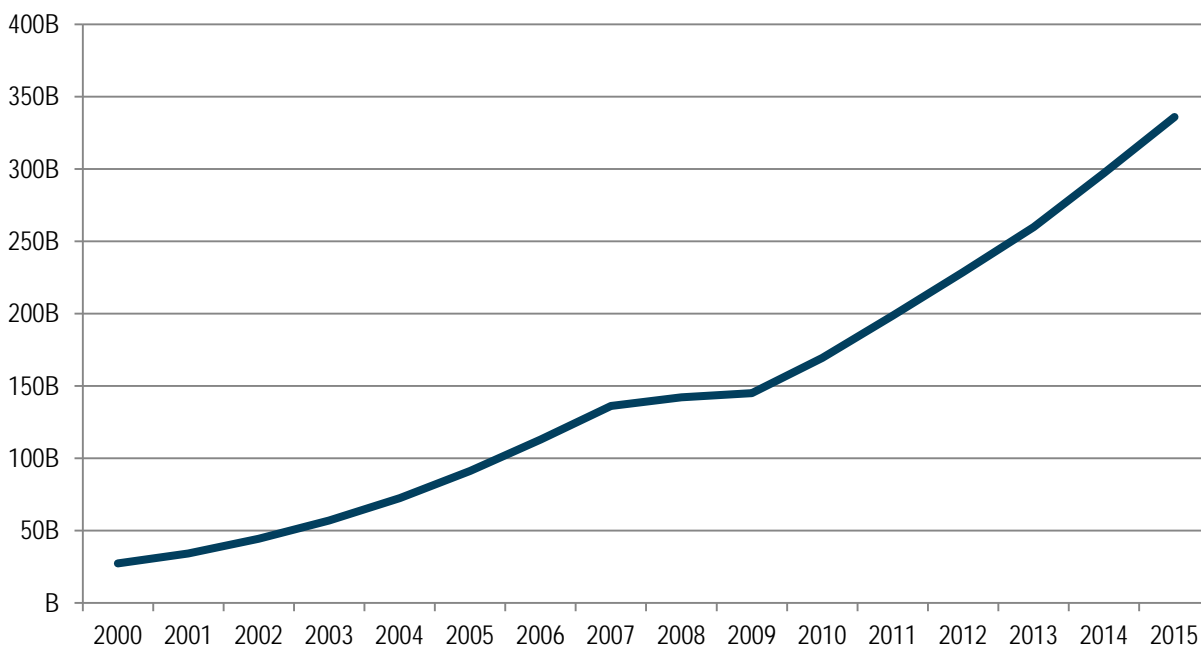
Impact on Transportation

Shopping trips make up a considerable portion of household travel in the United States. Out of all trips made by a household, 21% are shopping-related in purpose, accounting for 14% of an average person's total miles traveled over the course of a year.[26] The impact of online shopping on total travel seems to be mixed, with some studies suggesting reductions in travel while others suggest an overall increase. Individual shopping trips may be offset by the travel associated with delivery of ordered items. Interestingly, online shopping may help to facilitate hybrid shopping processes

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[21] Lister & Harnish, 2011
[22] U.S. Census, 2015
[23] Levinson, et. al., 2015
[24] Heller, 2011
[25] U.S. Census, 2015; 2015 data is projected based on the first three quarters of 2015.
[26] National Household Travel Survey, 2009

where people use different shopping channels for different types of purchases or during different stages of the shopping process.[27] For example, a shopper may notice an item in a store, research it online, and either buy it online or return to the store to purchase the item depending on their research. Table 1 shows some of the differences in how researchers have observed people buying different types of goods.

Table 1: Purchase arena for different types of consumer goods[28]

Good Type	Good Examples	Purchase Arena
Low-cost, frequently-purchased, physical products	Toiletries, groceries, etc.	Traditional stores and retailers
Low-cost, frequently-purchased, informational items	Books, movies, music, etc.	Online stores and retailers
High-cost, infrequently-purchased goods	Furniture, electronics, etc.	Either online or traditional retailers

Projections for e-shopping from the University of Minnesota vary greatly depending on the eventual saturation, or high point, is. A 10% saturation point seems unlikely, given that Chinese shoppers already make over 10% of their purchases online today.[29] Figure 6 shows these projections through the year 2050.

Figure 6: Projected growth in percentage of total sales made through e-shopping[30]
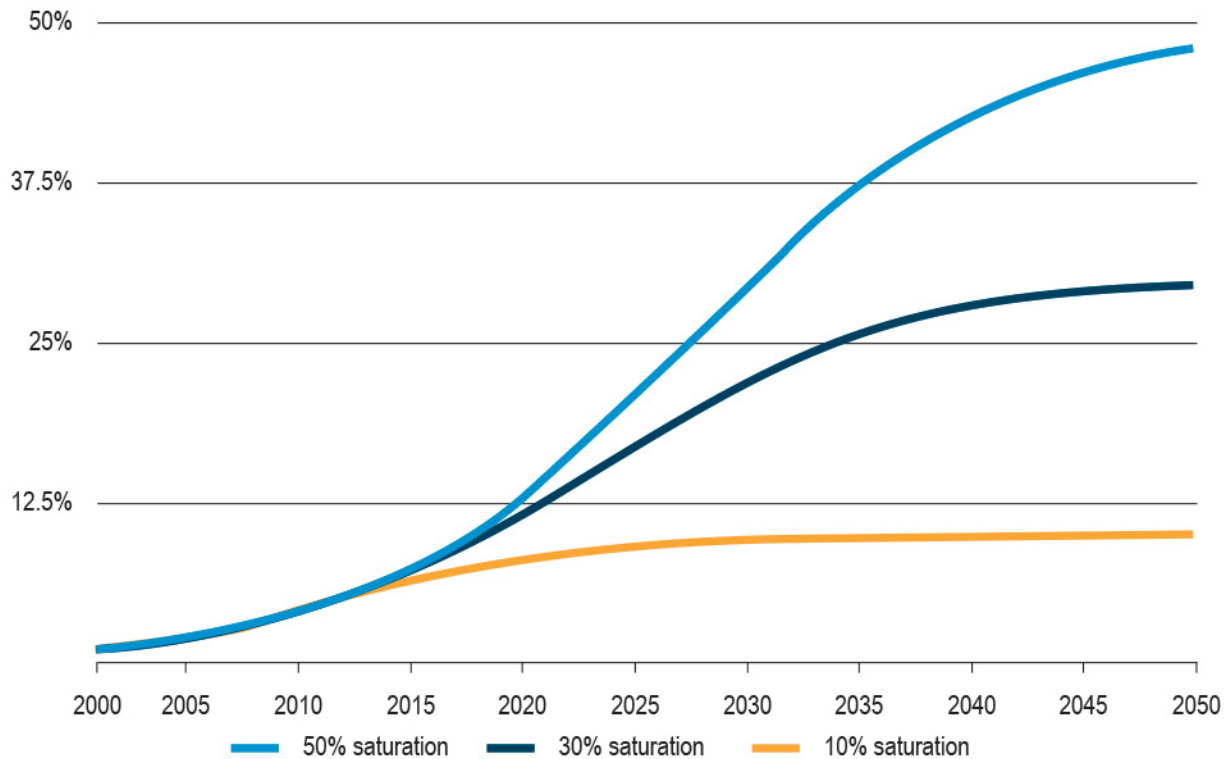
[27] Cao, 2012
[28] Peterson et. al., 1997
[29] Levinson et. al., 2015
[30] Levinson et. al., 2015

Same-day Deliveries

The continued expansion and development of online retailing has led to the development of new delivery services to increasingly mimic the speed of shopping at a brick-and-mortar store. In late 2015, Amazon began offering Prime Now same-day delivery services with free delivery on a wide range of items from flat screen TVs to groceries in the Twin Cities.[31] Walmart is testing a similar subscription service that would compete with Prime Now and offer same-day deliveries in select markets.[32] These services will likely result in significant changes to the way that goods are shipped from online retailers to consumers. More information on same-day shipping and emerging delivery trends can be found in the New Logistics trend paper.

TELEMEDICINE

The emergence of widely available broadband has opened new doors to remotely-accessible medical care in many parts of the country. Telemedicine, e-medicine, or telehealth services allow for real-time communication between patients and providers through communication technologies, be that the internet, over the telephone, or through a videoconference.[33]

In Minnesota, telemedicine takes on a variety of different forms. Direct patient to practitioner services like HealthPartner's *virtuwell* (founded in 2010) or CentraCare's eClinic allow patients to connect with a healthcare professional to treat a list of common ailments that are often treated at urgent care facilities.[34] As of December 2015, *virtuwell* has treated more than 170,000 cases nationwide.[35] In other cases, telemedicine is used to connect specialists at one healthcare facility to doctors and patients at an off-site facility. Hospitals and clinics that are part of the VA system in Minnesota use remote appointments to connect specialists from the Minneapolis system to other VA clinics in places like Saint Cloud, Alexandria, and Montevideo, significantly reducing the amount of advance notice needed to schedule an appointment and travel to a different clinic.[36] Telemedicine can be especially vital in emergency situations, when every second counts and time spent traveling to a specialist may be the difference between successfully treating a patient or not.[37] Beyond emergency situations advances in telemedicine can help to connect small rural clinics to medical professionals in larger urban areas, without placing significant travel demands on patients. It can also allow for real-time communication of vital statistics or condition monitoring between patients and practitioners. This can be especially important for Minnesota's seniors who may not want or be able to drive themselves to an appointment in a distant community.

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[31] Woltman, 2015
[32] Wahba, 2015
[33] American Telemedicine Association, 2016
[34] Virtuwell; CentraCare
[35] Business Wire, 2015
[36] Laxen, 2014
[37] Cronin, 2014